Science and Mathematics Education Centre

Educational Practices and Learning Environments In Rural and Urban Lower Secondary Science Classrooms in Kalimantan Selatan Indonesia

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

Signature:

Date: 26 March 2004

Abstract

This study investigated the educational practices and learning outcomes in rural and urban lower secondary school science classrooms of Kalimantan Selatan, Indonesia. Guided by six research questions, this study focused on curriculum implementation and its association with the existing working and learning environment, learning process and learning outcomes. The investigations were conducted in two stages and used two research methods.

The classroom learning environment and school level environment were investigated at the first stage using the questionnaire survey as a research method. The questionnaires were developed and validated with a sample of 1188 Year 9 students and their teachers in 16 schools. Validation of the questionnaire confirmed that the Indonesian version of the modified WIHIC is a valid and reliable instrument to measure the classroom learning environment in the Indonesian educational context. The results regarding the status of the classroom learning environment are summarised in four assertions. First, students tended to prefer a more favourable classroom learning environment than the one they actually experienced. Second, female students generally held slightly more positive perceptions of both actual and preferred learning environments. Third, students in rural schools experienced a less positive learning environment than did their counterparts in urban areas. Fourth, teachers' perceptions were more favourable than their students on both the actual and preferred learning environment for all seven scales, except on *Task Orientation* in which their perceptions were matched.

This study also confirmed that the Indonesian version of SLEQ, administered to relatively small number of respondents, has gained in merit as a good instrument. Each scale of the Indonesian SLEQ has acceptable internal consistency reliability and was able to differentiate between the perceptions of teachers in different schools. Further analysis indicated differences between perceptions of school environments of biology and physics teachers and of rural and urban school teachers, particularly on *Resources Adequacy*. This study also indicated the differences between teachers' views of the actual and preferred school environments in which the differences are

not only statistically but also practically significant. It is suggested that research for improving school environments, by matching teachers' actual and preferred perceptions, is noteworthy and more research needs to be conducted.

The second stage of this study explored the existing science curriculum documents, teachers' perceptions of the science curriculum, the implementation of science curriculum in the classrooms, and the students' outcomes in school science.

In lower secondary school, science is compulsory for all students of all Year levels, and is aimed to introduce the students to the basic concepts of scientific knowledge and to emphasize the use of tools and equipment during laboratory observations. Science in the lower secondary school consists of physics and biology subjects that were taught separately, but were given the same amount of classroom periods per week. The content was organized into themes or topics. Despite the content to be taught, the development of students' process skills and students' attitudes towards science and the environment were also emphasized. The suggested teaching approaches included the conceptual approach, the problem-solving approach, the inductive-deductive approach and the environmental approach, whereas the suggested teaching methods in science classroom are the experimental method, the demonstration method, the discussion method, the excursion method and the lecturing method. The evaluation and assessment sections of the curriculum documents expected science teachers to systematically and continuously assess the students. Three techniques were suggested to conduct evaluation in the science classroom, which included paper and pencil tests, verbal evaluations, and practical tests.

Science teachers and superintendents possessed different perceptions of the science curriculum as expressed in their preferences towards curriculum metaphors. The metaphor 'Curriculum as Content or as Subject Matter' was a view perceived by three teachers. 'Curriculum as intended learning outcome' was the second metaphor preferred by two teachers, who hold this view for different reasons. In contrast, two superintendents expressed their most preference on the metaphors 'Curriculum as discrete task and concepts' and 'Curriculum as programme planned activity', respectively.

Investigation of the implementation of the science curriculum in the classrooms confirmed that science-teaching practices in urban lower secondary schools was in agreement with those suggested in the curriculum documents. Science teachers in urban schools tended to use a variety of teaching methods, employed good questioning techniques, provided clear explanations and had high outcomes expectation, and maintained effective classroom management. On the other hand, to some extend science teaching practice in the rural lower secondary schools was not as expected in the curriculum document. Mostly, teachers in rural schools tended to use traditional chalk-and-talk teaching methods, employed a limited questioning techniques, had relatively unclear outcomes expectation, and performed less effective classroom management skills.

With regard to students' outcomes, this study showed less favourable results. Students' attitudinal outcomes, which were measured by the Indonesian version of adapted TOSRA, were not maximised, and students' cognitive outcomes are disappointing. The mean scores on the national wide examination, which is 5.46 out of possible maximum score of 10.00, indicated the poor performance of students in learning School Science. No statistically significantly differences were found on attitudinal outcomes between rural and urban and between male and female students' perceptions. However, the study identified that students' cognitive scores were statistically significantly different between rural and urban schools. Students in urban schools scored higher in the examination than did their counterparts in rural schools.

The study found association between students' outcomes and the status of classroom learning environments. Both simple analysis and multiple regression analysis procedures showed that all scales of the Indonesian WIHIC were statistically significantly associated with two scales of the Indonesian adapted TOSRA and students' cognitive scores.

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Table of Contents

List of Tables

List of Figures

Chapter 1. Background and Rationale

1.1 Introduction

1.1.1 Overview of Indonesia

The Republic of Indonesia, located in southeastern Asia, is the largest archipelago in the world covering an area of 1,919,444 square kilometres, being 5,150 kilometres from West to East and 1,930 kilometres from North to South. The country consists of approximetely13,700 islands of which 6,850 are inhabited and in 2002 it had more than 203 million inhabitants. The main islands are Sumatra (473,606 sq.km), Kalimantan (539,460 sq.km), Sulawesi (189,216 sq.km), Irian Jaya (421,981 sq.km), and Java (132,187 sq.km) (Indonesian Embassy in Prague, 2003). The Indonesian map is shown in Figure 1.1

Figure 1.1 Map of Indonesia (Adopted from Anonymous, 2003a)

(Source:http://www.lib.utexas.edu/maps/middle_east_and_asia/indonesia_adm_98.jpg-withdrawn at 03-11-2003)

At the beginning of 1999, Indonesia still consisted of 24 provinces, two special regions (*daerah-daerah istimewa, singular - daerah istimewa*), and one special capital city district (*daerah khusus ibukota*) that included 246 districts (*Kabupaten*) and 55 municipalities (*Kotamadia*), 3,592 sub-districts (*Kecamatan*), and 66,594 villages (*Desa* or *Kelurahan*). One of the provinces, East Timor, was withdrawn from Indonesia in 1999 after a referendum. The government of the Republic of Indonesia has expanded the number of provinces and districts/municipals. Currently, there are 27 provinces, two special regions (*daerah-daerah istimewa, singular - daerah istimewa*), and one special capital city district (*daerah khusus ibukota*) that includes 269 districts (*Kabupaten*) and 85 municipalities (*Kotamadia*), 4,646 sub-districts (*Kecamatan*), and 69,255 villages (*Desa* or *Kelurahan*) (Ministry of Home Affairs, 2002).

1.1.2 Overview of the province of Kalimantan Selatan

Kalimantan Selatan is one of the 26 provinces in Indonesia or one of four provinces in Kalimantan (formerly called Borneo). The province, marked by the square on the map as shown in Figure 1.1, is bordered by Kalimantan Timur and Kalimantan Tengah at the north, with Maccasar Strait at the east, with the Java Sea at the south and Kalimantan Barat and Kalimantan Tengah at the west. Kalimantan Selatan province covers an area of 37,000 square kilometres with 57 percent or about 21,000 square kilometres comprising forest and mountain ranges from an altitude of 1,000 to 1,500 meters above sea level. In the northern and central regions there are mountains called the Meratus range; the western area consists of lowland and swamp and the east side is occupied by forest and grassland. Figure 1.2 shows a map of the island of Kalimantan.

The native inhabitants of Kalimantan Selatan are the *Banjarnese*, which constitute the majority of the population. Other native inhabitants are *Palangan Dayak, Labuhan Dayak, Warukin Dayak, Bukit* or *Hulu Banyu Dayak, Datar Laga Dayak, Bakumpai, Abol, Dusun* and *Lawangan Dayak.* The non-natives are Javanese, Madurese, Bajau, Bugese, Chinese and Arabs. In daily communication, both the Indonesia language and Banjarnese are used; Banjarnese, which is very similar to Malay, is used for informal communication.

Figure 1.2 Map of Kalimantan (Adopted from Anonymous, 2003b)

(Source: http://www.asiamaya.com/peta/kalimantan.htm, 03-11-2003)

The province of Kalimantan Selatan consists of eight districts and two municipalities, 117 sub-districts and 1894 villages. According to the 1998 census, Kalimantan Selatan had more than 2.6 million people who are unequally distributed. On average, most districts only have 75 people per square kilometres while two municipalities have 5000 people per square kilometre. This inequality generates a problem for the Kalimantan Selatan government in providing both equity and quality improvement programmes in education. Generally, people in rural and remote areas are always disadvantaged in getting their education at all levels (Abdurrahman, 1999).

1.2 Background to the Study

1.2.1 The Indonesian Education System

According to Law No.2/1989, the national education system is categorized in terms of units, paths or channels, types, and levels of education. A unit of education arranges teaching and learning activities which are implemented within and outside the formal school system. Accordingly, two different education paths or channels are recognised in the Indonesian education system. First, in-school education is formally organised in school through teaching and learning activities that are gradual, hierarchical, and continuous. Second, out-of-school education is organised outside of formal schooling through teaching and learning activities which do not have to be hierarchical and continuous. This out-of-school education can be within family and includes *Kelompok Belajar (Kejar) Paket* A (Package A) and *Kejar Paket B* (Package B). Seven types of education included in in-school education that constitute the national education system, are general, vocational, special, service-related, religious, academic oriented, and professional education (Riyanto, 1991).

The formal schooling system of general education in Indonesia consists of six years of primary education (*Sekolah Dasar* or SD under the Ministry of National Education; *Madrasah Ibtidaiyah* or MI under the Ministry of Religious Affairs), three years junior or lower secondary education (*Sekolah Lanjutan Tingpat Pertama or SLTP* under the Ministry of National Education; *Madrasah Tsanawiyah or MTs* under the the Ministry of Religious Affairs) and three years of senior secondary education (*Sekolah Menengah Umum or SMU* under the Ministry of National Education; *Madrasah Aliyah or MA* under the Ministry of Religious Affairs). *Pesantren* or the Islamic Boarding School provides education from Years 1 to 12 under the Ministry of Religious Affairs. Both the Ministry of National Education (MNE) and the Ministry of Religious Affairs (MORA), under a common core curriculum known as Curriculum 1994, work together to provide this schooling. The schooling under the MORA is distinctive from those under the MNE in that it has its own unique curriculum on religious themes. The Ministry of National Education acts as the leading agency for overall planning, co-ordination, and regulation of the education sector (Riyanto, 1991). A simplified overview of the Indonesian education system is presented in Figure 1.3.

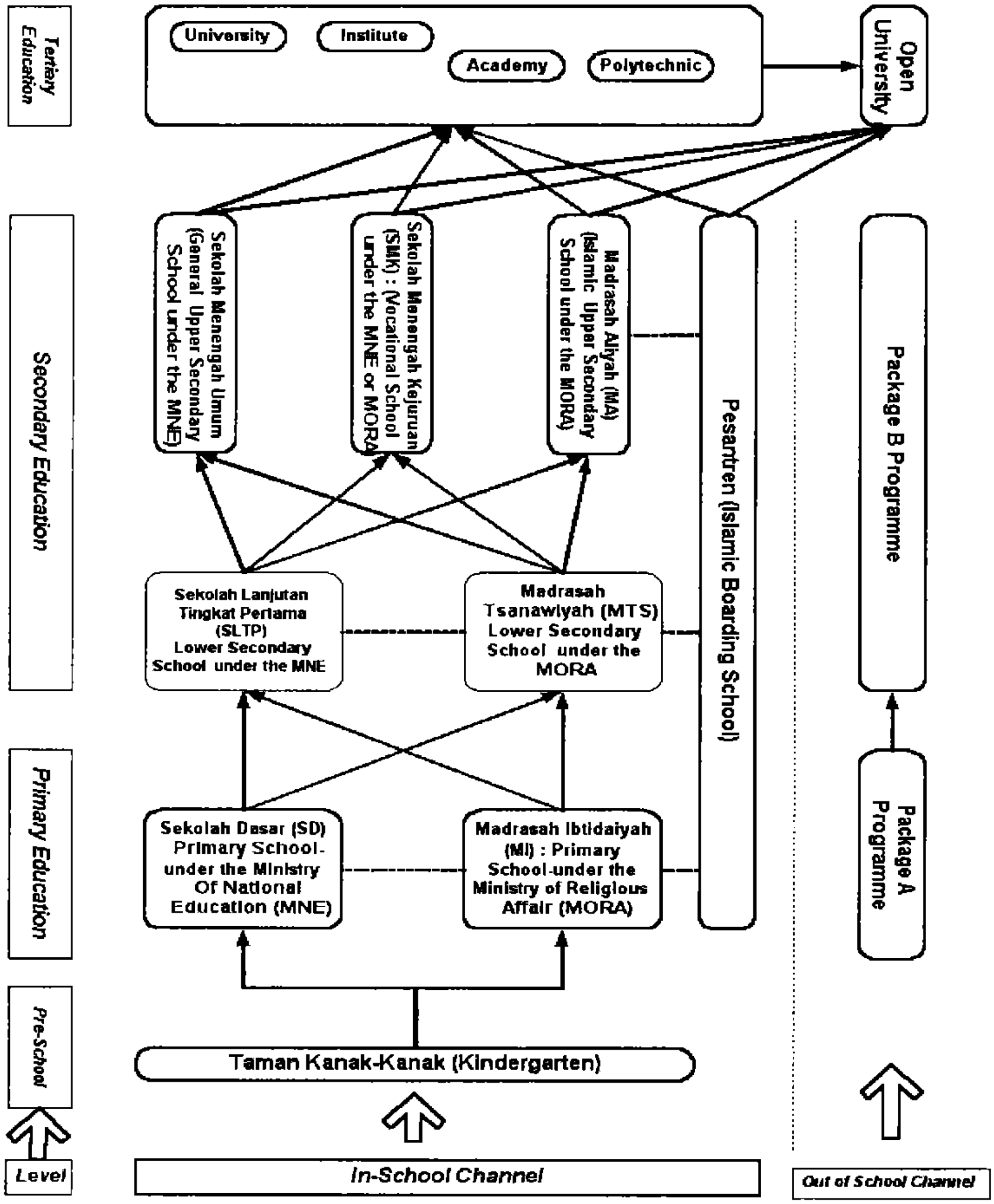

Figure 1.3 The Indonesian Education System (Adapted from Riyanto, 1991)

1.2.2 Basic Education Programme

Since 1974, the government has launched a programme of accelerated primary school construction. In 1994, with universal primary enrolment achieved, the government adopted the goal of universal nine years of basic education by the year 2003. According to Law No. 2/1989 and Government Regulation No. 28/1990, basic education is general education with a duration of nine years, including six years in primary school and three years in lower secondary school. Basic education carried out in primary school is intended to provide students with the ability to read, to write and to do arithmetic (3Rs); to introduce primary knowledge and skills which are useful for pupils in line with their development levels; and to prepare them to attend education in lower secondary school. At the lower secondary school level, basic education means to provide students with abilities such as the expansion of knowledge and improvement of skills obtained in primary school. In this way students can develop their lives as individuals, members of society, and citizens in line with their level of development. In addition, students are prepared to attend upper secondary education (Ministry of National Education, 2000a).

Teaching programmes in primary and lower secondary schools cover subject arrangement, time allocation and its distribution in every class and educational unit. Time allocations for a period in primary school are 30 and 40 minutes for Grades I to IV; in lower secondary school the time allocation is 45 minutes for all Grades. The arrangement of teaching programmes consists of curricular programmes and extra-curricular activities. Extra curricular activities included enrichment and improvement activities applied to the curricular programme that is conducted outside of school hours.

1.2.3 Science education in Indonesian lower secondary schools

Science in the Indonesian lower secondary schools is taught as a general science subject consisting mainly of biology and physics, with relatively few chemistry concepts. In practice, biology and physics are taught separately with equal time allocations of three classroom periods per week. However, in grading students for the school term or end of year report, student achievements in both biology and physics are combined.

Along with nine other subjects, science is compulsory for all students at all grades in lower secondary schools. In the lower secondary school, Science is taught through a 'spiral' approach, in which students at the higher grade study the same or similar concepts taught in the lower grade, but at a deeper level.

The Ministry of National Education, formerly the Ministry of Education and Culture, has shown serious intent to promote and enhance the quality of science education at all school levels. For example, the programme called *Pemantapan Kerja Guru* (PKG (Strengthening the Work of Teachers) was launched in 1978. This programme aimed to promote student-centred teaching and learning strategies and to update teachers' classroom competencies, so that science teachers become more confident in teaching and students become active learners. Following this programme, other programmes such as *Sanggar Pemantapan Kerja Guru* fragmented as SPKG (Forum for Strengthening the Work of Teachers) and *Musyawarah Guru Mata Pelajaran* or MGMP (Forum for the Same Subject Teachers) were developed. The success of the PKG and two other programmes has been reported by Thair (1996) in which teachers who participated in the programmes demonstrated better teaching practices.

Despite this substantial effort in teacher education, the quality of science education, particularly for lower secondary school level, as reflected in the students' outcomes in national science examinations, is very disappointing. During the last six years, the average score of students' achievement on the national science examination is less than 4.90 out of 10.00 (Ministry of National Education, 2003). This average score is the lowest among five other subjects, namely, mathematics, Indonesian language, English, social science, and *Pancasila* and civic education. In addition, Indonesian students' performance in international assessments supports this finding. Based on the results of assessment organised by the International Educational Achievement (IEA) as reported in the Third International Mathematics and Science Study (TIMSS), Indonesian students ranked at 34^{th} and 32^{nd} out of 38 countries which participated in the assessment for mathematics and science achievement, respectively (Martin et al., 2000). Similar results from the Programmeme for International Students Assessment (PISA) study were reported that among 41 countries, Indonesian students were ranked at 39^{th} and 38^{th} for mathematics and science achievement, respectively (UNESCO, 2003).

This study does not attempt to evaluate and investigate science education in lower secondary school as a whole, rather to address a neglected but essential aspect of the large problem associated with students' outcomes in science, namely the curriculum implementation processes and the classroom learning environment.

1.3 Rationale for the study

Learning is a unique process that is directly and indirectly influenced by such variables as teachers' beliefs, teaching instruction, students' attitudes and the classroom-learning environment. The working environment, school climate, community linkages and the socio-cultural background of both teacher and students are variables that can influence student-learning outcomes.

To date, ongoing efforts of the Indonesian government are to enhance educational equity and educational quality for all citizens (Sihombing et al., 2002). Equity in education means that regardless of ethnicity, gender, religion and tribe, every citizen has the right to education. To some degree, this effort has been successfully achieved. For example, the number of illiterate people has decreased and the number of student enrolments has increased (Ministry of National Education, 2000b; Sihombing et al., 2002). Yet, the government is still struggling to be sure that all students enrol in full-time schooling. While most schools in urban areas have successful enrolments, many schools in rural areas lag behind and are struggling to provide students with appropriate education. Reasons for the latter situations are the lack of physical resources (for example, textbooks, laboratories, electricity), lack of qualified teachers, and poor achievement in nation-wide examinations.

In order to overcome this problem, the representative office of the Ministry of National Education of Kalimantan Selatan, Indonesia, has conducted educational reforms for rural schools through a teacher professional development programme. However, the results of the programme are far from what was expected, indicating that reform in education needs to attend to more than one variable influencing the teaching and learning processes. If teachers' professional development is emphasised but other factors are neglected, this can lead to ineffective reform. Thus, other factors must be considered and taken into account. Of interest in this study is a focus on such factors as curriculum implementation and school climate, including the working and the classroom-learning environment.

To analyse curriculum, it is necessary to differentiate curriculum into several levels. Hence Akker's (1998) curriculum typologies are adopted in this study. According to him, there are six types of curriculum namely, *the ideal curriculum, the formal curriculum, the perceived curriculum, the operational curriculum, the experiential curriculum, and the attained curriculum.* A brief explanation of each curriculum type is provided as follows (Akker, 1998):

1. The ideal curriculum refers to the original vision underlying a curriculum (basic philosophy, rationale or mission).
2. The formal curriculum is the vision elaborated in a curriculum document (with either a prescribed/obligatory or exemplary/voluntary status).
3. The perceived curriculum means the curriculum as interpreted by teachers and students.
4. The operational or implemented curriculum represents the actual instructional process in the classroom, as guided by previous representation (also referred to as the curriculum-in-action or the enacted curriculum).
5. The experiential curriculum applies to the actual learning experiences of the students.
6. The attained curriculum relates to the resulting learning outcomes of the students.

For the purpose of this study, the word *intended curriculum* and *achieved curriculum* are used instead of the first two and last two types of curriculum typologies, respectively.

Research on curriculum reveals that the failure of curriculum reform in the past is commonly due to a lack of appropriate interpretations of the findings in terms of the curriculum level or representation. For instance, directly comparing the students' outcomes at the micro level (the attained curriculum) with policy intentions at the macro level (the ideal curriculum) by neglecting all intermediate process, such as perceived and implemented curriculum, will mislead the explanation. It has been shown that there is a considerable gap between the intended (ideal plus formal curriculum) and the operational (implemented or enacted) curriculum, which may lead to an unsatisfactory attained curriculum (Bekalo & Welford, 2000; Kuiper, 1995). Therefore, a worthy focus of this study is to investigate the links between the intended-perceived-implemented-achieved curriculum and factors that may influence them. Accordingly, this study does not attempt to evaluate and judge the existing science curriculum but rather to describe the intended curriculum to provide a picture on what science education should be achieved.

The ideal teaching and learning process will exist and lead to an ideal achieved curriculum if the implementation of the curriculum displayed in the classroom is congruent with the intended curriculum. The researcher's logic is that a better school climate will support teachers in interpreting and implementing the curriculum as it is intended. Therefore, a school with a healthy psychosocial environment will tend to have a better achieved curriculum than a school with an unhealthy psychosocial environment.

Since the 1960s, an increasing and important number of studies have attempted to analyse the social climate of the classroom in which the behaviour of the teacher, teacher-student interactions, and student-student interactions form a part. Over the past 30 years, a massive amount of educational research in this area has recognized the learning environment as a powerful factor in contributing to students' learning (Fraser, 1991, 1994, 1998a, 1998b; Fraser & Fisher, 1982a). Studies on student outcomes and the learning environment found that students who perceived their learning environment positively outperformed those who perceived their classroom environment less positively (Hattie, 1987). Furthermore, by using students' perceptions of their classroom psychosocial environment, it is possible to predict both affective and cognitive outcomes (Fraser & Fisher, 1982b; Rentoul & Fraser, 1980).

The assessment of the classroom psychosocial environment has been considered a promising yet neglected source of process criteria in curriculum evaluation and innovation (Fraser, 1981a, 1986, 1991, 1994; Fraser, Williamson, & Tobin, 1987). In this study, the researcher perceives that there is an association between the school climate which consists of the existing classroom environment and the working environment, and the implementation of the curriculum (teaching practice) derived from teachers' perceptions of the intended curriculum. Curriculum implementation that depicts teachers' beliefs on teaching and teachers' perceptions of the intended curriculum will affect students' perceptions of their classroom psychosocial environment. As Moos (1979) indicated, a school programme can be either positively or negatively affected by the classroom environment in which the programme is implemented, or as Fraser (1990) noticed, the classroom environment can differentiate curricula and educational innovations that do not show differences when standard performance evaluation criteria are used. Hence, student and teacher perceptions of the teaching-learning environment in their classroom are an important source of data for the direct evaluation of curriculum implementation, and indirectly of its quality (Suarez, Pias, Membiela, & Dapia, 1998). Therefore, understanding classroom-learning environments may help the study of the nature of curriculum implementation conducted by the teacher.

The working environment that is perceived by the teacher either directly or indirectly can influence teaching and learning activities. For example, teachers who perceived their working environment positively tended to conduct their teaching practice in a manner that creates a favourable learning environment (Dorman & Fraser, 1996). Similarly, Conley and Muncey (1999) asserted that teachers tended to excel in a school working-environment that allowed them to utilize their professional expertise and initiative.

The possible way that these factors interact and influence the learning process, thus affecting the quality of science education, can be simplified and displayed in Figure 1.4.

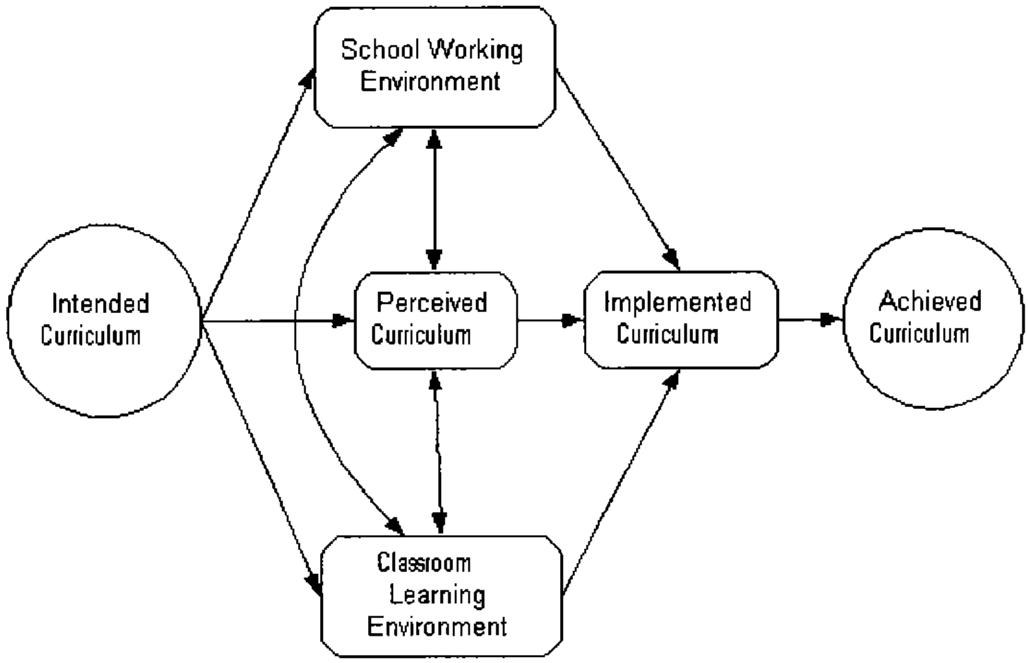

Figure 1.4 Interaction Among Factors that Affecting Learning Processes and Learning Outcomes

It is envisaged that the study, which focuses on school climate, curriculum implementation, achieved curriculum, and any associations that exist among these, will provide explanations for the situation of lower secondary school science in Kalimantan Selatan, Indonesia. Furthermore, it is also anticipated that such a comprehensive study can lead to a better understanding of the educational process so that appropriate policies can be made to enhance and improve the overall quality of science education, particularly in rural schools.

1.4 Aims of the study

The main aim of this study was to investigate the educational practices and learning outcomes in rural and urban lower secondary school science classrooms of Kalimantan Selatan, Indonesia. The study focused on curriculum implementation and its association with the existing working and learning environment, learning processes and learning outcomes. In more detail, the aims are formulated in the following six research questions:

1. How do students in rural and urban lower secondary schools perceive their classroom learning environments?
2. How do teachers in rural and urban lower secondary schools perceive their school working environments?
3. What is the intended science curriculum that exists in rural and urban lower secondary schools?
4. How do teachers perceive the intended science curriculum in rural and urban lower secondary schools?
5. How do teachers implement the existing science curriculum?
6. What are students' achievements on the science curriculum in those schools?

1.5 Definition of terms

In order to be specific about the study, the following operational definitions or terms were used.

- The intended curriculum is concerned with the official curriculum documents from policy papers to official textbooks.
- The perceived curriculum is related to teachers' perceptions of the existing curriculum.
- The implemented curriculum or the enacted curriculum refers to what actually take places in classrooms.
- The achieved curriculum is connected with students' learning outcomes; in this case, the curriculum achievement is referred to student's score of *Evaluasi Belajar Tahap Akhir Nasional* (EBTANAS) – a nation-wide final examination. In an ideal education system, it is assumed that there will be a complete match between the first two curriculum types that produce desirable outcomes reflected in curriculum achievement.
- The classroom learning environment relates to the atmosphere, character, ambience and ethos of the classroom that can influence the learning process. The classroom environment is described as the psychological and social-psychological aspects that form the environment as opposed to the physical environment.

- The working environment refers to the school's atmosphere, psychosocial working conditions that are perceived by the teacher and other school staff.

1.6 Significance of the study

Very few studies have been concerned with rural schools in Kalimantan Selatan. (Iskandar, 1987) and Mutiara (1987) conducted research in rural primary schools but no study has been conducted in rural secondary schools. Moreover, there is no study on classroom learning environments at all school levels in this province. Hence, this study is significant for three reasons:

- It fills the absence of research on rural lower secondary school in Kalimantan Selatan, Indonesia.
- It informs the representation office of Ministry of National Education (MNE) of Kalimantan Selatan province about the status of rural and urban schools' learning environment and educational practices, which can be used to formulate policy.
- It helps the principals and teachers, particularly of rural schools, to improve their practice in conducting science education.

1.7 Summary and Overview of the Thesis

This chapter began with the overview of Indonesia and of Kalimantan Selatan to provide information where this study took place. The background of the study, described in Section 1.2, briefly explained the Indonesian education system, the basic education programme and science education in lower secondary school. Following this section, a rationale for the study was elucidated to provide a theoretical underpinning. Section 1.4 explained the goals of the study that function as driving forces for the remaining chapters. Definition of terms was explained in Section 1.5. Finally, the significance of the study was stated in Section 1.6 ensuring that this study was relevant to the Indonesian educational context and to the major trends in previous and existing research.

An overview of the chapters in this thesis can be simplified in Figure 1.5.

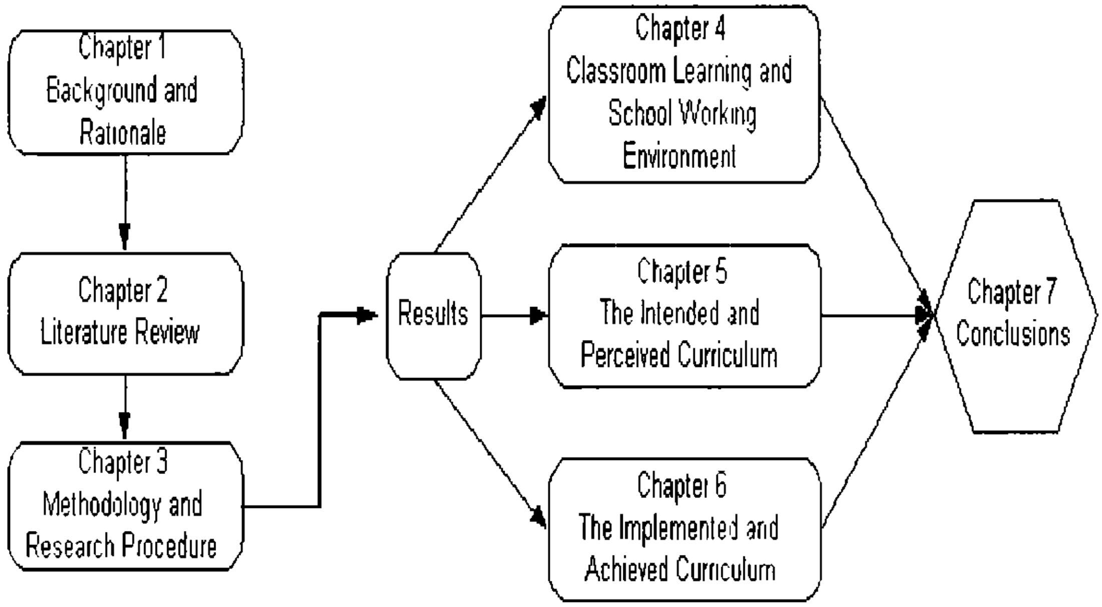

Figure 1.5 Overview of the Thesis

Beside this introductory chapter, which provided the background and rationale of the thesis, the research problem, the research questions, and the significance of the study, this thesis contains another six chapters. The Literature Review, presented in Chapter 2, describes previous research related to the focus of the current study, and shows that the current study is relevant to the major trends in previous research and opinions on the problems.

Chapter 3 explains the research methodology and procedures. In a more detail, it deals with the issues such as the research methods applied, the sample selected, the instruments used, procedural details to measure internal validity, and the data analysis procedures. The following three chapters are devoted to research findings. Chapter 4 presents the findings that focused on the classroom learning environment and the school working environment. Chapter 5 depicts the intended and perceived science curriculum, and Chapter 6 presents the implemented and achieved science curriculum.

Finally, Chapter 7 provides conclusions of the research which are organised into six main sections. An overview of the scope of the thesis, comprising a brief summary of the research questions being investigated, is presented in Section 7.2. A summary of the research design and the research procedures is included in Section 7.3 and followed by a summary of major findings of the research that is described in Section 7.4. Limitations of the study are presented in Section 7.5 and implications of the study are summarised in Section 7.6. Recommendations and possibilities for further research are offered in Section 7.7.

Chapter 2. Literature Review

2.1 Introduction

The present study, which focused on the implementation of the lower secondary school science curriculum at the classroom level and how this affected the learning environment, involved several driving forces. First, instruments for assessing the science classroom and perception of the school level environment were adapted and validated for the Indonesian lower secondary school context. Second, an investigation of some determinants of students' perceptions of the science classroom learning environment and of teachers' perceptions of the school level environment was conducted. Third, document analysis of the science curriculum of Indonesian lower secondary schools was carried out. Fourth, the teacher's perceptions of intended science curriculum were investigated. Fifth, the implementation of the science curriculum as perceived by teachers was observed in the classroom. Sixth, the association between student outcomes and classroom learning environment was investigated using student scores at the national-wide examination and science-related attitudes as the outcome measure.

The purpose of this chapter is to review the literature related to the present investigation. In particular, this chapter sets out to provide the background for answering the research questions related to science education practices in the Indonesian school context. Section 2.2 reviews literature pertaining to the development of science education in Indonesia leading to a discussion of the science education reforms currently undertaken. A review concerned with the level of curriculum representations is presented in Section 2.3. The following Section 2.4 reviews the issues relating to the effective implementation of the intended curriculum as well as the constraints encountered in science teaching. This study is unique in that it integrated students' and teachers' perceptions of the learning environment as part of the main elements in investigating science education practices. Section 2.5, therefore, is devoted to discussing issues related to the psychological constructs and related instruments to measure students' and teachers' perceptions of the classroom learning environment and the school working environment, respectively. Finally, the chapter concludes with a summary in Section 2.6.

2.2 Science education in Indonesia

When this study was conducted, the Indonesian education system was highly centralised and headquartered in Jakarta. This centralised education system caused considerable communication and transportation obstacles to serve the large and growing population distributed over a wide geographical area. This condition led the central government to deliberately give the provincial government mandates to handle the K-12 education programme by launching the Decree No. 22 1999 about local government (*Undang-Undang Nomer 22 Tahun 1999 tentang Otonomi daerah*). As a result of this regulation, education now is the responsibility of the local government whereas the central government deals with the standardisation of the national curriculum (Sumarno et al., 2001).

The Indonesian government has considered education as an essential component of the national development processes (Sihombing et al., 2002). Therefore, investing in education has been one of the cornerstones of Indonesia's development policy during its history and, as a result, the education level of the population has increased noticeably. In the early 1970's, for example, 74% of the population did not have a primary school education and this figure has now been reduced to just 34%. This expansion has enabled workers to increase their earnings by moving from lower paid to relatively higher paid jobs. Gender differences have also narrowed significantly (Sihombing et al., 2002). Furthermore, since 1966 the Indonesian government initiated a series of five-year development plans (*Rencana Pembangunan Lima Tahun or Repelita*) with each plan focusing on the development of particular aspect of the educational system. The first two decades following independence in Indonesia saw the secondary education system coping with the rapidly expanding population of secondary school students (Thair, 1996).

It was the government's goal that, by the end of the sixth plan, Indonesia should have a nation prepared for an era of industrialisation. To realize this goal, Indonesia had to have a workforce with adequate scientists and engineers (Anonymous, 1998). This goal placed a very clear focus on science education, particularly the Indonesian current school science curriculum and science textbooks and the ability of Indonesian science teachers to keep abreast of the rapid developments in modern science and technology. Issues of science curriculum development, science education reforms and research on science education in Indonesian school's context are reviewed in the following sections.

2.2.1 Science curriculum development

The school science curriculum in Indonesia has changed periodically every eight to ten years. A brief history of school science curriculum development in Indonesia is discussed in this section.

Education after Indonesian independence was heavily derived from and influenced by the colonialist education model. All textbooks and classroom instruction still adopted Dutch language until the 1950s (Soedijarto et al., 1980). Prior to 1975, the school curriculum, particularly the school science curriculum was subject-oriented and encouraged a teacher-centred approach in the classroom. A new curriculum, known as Curriculum 1975, was introduced progressively into the secondary school system between 1976 and 1978. The Curriculum 1975 adopted a student-centred approach, as replacement for the traditional one, that has dominated teaching and learning processes for a long period. Within this curriculum, science subjects were emphasised as providing factual knowledge and in addition students should develop a range of process skills that were developed through practical activities in the laboratories and classrooms.

In 1984, Curriculum 1975 was replaced by Curriculum 1984. Within this curriculum, no significant change occurred in school science but science teaching should be conducted using student active learning approaches. Ten years later, Curriculum 1994 was established to replace Curriculum 1984. Within Curriculum 1994, schooling was changed from two semesters to three terms in a year. A consequence was that teachers needed to conduct more assessment. Within this curriculum, in addition to already suggested teaching approaches in the previous documents, a new teaching approach in science, namely, Science Technology and Society, was introduced. This approach aimed to enable students to learn science in a meaningful way related to daily occurrences in their society and environment. Recently, the Ministry of National Education proposed a revised version of Curriculum 1994 that emphasised students' competence in each subject area. Science in K-12 schooling should be delivered in a contextual manner. Accordingly, the central government gave the opportunity to local government to develop local science curricula as a supplement to those mandated nationally.

Changes in curriculum always create problems, especially to the teachers who implement it. While the curriculum provided instructional objectives, the problems of identifying and locating appropriate instructional materials and lesson planning was left entirely to the individual classroom teachers. Consequently, many teachers were inadequately prepared to initiate effective teaching and learning strategies. As a result, many teachers continued to use the traditional 'chalk and talk' and lecturing methods with a heavy emphasis on memory type classroom activities (Thomas, 1991). Berg and Lunetta (1984) identified factors that would make student-centred activities difficult for teachers to adopt. These factors included large class size, the heavy teaching load for many teachers, lack of laboratory support staff, noisy classes, the context of Indonesian classroom culture, and the authority of senior staff.

2.2.2 Science education reforms in Indonesia

During the implementation period of Curriculum 1975, between 1976 and 1979, the Indonesian government established a number of professional development programmes in order to overcome the problems experienced by teachers in implementing the new curriculum. During this period, approximately 18,000 participants, including school principals, school administrators and teachers, attended these programmes (Penick & Amien, 1992). Through these programmes, science teachers were involved in intensive workshop activities that included demonstrations of effective science teaching methodology, preparation of lesson plans and materials conforming to the instructional objectives of the curriculum and micro-teaching sessions (Thomas, 1991). However, the results were disappointing as teachers had difficulty applying student-centred approaches and remained using teacher-centred approaches (Berg & Wilardjo, 1986).

To overcome these problems, the Indonesian government via the Ministry of Education and Culture launched the *Pemantapan Kerja Guru* (PKG) - Strengthening the Work of the Teachers' - project for mathematics and science teachers in the early 1980s. This project aimed to promote student-centred teaching and learning strategies and to update teachers' classroom competencies (Mahady, Wardani, Irianto, Somerset, & Nielson, 1996). A key feature of the PKG pedagogical style was student active learning rather than reception and rote learning as occurred in chalk-and-talk methods. This programme was successful in assisting science teachers to prepare and conduct their teaching. Through the programme, teachers were involved in discussing the content analysis of each topic to be taught, identifying major concepts and skills to be learnt by learners and planning of teaching strategies, trialing of laboratory activities, revising student worksheet for experiments, and designing diagnostic tests (Pietersz, 1982).

The success of the PKG programme as indicated by a large numbers of requests for coverage and PKG material dissemination (Pietersz, 1982) led to the formation of new programme called Sanggar Pemantapan Kerja Guru (SPKG). Essentially, the SPKG initiative was an attempt to disseminate the PKG teaching methodology and materials at a more rapid rate and at a lower cost than the original PKG induction process. This programme was successful in terms of the total number of SPKG programmes established. By 1988, there were more than 200 SPKG teams (one for each district) compared to only 26 PKG teams (one for each province). However, it was identified that the SPKG programme was run with some loss of quality and intensity of training compared to the original PKG (Somerset, 1988). The combination of in-service and on-service as originally conducted in the PKG was maintained in the SPKG, but the training was much less intensive (Mahady et al., 1996).

In 1993, the SPKG programme was replaced by a new programme called *Musyawarah Guru Mata Pelajaran (MGMP).* Due to financial limitation, the MGMP programme was run with fewer meetings and less activities. A year latter, the PKG model C was set up in response to the needs of teachers' development in rural schools (Mahady et al., 1996).

A review of the development and evolutions of science teacher professional development programmes in Indonesia conducted by Thair and Treagust (2003) suggested that the Indonesian government should adopt a more holistic and broad based sectoral approach. A new teacher professional development programme should recognise teacher commitment, establish a conducive professional culture and maintain good social interaction processes between teachers, head-teachers, principals and education department personnel (Thair & Treagust, 2003).

Studies that investigated the impact of the PKG project in assisting teachers has been conducted and showed an inconsistency. A survey in 10 provinces in Indonesia that involved 603 junior and senior secondary teachers who had participated in the PKG induction showed that teachers persisted to dominate the classroom with little attention being paid to the development of students' learning skills (Mahady et al., 1996). This finding supports Naim's (1995) assertion that many teachers reverted to a didactic teaching approach following their completion of the PKG training. In contrast, Treagust and Taylor (1989) reported that teachers participated in the PKG programme utilised student-centred approaches during their observations at various locations. A possible sound explanation to this contradictory evidence is the timing of the observations being made. Treagust and Taylor's (1989) observations reflect the situation during the fully funded phase of the PKG programme, whereas Mahady et al.'s (1996) conclusions represent the situation when the PKG programme had been scaled back considerably to the MGMP model. A review of studies related to practical activities in physics classrooms in the Indonesian school context showed positive outcomes such as improved process skills, increased student achievement, and improvement in student practical skills (Thair & Treagust, 1999).

Recently, the *MGMP* programme has been conducted in Kalimantan Selatan. The programme is semi self-funded by the schools and is minor subsidised by the local government. The schools provided incentive to the teachers who participated in the programme, and covered their travel costs from school to the centre; the government organised the programme, supplied consumable material and provided the key teachers to run the programme. Through the programme, teachers are involved in discussion about teaching content, make lesson plans, and share their day-to-day teaching experiences. The programme was run by an appointed key teacher and supervised by the superintendent in charge (Effendy, 2003).

2.2.3 Research on science education in Indonesia

Hidayat, as cited in Yager (1993), reported that no formal study has been made of science education in Indonesia. In contrast, however, Thair (1996) has synthesised a number of studies on science education in the Indonesian school context that were conducted during the 1988-1995 period. These studies investigated various aspects of science education and were conducted at both lower and upper secondary schools across the country. A review of science education studies in Indonesian schools based on the focus of this investigation is presented in this section.

Studies that focused on practical activities in the science classroom have become a concern for several authors. Investigations in physics classrooms confirmed that students' achievement in physics could be increased by using practical-based approaches to teaching (Mertajaya, 1993; Supriyono, 1991). Mertajaya (1993) conducted his study in Bali, whereas Supriyono (1991) did his research in Kalimantan Timur. Similarly, research in chemistry classrooms in three different provinces also supported these findings in which student-centred learning approaches using practical activities increased students' cognitive achievement in chemistry (Hastuti, 1993; Pulukadang, 1995; Wongkar, 1989). Researches in biology classrooms also informed similar findings (Adnyana, 1989, 1991; Naim, 1995). Moreover, Thair and Treagust (1997) asserted that in biology classrooms, practical activities were found to be more effective in enhancing student achievement and skills than traditional didactic classroom approaches.

Although the use of practical activities becomes apparent as a good teaching approach, however, there are limitations that impede teachers in many schools to employ it (Irianto, 1988, 1989; Irianto & Treagust, 1989). For example, Esomar (1988) and Irianto (1989) identified several factors that discourage science teachers to employ practical activities during teaching and learning processes. These factors include inadequate equipment, lack of preparation time and inadequate teachers' background knowledge in the subject area. In addition, Naim (1995) also suggested that a curriculum overloaded with content and poor students' achievement in the national examination may become factors that prevent teachers from using practical-based teaching approaches and reverting to traditional approach. Naim (1995) argued that a content overloaded curriculum is not conducive to time-consuming practical activities and poor national examination results encouraged teachers to come back to the traditional approach such as lecturing.

With regard to teaching strategies and students' involvement, Wanti (1993) reported that students' involvement during the learning processes increased when the teacher used a variety of teaching strategies. The teaching strategies observed included the use of open-ended questions and questions at higher cognitive levels, the use of whole class discussion sessions, group discussion sessions and laboratory activities. Wahyudi and Treagust (2001) also reported that the use of a group writing task in chemistry classroom improved students' participation during their learning.

This review identified that, while most of these research have been conducted across the country, very few studies have been conducted in Kalimantan Selatan province, except that of Wahyudi and Treagust (2001). Thus there is ample room to do research that explore aspects of science education practice in the province of Kalimantan Selatan.

2.3 The levels of curriculum representations

According to Jackson (1992), curriculum probably is the most elusive among the many abstract concepts in the educational literature. Similarly, Goodlad (1994) stated that as a field of study, it is very difficult and tantalizing to know exactly what curriculum is. Therefore, the literature rarely agrees on the definition of curriculum. Nevertheless, a definition of curriculum that is generic but informative has been suggested by Walker (1990) who refers the curriculum to the content and purpose of an educational programme together with their organization. The difficulty in defining and using the term curriculum appropriately has led the researcher to categorise curriculum into its level of representation.

In order to enable curriculum to be studied more systematically, educational researchers tried to dissect the term of curriculum into several levels of representation. Print (1993) segregated curriculum representation into three levels that included the intended curriculum, which is the basic philosophy of the curriculum as elaborated in a curriculum document, the implemented curriculum, which is the actual instructional process in the classroom and is often referred to as the curriculum-in-action, and the achieved curriculum, which is the resulting learning outcomes of the students. Similarly, Goodlad (1994) differentiated between various curriculum interpretations of curricular activities into three layers: at the system level or the macro level where policies are created (the design and development activities); at the institutional or school level where the policies are implemented (the implementation activity); and at the classroom or micro level where the curriculum is achieved (the evaluation activity). As explained in chapter 1, Akker (1998) has also categorised curriculum into several levels of representation. His typology begins with the designers' intentions (the ideal curriculum), then proceeds to the written forms (the formal curriculum), followed by the interpretation made by the users (the perceived curriculum), the way it is actualised in the classroom (the operational curriculum), then looks at the way it is experienced by the learners (the experienced curriculum) and concludes with achievement (the achieved curriculum). These curriculum typologies are useful for analysing the outcomes of curriculum innovation efforts, especially where curriculum reform is directed at lessening the incongruence between the new intended curriculum, the implemented curriculum and current student learning. Too often science education reform has been unsuccessful to affect classroom processes, which indicates the mismatch between the intended and the implemented curriculum (Bekalo & Welford, 2000; Print, 1993).

Klein (1991) elaborates nine essential elements of curriculum, namely, goals, objectives and purposes, content, material and resources, activities, teaching strategies, evaluation, grouping, time and space. Goals reflect the anticipated outcomes of teaching and learning, while objectives and purposes refer to the actual outcomes that teacher and students should achieve. Content refers to those facts and ideas, concepts, beliefs, attitudes and skills with which the students interact as they experience a curriculum through teaching and learning activities. Materials and resources are the objects that teachers use to facilitate the learning process. Activities refer to what students do when they engage in the process of learning. Furthermore, teaching strategies are defined as the role taken by the teacher in order to facilitate students' learning. Procedures for determining what the students are learning and have learned are forms of evaluation. Grouping refers to the processes and the results of determining the cluster of students that facilitate the learning processes. Time is a fundamental aspect of the curriculum when allocated on a formal or informal basis. Finally, space refers to the design and use of the physical learning environment such as the school, classroom or laboratory. It is noteworthy to consider these curriculum elements when one had to analyse curriculum documents. In this research, most of these curriculum elements are addressed in chapter 5 with regard to the analysis of the intended science curriculum in Indonesian lower secondary school.

The intended curriculum may be defined as the outcomes that curriculum developers wish learners to achieve as a result of participating in the curriculum practices. Curriculum intent includes the various forms of aims, goals and objectives found in curriculum documents, which altogether provide directions that can be achieved by learners as they interact with the curriculum (Print, 1993). Aims are broadly phrased statements of curriculum intent developed at the system level. Goals are precisely worded statements of curriculum intent that are derived from aims, which are usually phrased in non-technical language and directed towards students' achievement by emphasising content and skills. Furthermore, objectives are specific statements of curriculum intent, which refer to what students should learn through interaction with the curriculum. Usually objectives are expressed in terms of changed learners behaviour; however, these also may be seen as working statements whereby educational institutions translate goals into specific statements of educational intent (Print, 1993).

To investigate teacher perceptions of the curriculum (perceived curriculum), the educational researcher employs various strategies, for example, a questionnaire survey and interviews. Iriansyah and Wahyudi (In press) used the questionnaire survey in investigating Indonesian secondary school teachers' perceptions of the formal curriculum. They found that Indonesian secondary school teachers perceived the curriculum documents inconsistently. The teachers claimed they understood the curriculum documents, however, the results of a cognitive test on the curriculum content rejected this claim. Furthermore, an interview technique that employs metaphors has been used to scrutinise student teachers' perceptions towards the intended science curriculum (France & Gilbert, 2000); this study showed the power of metaphor in expressing teacher understanding of the intended curriculum.

2.4 The curriculum implementation

The success of a curriculum's implementation must reflect the willingness and ability of the developers to accommodate changes to the intent, content, learning activities and evaluation procedures to suit the new needs of the country. A curriculum can be implemented successfully if a strategy is developed to implement, present and support the process at a systemic level. In most cases, some modifications are required to the implemented curriculum. These modifications consider differing local contextual factors such as the nature of the students, differing school resources and teachers, community support and parental input (Print, 1993).

In addition, Bybee and Ben-Zvi (1998) asserted that when a new curriculum is being implemented in any country, the curriculum must be complete, accurate and provide the appropriate resources, support for teachers, adequate material and equipment. Although it is a part of the curriculum planner's responsibility for the full implementation of the science curriculum, it is the teacher who has responsibility for the final translation of a curriculum into actual classroom practices. Inevitably, teachers often make decisions on unique aspects in the classroom that include students' needs, the students' conceptual levels and development stages and the availability of resources. These decisions are influenced by teachers' background science such as beliefs about teaching science, and time available for instruction. Furthermore, Bybee and Ben-Zvi (1998) emphasized that in order to be effective implementers of curricula, teachers must understand the science content and pedagogy, the expected outcomes and the assessment strategies.

Akker (1998) identified four areas of science curriculum implementation problems: a lack of teacher's knowledge in subject content matter, lack of teacher's confidence in instructing subject matter, changing roles of the learners and teacher, and assessment. On the other hand, Feiter, Macfarlane, Stoll, and Akker (1998) stated that successful implementation of curriculum could be achieved by providing intensive support scenarios that included the use of well-tried, contextually relevant, preferably low-cost and locally available materials. Issues that related to the factors affecting teachers in implementing science curriculum are reviewed in the following sections.

2.4.1 Teachers' beliefs, teachers' content knowledge and teaching practices

During the last two decades, research on the teaching of mathematics and science has increased attention on the association between teachers' beliefs and their teaching practices. Although some findings (Kesler, 1985; Parmelee, 1992; Zoest, Jones, & Thornton, 1994) show that teachers' actions are not always consistent with their stated beliefs, other research indicates that teachers' beliefs play important roles in the teaching and learning processes. Brophy and Good (1986) confirmed that teachers' belief systems influence their teaching decisions. Furthermore, Cronin-Jones (1991) identified four major categories of teachers' beliefs that strongly influenced the science curriculum implementation process. These are beliefs about how students learn, beliefs about a teacher's role in the classroom, beliefs regarding the ability level of students in a particular age group, and beliefs about the relative importance of content topics. In addition, Varella (1997) found that there is a significant relationship between teachers' beliefs and their teaching practices in constructivist science teaching. King (2002) maintained that the beliefs of science teachers are key to decisions that teachers make in the classroom. In a study of secondary school chemistry teachers, Farrow (1999) confirmed that there was a correspondence between the core beliefs of teachers and their teaching practices. Similarly, Prawat (1989) stated that teachers who have the same level of conceptual understanding or content knowledge might teach differently depending upon their educational beliefs such as their belief about teaching and learning.

According to Ernest (1989), teachers' beliefs consist of three components, namely, teachers' view of the nature of subject matter, the nature of subject matter teaching, and the process of students' learning of subject matter. The two last components are considered specifically in this study, where teacher beliefs of the nature of subject matter teaching are referred to as teachers' beliefs about their roles in teaching practice; and beliefs about the process of students' learning are framed in the teachers' views of students' roles during teaching and learning activities.

Another focus of research in education is the connection between teachers' content knowledge and instructional practices. Research on a variety of subject areas has provided evidence that teachers' content knowledge has an effect on both the content and the processes of their teaching instruction, thus influencing both what and how they teach (Haimes, 1996; Lloyd & Wilson, 1998; McGraw, 1987; Shulman, 1986a, 1986b, 1987).

2.4.2 Exemplary teaching practices

Rarely do teachers observe good teaching in the classrooms of others, usually because they are too busy in their own classrooms. This condition is common in both developed and developing countries. In fact, it is worthwhile for teachers to learn from others who have established good teaching practices. Research in science education focusing on the behaviour of exemplary teachers assumes that descriptions and analysis of how these teachers perform may improve science teaching (Waldrip & Fisher, 2002). Nevertheless, exemplary teaching is difficult to define and research on effective teaching has identified a finite set of elements in order to reduce effective or exemplary teaching to something that can be observed, measured and quantified for calculating good teaching (Ellsworth & Monahan, 1998). Research in the 1970s documented the characteristics of effective teaching that included the teacher's communication skills and performance (Flanders, 1970; Galloway, 1970) as well as the teacher's content knowledge and personality (Medley, 1979).

More recently, researchers such as Tobin and Fraser (1988) and Fraser and Tobin (1989) observed that exemplary science teachers employ effective managerial strategies, encourage student participation in learning activities, monitor students' understanding of content to be learned, and maintain a favourable learning environment. Using a meta-analysis, Porter & Brophy (1988) identified some of the factors contributing to exemplary teaching that included being clear about instructional goals, being knowledgeable about content and concomitant effective teaching strategies, using existing instructional material well, accepting responsibility for student learning outcomes, and providing students with opportunities to engage in higher level cognitive construction.

Treagust's (1987, 1991) studies of two exemplary biology teachers showed a similar trend identified by five assertions. The assertions were that the exemplary teachers demonstrated successful classroom management that resulted in smooth transitions between one class structure and another; promoted learning from students of different ability levels; controlled the learning environment to motivate students to engage in academic work; created academic work with a high level of cognitive demand; and employed the laboratory in an inquiry mode and as an integral part of the lesson. Studies with high school chemistry teachers (Garnett, 1987) and physics teachers (Deacon, 1987) also revealed similar features of good teaching practices in the sense of maintaining both classroom management and a positive learning environment. In addition, Garnett (1987) added that monitoring students' understanding of concepts is a part of exemplary teacher behaviour. In a similar view, Pittman (2000) documented several behaviour patterns of exemplary science teachers that included organising their classes for collaborative and individual responsibility, planning according to the needs and interests of the students, encouraging scientific discourse and decision making among the students, facilitating the scientific inquiry process with hands-on, higher-order activities, and using alternative assessment strategies.

In comparing the practice of master or exemplary teachers and that of the novice teachers, Reap (2000) claimed that the most significant difference was the use of questioning and discussion. Exemplary teachers tended to use diverse questioning techniques and guided students in discussion of their findings while novice teachers tended to use more rote response questions and controlled the discussion. A more comprehensive study of the beliefs and practices of teachers confirmed that productive schools are characterised by having a tradition of exemplary teachers.

Akker (1998) describes these productive schools as having a high level of student involvement; more student initiative in the learning processes; a lot of group work and interactions, teaching involving stimulation and facilitation, numerous emphases on process skills for exploration, and attitudinal goals such as curiosity and perseverance.

In research using a case study approach that focused on exemplary teaching practices in an Indonesian school context, Mu'id and Wallace (1994) documented four features that contributed to exemplary teaching practices in secondary Biology classrooms. The teachers used various strategies to encourage the development of students' process skills, used creative ways to modify activities to suit their teaching environment, employed management strategies which made possible students' involvement in activities, and maximised their use of available teaching time.

2.4.3 Effective teaching and classroom learning environment

Research in science education that focuses on students' conceptual change asserts that effective teaching approaches which contribute to students' conceptual change require a learning environment that is sensitive to learners' needs, feelings, and ideas (Scott, Asoko, & Driver, 1992). White (1989) study also stated that the context in which learning takes place must be supportive and comfortable and free from any form of repression. Assertions from robust learning environment studies support those claims. For example, studies on classroom learning environments found that there are four characteristics of the learning environment that promote cognitive and affective outcomes as a requirement of effective learning (Fraser, 1994; Fraser, Rennie, & Tobin, 1990; Fraser & Tobin, 1991). Those characteristics are high levels of personalisation, involvement, order and organisation, and task orientation. These findings reveal that teachers should give more opportunities for students to interact with each other and care about students' welfare and social growth (*Personalisation*); encourage students to participate in the learning process (*Involvement*); establish and maintain a well-organised class wherein students are behaving in an orderly manner (*Order and Organisation*); and provide students with clear tasks (*Task Orientation*). Moreover, these findings parallel the assertions of Haertel, Walberg, & Haertel's (1981) meta-analysis of 12 studies of learning environment-students' outcome relationships that involved 17,805 students in four nations. They argued that students' effective learning is positively related to the levels of cohesiveness, satisfaction, and task orientation in the classroom, and negatively related to levels of friction and disorganisation. Therefore, it is suggested, for the sake of students' effective learning, that a teacher must establish such a classroom learning environment within which students feel confident and able to express and discuss their opinions freely. Consequently, educational research such as this study also investigates the classroom learning environment as one focus of the research.

One of the robust traditions in past learning environment studies is the investigation of association between students' cognitive and affective learning outcomes and their perceptions of the classroom psychosocial environments. Hattie (1987) found that in general students who perceived their learning environment positively outperformed those who perceived their classroom environment less positively. Furthermore, by using students' perceptions of their classroom psychosocial environment, it is possible to predict both affective and cognitive outcomes (Fisher & Fraser, 1982; Rentoul & Fraser, 1980). A study by Fisher and Fraser (1983), which employed both actual and preferred forms of questionnaires, indicated that actual-preferred congruence (person-environment fit) could be a determinant factor in predicting students' achievement. They suggested that changing the actual classroom environment in ways that bring it closer to that desired by the class might augment class achievement of certain outcomes.

With regard to Walberg (1981) multi-factor psychological model of educational productivity, the classroom psychosocial environment plays a significant role in determining the learning process. This model states that learning is a function of student age, ability and motivation, quality and quantity of instruction and of the psychosocial environments of the home, the classroom, the peer group and the mass media. Empirical probes of this educational productivity model asserted that among other factors, the classroom and school environment was claimed to be a strong predictor of both achievement and attitude outcomes, even when a comprehensive set of other factors was held constant (Fraser, 1998a, 1998b).

According to Walberg (1981) model of educational productivity, efforts to improve student's learning will be more successful by raising the factors that currently inhibit learning or are being ignored, rather than enhancing those that already are high (Fraser, 1998a, 1998b). Putting this argument into the Indonesian educational context, in which such efforts had been devoted mainly to instruction, improving other factors such as the psychosocial learning environment may improve students' learning. Thus, a study in this area is needed to collect evidence to show all stakeholders that the educational learning environment should not be neglected.

2.5 Classroom learning environment and school working environment

Research studies in education that focus on classrooms and school-level learning environments have escalated and produced promising findings that lead to the enhancement of the teaching and learning process. A great deal of progress has involved the conceptualisation, assessment and use of learning environments (Fraser, 1989). This research area has captured all school levels from primary to university, urban and rural, cross-national studies beyond non-Western countries, actual and preferred forms, and comparisons between teachers' and students' perceptions of their classroom learning environments, and has employed a number of salient and robust instruments that have been validated and revalidated (Fraser, 1998a, 1998b). Furthermore, this research area has also attracted researchers to conduct their research in non-Western countries, for example, Malaysia, Brunei, Korea, Taiwan, Nigeria, Japan and Papua New Guinea. Thus, there has been an acceptance of the learning environment as a significant variable in predicting the success of educational practice. It seems that the evaluation of the learning environment is as important as evaluating other student performances and outcomes.

While research in this area in Western countries and in some developing countries has grown up rapidly, this did not occur in Indonesia. Over nearly four decades, there have been very few studies in Indonesian education devoted to learning environment issues. Therefore, a review of learning environment research in Indonesia is needed in order to describe the present condition and indicate possible future directions for research in this area. Consequently, this section is devoted to reviewing the literature related to classroom and school level learning environments that occurred in the Indonesian educational context. To provide the background, a historical perspective of classroom learning environment is presented in Section 2.5.1 followed by the instrument for measuring classroom that is presented in Sections 2.5.2. Sections 2.5.3 and 2.5.4 deal with background of school learning environment study and the instruments used, respectively. Finally, past studies of classroom and school level learning environments in Indonesia are reviewed in Section 2.5.5.

2.5.1 Historical perspective of classroom learning environment studies

Reviews of learning environment studies have been provided conveniently and comprehensively, for example, in Fraser's (Fraser, 1994, 1998a, 1998b) studies. Those reviews dissect the development of learning environment research from the beginning to the recent trend of learning environment research. Concisely, this section is concerned with the theoretical development of learning environment studies.

A cornerstone of learning environment research can be traced back to 1936 when Kurt Lewin claimed that both the environment and its interactions with personal characteristics of the individual determine human behaviour (Lewin, 1936). His formula, $B = f\ (P, E)$, has guided research strategies in which behaviour (B) is concerned to be a function of the person (P) and of the environment (E). Two years later, Murray's (1938) study adopted Lewin's approach in studying human environment and proposed a need-press model, which permits the analogous representation of person and environment in common terms. He employed *personal needs* that refer to motivational, personality characteristic representing tendencies to move in the direction of certain goal, and *environmental press* that provides an external situational counterpart, which supports or frustrates the expression of internalised personality needs. Furthermore, Murray differentiated *environmental press* into two types, namely *alpha press*, which refers to the environment as observed by an external observer, and *beta press* that depicts the environment as perceived by milieu inhabitants. Stern, Stein, and Bloom (1956) expanded Murray's distinction of alpha and beta press by differentiating beta press into *private* and *consensual press*. Private beta press describes each person's view of the environment, and consensual beta press provides a shared view of the environment by a group member. This need-press theory has been popularised and elucidated as underpinning current learning environment studies. Many studies regarding classroom learning environment and its influence on teaching and learning have been established. A review of several studies in this field that related to this study is presented in Section 2.4.3.

2.5.2 Instruments for assessing classroom learning environment

The development and the use of instruments in learning environments studies began in the 1960s in conjunction with the use of learning environment assessment in an evaluation of Harvard Project Physics (Walberg & Anderson, 1968). Subsequently, this area of research has undergone incredible growth, diversification and internationalisation. It is claimed that learning environment study is one of few fields of educational research that has such a rich diversity of valid, economical and widely applicable assessment instruments. Fraser's (1994, 1998a, 1998b) studies provide a comprehensive and convenient review of the development of the use of instruments for assessing classroom and school level environments. Among the existing instruments, there are nine major instruments for measuring classroom learning environment. The nine major classroom environment instruments, namely, *Learning Environment Inventory (LEI), Classroom Environment Scale (CES), Individualised Classroom Environment Questionnaire (ICEQ), My Class Inventory (MCI), College and University Classroom Environment Inventory (CUCEI), Questionnaire on Teacher Interaction (QTI), Science Laboratory Environment Inventory (SLEI), Constructivist Learning Environment Survey (CLES) and What Is Happening In This Class (WIHIC)*, have had much use in studies from primary school to university, and have proven each instrument's validity and reliability. All these instruments capture Moos's three psychosocial dimensions, namely *Relationship Dimensions, Personal Development Dimensions, and System Maintenance and System Change Dimensions* (Moos, 1974), with the exception of the MCI instrument that does not capture the third dimension.

Researchers have used these instruments not only to measure the nature of the classroom learning environment, but also to investigate the association between the environment and other aspects of learning. Although the strongest tradition of research in this area is studying the link between students' outcomes and their learning environment, the focus of the studies has been expanded to such areas as evaluation of curriculum innovation, classroom learning environment improvement, differences between teacher and student perceptions, whether students achieve better in their preferred environment, incorporating educational environment ideas into school psychology, and teacher assessment (Fraser, 1994, 1998a, 1998b).

Within the context of this study, the instrument, namely, What Is Happening In This Class or WIHIC was chosen, modified and translated into the Indonesian language. A more detailed description of the WIHIC is presented in Chapter 3, Section 3.2.2.

2.5.3 Historical perspective of school level learning environment studies

School environment is defined as a set of factors that gives each school a personality, a spirit, a milieu, a culture and an atmosphere (Fisher & Fraser, 1990; Tye, 1974). Over the last three decades, school environment has consistently been identified as one of the main factors that affect the effectiveness of a school (Creemers, Peters, & Reynolds, 1989). In conjunction with curriculum, resources, and leadership, the school environment plays a significant role in creating a school's effectiveness. The better the school environment, the more effective is the school. This notion is confirmed by the findings of various studies. For example, (Fisher & Fraser, 1990) showed that the improvement of school environment could enhance school effectiveness, and in turn provide students with better learning.

Freiberg (1998) claimed that a healthy school climate contributed to effective teaching and learning. The establishment of a favourable school working environment enables all members of the school community to teach and learn at optimum levels. Grift, Houtveen, and Vermeulen (1997) measured instructional climate in 121 Dutch senior secondary schools and showed that student achievement in mathematics was positively influenced by students' enjoyment of mathematics, attitudes towards high grades, appreciation of teachers' efforts, and an orderly instructional climate. Atwool (1999) suggested that a school climate, wherein children have the opportunity to establish meaningful connections within the school environment, is pivotal to enhance student ability to learn, to facilitate appropriate behaviour and has the potential to counteract the impact of difficulties at home. Moreover, Samdal, Wold, and Bronis (1999) have also identified three aspects of the psychosocial school setting as predictors of students' perception of their academic achievement. These were students' satisfaction with school, students' feeling of appropriate teacher expectation, and a good relationship with their fellow students. They suggested that interventions that enhance the students' satisfaction with school were likely to improve their achievement as well. Hoy and Hannum (1997) claimed that school environment with better teacher affiliation, resource support, academic expectation, and institutional integrity promoted better student achievement. Furthermore, Sweetland and Hoy (2000) indicated that school climate which had strong teacher empowerment crucial for school effectiveness, thus affecting student achievement.

Past research has also provided evidence of the association between school environment and student satisfaction and achievement. Generally, student achievement and satisfaction were greater in the schools that have better student support. It is asserted that more effective and satisfying student learning is significantly linked to teachers' friendliness and supportiveness (Griffith, 2000; Hoy, Tarter, & Bliss, 1990; Moos, 1979; Stockard & Mayberry, 1992). In turn, student satisfaction lead to positive attitudes towards subject matter. Papanastasiou (2002) found that school climate had a direct and indirect effect on students' attitude towards science.

Comparative studies in this field have been conducted between primary and secondary schools and between government and Catholic schools. Studies that involved primary and secondary teachers such as Fisher and Fraser (1991) and teachers of government and catholic schools such as Dorman and Fraser (1996) revealed the differences in teachers' perceptions of their working environments. For example, primary school teachers tended to view their working environments more favourable than did high school teachers, and Catholic school teachers perceived their schoolsas having greater empowerment and higher mission consensus than did government school teachers. Previously, Fisher, Docker, and Fraser's (1986) study, which employed the Working Environment Scale (WES), provided a brief review of the development of and the use of instruments for assessing school level environments. Fisher et al. also examined and compared the perceptions of the school level environment between primary teachers and high schools teachers and asserted that primary teachers held their working environment more positively than did high school teachers.

2.5.4 Instruments for assessing school level learning environment

The development of instruments to describe the organisational working environments can be traced back to the late 1950s when Pace and Stern (1958) developed the College Characteristics Index (CCI) to measure students' or teachers' perceptions of 30 environmental characteristics. Based on this instrument, Stern (1970) constructed the High School Characteristics Index (HSCI) to measure high school climate. Among the existing instruments, perhaps the most widely used instruments for measuring an organisational working environment were the Organizational Climate Description Questionnaire (OCDQ) (Halpin & Croft, 1963) and the Work Environment Scale (WES) (Moos, 1974). Later, these two instruments were used as a basis for the development of new instruments, namely, School Level Environment Questionnaire (SLEQ) (Rentoul & Fraser, 1983) and School Organisational Climate Questionnaire (SCOQ) (Giddings & Dellar, 1990) that are more suitable to a secondary school environment.

In the context of this study, the School Level Environment Questionnaire or SLEQ (Rentoul & Fraser, 1983) was selected and translated into the Indonesian language. The description of this questionnaire is available in Chapter 3, Section 3.2.2.

2.5.5 Status of learning environment studies in Indonesia

Despite the fact that learning environment research has been implemented since 1960 and become a salient research area in education around the world, few studies have been conducted in Indonesia. The development of research in the learning environment area in Indonesia during the last four decades displays an apparent lack of interest by Indonesian educators to conduct their research in this area. This claim is supported by the shortage of publications of learning environment research in Indonesia until the year 2000.

Mangindaan, Sembiring, and Livingstone (1978) study might be considered as the early icon of the study of learning environment in Indonesia. They included classroom climate as a factor that determines school achievement and found as a part of their large studies, namely *National assessment of the quality of Indonesian Education*, that classroom climate was closely linked with total school achievement, playing such an important role in supporting students' learning as depicted in students' outcomes. At the same time, Paige (1978) finished his study that examined relationships among classroom learning environment and two outcomes, namely, cognitive achievement and individual modernity in East Java. These two studies revealed that classroom learning environment was an important aspect of learning that should be taken into account.

However, no further study was conducted until 1982 when a group of researchers started to examine the classroom learning environment seriously (Fraser, Pearse, & Azmi, 1982). Rideng and Schibeci's (1984) study and Schibeci, Rideng, and Fraser's (1987) investigation on classroom learning environment filled the paucity of research during this decade. Moreover, the assertions of Adams and Boediono's (1992) study of education in Indonesia that two of the many characteristics of effective teaching or instruction are an orderly, safe, healthy environment and recognition of the individuality of each student in the classroom, meant that the psychosocial learning environment plays an important role in effective learning. However, this notion has never been taken into consideration during the programme for education development. This claim is supported by the fact that Indonesian Education Development Programmes, which commenced in the 1970s, for example, the PKG programme (*Peningkatan Kerja Guru* means Strengthening the Work of Teachers), have focused mainly on enhancing teacher skills such as teaching strategies as indicated in Thair's (1996) study. None of the programmes attempted to take the learning environment into account.

During the last four decades, there were about seven studies on classroom learning environment research in the Indonesian educational setting. The scarcity of publications and studies of learning environments in Indonesia during the late 1970s to 1990s periods indicates the unfavourable status of learning environment research in Indonesian education. For this reason, it can be said that the learning environment is a neglected research area in Indonesian educational research.

This assertion, however, becomes tentative when recent learning environment studies in Indonesia are observed. During the last five years, several studies that focused on this area have been conducted. One unpublished doctoral thesis had been written (Soeharto, 1998); and several papers concerning learning environment in Indonesia have been presented at international conferences, for example studies by Irianto and Treagust (2001), Margianti and Fraser (2000), Margianti, Fraser, and Aldridge (2001), Wahyudi and Fisher (2003), Wahyudi and Treagust (2003), Soerjaningsih, Fraser, and Aldridge (2001). This evidence shows that despite its status as a neglected research area in the past, learning environment study now is gaining importance in the Indonesian educational setting.

The fact that learning environment is very important for students' effective learning and that learning environment research in Indonesia is still in its infancy suggests that further studies in this area are strongly recommended. The previous studies reviewed in this section should be considered as points of departure for future research. As suggested, there are plenty of directions and rooms to conduct learning environment studies in Indonesia. For example, it will be noteworthy for the researcher to focus the study not only on measuring the nature of the classroom learning environment, but also on the relationship between learning environments and educational innovation (Dryden & Fraser, 1998; Fraser, 1979; Raviv, Raviv, & Reisel, 1993), on improving classroom and school level environment, and on the transition between primary and secondary schooling. Consequently, as explained in chapter 1, this present study has integrated the classroom learning environment and school working environment in the investigation of science educational practices in lower secondary schools.

2.6 Summary of the chapter

A review of literature concerning the past and present science education in the Indonesian school context was addressed in Section 2.2. Issues such as the development of the science curriculum since the post-colonial era, the past teaching and learning of science practices, and science education reform via the PKG programme were presented. The related literature showed that the school science curriculum in Indonesia has changed periodically every eight to ten years and that teachers always faced difficulty in responding to these changes. As a result of these difficulties, the government has conducted several programmes to help the teachers. The evolution of the programmes from a fully funded PKG to semi self-funded MGMP occurred due to less funds being available. The MGMP is now the only teacher development programme that is run to accommodate teachers' need to cope with changes. Moreover, it is shown that many formal studies have conducted in science classroom across country; however, none was conducted in Kalimantan Selatan. Therefore, this study is relevant to fill this void.

Section 2.3 provided a review of literature that related to the level of curriculum representation. The results of the studies being examined show that often science education reform has been unsuccessful in changing classroom processes due primarily to the mismatch between the intended and the implemented curriculum. The reviewed literature emphasised the need for educational researchers to differentiate levels of curriculum representation to achieve a successful curriculum evaluation. Because this study examined educational practices in science classrooms that focused on the implementation of the science curriculum, this study takes that suggestion by investigating the science curriculum at four levels, as explained in Chapter 1, Section 1.5.

The review of literature that focused on factors that influence the shortfall and successful curriculum implementation was discussed in Section 2.4. The results of the review indicated those aspects that contribute to teaching and learning in classrooms. These factors included school resources and teachers' background such as beliefs, content knowledge and pedagogical skills. The results of the studies examined in this review are relevant because this study also investigated teaching and learning processes as curriculum implementation. The research in this thesis used these findings as points of departure and the basis for data analysis.

Finally, Section 2.5 provided a review of research of classroom and school level learning environments. The results of the literature reviews showed that both classroom and school level learning environments are essential factors that influence students' outcomes, and as useful tools in examining educational programmes. The results also indicated the paucity of research in this area in Indonesian educational contexts, with no study in Kalimantan Selatan examining the classroom and school level environment. Accordingly, it is significant to integrate the investigation of classroom and school level learning environment in this study.

This chapter provided the contextual background and a theoretical basis for carrying out the present study. Chapter 3 describes the methodology and research procedures used in this research.

Chapter 3. Research Methodology

3.1 Introduction

As mentioned in chapter 1, the main aim of this study was to investigate the educational practices and learning outcomes of science classrooms in rural and urban lower secondary schools of Kalimantan Selatan, Indonesia. The focus of the study was the curriculum implementation and its association with the existing working and learning environment. This study was directed by six research questions as described in Section 1.4 and involved two phases of data collection, which employed two different methodologies. At the first stage, questionnaire surveys were used to gather students' and teachers' perceptions of their classrooms and working environment, respectively. The results that provided a glance of insiders' (students and teachers) views of their schools environments were then followed by in-depth investigations of teaching and learning science processes at the willing and selected schools, using a multiple site case study as the method. For the sake of simplicity, a summary of the research methods that relate each research question with the research procedures is provided in Table 3.1.

The purpose of this chapter is to describe the research methodologies used in the study. Section 3.2 explains the selection of methodology used at the first stage of data collection that deals with the first and second research questions. Section 3.3 describes a choice of methodology, namely a multiple sites case study, to answer the remaining four research questions. Section 3.4 describes briefly the ethical considerations taken in this study. Finally, Section 3.5 provides a summary of this chapter.

Table 3. 1 Summary of Research Questions and Methodology

Research Question	Data Type	Instrument Developed	Sample(s)	Data Collection Strategy	Internal Validity	Data Analysis
1 How do students in rural and urban lower secondary schools perceive their classroom learning environments?	Quantitative & Qualitative	Questionnaire & Classroom observation	Students; Classroom teacher	Questionnaire survey and Observation	Statistical test and Long Term Observation	Statistical and Description
2. How do teachers in rural and urban lower secondary schools perceive their school working environments?	Quantitative & Qualitative	Questionnaire and interview protocols	Teachers	Questionnaire survey and Interview	Statistical test and Triangulation	Statistical and Description
3 What is the intended science curriculum that exists in rural and urban lower secondary schools?	Qualitative	N/A	Curriculum documents	Mining documents; Interview	Check-recheck of researcher's judgment of documents	Description
4. How do teachers perceive the intended science curriculum in rural and urban lower secondary schools?	Qualitative	Interview protocols	Teacher, Superintendent,	Interview	Member checking	Description
5. How do teachers implement the existing science curriculum?	Qualitative	Interview protocol and Classroom Observation.	Science teachers	Observation and interview	Member checking	Description
6. What are students' achievements on the science curriculum in those schools?	Quantitative	Questionnaire	Students and Students' score on EBTANAS (nation-wide examination)	Survey and Mining Documents	Statistical test	Statistical and Description

3.2 Choice of methodology for measuring classroom and school learning environment

Three methods are commonly used for measuring classroom and school learning environments. These methods include direct observations by an external observer, case studies, and paper and pencil tests to assess student and teacher perceptions (Fraser, 1998a, 1998b) In this study, a perceptual measure using a paper-and-pencil test was used. This choice is based on the strength of perceptual measures over other methods as outlined in Fraser (1998a, 1998b) and Walberg's (1981) study. First, paper-and-pencil perceptual measures are more economical than the two other techniques. Second, perceptual measures are based on students' experiences over many lessons or teachers' long-term understanding within a work setting, while in other approaches data usually are limited to a very small number of observations by outsiders. Third, perceptual measures involve the pooled judgments of all students in a class or teachers in a school, whereas the other methods typically involve only a single or a few observers. Fourth, students' and teachers' perceptions, as they are the determinant of their behaviours more so than the real situation, can be more important than observed behaviours. Fifth, perceptual measures of classroom environment distinctively have been found to account for considerably more variance in student learning outcomes than have directly-observed variables (Fraser, 1998a; 1998b).

Sections 3.2.1 and 3.2.2 describe the instruments selected, the samples engaged, the procedures of questionnaires administration taken, and the data analysis methods that were employed to answer Research Questions 1 and 2, respectively.

3.2.1 Research Question 1: How do students and teachers in rural and urban lower secondary schools perceive their classroom learning environments?

3.2.1.1 The instrument selected for measuring classroom learning environment

After conducting intensive literature reviews, *What Is Happening In this Classroom* (WIHIC) was chosen to assess students' perception of their classroom environments. The *What Is Happening In this Classroom* (WIHIC) (Aldridge & Fraser, 2000) questionnaire was chosen for three reasons. First, this questionnaire is suitable for secondary schools; second, it has been proven as a robust and reliable questionnaire when used for cross-cultural studies; and third, all statements in this questionnaire are non-threatening (Aldridge & Fraser, 2000; Aldridge, Fraser, & Huang, 1999; Chionh & Fraser, 1998; Fraser, 1998a; Kim, Fisher, & Fraser, 2000).

3.2.1.2 Description of What Is Happening In this Classroom (WIHIC)

The *What Is Happening In this Classroom* (WIHIC) was originally constructed by Fraser, McRobbie, and Fisher (1996) by extracting the most salient scales from the existing questionnaires to bring parsimony to the field of learning environments. Subsequently, this instrument has been used widely in many studies, including cross-cultural studies such as that of Aldridge and Fraser (2000), Aldridge et al. (1999), Chionh and Fraser (1998), Fraser (1998a), Kim et al. (2000), and Riah and Fraser (1998). WIHIC consists of 56 items that are spread equally among seven scales to assess the seven dimensions of the classroom environment. The description of these scales accompanied by examples of an item from each scale is provided in Table 3.2.

Table 3.2 Descriptions of Scales in WIHIC and Representative Items

Scale Name	Scale Description	Example of the item
Student Cohesiveness	Extent to which students know, help, and are supportive of one another	I help other class members who are having trouble with their work
Teacher Support	Extent to which the teacher helps, befriend, trust, and shows interest in students	The teacher considers my feelings
Involvement	Extent to which students have attentive interest, participate in discussion, perform additional work, and enjoy the class	I give my opinion during the class discussions
Investigation	Emphasis on the skill and processes of inquiry and their use in problem solving and investigation	I explain the meaning of statements diagrams, and graphs.
Task Orientation	Extent to which it is important to complete activities planned and to stay on the subject matter	I am ready to start this class on time
Cooperation	Extent to which students cooperate rather than compete with one another on learning tasks	I cooperate with other students when doing assignment work
Equity	Extent to which students are treated equally by the teacher	I receive the same encouragement from the teacher as other students do

3.2.1.3 Development of the Indonesian version of WIHIC

The instrument, namely, *What Is happening In this Class?* (WIHIC) questionnaire (Aldridge et al., 1999; Fraser et al., 1996) was adapted in this research to ensure its suitability for measuring classroom learning environment in the Indonesian educational context. A contextual, rather than textual, translation of the original version of the WIHIC was undertaken. Instead of administering the actual and preferred forms of the WIHIC separately, both forms were integrated so that each question was asked only once and there was provision side-by-side to respond to the actual and preferred versions. The combination of the two forms of the questionnaire was made to reduce the shortcomings of students answering the questionnaire repetitively. It was assumed that, if students were given two similar questionnaires at different times, the later feedback could be somewhat inconsistent with the previous responses. Therefore, a combination of both forms was considered in this instrument development. To ensure that students would be able to differentiate between actual and preferred questionnaire items, specific directions were emphasised on the front page of the questionnaire. Moreover, at the outset of questionnaire administration, students also were provided with oral explanations by the researcher.

Because the original instrument was designed for Western students, with all statements in English, careful translation and back translation as suggested by Brislin (1970, 1980) were carried out. After translation into Indonesian, an independent person who is fluent in both English and Indonesian conducted a back translation into Indonesian to investigate whether or not the translation had captured the original meaning.

Prior to the main data collection, a pilot study that involved 212 Grade 9 students and their teachers was conducted to determine suitability and readability of the questionnaire. The pilot study generally revealed that the questionnaire had good reliability and discriminant validity. The Cronbach alpha reliability coefficient was relatively high for all scales, with a minimum value of 0.77 for the Teacher Support and Involvement scales, and with a value of more than 0.80 for other scales of the actual form. Those values were even higher for the preferred form. These results suggest the trustworthiness of the Indonesian version of modified WIHIC questionnaire in measuring this group of students' perceptions of their science classroom learning environment. Furthermore, the mean correlation of a scale with the other scales, which measures each scale's discriminant validity, varied from 0.41 to 0.51, indicating that each scale measured a reasonably distinct aspect of the classroom learning environment, although with a degree of overlap with other scales. Regarding the item wording, interviews were conducted with students to ensure that the Indonesian version was clear and understandable. Students considered the questionnaire to be simple, clear and non-threatening. A minor explanation was requested of the meaning of the word 'eksperimen/percobaan', which is derived from the word 'experiment'. Taken as a whole, the pilot study results suggested that the questionnaire was suitable to be used for the main data collection.

The Indonesian version of WIHIC had seven scales with eight items per scale. All items were scored on a five-point frequency scale with Almost Never representing the most negative perception and Almost Always representing the most positive perception. The original version of WIHIC, the Indonesian version of WIHIC and back translation are available in Appendices A, B and C.

3.2.1.4 The Samples involved in the administration of the Indonesian version of WIHIC

The assessment of the classroom learning environments was purposively focused on a small population from which a sample of schools and students was drawn. A multistage sampling or cluster sampling method (Haber, 1994) was employed that initially included three out of ten districts in Kalimantan Selatan province. Second, schools in these selected districts were categorised into rural and urban. In so doing, a consultation with the Ministry of National Education of Kalimantan Selatan was sought, resulting in a total of 16 schools from these selected districts. Finally, Year 9 classes at each school were randomly selected to be included in this study. As a result, the samples involved in the WIHIC administration included the willing and chosen participants of 1188 students of 36 classes and their science teachers in 16 lower secondary schools in urban, and rural areas of Kalimantan Selatan, Indonesia.

3.2.1.5 Procedures for administration of the Indonesian version of WIHIC

Before administering the questionnaires, formal permission from both the Ministry of National Education (MNE) of Kalimantan Selatan representative and the principals of the schools involved was sought and obtained. The procedures for the Indonesian version of WIHIC questionnaire administration are described in this section, while those of the Indonesian version of SLEQ is described in Section 3.2.2.5.

After a formal meeting with the principals, the researcher was introduced to the science teachers whose classes were chosen in this study. After explaining the purpose of his visit, the researcher together with the science teachers went to the assigned classes to administer the Indonesian version of WIHIC. An outline of the procedures undertaken by the researcher in administering the Indonesian version of WIHIC is as follows:

1. The science teacher introduced the researcher to the students and explained the purpose of his visit and his study.
2. Given the opportunity by the science teacher, the researcher explained the students about the nature of the questionnaire and the instructions, and explained how it should be answered.
3. The researcher encouraged students to ask him for explanation if they were unsure while answering the questionnaire.
4. The researcher and the science teacher distributed the copies of questionnaire and instructed students to begin answering it. While the students responding the questionnaire, the science teacher was given the same questionnaire yet in the 'teacher format'.
5. The researcher collected the copies of questionnaire from the students and the teacher at the end of the session.

These procedures were adhered to very closely for all 36 classes. On the whole, the administration of the questionnaire proceeded smoothly, all students had time to complete the questionnaire, and very few students had any queries about the items.

3.2.1.6 Data analysis for the Indonesian version of WIHIC

Data analysis methods for the Indonesian version of WIHIC questionnaire included the validation of the questionnaire and descriptive analysis for each scale in the questionnaire. The method of validation of the Indonesian WIHIC is outlined in Section 3.2.1.6.1 while the descriptive analysis method is briefly described in Section 3.2.1.6.2

3.2.1.6.1 Validation of the Indonesian version of WIHIC

The issues of instrument validity included factor structure of the questionnaire, scale internal consistency reliability, and the ability of the questionnaire to differentiate perceptions between groups. The factor structure analysis calls for an adequate number of respondents; if the number is not sufficient, alternatively a mean correlation as the discriminant validity measure can be employed.

The Statistical Package for Social Science (SPSS) software version 10.0 was used to analyse the Indonesian version of WIHIC regarding its factor structure, scale internal consistency reliability, and ability to differentiate between the perceptions of students in different classrooms. Both factor and item analyses were accomplished.

The establishment of meaningful grouping of items identified by factor loading is important in ascertaining validity with factor analysis (Tabachnick & Fidell, 1996). Generally, a factor loading 0.30 is considered to be the least acceptable item correlation; therefore, items that had factor loadings less than 0.3 were omitted (Stevens, 1992). In this study, a principal component factor analysis with varimax rotation was employed to scrutinize whether all of the items from the seven scales of the Indonesian version of WIHIC formed seven independent measures of the psychosocial learning environment. The results are presented in chapter 4, Section 4.2.1.

When developing a questionnaire, it is essential to establish that each item in a scale assesses a common construct. If this condition is fulfilled, then the scale can be considered as being homogenous or having internal validity. In this study, Cronbach's (1970) alpha coefficient was calculated for each scale as an estimate of the internal consistency reliability. According to McMillan and Schumacher (1993), the acceptable score of Cronbach alpha reliability coefficient for most instruments ranges from 0.70 to 0.90. Yet, these authors suggest that since reliability is essentially a function of the nature of the attribute being examined, assessment of achievement should generally have high reliabilities. On the other hand, measures such as personality may have lower reliabilities. Moreover, high reliabilities are mandated if results are used to make decisions about individuals whereas studies of groups can accept lower reliabilities. It is suggested that in a case of exploratory research, a reliability of 0.50 is acceptable (McMillan & Schumacher, 1993). Considering the nature of this study which was exploratory, therefore this study adopted Cronbach alpha reliability scores of 0.50 as the benchmark.

As further indication of the validity of the instrument, an Analyses of Variance (ANOVA) test (with class membership as the independent variable while seven scales of the Indonesian WIHIC as dependent variables) was conducted to determine the ability of each scale to differentiate between classes. The results together with reliability coefficients for each scale are presented in Chapter 4 Section 4.2.2.

3.2.1.6.2 Descriptive Analysis for the Indonesian version of WIHIC

To describe the classroom learning environment of science classes in Indonesian lower secondary schools, descriptive analyses were calculated based on students and teachers' responses to the Indonesian WIHIC. The average item mean, or the scale mean divided by the number of items in a scale, was used as the basis of comparison between different scales of each instrument. A t-test using either paired samples or independent samples was conducted to investigate the differences between two groups' perceptions of each scale. In this study, comparisons were performed between boys and girls, students and teachers, and rural and urban respondents. The results are presented in Chapter 4, Section 4.3.

3.2.2 Research Question 2: How do teachers in rural and urban lower secondary schools perceive their existing working environments?

3.2.2.1 The instrument selected for measuring school level environment

After conducting intensive literature reviews, *School Level Environment Questionnaire* (SLEQ) (Fisher & Fraser, 1990) was chosen to measure teachers' views of their school environments. The *School Level Environment Questionnaire* (SLEQ) was chosen based on three reasons. First, this questionnaire has been validated and proven as a robust instrument to measure secondary school environments (Fisher & Fraser, 1990). Second, it is relatively simple and easy to administer. The original SLEQ contains 56 items dispersed equally into eight scales. The teacher needs to spend approximately 30 to 45 minutes to complete the questionnaire. In addition, all statements on the SLEQ are non-threatening so that this feature may enhance a teacher's willingness and honesty in answering the questionnaire. Finally, another reason for choosing the SLEQ as the instrument is its extensive used in many studies (Dorman & Fraser, 1996; Fisher & Fraser, 1990, 1991).

3.2.2.2 Description of School Level Environment Questionnaire (SLEQ)

The *School Level Environment Questionnaire* (SLEQ), originally developed by Rentoul and Fraser (1983), was designed to recognise and consider the potential strengths and problems associated with the existing school environment instruments. Consequently, they explored the SLEQ's validity through intensive interviews with teachers, to ensure that dimensions and individual items covered what teachers saw as salient; only material which was specifically relevant to the school was included. Rentoul and Fraser (1983) also attempted to achieve questionnaire economy by keeping to a relatively small number of reliable scales, each containing seven items. In order to capture all aspects of the school environment, the SLEQ covers Moos's (1974) three general categories of dimensions, namely, relationship, personal development and system maintenance and system change. While the original SLEQ only contained seven scales with seven items for each scale, the new version of the questionnaire (Fisher & Fraser, 1990) included an eighth scale, namely Work

Pressure. A description of the scales of the SLEQ used in this study together with sample items is provided in Table 3.3.

Table 3.3 Descriptions of Scales in SLEQ and Representative Items

Scale	Description of Scale	Sample Item
Student Support	There is good rapport between teachers and students, and students behave in a responsible self-disciplined manner.	There are many disruptive, difficult students in the school. (-)
Affiliation	Teachers can obtain assistance, advice and encouragement and are made to feel accepted by colleagues.	I feel that I could rely on my colleagues for assistance if I should need it. (+)
Professional Interest	Teachers discuss professional matters, show interest in their work and seek further professional development.	Teachers frequently discuss teaching methods and strategies with each other. (+)
Staff Freedom	Teachers are free of set rules, guidelines and procedures, and of supervision to ensure rule compliance.	I am often supervised to ensure that I follow directions correctly. (-)
Participatory Decision Making	Teachers have the opportunity to participate in decision-making.	Teachers are frequently asked to participate in decisions concerning administrative policies and procedures. (+)
Innovation	The school is in favour of planned change and experimentation, and fosters classroom openness and individualisation.	Teachers are encouraged to be innovative in this school. (+)
Resource Adequacy	Support personnel, facilities, finance, equipment and resources are suitable and adequate.	The supply of equipment and resources is inadequate. (-)
Work Pressure	The extent to which work pressure dominates the school environment.	Teachers have to work long hours to keep up with the workload. (+)

Items designated (+) are scored by allocating 5, 4, 3, 2, 1, respectively, for the responses Strongly Agree, Agree, Not Sure, Disagree, and Strongly Disagree. Items designated (-) are scored in reverse manner. Omitted or invalid responses are given a score of 3. [Adapted from Fisher and Fraser (1990, p.2)]

3.2.2.3 Development of the Indonesian version of SLEQ

Similarly, the procedures for the development of the Indonesian version of WIHIC were also applied for the Indonesian version of SLEQ. To ensure that the original meaning of the SLEQ was captured in the Indonesian version, Brislin's (1970, 1980) suggestions were followed. First, the researcher translated the English version of the SLEQ into the Indonesian language. Second, this translation was given to an independent person who is fluent in both English and Indonesian to be back translated into English. This back translation was compared to the original version of the SLEQ, to check whether or not the Indonesian version of the SLEQ had captured the original one.

Furthermore, modifications were made in order to ensure the instrument's suitability for measuring school level environment in an Indonesian educational context. Those modifications included combining both actual and preferred forms in one package of questionnaire, and a contextual rather than textual translation and back translation of the original version of SLEQ. The integration of both forms of the questionnaire was made to reduce the bias of teachers answering the questionnaire repetitively. It is assumed that when respondents are given similar questionnaires in different times, the later feedback is commonly inconsistent with the previous. Therefore, integration of both forms was considered in this instrument development.

The final version of the Indonesian SLEQ contains 56 items that were distributed equally among eight scales so that each scale was measured by seven items. All items were scored on a five point Likert scale, in which 1 was the most negative perception representing Strongly Disagree and 5 was the most positive view representing Strongly Agree. Copies of the instruments, the original versions of SLEQ, the Indonesian version of the SLEQ and the back translation of the Indonesian version of SLEQ are provided in Appendices D, E and F.

3.2.2.4 The Samples involved in the administration of the Indonesian version of SLEQ

A multistage sampling or cluster sampling method (Haber, 1994) was employed to select samples involved in the administration of the Indonesian version of the SLEQ. As described in Section 3.2.1.4, a total of 16 schools from urban and rural areas were selected. Therefore, 68 teachers from these 16 schools were randomly selected and asked to respond to the Indonesian version of SLEQ. In addition, 63 science teachers who participated in *Musyawarah Guru Mata Pelajaran IPA SLTP Tahun 2003* (Forum of Science Teacher Meeting for lower secondary school Year 2003) in Kota Banjarmasin were included in the administration of the Indonesian version of SLEQ.

3.2.2.5 Procedures for Administration of the Indonesian version of the SLEQ

The administration of the Indonesian version of SLEQ in the participating schools was conducted after the administration of WIHIC. Mostly, the researcher accompanied by either the principal or vice principal conducted the questionnaire administration. After the researcher explained the purpose of his visit and his study, he distributed the questionnaire to the teachers. Briefly, the researcher described the nature of the questionnaire and the procedures for answering it. Teachers were encouraged to answer the questionnaire honestly since the confidentiality of their responses was assured as indicated in the ethical issued sections. Teachers were given choices either to finish the questionnaire at that time or to answer it later at their convenience. Most teachers preferred to complete the questionnaire in their own time. Therefore, the researcher asked the principals or the vice principals to collect the completed copies of the questionnaire from the teachers and these were picked up on the following day.

The researcher was aware of the typical culture of Indonesian schools as indicated by Irianto (2001) in that teachers tend to be less serious in completing such a questionnaire, unless they believed that it gave real benefits for the school and for themselves. Therefore, the researcher emphasised the benefit of the study for the school at the outset of questionnaire administration, and informally informed the teachers the incentive they would receive after completing the questionnaire. The researcher provided a small amount of money as a direct incentive for the teachers.

This effort was carried out to enhance the teachers' seriousness in completing the questionnaire.

Meanwhile, a workshop, named *Musyawarah Guru Mata Pelajaran IPA SLTP* - a forum for lower secondary school science teachers to exchange their experiences was held by the Ministry of National Education in the district of Kota Banjarmasin. The researcher took advantage of these occasions by asking the superintendent who was in charge of this workshop for permission to administer the questionnaire. The superintendent agreed and even offered himself to help the researcher in administering the questionnaire. Thus, the researcher gave the copies of the questionnaire to the superintendent and explained the purpose of the study, the nature of the questionnaire and the procedures for the administration. Approximately two weeks later, he sent back 63 copies of the completed questionnaire.

3.2.2.6 Data analysis for the Indonesian version of the SLEQ

3.2.2.6.1 Validation of the Indonesian version of the SLEQ

Similar procedures and the same software programme were used to determine the validity of the Indonesian version of the SLEQ. However, due to the small size of the sample, it was inappropriate to conduct factor analysis of the instrument. Instead, mean correlations were calculated to investigate whether the Indonesian version of the SLEQ provided eight independent scales to measure the school working environment. The investigation of the instrument's ability to differentiate teachers' perceptions from different schools was carried out using the ANOVA test with school membership as the independent variable. The internal consistency reliability for each scale was obtained through the calculation of the Cronbach alpha coefficient. The results are presented in Chapter 4, Section 4.4.

3.2.2.6.2 Descriptive analysis for the Indonesian version of SLEQ

To describe the school level environment in Indonesian lower secondary schools, descriptive analyses were presented based on teachers' responses to the Indonesian version of SLEQ. The average item mean, or the scale mean divided by the number of items in a scale, was used as the basis of comparison between different scales of each instrument. A t-test using either paired samples or independent samples was conducted to determine the differences between different groups' perceptions of each scale. In this study, comparisons were performed based on the subjects being taught and on school's locality. The results are presented in Chapter 4, Section 4.5.

3.3 Choice of methodology for studying educational practices

With regard to the remaining four research questions, a case study was chosen as the research design in the second stage of this study. In scholarly circles, case studies are frequently discussed within the context of qualitative research and naturalistic inquiry. Case studies are often referred to interchangeably with ethnography, field study, and participant observation. The underlying philosophical assumptions for these types of qualitative research are similar because each takes place in a natural setting such as a classroom, and strives for a more holistic interpretation of the event or situation under study.

As a research method, a case study has been defined and used by various scholars from many disciplines. In recent years, there has been an increased use of case study methodology in education that has resulted in case studies being considered as legitimate research methods in evaluation (Yin, 1997). In the field of education, extensive works using the case study method have been done, for example, by Yin (1984) and Merriam (1988) whose works informed the method chosen in the second stage of this study. In this study, a multiple site case study method refers to a case study method that was applied in several places or schools. The rationale for choosing a case study as a method in the second stage is elaborated in the following paragraphs.

This research design in the second stage of the study parallels Merriam's (1988) definition of case study as an examination process of a specific phenomenon such as a programme, an event, a person, a process, an institution, or a social group, in which the focus of this study is the process of curriculum implementation. This research design also fits into Yin's (1984) definitions of a case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used. This study assumed that science curriculum implementation is a contemporary phenomenon within classrooms in both rural and urban lower secondary schools. The phenomenon, science curriculum implementation, was subject to many and various influences such as the teachers' background, the availability of resources in each school, the schools' locality, and the learning environments. The boundary between science curriculum implementation (phenomenon) and the classrooms (context) was often unclear because the combination of phenomenon (science curriculum implementation) and context (science classroom) were unique to each school. Finally, this study called for multiple sources of evidence in order to answer the last four research questions. Case studies are likely to be much more convincing and accurate if they are based on several different sources of information, following a corroborating mode. To ensure that a case study was an appropriate method for this study, Merriam's (1988) and Yin's (1984) suggestions were considered, namely, the type of research question being posed, the extent of control a researcher has over actual behavioural events, and the desired end product.

The second stage of the study involved four research questions to evaluate educational practices, particularly the science curriculum implementation and its contributory factors in lower secondary schools. The types of questions posed in this study were sought for a deep understanding of contemporary phenomenon, matching Merriam's (1988) argument that case study research, particularly a qualitative case study, is an ideal design for understanding and interpreting observations of educational phenomena.

Furthermore, the more control the researcher has, the more experimental the design. Case study methods offer an appropriate niche in research situations that deal with contemporary events in which the behaviour of the people or system cannot be manipulated. Considering that in this study no variables were controlled and no treatment was manipulated, therefore, this study can be classified as non-experimental research such as a case study.

Finally, the objective of the study was to gain an insight into the educational practices, learning outcomes and associated factors. This objective has the characteristics of holistic, intensive descriptions and interpretations of a contemporary phenomenon rather than an end product of a cause-and-effect investigation. Accordingly, these characteristics of the product were some of the case study's characteristics.

A part of the flexibility of case study as a research design was found in the use of the data collection strategies. A case study does not claim any particular methods for data collection; any and all methods of gathering data from testing to interviewing can be used in a case study (Merriam, 1988). Therefore, the choice of case study as an umbrella for the research design in this second stage was appropriate since the study involved both qualitative (educational practices) and quantitative (students' outcomes) data and also called for a range of data collection strategies.

The following sections continue with research procedures of the second stage in this study that included instrument development, sample selection strategies, data collection strategies, internal validity measurements, and data analysis. The general description of research procedures in this study is outlined in the following paragraphs, while the details of the research procedures for research questions 3, 4, 5 and 6, respectively, are presented in Sections 3.3.1, 3.3.2, 3.3.3, and 3.3.4. The general description of research procedures was elaborated to provide a rationale of the strategies chosen in this stage.

Success in data collection depends on many factors, for example the instruments used in data gathering process. During the preparation for the main study, instruments such as an interview protocol, classroom observation sheets and questionnaires were developed and piloted. Interview protocols were needed to deal with Research Questions 2, 3, 4, and 5. Questionnaires, along with interview protocols and classroom observation sheets, were used to answer Research Questions 2 and 5, respectively. The other research questions, namely Research Questions 3 and 6, do not need any particular instrument because they deal with mining data collection strategies (Merriam, 1988).

Another factor that determined the feasibility of the data collection process was the choice of samples. Both types of sampling methods, namely probability (statistical) and non-probability sampling methods, have been used in case study research. However, non-probability method was commonly used as a method of choice, especially in qualitative case studies (Merriam, 1988). Accordingly, the second phase of this study used purposeful sampling strategy. The power of purposeful sampling lies in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the evaluation (Patton, 1987). Therefore, using this sampling strategy allowed the researcher to gather relevant in-depth data to answer these related research questions.

There are ten different strategies for purposefully selecting information-rich cases, i.e., extreme or deviant case sampling, maximum variation sampling, homogeneous samples, typical case sampling, critical case sampling, snowball or chain sampling, criterion sampling, confirmatory and disconfirming cases, sampling politically important cases, and convenience sampling (Patton, 1987). Two of ten purposeful sampling strategies, namely, typical case and convenience sampling strategies, were adopted in this study.

In addition, fieldwork in evaluation often involves on-the-spot decisions about sampling to take advantages of new opportunities during actual data collection. Unlike experimental designs, qualitative methods and naturalistic inquiry designs have their flexibility in using and adding samples during the research. Qualitative methods and naturalistic inquiry designs such as case study can include new sampling strategies to take advantage of unforeseen opportunities after the fieldwork has begun (Patton, 1987). In this study, the strategy of opportunistic sampling also was applied for Research Questions 4 and 5.

A further step that controls the quality of the data gathering process is the data collection strategy itself. Compared to other research design such as experimental, survey, or historical research, a case study has more flexibility in that it does not claim any particular methods for data collection. This flexibility parallels Yin's (1981) notion of the characteristics of case study design in which multiple sources of evidence are used. Using case study permits us to use any and all methods of gathering data from testing to interviewing, although certain techniques are used more than others (Merriam, 1988). In the second phase of this study, observations and interviews were mainly used concerning Research Questions 4 and 5, while mining data was used to deal with Research Question 3 and 4.

Claims, even a modest one that emerged from a study, can fail to stand up to scrutiny unless they can be shown to be grounded in data which have two key characteristics - reliability and validity. Hence, the reliability of and validity of the data became important aspects of the quality of the study. Once these can be achieved, strong conclusions and robust recommendations can be claimed. Merriam (1988) defines reliability as the extent to which an experiment, test, or any measuring procedure can be replicated or yields the same result on repeated trials. Without the agreement of independent observers being able to replicate research procedures, or the ability to use research tools and procedures that yield consistent measurements, researchers would be unable to satisfactorily draw conclusions or make claims about the reliability of their research. However, due to the nature of human life that is ever changing, it is impossible to replicate the results precisely. Therefore, Lincoln and Guba (1985) suggest the use of the term 'dependable' or 'consistency' instead of reliability. They pointed out that the researcher in a social science study should able to produce the findings that are dependable and consistent with the previous one. Accordingly, this study adapted the audit trail method (Merriam, 1988) as a way to ensure the reliability or consistency of the findings. This strategy requires the researcher to provide details of how data were collected, how categories were derived, and how decisions were made throughout the inquiry. Hence, Merriam's (1988) suggestions were conducted by providing the details of research procedures in the next Sections (3.3.1, 3.3.2, 3.3.3, 3.3.4).

Validity refers to the degree to which a study accurately reflects or assesses the specific concept or phenomenon that the researcher is attempting to measure. To ensure that the finding of the study is robust and accurate, both internal and external validity should be taken into account. (Merriam, 1988) defines internal validity as a measure of how one's findings match reality: Do the findings capture what is really there? On the other hand, external validity is concerned with the extent to which the findings of one study can be applied to other situations; that is, how transferable are the results of the research study?

With regard to qualitative data, there are six basic strategies that an investigator can use to ensure internal validity for qualitative research. These are triangulation, member checking, long-term observations, peer examination, participatory modes of research, and clarifying the researcher's assumptions (Merriam, 1988).

In this study, the member checking strategy was applied for Research Questions 4 and 5; long-term observation and member checking strategies were used together for Research Question 5; and researcher judgment was used to find out internal validation for Research Question 3. Member checking is a technique used in case study research to ensure the trustworthiness of the data collected. The researcher checked the phenomenon that occurred during observations or interviews with the participants so that the researcher could gain an understanding perceived by the participants, rather than his own perceptions of the phenomenon (Merriam, 1988).

Finally, the most crucial stage in case study research rests on how the data were being analyzed. Within the context of this study, simultaneous analysis during data collection was conducted to allow the researcher to develop a database that is both relevant and parsimonious (Merriam, 1988). After each classroom observation, the researcher tried to sort out the relevant events emerging from classroom transactions. The issues yielded were confirmed with the teacher, students, and curriculum documents.

Data coding helps researchers to define categories and organise them into some form of order and structure (Cohen, Manion, & Morrison, 2000). Accordingly, qualitative data obtained from the interviews, classroom observations, and field notes were coded and classified to help the researcher in interpreting the phenomenon. Following the data coding processes was the identification of pattern or theme. This identification allowed the researcher to create a coherent explanation or description of aspects that contributed to the science teaching in rural lower secondary schools (Merriam, 1988).

In this study, the researcher used a simple format of data coding with a combination of numbers and characters, for example I.TA.S1.26.02.02, to cross reference data to the transcripts. The first letter indicates that the data were drawn from the interview, the second and third characters identify the teacher being interviewed, the fourth and fifth characters refer to the school wherein the teacher was affiliated, and the last 6 numbers represent the day, the month and the year of the data collection. Similarly, a classroom observation coded as (CO.TB.S2.23.01.02) read as classroom observation in teacher B classroom of school 2, on 23 January 2002. Field notes were coded as (FN.S3.06.03.02) which cross-referenced as notes created during a visit to School 3 on six of March 2002.

As mentioned above, this study adapted the audit trail method (Merriam, 1988) as a way to ensure the reliability or consistency of the findings. Consequently, this strategy requires the researcher to provide details of how data were collected. The following sections deal with the details of research procedures for each research question.

3.3.1 Research Question 3: What is the intended lower secondary schools science curriculum?

3.3.1.1 Instrument Development

To answer Research Question 3, no particular instrument was needed. The collecting strategy involved mining documents where the document is the primary resource data. According to Merriam (1988) the term document in the qualitative case study refers to a wide range of written and physical materials. The first material, public or archival records, included authentic records of births or deaths, national census, police records, agency records, government documents, education statistics, previous studies, organizational rules, regulations, and so on. The second, personal documents, included diaries, letters, home videos, photo albums, children's growth records, autobiographies, and so on. The third group, physical trace material, is any change in the physical environment due to the human action. The fourth group consists of documents created for the purpose of the study. The documents used as resources in this study were the Indonesian government documents such as the regulation of the Ministry of Education and Culture (MOEC) – now Ministry of

National Education (MNE), (*Keputusan Menteri Pendidikan dan Kebudayaan or Kep. Men. Dikbud*) number 060/U/1993 dated 25 February 1993 and its complementary documents about Curriculum 1994 for Primary Eduaction, Content Analysis of Teaching Material (*Analisis Materi Pelajaran*), and textbooks, and refer to the first category.

3.3.1.2 Documents Sample Selection

Based on the regulation of the Ministry of Education and Culture (MOEC) number 060/U/1993 there is a number of documents, as attachments of this regulation, that teachers need to read before implementing Curriculum 1994. Attachment I is a single book, namely, *Curriculum 1994 for Primary Education: Foundation, Programme and Development* (*Kurikulum Pendidikan Dasar 1994: Landasan, Programme dan Pengembangan*). Attachment II is *Broad Outline of Teaching Programmes* (*Garis-garis Besar Programme Pengajaran-GBPP Mata Pelajaran*). Each subject taught at each school level is provided with a single *GBPP*. Finally, attachment III entitled *Guidelines for Implementing Curriculum Textbooks* (*Buku Pedoman Pelaksanaan Kurikulum*) consists of four documents. These documents are *Technical Direction for Curriculum implementation at classroom level for each subject* (*Petunjuk Teknis Pelaksanaan Kurikulum di Kelas untuk setiap mata pelajaran*), *Guiding Principle for Conducting Teaching and Learning Processes* (*Petunjuk Pelaksanaan Proses Belajar Mengajar*), *Directions for Conducting Assessment or Evaluation* (*Petunjuk Pelaksanaan Penilaian*), and *Procedure for Conducting Guidance and Counseling* (*Petunjuk Pelaksanaan Bimbingan dan Konseling*). All of these documents were included as samples. In addition, *Content Analysis of Teaching Material for Biology and Phyiscs* (*Analisis Materi Pelajaran – AMP IPA Biologi dan Fisika*); and Science textbooks in biology and physics for Year 9 students were also included.

3.3.1.3 Data Collecting Strategy

The data collecting strategy for Research Question 3 was called mining document. The documents required were not difficult to be found, as all of them were available in each school. The researcher borrowed the documents and made a copy each of the documents, and purchased relevant textbooks used in the science classrooms for data analysis purposes.

3.3.1.4 Internal Validity Measurement

It is the investigator's responsibility to determine as much as possible about the document, its origins and reasons for being written, the author, and the context in which it was written (Merriam, 1988) To deal with these, Guba and Lincoln (1981) suggest three questions that can be used to help researcher in judging the authenticity of the documents collected. These questions are (1) Is the document complete, as originally constructed?, (2) For what purposes was it produced?, and (3) For whom was the document intended?

However, the fact that most documents except for the textbooks were visibly available, and officially provided in each school, it can be assumed that these documents were authentic. Accordingly, internal validity measurement for these samples has been accomplished by its nature.

3.3.1.5 Data Analysis

Content analysis used to examine the documents is a systematic procedure for describing the content of communication (Merriam, 1988). To analyze the data available, like other sources of data, documents have their limitations and their advantages. Because they are produced for reasons other than research, they may be fragmentary, they may not fit the conceptual framework of the research, and their authenticity may be difficult to determine. On the other hand, because they exist independent of a research agenda, they are non-reactive, that is, are unaffected by the research process (Merriam, 1988). Similarly with this study, the data available were not produced for research purposes. In analyzing these data, the researcher used each curriculum document as the unit of analysis. The researcher read all documents thoroughly to categorize the contents and theme within the documents. The findings are presented descriptively in Chapter 5, Section 5.2.

3.3.2 Research Question 4: How do teachers perceive the intended science curriculum in lower secondary schools?

3.3.2.1 Instrument Development

To collect the data related to this research question, interviews were employed as the data collection strategy. The interview was semi-structured; therefore, the interview protocol was developed to guide the interviewing processes. Considering that the curriculum terminology possesses various meanings, Schubert's (1986) metaphors of curriculum were adapted. Based on these metaphors, the interview protocol was designed and piloted with a number of Indonesian postgraduate students who were studying at the Faculty of Education, Curtin University of Technology.

A draft of the interview protocol was designed by the researcher and discussed with the thesis supervisor. This draft was given to a group of Indonesian teachers and school administrators who studied at the Faculty of Education, Curtin University of Technology. This group discussed the draft, checked readability of the draft, selected the Schubert's metaphors that may be suitable with the Indonesian lower secondary school teachers' views, and provided feedback. Based on their suggestions, the researcher discussed and revised the draft with the thesis supervisor before the final use.

This pilot study produced an interview protocol concerned with three parts of the curriculum. The first part consisted of three main questions directed to explore the teachers' views of the existing lower secondary school science curriculum. The second part contained four main questions intended to investigate factors that may influence teachers in implementing the official science curriculum. The third part of this instrument comprised three main questions geared to tap teachers' idea of improving students' achievement of the science curriculum. While the first part of the instrument dealt directly with Research Question 4, the others are relevant to answer Research Question 5. This interview protocol was used with the two superintendents who acted as respondents. Detail of interview protocol is provided in Appendix G.

3.3.2.2 Sample Selection

The target interviewees were the teachers whose classes were observed, and the superintendents in charge. Two biology and two physics teachers from four different schools that were representative of rural and urban areas and two superintendents who were in charge to lower secondary school science were selected. The educational background and work experiences of each respondent are described in Chapter 6.

3.3.2.3 Data Collecting Strategy

The interviews were conducted prior to classroom observations. The interviews took place in various settings such as laboratory, office, canteen, and at home and at the respondents' conveniences. Prior to the interview, the respondents were asked their permission for recording the interview processes. Some respondents were reluctant to express their views verbally. To accommodate this situation, the researcher persuaded the respondents to answer all the questions in writing. Accordingly, the interview protocol was copied and given to them.

3.3.2.4 Internal Validity Measurement

Member checking was used to ensure the internal validity. Clarification of the terms also was done during the interview. Interview records were transcribed and given to the respondent as a member checking procedure. The researcher's interpretation of respondents' comments or views was also confirmed to enhance the credibility of the data obtained.

3.3.2.5 Data Analysis

The interview transcripts were coded and analyzed by identifying the key terms that were used during the interview. Information identified from the transcript was categorized and structured to create a coherent explanation or description of aspects that contributed to the teachers' perceptions of the intended science curriculum in the Indonesian lower secondary school context. The results were interpreted and presented in descriptive form in Chapter 5, Section 5.3.

3.3.5 Research Question 5: How do teachers implement the existing science curriculum?

3.3.5.1 Instrument Development

The best way to obtain the data related to Research Question 5 was by prolonged direct classroom observations. Through this process, the researcher gained an insight into the teachers' perceptions of how they implemented the intended curriculum. There are a number of techniques for observing classroom processes and crosschecking data (Middleton, 1981). These techniques are (1) audio-recording and transcribing; (2) video recording; (3) observation schedules (4) photography; (5) interviews; (6) document analysis; and (7) notes and plans. The techniques (1) to (4) are most appropriate for direct observation while (5) is more useful for checking observations or ideas about the activity in the classroom. In this study, techniques such as observations, photography and interviews were employed. The interview protocol part two as explained in Section 3.3.4.1 was used. Furthermore, a classroom observation schedule was developed. In so doing, Middleton's (1981) suggestions were taken, because 'It is better to record in detail rather more than is required' (Middleton, 1981, p. 23). Accordingly, the classroom observation schedule sheets contained any aspects of observations which focused on how the science teacher conducted the lesson in delivering the intended curriculum. This observation schedule should answer questions such as: (1) What is the topic of the lesson?, (2) Does the teacher have a lesson plan?, (3) Is there any specific activity suggested in the intended curriculum? (4) Does the teacher follow that suggestion? If not, why?, and (5) What do classroom transactions look like? The classroom observation schedule used in this study is available in Appendix H.

3.3.5.2 Sample Selection

Four science teachers from four schools agreed to participate in long-term classroom observations. These were two biology teachers and two physics teachers from different schools in urban and rural areas. Teachers from rural schools included Teacher A of School 1 for the biology classroom observations and Teacher B of School 2 for the physics classroom observations. On the other hand, teachers from urban schools comprised Teacher C of School 3 and Teacher D of School 4 for physics and biology classroom observations, respectively. Details of the schools and teachers background are provided in Chapter 6.

Although each teacher taught more than three classes, only one of their classes was randomly observed. As a result, the samples comprised two Year 9 biology classrooms from each of two different schools in urban and rural areas and two Year 9 physics classrooms from two different schools in urban and rural areas.

In addition, as mentioned previously in Section 3.3, qualitative research often employs the strategy of opportunistic sampling to take advantage of unforeseen opportunities after the fieldwork has begun (Patton, 1987). Similarly, this study also took this sampling method to obtain additional data that allowed the researcher to describe science curriculum implementation in more rich and detail descriptions. As a result, Teacher E of School 5 who taught physics, and Teacher F of School 6 who taught both physics and biology were included based on their willingness. They agreed to be interviewed and had one of their science classrooms observed. Where School 5 is located in an urban area, School 6 is situated in a rural area.

3.3.5.3 Data Collecting Strategy

Using the classroom observation schedule, data regarding the ways the curriculum was implemented were collected. Classroom observations were conducted during 12 weeks of the third term at each school where science was allocated three periods of 45 minutes per periods. Therefore, a total of 36 class periods were spent by the researcher in observing classroom interactions for each class in each school. At the first time of classroom observations, the teacher introduced the researcher to the students and explained the purpose of his visit and his role. The teacher emphasized to the students that observations conducted by the researcher were for research purposes and would not influence their grades and the teacher asked students to act normally. These explanations allowed the researcher to gain relatively real or the original setting of the teaching and learning practices in the classrooms that were observed.

Data regarding all aspects of classroom transactions as described in Section 3.3.5.1 were recorded. Interviews, if needed, were conducted after the lessons to check or to confirm the phenomenon that occurred during observations or to pursue teacher explanations on how and why he or she did certain activities. Field-notes were also taken to anticipate events that were relevant to the purpose of the study but not listed in the classroom observation sheet.

3.3.5.4 Internal Validity Measurement

At the outset, the teachers were informed that during the observations the researcher would only act as a non-participant and would not make any kind of personal value judgement about the quality of teaching. This effort was taken to ensure classroom transactions occurred in a normal manner. The observations simply recorded for further analysis what was happening in the classroom. Member checking was used as a way of ensuring the validity of the data that were collected. In so doing, after each observation, interviews with the teachers or students regarding events captured in the classroom observations were conducted to clarify the researcher's judgement.

3.3.5.5 Data Analysis

After completing classroom observations, all the data gathered during these processes including records, field-notes, interview logs and photographs were organized to develop the case study database (Yin, 1984). This database was either chronologically or topically structured to enable the researcher to easily have access and analyse the data. From this database, categories or classifications and themes were developed. The data then were structured to explain those phenomena that contributed to the implementation of school science curriculum at the classroom level. The results are descriptively presented in Chapter 5, Section 5.4. A narrative account in the form of a vignette was used to describe the school and classroom's context under study.

3.3.6 Research Question 6: What are students' outcomes of the science curriculum in Indonesian lower secondary schools?

3.3.6.1 Instrument Development

There are two students' outcomes, namely, students' attitudes towards science lessons and students' cognitive achievement, which were included in this investigation. Students' cognitive outcomes were drawn from students' scores of science on the nation-wide examination (*Evaluasi belajar tahap akhir-Ebtanas*) which were available from the school's report. No instrument was needed to gather these data.

On the other hand, a questionnaire adapted and translated from the *Test of Science Related Attitudes* or TOSRA (Fraser, 1981b) was used to collect students' attitudinal outcomes. Two scales of the original TOSRA, namely, Attitude to Scientific Inquiry and Enjoyment of Science Lessons were adapted and used. The development of the Indonesian adapted TOSRA followed the standard procedures as described in Section 3.2.2. The questionnaire contains 16 items with each scale measured by eight items. Copies of the Indonesian version of the adapted TOSRA and its back translation into English are provided in Appendices 3.9 and 3.10. A description of the scales of the adapted TOSRA used in this study together with sample items is provided in Table 3.4.

Table 3.4 Description of Scales in the Adapted TOSRA and Representative Items

Scale	Scale Description	Example of the item
Attitude to Scientific Inquiry	Acceptance of scientific inquiry as a way of thought	I would prefer to do experiments than to read about them. (+)
Enjoyment of Science Lessons	Enjoyment of science learning experiences	Science lessons are boring (-)

Items designated (+) are scored by allocating 5, 4, 3, 2, 1, respectively, for the responses Strongly Agree, Agree, Not Sure, Disagree, and Strongly Disagree. Items designated (-) are scored in reverse manner. Omitted or invalid responses are given a score of 3.

3.3.6.2 Sample Selection

Using a multistage sampling method, Year 9 students from selected urban and rural lower secondary schools as described in Section 3.2.3 were engaged as the samples. A total of 1188 students answered the Indonesian version of the adapted TOSRA and their science scores on the nation-wide examination also were collected.

3.3.6.3 Data Collecting Strategy

After official permission was given, students' cognitive scores were collected. These data then were matched with students' responses to the Indonesian WIHIC for further analysis. With regard to attitudinal outcomes, a questionnaire survey was given to the students. The administration of the Indonesian version of the adapted TOSRA questionnaire was done following procedures used during the administration of the Indonesian WIHIC as explained in Section 3.2.4.

3.3.6.4 Internal Validity Measurement

With regard to students' outcomes on the cognitive test, validity of the instrument had been achieved through the established nation-wide examination system. Hayat (1998) asserted that the quality of items in the national examination has improved from year to year and shows acceptable validity and reliability. Therefore, no attempt was taken by the researcher to validate the test used in the nation-wide examination. On the other hand, internal validity of the Indonesian adapted TOSRA was investigated. In doing so, all responses of the Indonesian version of adapted TOSRA were coded, matched and entered into the students' responses to the Indonesian version of WIHIC data. Some items were scored 5 for Strongly Agree (*Sangat Setuju*), 4 for Agree (*Setuju*), 3 for Not Sure (*Tidak Berpendapat/Tidak Yakin*), 2 for Disagree (*Tidak Setuju*), and 1 for Strongly Disagree (*Sangat Tidak Setuju*). For the negative items, the scoring was reversed in which 1 for Strongly Agree (*Sangat Setuju*), 2 for Agree (*Setuju*), 3 for Not Sure (*Tidak Berpendapat/Tidak Yakin*), 4 for Disagree (*Tidak Setuju*), and 5 for Strongly Disagree (*Sangat Tidak Setuju*). The same procedures used to validate the Indonesian version of WIHIC as illustrated in Section 3.2.5.1.1 were carried out. The results are presented in Chapter 5, Section 5.5.

3.3.6.5 Data Analysis

After the students' scores on science at the nation-wide examination were gathered, and students' responses to the Indonesian version of adapted TOSRA were obtained, these data then were entered and matched with students' data responding to the learning environment questionnaire (the Indonesian WIHIC). The data were analyzed statistically using SPSS software. Descriptive analysis was carried out to determine the means and standard deviations of students' scores on the cognitive test for each class and school. With regard to attitudinal outcomes, data analysis methods for the Indonesian adapted TOSRA questionnaire included the validation of the questionnaire and an analysis for describing students' attitudes towards science lessons. The methods of the validation of the instruments have been outlined in Section 3.2.5.1, while the descriptive analysis method was briefly described in Section 3.2.5.2. Finally, the most striking feature of this study was an attempt to make a link between teaching and learning practices, as perceived by the students in the responses to their classroom learning environments, and students' outcomes. Correlations between students' outcomes in science and scales of science classroom environments were computed using both simple and multiple correlations methods.

3.4 Ethical Issues

In a qualitative study, concerns about ethics are as important as concerns about validity and reliability. Not only should the study be valid and reliable, but also it must be conducted in an ethical manner. Merriam (1988) identifies that ethical issues tend to occur both during the data collection and in the dissemination of findings. Hence, in designing this study, the researcher was conscious of ethical codes that respect the wellbeing of all individuals and the institutions participating in this study. In order to anticipate ethical issues that may arise during and after study, the following actions were taken. First, appropriate permission had been sought from the principals whose schools were involved in the study. Second, students and teachers had been given the choice as to whether or not they wished to participate. Third, since the ongoing support of the teachers as well as students was critical to the success of the study, they were informed of the approximate amount of time required prior to its commencement. Data collection was planned carefully with the cooperation of the teachers, students, and the principals so that the process would not disrupt the lesson and schools' programmes. Finally, when the study was completed, the names of the participating people and schools were altered to protect confidentiality unless otherwise requested.

3.5 Summary of the chapter

The purpose of this chapter was to illustrate the research methodologies used in this present study. The study was guided by six research questions and conducted in two stages. The first stage that was concerned with the first two research questions employed a questionnaire survey as research methodology and aimed to describe classroom learning environments and school level working environments. The second stage of this study employed a multiple site case study as the research methodology. The focus of the second stage was the educational practices in science classroom of lower secondary schools. The investigations included the intended or formal science curriculum, teacher perceptions of the intended science curriculum, the implementation of science curriculum at classroom level, and students' outcomes of science curriculum achievements.

Two already established questionnaires, namely, *What Is Happening In this Classroom* (WIHIC) and *School Level Environment Questionnaire* (SLEQ), were translated and modified to assess the classroom learning environment and school working environment, respectively. A sample of 1188 Year 9 students from 36 science classes and their biology or physics teachers, in 16 randomly selected coeducational government schools in urban and rural area, were involved in the Indonesian WIHIC administration. Furthermore, a total of 131 teachers participated in the Indonesian SLEQ administration.

Following the administration of the questionnaires, a selection of statistical measures was used to analyse the data. In order to cross-validate the Indonesian WIHIC, a series of item and factor analyses were performed. With the Indonesian SLEQ, factor analysis was not conducted due to the small size of the sample. Alternatively, mean correlation of seven scales of the Indonesian SLEQ was counted as indices of discriminant validity. Alpha reliability of both questionnaires was generated as indication of scale reliability. Furthermore, a series of analyses of variance (ANOVA) was carried out to determine if the actual version of each scale in both questionnaires was able to differentiate significantly between perceptions of teachers or students in different groups. Finally, a series of t-tests was conducted to explore the differences of students' and teachers' perceptions of classroom learning environment and school working environment, respectively, based on gender, school locality and subject matter. This enabled the researcher to obtain a more complete picture of the quality of classrooms and schools environment.

In the second stage of this study, a range of data collection strategies was employed to gather data related to the last four research questions. The mining document strategy was used to extract the intended science curriculum; whereas interviews were employed to tap teachers' and superintendents' perceptions of the formal science curriculum. To explore how science curriculum was implemented, both classrooms observations and interviews with science teachers were conducted. After all, mining documents on students' cognitive outcomes and a survey on students' attitudinal tests towards science lesson were employed to assess students' outcomes with regard to the science curriculum.

Ethical issues are explained in Section 3.4. Ethical codes that respect the wellbeing of all individuals and the institutions participating in this study were maintained. By this means, several steps were carried out. These steps included obtaining permission from the principals whose schools were involved in the study; giving all participants the choice as to whether or not they wished to participate; carefully planning data collection with the cooperation of the participants so that the process would not disrupt the lessons and schools' programmes; and altering the names of people and schools to protect confidentiality unless otherwise requested when the study is completed.

While this chapter is solely devoted to elaborate research methodologies, the following chapters are allocated to describe the findings of this study. Chapter 4 describes and discusses the findings yielded from the first stage, while Chapters 5 and 6 present the results obtained in the second stage.

Chapter 4. Classroom and School Learning Environment

4.1 Introduction

The purpose of this chapter is to describe the results that emerged from the first stage of the study responses to the first two research questions: (1) How do students and teachers in rural and urban lower secondary schools perceive their classroom learning environments? and (2) How do teachers in rural and urban lower secondary schools perceive their existing working environments? As mentioned previously in Chapter 3, the Indonesian version of *What Is Happening In this Classroom* (WIHIC) was administered to a sample of 1188 students from 36 classes and their science teachers in 16 lower secondary schools of Kalimantan Selatan, Indonesia. The intent of the questionnaire was to obtain students' and teachers' responses regarding their perceptions of the learning environment in their science classrooms. The Indonesian version of the *School Level Environment Questionnaire* (SLEQ) was given to a sample of 131 teachers to assess their views about their school working environments. Before other analyses could be started, it was essential to generate information regarding the questionnaires' validity. This information included the factor structure of each questionnaire or discriminant validity, whichever was suitable, the scale's internal consistency reliability, and ability to distinguish among the different class grouping. Collectively, these statistical measures provided an indication of the suitability of each questionnaire for portraying the classroom learning and school working environments studied, as well as providing evidence to support the validity of the questionnaires for future and wider use in an Indonesian school context.

As indicated in Section 3.2.5.2, the responses were subjected to descriptive statistical analysis by calculating the mean and standard deviation of each scale for each instrument. The average item mean, or the scale mean divided by the number of items in a scale, was used as the basis of comparison between different scales of each instrument. Furthermore, to provide a more detailed picture of these learning and working environment, a t-test using either paired samples or independent samples was conducted to determine the differences between two groups' perceptions of each scale. In this study, comparisons were performed between boys and girls, students and teachers, and rural and urban groups for the Indonesian WIHIC, whereas comparisons between science and non-science teachers based on school's locality were established for responses to the Indonesian version of the SLEQ.

The analyses and results in this chapter are structured for discussion into four main sections. The validation of the Indonesian version of the WIHIC is presented in Section 4.2. The descriptions of science classroom learning environment is presented in Section 4.3. The validation of the Indonesian version of the SLEQ and the descriptions of school working environments in Indonesian lower secondary schools context are presented in Sections 4.4 and 4.5, respectively.

4.2. Validation of the Indonesian version of WIHIC questionnaire

As explained in Section 3.2.5.1.1, the criteria for questionnaire validity included factor structure, scale internal consistency reliability, and ability to differentiate between the perceptions of groups. Considering the number of classes that is large enough for statistical analysis purposes, individual students' scores and class means were used as the unit of analysis. Results regarding the criteria mentioned above were explained in the following sections. Factor structure of the Indonesian version of the WIHIC is described in Section 4.2.1. Scale internal consistency reliability is explained in Section 4.2.2, whereas scale's ability to differentiate between the perceptions of groups is presented in Section 4.2.3.

4.2.1 Factor structure of the Indonesian version of WIHIC

Before conducting factor analysis procedures, an inspection of the assumptions and practical considerations underlying the application of the method was performed and the outcomes were in agreement with the criteria advised by Coakes and Steed (1999). First, the size of sample of 1188 students, according to Coakes and Steed (1999) and Stevens (1992), allowed the researcher to carry out factor analysis to

Table 4.1 Factor Analysis Result of Indonesian Version of Modified WIHIC

Item	Factor Loading						
No.	SC	TS	Involve	Invest	TO	CO	Equity
1	0.65						
2	0.53						
3	0.47						
4	0.58						
5	0.48						
6							
7	0.60						
8	0.34	0.32				0.33	
9		0.54					
10		0.68					
11		0.67					
12		0.58					
13		0.42					
14		0.61					
15		0.47					
16		0.32					
17			0.61				
18			0.70				
19			0.41				
20			0.69				
21			0.55				
22			0.59				
23			0.49				
24			0.60				
25			0.47	0.46			
26			0.49	0.39			
27			0.44	0.54			
28			0.46	0.40			
29				0.63			
30				0.66			
31				0.72			
32				0.68			
33					0.48		
34					0.58		
35					0.54		
36					0.64		
37					0.65		
38					0.62		
39					0.62		
40					0.55		
41						0.62	
42						0.59	
43						0.41	
44						0.44	
45						0.65	
46						0.69	
47						0.65	
48						0.49	
49							0.60
50							0.68
51							0.70
52							0.72
53							0.70
54							0.66
55							0.63
56							0.69
% Variance	2.42	3.53	22.23	2.78	4.19	3.82	5.83
Eigen value	1.35	1.98	12.45	1.56	2.35	2.14	3.27

Loading smaller than 0.3 excluded. N= 1188 in 72 classes of 16 schools.
SC = Student Cohesiveness; TS = Teacher Support; Involve = involvement; Invest = investigation; TO = Task Orientation; CO = Cooperation.

scrutinize the internal structure of the Indonesian version of the modified WIHIC which had 56 items. Second, an examination of the correlation matrix indicated that a considerable number of correlations exceeded 0.3; therefore the matrix is suitable for factoring. Third, the Bartlett test of sphericity is significant and the Kaiser-Meyer-Olkin measure of sampling adequacy is 0.91, which is greater than the minimum requirement (0.60). Fourth, the inspection of an anti-image correlation matrix shows that each of these measures of sampling adequacy were above the acceptable level of 0.5 (Coakes and Steed, 1999). Accordingly, all assumptions were fulfilled, and it was envisaged that the results of factor analysis are robust and relevant to explain the structure of the questionnaires.

A factor analyses was conducted starting with a principal component factor analysis followed by varimax rotation was used (Coakes & Steed, 1999). The results as depicted in Table 4.1 reveal that all items of the seven scales, except item number 6, have satisfactory factor loadings greater than or equal to 0.3. However, there is some overlap of some items on more than one scale. For example, four items of the *Investigation* scale overlap with those four of *Involvement*; and one item in the *Student Cohesiveness* scale overlaps with other items in *Teacher Support* and *Cooperation*. Nevertheless, this study documented that the *a priori* seven-factor structure of the final version of the Indonesian version of the modified WIHIC was replicated; nearly all items had a factor loading of at least 0.3 on their *a priori* scale and no other scale. Similar results were established using the same procedures with the samples of students in urban schools (n = 544) and of students in rural schools (n = 644) when taken separately which indicates the further strength of the questionnaire's factor structure. In addition, past studies that used the WIHIC questionnaire (Aldridge & Fraser, 2000; Aldridge, Fraser, & Huang, 1999; Margianti & Fraser, 2000; Margianti, Fraser, & Aldridge, 2001) have reported similar factor structures.

As mentioned previously, the factor analysis results showed that four items in the *Investigation* scale overlapped with those four in the *Involvement* scale and one item in the *Student Cohesiveness* scale overlapped with other items in *Teacher Support* and *Cooperation* scales. These overlaps indicate that students might not be able to differentiate significantly in responding to those overlapped items. Investigations on the items in the scales, where overlapping occurred, suggest that the corresponding items measure similar but distinct activities. Consequently, it is understandable if the students perceived these items in a similar way. For that reason, it was acceptable to maintain all 55 items of the seven scales in this questionnaire for further analysis.

4.2.2 Scale internal consistency reliability of the Indonesian WIHIC

Further analysis was aimed to check whether or not each item in a scale assessed a common construct. Therefore, Cronbach's alpha coefficient was calculated using both individual scores and class means as the units of analysis. As expected, reliability estimates were higher in most instances when the class mean was employed as the unit of analysis. Cronbach alpha reliability coefficients for both actual and preferred perceptions with two units of analysis and analysis of variance (ANOVA) eta^2 results are shown in Table 4.2.

Table 4.2 Internal Consistency Reliability (Cronbach Alpha Coefficient) and ANOVA Results for the Indonesian Version of Modified WIHIC With Two Units of Analysis

Scale	No of Items	Unit of Analysis	*Alpha Reliability*		ANOVA eta^2
			Actual	Preferred	Actual
Student Cohesiveness	7	Individual	0.68	0.70	0.18**
		Class Mean	0.83	0.88	
Teacher Support	8	Individual	0.78	0.78	0.19**
		Class Mean	0.89	0.88	
Involvement	8	Individual	0.81	0.85	0.15**
		Class Mean	0.91	0.93	
Investigation	8	Individual	0.83	0.88	0.16**
		Class Mean	0.92	0.94	
Task Orientation	8	Individual	0.79	0.84	0.23**
		Class Mean	0.90	0.95	
Cooperation	8	Individual	0.79	0.77	0.21**
		Class Mean	0.92	0.86	
Equity	8	Individual	0.88	0.78	0.15**
		Class Mean	0.96	0.90	

** $p<0.01$

On the whole, the statistics obtained were acceptable. Compared to the results of the original cross-validation (Aldridge et al., 1999), the internal consistency indices produced for the sample of this study were similar. For example, the Cronbach alpha coefficient ranged from 0.68 to 0.88 and from 0.70 to 0.88 for the actual and preferred versions, respectively, when individual scores were used as the unit of analysis. Cronbach alpha coefficients of the seven scales were above 0.83 for both the actual and preferred versions when the class means were used as the unit of the analysis. These results suggest that the internal consistency for the Indonesian version of WIHIC is acceptable.

4.2.3 Ability to differentiate between the perceptions of groups

A one-way analysis of variance (ANOVA) was conducted to determine if the Indonesian version of the modified WIHIC was able to differentiate significantly between the perceptions of students in different classrooms. This characteristic was examined for each scale with class membership as the main effect and using individual scores as the unit of analysis.

The result of a series of analyses of variance (ANOVA) as shown at the last column in Table 4.2 indicated that each scale in this questionnaire was able to differentiate significantly ($p<0.01$) between the perceptions of students from different classes. The eta^2 statistic, which represents the amount of variance in the environment scores accounted for by class membership, ranged from 0.15 to 0.23 for the present sample. These values are comparable to those of (Aldridge et al., 1999), but higher than those found in Margianti and Fraser (2000) and Margianti et al. (2001). These findings provide further evidence for the reliability and validity of the Indonesian version of the modified WIHIC for assessing the classroom learning environment in Indonesian lower secondary schools.

Based on the results generated from the factor structure analysis, scale internal reliability analysis and a series of ANOVA, this study claims that the Indonesian version of the modified WIHIC is a valid, robust and reliable instrument for measuring classroom-learning environment in Indonesian secondary schools, although minor revisions were needed. For further use, items 6, 25, 26, 27, and 28 of this questionnaire are in need of rewording in order to enhance the robustness, validity and reliability of the questionnaire. Suggestions are provided as follows. First, the word '*menolong*' (to help) in item 6 should be replaced with the word '*membantu*' (to assist), since the latter has more positive connotation than the previous one. Second, the word '*penyelidikan*' in items 25 and 27 should be replaced with '*penelitian*'. These two words have similar meaning as *to investigate*; however, the latter (*penelitian*) is more specific and frequently used in the classroom. Third, item 26 should be simplified and changed from a passive into an active sentence. The former statement, '*Saya diminta untuk memikirkan fakta-fakta yang mendukung suatu pernyataan*' (I am being asked to think about the facts that support a statement) has an emphasis on the phrase 'being asked'. It is recommended to rewrite item 26 as '*Saya memikirkan fakta-fakta untuk mendukung suatu pernyataan*' (I do think about the facts to support a statement). In contrast to the former sentence, this active sentence emphasises the students' activity of thinking rather than of being asked to think about facts. Finally, it is recommended to change item 28 into a less complex sentence. The former sentence, '*Saya menjelaskan arti dari suatu pernyataan, diagram dan grafik*' (I explain the meaning of a statement, diagram and graph), may confuse the students since it has three objects (statement, diagram and graph). Therefore, a new sentence such as '*Saya menjelaskan arti suatu diagram atau grafik*' (I explain the meaning of a diagram or a graph) is likely to be more understandable.

4.3 Descriptions of typical science classroom learning environments

To explore the nature of the science classroom learning environment, the average item mean (the scale mean divided by the number of items in that scale) and average item standard deviation of each scale for both actual and preferred forms of the questionnaire were calculated. A t-test for paired samples for students' responses to both actual and preferred forms was performed to check whether or not significant differences in students' perceptions of their learning environment take place. To provide a more detailed picture of the classroom learning environment, this study also sought the differences in students' perceptions of their science classroom learning environment based on gender and on the schools' locality, and the differences between students' and teachers' perceptions of their classroom learning environment. These differences were measured using t-tests with either paired or independent sample whichever was appropriate. The results are organised into four sections. First, differences between students' perceptions of the actual and preferred science classroom learning environment are described in Section 4.3.1. Second, differences between male and female students' perceptions of the science classroom learning environment are explained in Section 4.3.2. Third, differences between students' perceptions of the actual science classroom learning environment based on the schools' locality are presented in Section 4.3.3. Finally, differences between students' and teachers' perceptions of their science classroom learning environment are explained in Section 4.4.4.

4.3.1 Differences Between Students' Perception of the Actual and Preferred Science Classroom Learning Environment

The results from t-tests for paired samples showed that there were significant differences ($p<0.01$) between students' perceptions of their actual and preferred learning environment on all scales except the *Involvement* scale. A summary of the average item means and average standard deviations for the two versions of the questionnaire is reported in Table 4.3 and the same data are graphed in Figure 4.1.

Table 4.3 Average Item Mean, Average Standard Deviation, and t Value from t-tests with Paired Samples for Differences Between the Actual (A) and Preferred (P) Perceptions (n=1188)

Scale	Average Item Mean		Average Standard Deviation		t value
	A	P	A	P	
Student Cohesiveness (SC)	3.79	4.60	0.49	0.41	57.66**
Teacher Support (TS)	2.84	4.15	0.64	0.60	67.83**
Involvement (INL)	2.62	2.62	0.62	0.62	NA
Investigation (INV)	2.51	3.81	0.72	0.76	62.80**
Task Orientation (TO)	3.77	4.59	0.53	0.46	58.40**
Cooperation (CO)	3.25	4.03	0.61	0.65	43.93**
Equity (EQ)	3.61	4.46	0.74	0.58	44.16**

$^{**}p<0.01$

In sum, Table 4.3 suggests that the students' perceptions of six of the scales on the preferred version of the science classroom learning environment questionnaire are statistically higher than their perceptions on the actual version of the same questionnaire. The results are consistent with previous studies (Fisher & Fraser, 1983) and suggest that most students would prefer a learning environment which is characterised by having more teacher support, enhanced student cohesiveness, provision of clearer task orientation, doing more investigations, and ensuring greater cooperation as well as more equity during class sessions.

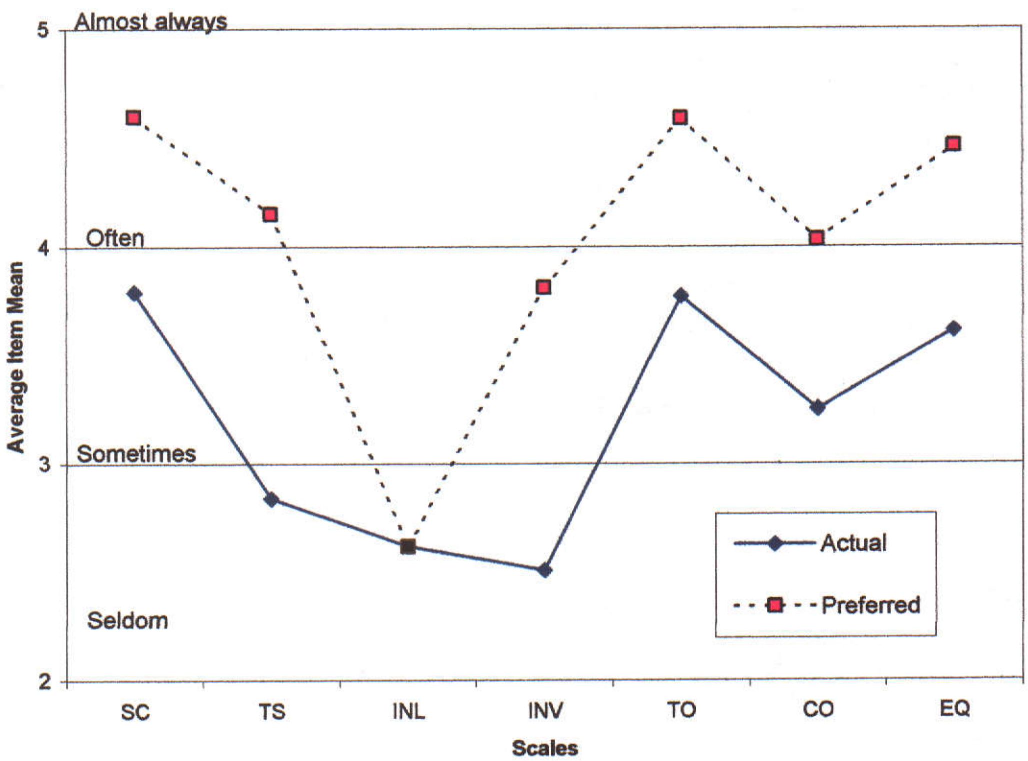

Figure 4.1 Comparisons Between Students' Perceptions of the Actual and Preferred Science Classroom Learning Environments

This findings imply that the teachers need to consider their teaching strategies in order to provide students with the classroom learning environment that they expected. These differences in both actual and preferred scales can be used by teachers or principals as a focus for improving the classroom learning environment in keeping with Fraser's (1989) five stages for learning environment enhancement.

Interestingly, students perceived the same level on the *Involvement* scale for both the actual and preferred forms. This anomaly warrants further investigation. This scale's mean of 2.62 informs that students have classroom experiences that constitute involvement that are in between 'seldom' and 'sometimes'. Therefore, it can be inferred that students were happy within the classroom atmosphere that allows them to be passive. This finding confirms Thair and Treagust's (1997) study, which asserts that the teacher in the Indonesian classroom has absolute authority and gives students little chance to participate.

4.3.2 Differences Between Male and Female Students' Perceptions of the Science Classroom Learning Environment

Using the paired sample t-tests procedure, the average item mean for group of male and female students was used as the unit of analysis. Since the number of male and female students was not equal, therefore the data were organised into groups of males and females for each class, resulting in 72 groups of males and 72 groups of females. These pairs of data then were matched for further analysis and the results are depicted in Table 4.4. For comparison purposes, the average item means for both actual and preferred versions for males and females are provided in Figure 4.2.

In summary, Table 4.4 also indicates that in respect of the preferred version of the questionnaire, the statistically significantly differences were occurred in which female students possessed more favourable perceptions of Student Cohesiveness, Investigation, Task Orientation and Cooperation than male students did.

Table 4.4 Average Item Mean, Average Item Standard Deviation and t Value from t-tests with Paired Samples for Differences Between Male and Female Students' Perceptions of Science Classroom Learning Environment (n=72)

Scale	Form	Average Item Mean		Average Item Standard Deviation		t value
		Male	Female	Male	Female	
Student Cohesiveness	Actual	3.76	3.76	0.27	0.25	0.02
	Preferred	4.52	4.61	0.26	0.22	2.50*
Teacher Support	Actual	2.89	2.78	0.41	0.34	2.15*
	Preferred	4.11	4.14	0.34	0.33	0.85
Involvement	Actual	2.59	2.64	0.39	0.31	1.05
	Preferred	2.59	2.64	0.39	0.31	1.05
Investigation	Actual	2.54	2.51	0.49	0.38	0.48
	Preferred	3.73	3.87	0.46	0.37	2.49*
Task Orientation	Actual	3.69	3.81	0.31	0.30	2.73**
	Preferred	4.50	4.64	0.35	0.22	3.38***
Cooperation	Actual	3.18	3.27	0.34	0.38	1.13
	Preferred	3.92	4.05	0.41	0.31	2.45*
Equity	Actual	3.55	3.62	0.42	0.44	1.24
	Preferred	4.40	4.49	0.32	0.28	1.86

*p<0.05; **p<0.01; ***p<0.001

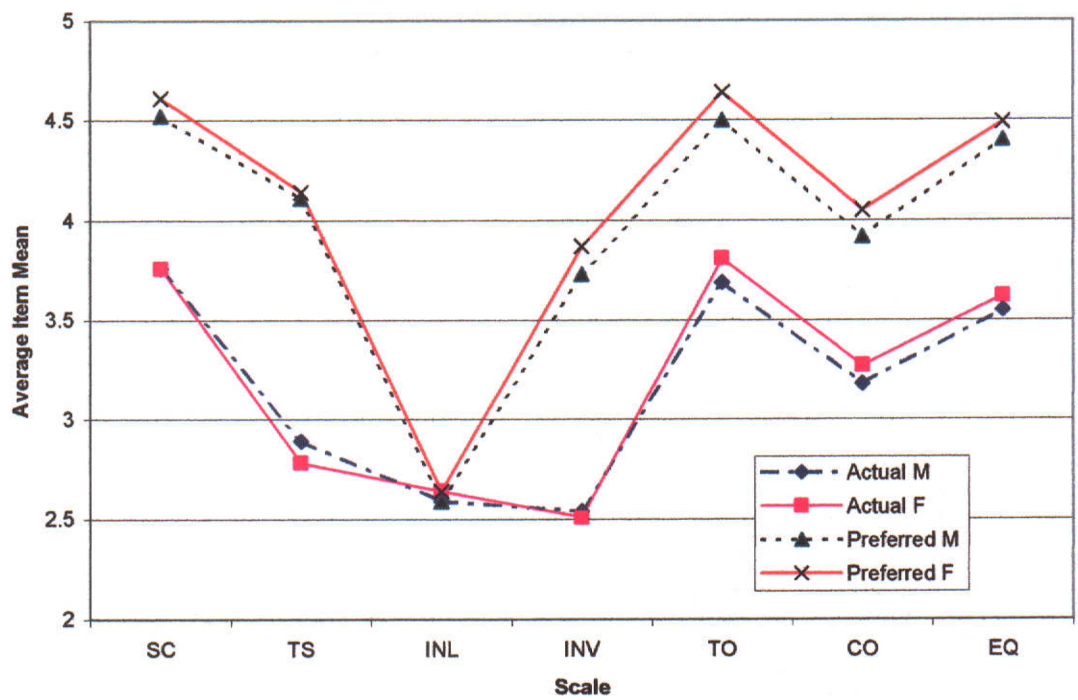

Figure 4.2 Comparison Between Male and Female Students' Perceptions of the Actual and Preferred Science Classroom Learning Environments

Moreover, Table 4.4 and Figure 4.2 also suggest that generally females have perceptions slightly more favourable than the males on the actual science classroom-learning environment. While the magnitudes of the differences between male and female students' views of the classroom learning environment are small, statistically significant differences occur on two scales, namely, *Teacher Support* and *Task Orientation*. Males perceived that their actual teachers' support is more favourable than do females. On the other hand, males perceived task orientation set by their teachers less positively than did the females. Furthermore, females tended to have a higher preference of seven scales towards their ideal science classroom-learning environment than the males did. In detail, significance differences ($p<0.05$) existed for four scales, namely *Student Cohesiveness, Investigation, Task Orientation, and Cooperation*. The results of this study corroborated the findings from the previous studies (Goh & Fraser, 1995; Goh, Young & Fraser, 1995, Riah, 1998; Riah & Fraser, 1998; Wong, 1994), in which females held better perceptions of the classroom-learning environment than did males.

These findings imply that with regard to gender equity, teachers should be aware of this fact and provide such efforts to eliminate this gap. Teachers should learn how to enhance the teaching atmosphere in order to provide more support to female students and give clearer learning direction for male students.

4.3.3 Differences Between Students' Perceptions of the Science Classroom Learning Environment Based on Schools' Locality

To investigate the differences between students' perceptions of the science classroom learning environment based on schools' locality, t-tests with independent samples procedure were carried out. All seven scales of both actual and preferred forms of the Indonesian WIHIC were placed as the dependent variables, whereas schools locality variable was placed as the determinant variable. A summary of average item mean, average item standard deviation, and t values from t-tests for independent samples for differences between rural and urban students' perceptions of their science classroom learning environment is provided in Table 4.5. For comparison purposes, these data also are graphed and presented in Figure 4.3.

Table 4.5 Average Item Mean, Average Item Standard Deviation and t Values from t-test with Independent Samples for Differences Between Rural (n=544) and Urban (n=644) Students' Perceptions of Science Classroom-Learning Environment

Scale	Form	Average Item Mean		Average Item Standard Dev.		t value
		Rural	Urban	Rural	Urban	
Student Cohesiveness	Actual	3.72	3.85	0.53	0.44	4.40***
	Preferred	4.48	4.70	0.47	0.31	9.91***
Teacher Support	Actual	2.78	2.90	0.67	0.62	3.16***
	Preferred	4.05	4.23	0.67	0.53	5.22***
Involvement	Actual	2.54	2.69	0.65	0.58	4.06***
	Preferred	2.54	2.69	0.66	0.58	4.02***
Investigation	Actual	2.42	2.59	0.73	0.70	4.08***
	Preferred	3.69	3.91	0.77	0.73	5.11***
Task Orientation	Actual	3.68	3.84	0.56	0.50	5.09***
	Preferred	4.48	4.68	0.51	0.38	7.83***
Cooperation	Actual	3.06	3.42	0.63	0.55	10.63***
	Preferred	3.89	4.15	0.67	0.60	6.99***
Equity	Actual	3.46	3.74	0.78	0.69	6.56***
	Preferred	4.36	4.54	0.66	0.49	5.43***

***$p<0.001$

Table 4.5 and Figure 4.3 reveal that students in rural schools held less favourable perceptions than did students in urban schools for all seven scales. Statistically significantly differences ($p<0.001$) occurred for all seven scales between urban and rural students' perceptions for both actual and preferred classroom learning environment in favour of the urban students. This fact could be confirmed with findings from the classroom observations. In most cases, classroom transactions in rural schools were more dominated by teacher-centred method, having less investigation or laboratory activities and students were less sure of teacher's expectation. Frequently, in rural schools students were told to copy notes from the blackboard before the teachers explained them (Classroom observations, Schools 2, 6, 8, 9). Consequently, students in rural schools did not have a chance to develop a better learning environment. Interviews with the superintendents also supported this assertion. One of superintendents informed the researcher that mostly rural schools were deprived due to their conditions, such as the lack of resources and of teachers. It is common that a teacher should handle more than one or two subjects in which he or she is not competent, thus resulting in relatively poor teaching performance in these subjects (I.S1.18.04.02).

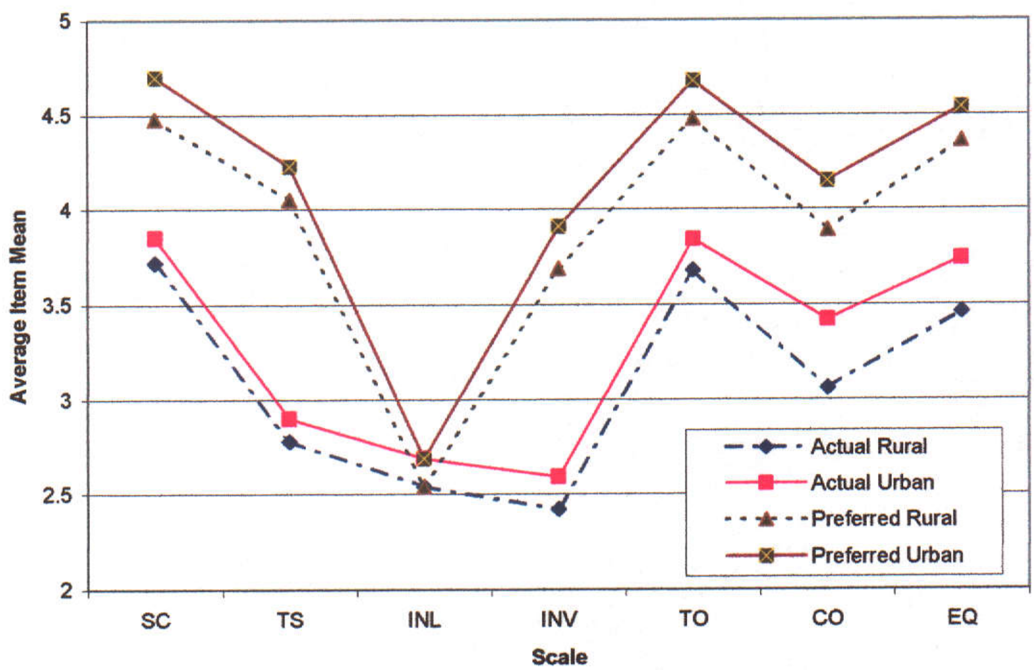

Figure 4.3 Comparison Between Rural and Urban Students' Perception of their Science Classroom Learning Environment

4.3.4 Differences Between Students' and Teachers' Perceptions of Their Science Classroom Learning Environment

In line with previous studies, an investigation on the differences between students' and teachers' perceptions was carried out using class means of students' scores and individual scores of classroom teachers' responses as the unit of analysis. Science classrooms in Indonesian lower secondary school consist of biology and physics, therefore the data were organised into groups of biology and groups of physics classes. This organization yielded 36 data sources for each group. Finally, these 72 class-mean scores were matched with individual scores of appointed science teachers for further analysis. A summary of the average item means and average standard deviations of each scale for both actual and preferred forms is reported in Table 4.6. The average item means are displayed in Figure 4.4 to show the differences between students' and their teachers' perceptions on both the actual and preferred classroom learning environment questionnaires.

Table 4.6 Average Item Mean, Average Item Standard Deviation and t value from t-tests with Paired Samples for Differences Between Students' and Teachers Perceptions of Science Classroom Learning Environment (n=72)

Scale	Form	Average Item Mean		Average Standard Deviation		t value
		Student	Teacher	Student	Teacher	
Student Cohesiveness	Actual	3.77	4.08	0.16	0.46	-2.70*
	Preferred	4.58	4.67	0.16	0.31	-1.15
Teacher Support	Actual	2.86	3.69	0.19	0.33	-7.84**
	Preferred	4.13	4.43	0.17	0.36	-2.87*
Involvement	Actual	2.63	3.34	0.21	0.53	-5.22**
	Preferred	2.63	3.34	0.21	0.53	-5.22***
Investigation	Actual	2.51	2.75	0.24	0.73	-1.39
	Preferred	3.81	4.22	0.26	0.38	-3.48**
Task Orientation	Actual	3.75	3.75	0.16	0.49	0.03
	Preferred	4.58	4.71	0.19	0.26	-1.52
Cooperation	Actual	3.21	3.54	0.23	0.59	-2.32*
	Preferred	4.01	4.57	0.40	0.18	-5.37***
Equity	Actual	3.61	4.16	0.25	0.45	-4.01**
	Preferred	4.46	4.72	0.18	0.30	-2.83*

*p<0.05; **p<0.01; ***)p<0.001

Table 4.6 indicates that in most cases, teachers hold more favourable views of the actual classroom learning environments than do their students, with the exceptions of the *Task Orientation* scale for which both students and teachers views are in agreement. In detail, Table 4.6 reveals that students and their teachers perceived their science classroom learning environment significantly differently on five of the seven scales, namely, *Student Cohesiveness* (p<0.05), *Teacher Support* (p<0.01), *Involvement* (p<0.01), *Cooperation* (p<0.05), and *Equity* (p<0.01). This finding corroborates previous study results (Fisher & Fraser, 1983) in that the teachers' views of the science classroom learning environment were more positive than those of the students.

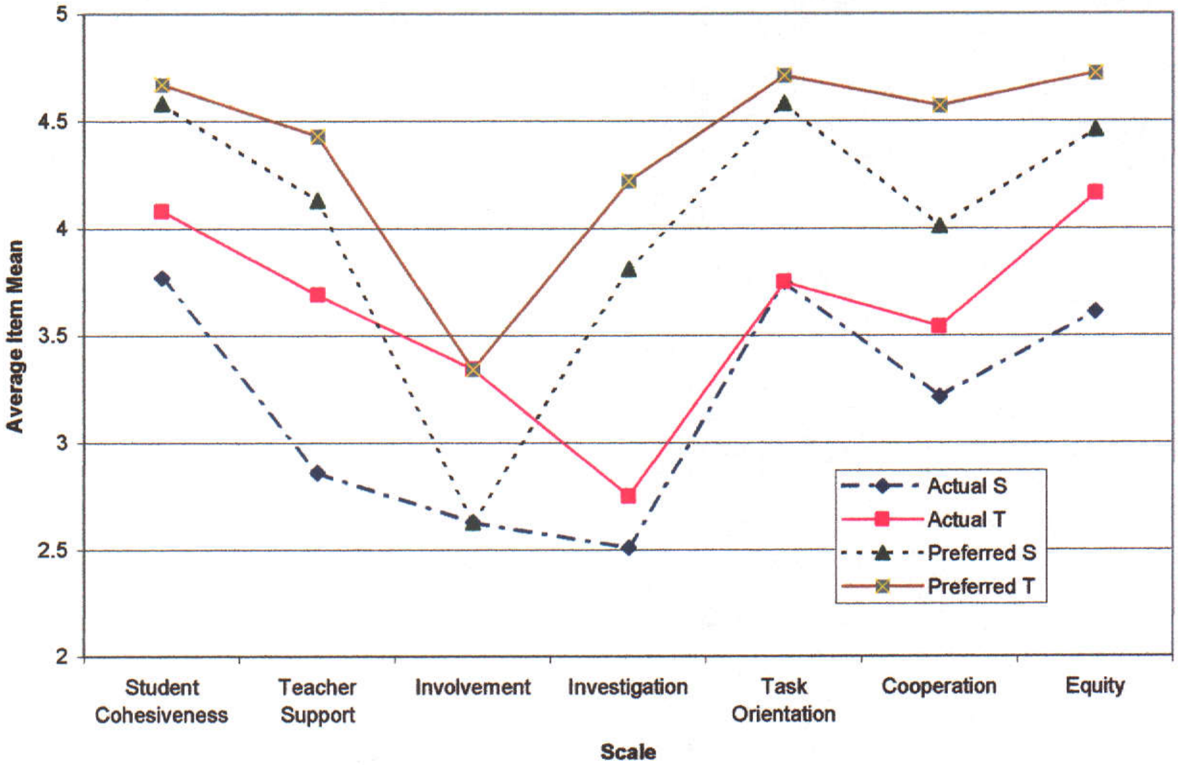

Figure 4.4 Comparison Between Students' and Teachers' Perceptions of the Actual and Preferred Science Classroom Learning Environments

For the preferred learning environment, the teachers tended to have significantly higher preference of the classroom learning environment than their students did. Additionally, statistically significant differences remain for all scales, except *Student Cohesiveness* and *Task Orientation* scales.

Figure 4.4 displays that teachers viewed equally on the *Involvement* scale for both actual and preferred versions as did the students, although the means were significantly different for those two groups. Instead of claiming that both students and teachers may be content with their perceptions based on the *Involvement* scale, a careful analysis shows that both are content but have different perceptions. While the teachers are content in their views about students' involvement, students' responses are somewhere in between 'seldom' and 'sometimes' occurrences. Therefore, if the teachers desire their students to experience more involvement in the learning process, which is what teachers perceive, the teachers need to reconsider the way they teach. This study suggests that teachers should consider teaching strategies that naturally can improve students' involvement as was reported by Wahyudi and Treagust (2001) in chemistry classes.

4.4 Validation of the Indonesian version of SLEQ

As mentioned in Section 3.2.2, the Indonesian version of SLEQ was administered to 131 teachers. This small number of respondents did not enable the researcher to conduct a factor structure analysis. Alternatively, discriminant validity was explored to investigate the strength of the Indonesian SLEQ's scales. In so doing, the mean correlation of a scale with other scales was calculated. The results are presented in Section 4.4.1. Issues concerning the scales' reliabilities are explained in Section 4.4.2. Due to the small size of the sample, only individual scores were used as the unit of analysis. Finally, the ability of the SLEQ in differentiating teachers' views of the school working environment in different schools was determined using the ANOVA test. The results are discussed in Section 4.4.3.

4.4.1 Discriminant validity of the Indonesian SLEQ scales

Mean correlation of a scale with other seven scales in the Indonesian SLEQ was counted and used as the criterion of discriminant validity. The lower mean correlation suggests a greater discriminant validity for that scale. The results for both actual and preferred versions of the Indonesian SLEQ are presented in Table 4.7.

Table 4.7 shows that the discriminant validity, which measured the mean correlation of a scale with other seven scales, ranged from 0.18 (*Work Pressure scale*) to 0.45 (*Innovation scale*) for the actual form, whereas the preferred form has lower (means better) mean correlation scores, which ranged from 0.07 (*Staff Freedom scale*) to 0.33 (*Innovation scale*). These scores are comparable to those of previous studies such as Fisher and Fraser (1990) that ranged from 0.05 to 0.43.

Table 4.7 Mean Correlation of Scales of The Indonesian Version of SLEQ based on teachers' responses (n=131)

Scale	Number of Items	Mean correlation	
		Actual	Preferred
Student Support	7	0.31	0.29
Affiliation	7	0.35	0.31
Professional Interest	7	0.39	0.29
Staff Freedom	7	0.20	0.07
Participatory Decision Making	7	0.33	0.27
Innovation	7	0.45	0.33
Resources Adequacy	7	0.37	0.27
Work Pressure	7	0.18	0.11

Furthermore, the results as shown in Table 4.7 are lower (meaning has a better construct) than those of Irianto (2001). Therefore, these results suggest that the Indonesian version of SLEQ used in this study possessed relatively satisfactory scales construct, although a degree of overlap still existed.

4.4.2 Reliability of the Indonesian SLEQ scales

As explained in Section 3.5.2.1, the Cronbach's (1970) alpha coefficient was calculated for each scale as an estimate of the internal consistency reliability. The results together with eta^2 scores yielded from ANOVA test are displayed in Table 4.8. As mentioned before, only individual teacher scores were used as the unit of analysis.

Table 4.8 shows that in respect of the actual version, the Cronbach alpha coefficients for all scales ranged from 0.54 to 0.82, being greater than the threshold of 0.50 given by Nunnally (1967, 1978), except for *Participatory Decision Making* scale. This relatively low reliability of 0.48 implies that teachers perceived most items in this scale inconsistently. While most items in the original SLEQ measure aspects of school environment which are appropriate for western school culture, these items may not perfectly fit into Indonesian school culture.

Table 4.8 Cronbach Alpha Coefficient (Internal Consistency Reliability) and ANOVA Results of the Actual and Preferred forms of the Indonesian Version of SLEQ (n =131)

Scale	Number of Items	Internal Consistency Reliability		Eta²
		Actual	Preferred	Actual
Student Support	7	0.64	0.58	0.11***
Affiliation	7	0.67	0.59	0.04**
Professional Interest	7	0.65	0.49	0.09***
Staff Freedom	7	0.54	0.54	0.00
Participatory Decision Making	7	0.48	0.38	0.12***
Innovation	7	0.72	0.60	0.15***
Resources Adequacy	7	0.82	0.70	0.08**
Work Pressure	7	0.54	0.36	0.19***

** $p<0.01$ and *** $p<0.001$

For example, an examination of the responses to the items in *Participatory Decision Making* scale shows that they are mostly contradictory of each other. This finding is probably due to cultural bias which may be held by teachers when they interpreted the items. While teachers in western countries can provide 'yes' or 'no' answers towards such items or questions that ask about their role in determining their school programme, seldom are teachers in Indonesia able to do this. The following interview transcripts support this interpretation.

> I: When the school conducts a programme, such as additional lessons after school hours, especially for Year 9 students, are you and other teachers involved in determining that programme?
>
> T: There were many stages to determine a programme. First, the school calls for inputs from all teachers about the proposed programme. Second, the school invited *BP3* (Parent Association) representative to discuses the proposed programme. Finally, the school [*the principal and his or her staff*] organised the programme. (I.TC.S3.12.02.02).

Teacher responses as illustrated in the transcripts reveal a 'diplomatic response' rather than a direct yes or no answer. If teachers responded to the questionnaire in this way, there is no doubt that their responses to the scale such as *Participatory Decision Making* were somewhat variable which resulted in relatively low scale reliability.

However, observing that the margin between the actual score of this scale (0.48) and the threshold score (0.50) which is very small, and considering that the nature of this study is exploratory, thus all scales in the actual form of the Indonesian SLEQ have acceptable internal consistency reliability (McMillan & Schumacher, 1993; Nunnally, 1967, 1978). In addition, these values are also considered acceptable due to the considerably small sample (Stevens, 1992). Therefore, all 56 items of the actual version of the Indonesian SLEQ were maintained for further analysis to explore the nature of school level learning environment.

In comparison, a study using the SLEQ with seven scales of Student Support, Affiliation, Professional Interest, Mission Consensus, Empowerment, Innovation and Resource Adequacy (without Work Pressure Scale), which involved three groups of samples showed that the instrument has alpha reliability coefficients for the scales varying from 0.64 to 0.86 (Fisher & Fraser, 1990). The Indonesian version of this SLEQ used by Irianto (2001) with 27 respondents found the alpha reliability coefficients for the scales varying from 0.20 to 0.91. Another study involving SLEQ (English version), which included the Work Pressure Scale, indicated that alpha reliability coefficients for the eight scales ranged from 0.72 to 0.92 (Cresswell & Fisher, 1996).

With regard to the reliability coefficient scores for the preferred version, the results show that all scales have lower value than those of the actual version. Similar to the pattern found in the actual version, the *Participatory Decision Making* scale, along with the *Work Pressure* scale, have reliability values lower than the threshold. Another scale, namely, *Professional Interest,* has reliability coefficient 0.49 which almost reaches the threshold. These results indicate the need for further study to find out better items to measure the *Participatory Decision Making* and *Work Pressure* dimensions. The rearrangement of items from cyclic order to grouping items for each scale is also a suggestion.

4.4.3 Ability of the Indonesian version of SLEQ to differentiate teachers' perceptions from different schools

Validity features of an instrument are its ability to differentiate the perceptions between groups. Consequently, a one-way analysis of variance (ANOVA) was conducted to determine if the Indonesian version of the SLEQ was able to differentiate significantly between the perceptions of teachers in different schools. This characteristic was examined for each scale with schools membership as the main effect and using individual scores as the unit of analysis.

The analysis of variance (ANOVA) results shown in Table 4.8 suggest that all scales in the Indonesian SLEQ, except *Staff Freedom*, are capable of differentiating between the perceptions of teachers from different groups. The eta^2 values ranged from 0.04 (*Affiliation*, $p<0.01$) to 0.19 (*Work Pressure*, $p<0.001$). These features support the robustness and validity of the Indonesian SLEQ.

Considering the results generated from discriminant validity analysis, scale internal reliability analysis and a series of ANOVA tests, as detailed in Sections 4.4.1, 4.4.2, and 4.4.3, this study suggests that the Indonesian SLEQ is a reasonably robust instrument to measure Indonesian secondary schools' environments and can be used with confidence; however, it could be improved even more for future use.

4.5 Description of school working environments

To depict the nature of the school working environment, the average item mean (the scale mean divided by the number of items in that scale) and average item standard deviation of each scale for both actual and preferred versions of the questionnaire were calculated. T-tests for paired samples for teachers' responses to both actual and preferred versions were performed to check whether or not there were any statistically significant differences of teachers' perceptions of their school working environments. To obtain a more complete picture of the school working environment, this study also sought the differences of teachers' insights of their school working environment based on subject matter taught and on the schools' locality. The results are organised into three sections. First, differences between teachers' perceptions of the actual and preferred school working environments are described in Section 4.5.1. Second, differences between teachers' perceptions of the actual school working environment based on locality are explained in Section 4.5.2. Third, differences between teachers' perceptions of school working environments based on subject matter being taught are presented in Section 4.5.3.

4.5.1 Differences between teachers' perceptions of the actual and preferred school working environments

To extract teachers' views of the actual and preferred school working environments, t-test with paired samples was conducted. Individual data of actual and preferred responses on each scale were matched prior to data analysis. The results consisting of the average item means and average standard deviation for the two versions of the questionnaire and t values are reported in Table 4.9 and the same data are graphed in Figure 4.5.

Table 4.9 Average Item Mean, Average Item Standard Deviation, and t Value from t-test with Paired Samples for Differences Between Actual and Preferred of The Indonesian School Level Learning Environment (n=131)

Scale	Average item mean		Average Standard Deviation		t value
	A	P	A	P	
Student Support (SS)	3.94	4.42	0.46	0.43	9.17***
Affiliation (AFL)	3.87	4.18	0.40	0.49	7.08***
Professional Interest (PI)	3.81	4.17	0.42	0.45	8.36***
Staff Freedom (SF)	2.73	2.65	0.54	0.71	1.57
Participatory Decision Making (PDM)	3.22	3.52	0.56	0.59	4.23***
Innovation (INN)	3.53	4.16	0.53	0.46	12.78***
Resources Adequacy (RA)	3.22	4.49	0.76	0.48	16.60***
Work Pressure (WP)	3.15	3.20	0.52	0.57	1.09

***$p<0.001$

Results from the t-tests for paired samples as displayed in Table 4.9 show that there are statistically significant differences ($p<0.001$) between teachers' perceptions of their actual and preferred working environment on all scales except *Staff Freedom* and *Work Pressure* in favour of the preferred version. Additionally, we also can draw tentative assertions from Figure 4.5. First, the teachers held their views of their school environment positively, except on the *Staff Freedom* scale. Interestingly, teachers indicated that they preferred school environments that had less staff freedom than they perceived to be actually present. An explanation of this is that teachers might be accustomed to working under certain orders and procedures provided by the principal or school administrator. Alternatively, teachers tend to work constantly in order to cover all material for final examination purposes. Therefore, they are content to work in the environment that has set down certain procedures rather than in a completely unstructured free atmosphere.

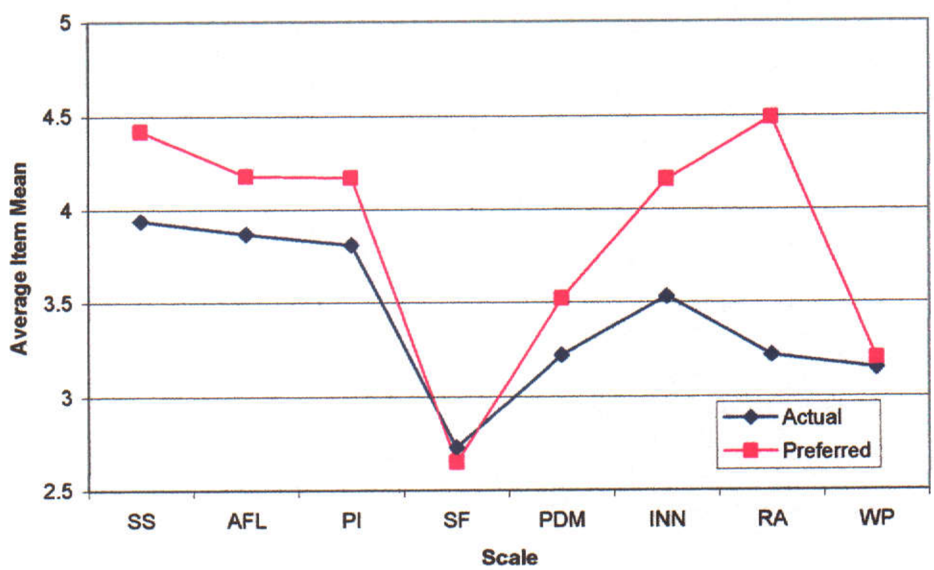

Figure 4.5 Comparisons Between Teachers' Perceptions of the Actual and Preferred School Level Learning Environments

Second, the greatest difference between actual and preferred perception, which is more than twice the standard deviation, occurs on the *Resource Adequacy* scale. This means that teachers want their schools to have more resources, such as more textbooks and laboratory equipment, to support them in conducting teaching and learning practices. Third, teachers in different schools also tended to have desired school environments in which more innovations occur. This might contradict teachers' perceptions on *Staff Freedom* scale, since innovation calls for staff freedom. However, it may be explained that teachers' preference for more innovation in their school environments refers to their preference as a group rather than as an individual. Fourth, teachers in different schools have similar degrees of preference that their schools' environments had more affiliation and student support, and provided the teachers with more professional development and more involvement in school decision-making. Fifth, teachers were content with the extent to which schools emphasised work pressure as no significant difference was found on this scale. A better explanation for this is that teachers tend to be happy with the degree of work pressure set by their school at slightly above 'sometimes'. They did not want their schools to put a higher work pressure since it would require them to stay longer at school and to do extra jobs. In fact, most teachers in Indonesia have a second or even a third job teaching at others school to make additional income. Therefore, being happy with their perception of work pressure scale at 'sometimes' level is a reasonable response given these circumstances.

4.5.2 Differences between teachers' perceptions of the actual school working environment based on school locality

The investigation of the differences in teachers' perceptions of their school environment based upon school locality was conducted using t-tests with independent samples. All seven scales of both actual and preferred forms of the Indonesian SLEQ were placed as the dependent variables, whereas schools' locality variable was placed as the determinant variable. A summary of average item mean, average item standard deviation and t values from t-tests for independent samples for differences between rural and urban teachers' perceptions of their school working environment is provided in Table 4.10. For comparison purposes, these data also are graphed and presented in Figure 4.6.

Table 4.10 shows that there are no statistically differences in the urban and rural teachers' perceptions of their school working environment except on the actual perception of the *Participatory Decision Making* ($p<0.05$), and *Work Pressure* ($p<0.05$), where the rural teachers' perceptions are statistically significantly better than those of their urban counterparts. Figure 4.6 provides comparison of the average item means for eight scales of the Indonesian SLEQ based on school locality.

Table 4.10 Average Item Mean, Average Item Standard Deviation and t Values from t-test with Independent Samples for Differences Between Rural (n = 56) and Urban (n=75) Teachers' Perceptions of the Actual and Preferred School Working Environment

Scale	Form	Average Item Mean		Average Item Standard Dev.		t value
		Rural	Urban	Rural	Urban	
Student Support	Actual	3.99	3.91	0.51	0.42	1.00
	Preferred	4.42	4.42	0.42	0.44	0.07
Affiliation	Actual	3.89	3.85	0.44	0.37	0.53
	Preferred	4.19	4.17	0.52	0.47	0.30
Professional	Actual	3.85	3.77	0.44	0.41	0.96
Interest	Preferred	4.24	4.12	0.47	0.43	1.42
Staff Freedom	Actual	2.76	2.70	0.52	0.56	0.66
	Preferred	2.75	2.57	0.69	0.73	1.41
Participatory	Actual	3.36	3.11	0.61	0.50	2.42**
Decision Making	Preferred	3.61	3.44	0.59	0.58	1.67
Innovation	Actual	3.55	3.51	0.58	0.48	0.40
	Preferred	4.24	4.09	0.45	0.45	1.96
Resources	Actual	3.26	3.19	0.77	0.76	0.52
Adequacy	Preferred	4.57	4.43	0.45	0.50	1.62
Work Pressure	Actual	3.25	3.06	0.62	0.42	2.18**
	Preferred	3.31	3.11	0.53	0.58	2.12**

**p<0.05

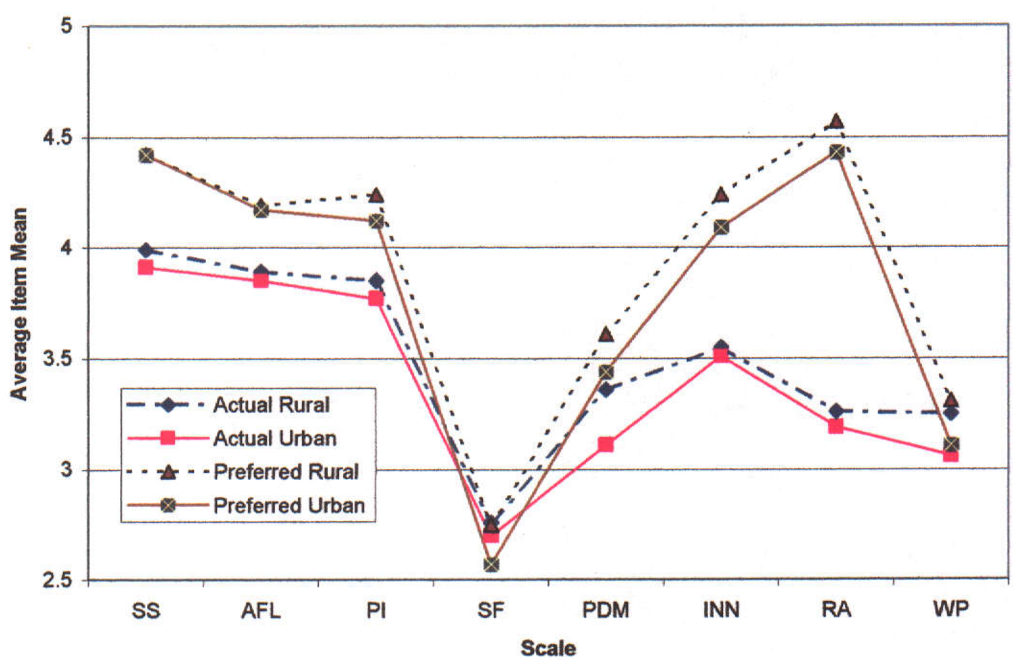

Figure 4.6 Comparisons of Teacher Perceptions of the Actual School Environments Based on School Locality

This study shows that to some extent teachers in rural schools (n=56) experienced a relatively more favourable working environment than did teachers at urban schools (n=75). However, all teachers share relatively similar perceptions on three scales, namely, *Affiliation, Professional Interest, and Innovation*, and their perceptions were different but not statistically significant on *Student Support, Staff Freedom, and Resource Adequacy* scales. Only *Work Pressure* and *Participatory Decision Making* scales were perceived significantly different ($p<0.05$). Similarly, this trend also occurred on teachers' perceptions of the preferred working environment.

As mentioned above, teachers in rural schools held a slightly more positive view on *Student Support* than did their counterparts in the urban area. Although the difference was not statistically significant, however, it showed that teachers in rural schools faced relatively fewer problems with their students' behaviour than did urban school teachers. This finding was confirmed with the data that emerged from school and classroom observations followed by teacher interview. Teachers in urban schools admitted that their schools were sometimes disturbed by students' disruptive behaviour such as fighting, leaving school without permission, and being off task during the lessons (I.TD.S4.24.01.02). In contrast, rural teachers found their students to be polite and good members of the class or school community (I.TA.S1. 14.02.02). Tentatively, these differences can be explained as a result of societal differences between rural and urban settings. The dynamic rhythm of urban living affects, either positively or negatively, the value and culture held by the community members. It was reported that students' crime and misbehaviour increased both quantitatively and qualitatively in urban areas and in schools during the late 1990s (Kompas, 1999). On the other hand, a stable rural living enabled the people to hold firm to their values and culture. Consequently, students from this area are humble, respect their elders, and are cooperative with their peers.

In contrast, the findings on the *Resources Adequacy* scale were refuted with those from the classroom observations described in Chapter 6, Sections 6.2.1 and 6.2.2. Schools in urban areas are better equipped than their counterparts in rural areas. This finding contradicts the teachers' perceptions on this scale. A possible explanation for this contradiction is due to the total number of students and the practical activities that the teachers taught. Teachers in rural schools dealt with a lesser number of students and conducted fewer practical activities than did their counterparts in urban schools. These conditions, therefore, may affect teachers in urban and rural schools in perceiving this scale.

4.5.3 Differences between the teachers' perceptions of the school working environment based on the subject matter being taught

To find out if there were statistically significant differences in the teachers' views of their actual school working environment based on the subject matter being taught, similar procedures as taken in Section 4.5.2 were followed. Using all eight scales of the Indonesian SLEQ as the dependent variables, and subject matter as the determinant variable, a one-way between groups ANOVA with post-hoc comparisons was performed. The Tukey's honesty significant difference (HSD) multiple comparison test was employed to confirm statistically significant differences that exist between groups, and the results was provided in Appendix I. Comparison of the average item means for eight scales of the Indonesian SLEQ based on subject matter being taught is provided Table 4.11 and in Figure 4.7.

Table 4.11 Average Item Mean and Average Item Standard Deviation From a One-way Between Groups ANOVA With Post-hoc Comparisons and With Independent Samples for Differences Among Biology (n = 49), Physics (n = 51) and Non-science (n = 31) Teachers' Perceptions of the Actual School Working Environment

Scale	Biology		Physics		Non-science	
	Mean	SD	Mean	SD	Mean	SD
Student Support (SS)	3.85	0.47	3.87	0.46	4.21	0.35
Affiliation (AFL)	3.84	0.40	3.81	0.44	4.00	0.31
Professional Interest (PI)	3.75	0.44	3.72	0.42	4.04	0.33
Staff Freedom (SF)	2.80	0.51	2.67	0.57	2.72	0.55
Participatory Decision Making (PDM)	3.04	0.56	3.17	0.46	3.57	0.59
Innovation (INN)	3.42	0.54	3.41	0.53	3.89	0.29
Resources Adequacy (RA)	2.90	0.77	3.31	0.71	3.59	0.64
Work Pressure (WP)	3.09	0.52	2.95	0.41	3.55	0.46

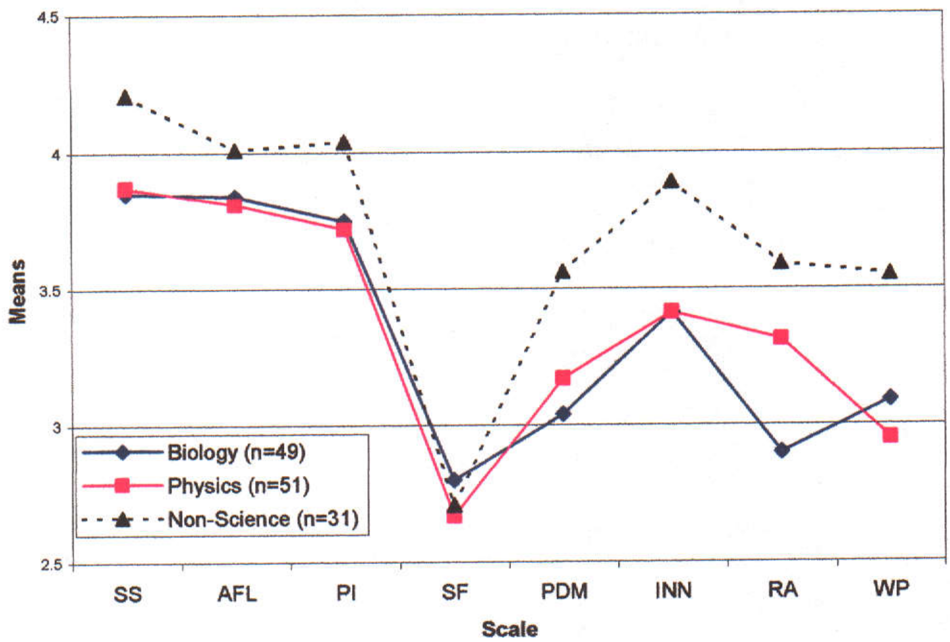

Figure 4.7 Comparisons of Teacher Perceptions of the Actual School Environment Based on Subject Matter Being Taught

In general, non-science teachers (n=31) hold a more favourable view of their school working environments than biology and physics teachers. The results as presented in Appendix I indicate that significant differences were found on all scales except *Affiliation* and *Staff Freedom*. On the other hand, biology (n=49) and physics (n=51) teachers perceived their school environments similarly; but small differences between their perceptions were found on three scales, namely, *Staff Freedom, Participatory Decision Making,* and *Work Pressure*. Biology teachers hold a more positive view of their working environment on *Staff Freedom* and *Work Pressure*, but less favourable on *Participatory Decision Making* than physics teachers did, but these differences were not statistically significant. A statistically significant difference between their perceptions was found only on the *Resource Adequacy* scale in favour of physics teacher. This finding implies that most schools have more equipment for physics than for biology. This condition may be due to the expensiveness of biology laboratory equipment. While most biology lessons require expensive consumable material, physics lessons can use materials that are readily available and much cheaper. Therefore, most schools tend to have better and more adequate physics resources than biology ones.

4.6 Summary of the chapter

This chapter reported the findings obtained in the first stage of the study based on the methodology that was discussed in Chapter 3, Section 3.2. With regard to the use of the Indonesian WIHIC, the findings included the cross-validation of the questionnaire, the comparison of the actual and preferred perceptions of students and teachers, of male and female students', and of school locality. The findings related to the Indonesian version of SLEQ included the cross-validation of the instrument, the comparison of the actual and preferred perception of teachers, the comparison of teachers' perception of the actual school working environment based on school locality, and on subject matter being taught.

Briefly, it is summarised that both questionnaires met the criteria as good and reliable instruments to investigate science classroom learning environments and school working environments in an Indonesian lower secondary school context. Regarding the Indonesian version of WIHIC, generally each scale in this questionnaire exhibited satisfactory internal consistency reliability and discriminant validity, and it differentiated between the perceptions of students in different classes. The results, using both the individual score and the class mean as the unit of analysis, were acceptable by and large, and were comparable to those obtained previously with the original cross validation sample (Aldridge et al., 1999; Fraser, McRobbie, & Fisher, 1996) and were slightly better than those obtained in the study at an Indonesian university context (Margianti & Fraser, 2000; Margianti et al., 2001). Factor analysis for the Indonesian WIHIC, involving the individual student's score as the unit of analysis, produced a factor structure that replicated to a large extent the structure reported previously by (Aldridge et al., 1999).

The descriptions of science classroom learning environments can be summarised as follows. First, there was a gap between the actual and preferred perceptions held by the students at all schools regardless of locality. Obviously, students were not content with the actual learning environment as indicated in their preferred view of what kind of learning environment should be created by the teacher. Students would prefer a learning environment that has more teacher support, better student cohesiveness, clearer task orientation, more investigations, and greater cooperation, as well as greater equity during class sessions.

Second, female students have somewhat better perceptions of the actual and preferred classroom learning environment than do male students on all scales except *Teacher Support* of the actual version. With regard to gender equity, teachers should be aware of this fact and provide such efforts to eliminate this gap. With regard to this finding, teachers should learn how to enhance the teaching atmosphere in order to provide more support to female students and give clearer learning direction for male students.

Third, disparities also arose between perceptions of students in rural schools and of students in urban schools. In most cases, students in rural schools experienced a less positive learning environment than did their counterparts in urban areas. This finding warrants teachers in rural schools and policy makers to consider what should be done to provide a better education, with respect to classroom learning environment, in those schools.

Fourth, this study found that teachers' perceptions were more favourable than their students on both the actual and preferred learning environment for all seven scales, except on *Task Orientation* in which their perceptions are matched. This finding suggests that teachers should be aware and try to investigate why their students have less positive perceptions If teachers expect their students to perceive as the teachers reported, these data suggest that teachers examine and improve their teaching practices.

The Indonesian version of SLEQ, administered to relatively small number of respondents, has also gained its merit as a good instrument with few constraints. Generally, each scale of the Indonesian SLEQ has acceptable internal consistency reliability, except the preferred version in which three scales have lower scores than the threshold as set up by Nunnally (1967, 1978). Despite this limitation, however, the Indonesian SLEQ possessed satisfactory discriminant validity which is comparable to those obtained in a previous study (Fisher & Fraser, 1990); and it also differentiated between the perceptions of teachers in different schools. Taken as a whole, this instrument is worthy of being used in further study in the Indonesian school context yet minor revision is needed to enhance its reliability and validity.

The differences between perceptions of school environments of biology and physics teachers and among rural, suburban and urban schools teachers, particularly on *Resources Adequacy*, warrant further investigation. It is necessary to identify why their perceptions are different in order to provide an appropriate intervention.

This study also indicated that the differences between teachers' views of the actual and preferred school environments are not only statistically but also practically significant. Most scales, except *Staff Freedom* and *Work Pressure*, have different effect size of actual and preferred versions that ranged from 0.52 to 2.05. It is suggested that research for improving school environments, by matching teachers' actual and preferred perceptions, is noteworthy and more research needs to be conducted.

Chapter 5. The Intended and Perceived School Science Curriculum

5.1 Introduction

This study was designed to investigate the educational practices and learning outcomes in science classrooms of rural and urban lower secondary schools in Kalimantan Selatan, Indonesia. As explained in Chapter 1 and elaborated further in Chapter 3, six research questions were used to guide this study. As previously mentioned in Chapter 3, this study was conducted in two stages. The first stage was concerned with the first two research questions and the results have been presented in Chapter 4. The second stage was conducted in response to the last four of the six research questions, namely: (3) What is the intended science curriculum that exists in rural and urban lower secondary schools?, (4) How do teachers perceive the intended science curriculum in rural and urban lower secondary schools?, (5) How do teachers implement the existing science curriculum?, and (6) What are students' outcomes of the science curriculum in these schools?

The purpose of this chapter is to describe the results that emerged from the second stage of the study, particularly on the aspects of the intended and perceived science curriculum. While this chapter provides direct responses to Research Questions 3 and 4, responses to Research Questions 5 and 6 are addressed separately in Chapter 6. The structure of this chapter is organised as follows: first, the description of the intended lower secondary school science curriculum is elaborated in Section 5.2; second, teachers' perceptions of the intended science curriculum in lower secondary schools are illustrated in Section 5.3; and finally, summary of this chapter is described in Section 5.4.

5.2 The intended lower secondary school science curriculum

As mentioned in Chapter 3 Section 3.3.1.2, all the complementary documents of the *Regulation of the Ministry of Education and Culture (MOEC) (Keputusan Menteri*

Pendidikan dan Kebudayaan or Kep. Men. Dikbud) number 060/U/1993 dated 25 February 1993, *Content Analysis of Teaching Material for Biology and Physics* (*Analisis Materi Pelajaran –AMP IPA Biologi dan Fisika untuk SLTP*), and the relevant textbooks were included as samples to explore the official or intended science curriculum in lower secondary school. Accordingly, the results are organized into the following sections. Extracts from the document of *Curriculum 1994 for Primary Education: Foundation, Programme and Development* (*Kurikulum Pendidikan Dasar 1994: Landasan, Programme dan Pengembangan*) is presented in Section 5.2.1. *Outlines of Instructional Programmes of Biology and Physics for lower Secondary School* (*Garis-garis Besar Programme Pengajaran-GBPP Mata Pelajaran IPA Biologi dan Fisika untuk SLTP*) are explained in Section 5.2.2. A summary of a content analysis of the *Guidelines for Implementing Curriculum Textbooks* (*Buku Pedoman Pelaksanaan Kurikulum*) is displayed in Section 5.2.3. The results from *Content Analysis of Teaching Material for Biology and Physics* (*Analisis Materi Pelajaran –AMP IPA Biologi dan Fisika untuk SLTP*) and of science textbooks in biology and physics for Year 9 students are presented in Sections 5.2.4 and 5.2.5, respectively. Finally, a summary of curriculum documents analyses results is provided in Section 5.2.6.

5.2.1 Curriculum 1994 for Primary Education: Foundation, Programme and Development (Kurikulum Pendidikan Dasar 1994: Landasan, Programme dan Pengembangan)

This book contains six chapters and describes principle guidelines for developing and implementing the Basic Education Curriculum 1994 at the provincial level.

Chapter 1 of this document, Basis (*Landasan*), explains the philosophical grounds of the Indonesian national education system. It is stated that the Indonesian national education system is rooted and grounded on the Indonesian nation's culture, and is based on *Pancasila - five principles as national philosophy* and the 1945 Constitution (*Undang-Undang Dasar 1945*). It implies that all educational activities in any school within Indonesia should not be contrary to the values of Pancasila and of the 1945 Constitution. This chapter also describes briefly the functions of national education as to develop the ability and to increase the standard of living and the dignity of the Indonesian people in the frame of endeavours to realize national goals.

Furthermore, this chapter defines basic education as a 9-year education programme, which consists of six years in primary school and three years in lower secondary school.

As a general overview, the chapter also asserts that the basic education curriculum is designed to achieve national education goals by considering the student's development levels, concurrence with the environment, the needs of national development, the development of science and technology, and the arts. With regard to basic education at the primary school level, the curriculum should emphasize basic skills and ability to read, write and do arithmetic or 3Rs (*Baca-Tulis-Hitung or Calistung*). On the other hand, the Curriculum at the lower secondary school level should give emphasis to the student's ability in mastering the principles of science and technology. It is expected that students at the lower secondary school will be able to gradually develop various skills, such as systematic and critical thinking, simple problem solving, and be able to act independently in the spirit of togetherness. Finally, the chapter mandates the adoption of a basic education curriculum for all educational units including within school as well as out of school paths. The latter is allowed to take necessary adjustments due to any constraints that may be faced.

Chapter 2, Goal (*Tujuan*), clarifies the goals of education in Indonesia. National Education is aimed at elevating the intellectual life of the nation and developing the complete Indonesian person, i.e. one who is devout and God fearing, with high morality, possessing knowledge and skills, physically and mentally healthy, who has a stable mentality, is independent and has responsibility towards the society and nation. At the institutional levels, the educational goals are specified as to the primary school and the lower secondary school levels. Basic education at primary school level is aimed to give students with the basic skills of 'Reading-Writing-Arithmetic' or 3Rs (*Baca-Tulis-Hitung*), basic knowledge and skills that are useful for the students according to student's development level, and also to prepare the students for entering and participating in lower secondary school. While at the lower secondary school-*SLTP*, the goal of education is to promote and elaborate the basic knowledge and skills that students achieved at primary school, and prepare the students to study at upper secondary school.

The definition of basic education curriculum and its contents, the subject matter that should be taught, the duration of schooling and the structure of teaching programmes are explained in Chapter 3. The basic education curriculum is defined as a set of plans and policies about the content and lesson materials as well as strategies used in conducting teaching and learning processes in primary and secondary schools. The basic education curriculum consists of ten subjects which are presented in Table 5.1.

Table 5.1. The Structure of the Teaching Programme for Grade 1-9 According to the Basic Education Curriculum

Subjects	Number of Periods (per week) at Each Level and Grade								
	Primary School						Secondary School		
	1	2	3	4	5	6	7	8	9
Pancasila and Civic Education	2	2	2	2	2	2	2	2	2
Religions	2	2	2	2	2	2	2	2	2
Indonesian Language	10	10	10	8	8	8	6	6	6
Mathematics	10	10	10	8	8	8	6	6	6
Natural Science (IPA)	-	-	3	6	6	6	6	6	6
Social Science (IPS)	-	-	3	5	5	5	6	6	6
Handicraft and Arts	2	2	2	2	2	2	2	2	2
Health and Physical Education	2	2	2	2	2	2	2	2	2
English	-	-	-	-	-	-	4	4	4
Local Content	2	2	4	5	7	7	6	6	6
Total	30	30	38	40	42	42	42	42	42

Notes: The length of period varies; it is equal to 30 minutes for Year 1 and 2; 40 minutes for Year 3 to Year 6; and 45 minutes for Year 7 to Year 9. (Ministry of Education and Culture, 1994a)

Table 5.1 indicates that basic education is delivered within six years in primary school and three years in lower secondary school. Natural Science at lower secondary school is given 6 periods per week and in practice this allocation is divided equally for Biology and Physics classes.

Natural Science functions to provide the students with knowledge of the natural environment, to develop student's skills and technology awareness relevant to its application in daily life. Science in primary school is introduced at the beginning of Year 3 and more or less is aimed to give students information through observations of various natural and modified environments. In lower secondary school, Science is compulsory for all students of all Year levels, and is aimed to introduce the students to the basic concepts of science knowledge such as causal-effect law and emphasizes the use of tools and equipment during the observations.

The following chapter, Implementation (*Pelaksanaan*), elucidates schooling terms, the teaching system, lesson planning, and the instructional language. According to Curriculum 1994, schooling in primary and lower secondary schools is divided into three terms. The minimal effective teaching and learning days in a year is 240 days including end of term evaluation. Primary schools adopt the classroom teacher system, while lower secondary schools use the subject matter teacher system instead. Each teacher is advised to create yearly plans, term plans, and lesson plans as requirements for teaching preparation. Teaching and learning practices are conducted in the classical system in which students of similar age and ability are grouped together. The instructional language is Bahasa Indonesia - the Indonesian language; however, the local language may be used at the early stage of primary school or as far as it is deemed necessary.

The evaluation system on teaching and learning progress as well as on students' achievement is regulated and planned by the office of the Ministry of National Education (MNE) at the provincial level. Chapter 5 of the book stated that students' results of assessment at the end of the academic year are used as a consideration for placing students at the following class or level of school. At the end of Year 6 of primary school and Year 9 of lower secondary school, the assessments are nationally organized, known as *Evaluasi Belajar Tahap Akhir National (EBTANAS)*, for some subjects, including Natural Science.

Finally, Chapter 6 of the document explains the general rule for further development of Curriculum 1994 at the provincial level. Basically, the general principle of Curriculum 1994 must be adhered to, yet the district or even schools are given the freedom to choose teaching strategies and resources used in implementing the curriculum.

5.2.2 Outlines of Instructional Programmes of Biology and Physics for lower secondary school (Garis-garis Besar Programme Pengajaran-GBPP Mata Pelajaran IPA Biologi dan Fisika untuk SLTP)

Outlines of instructional programmes (*Garis-Garis Besar Programme Pengajaran-GGBP*) are specific for each subject matter. It contains definitions and functions of the subject matter, goals, content coverage and indicators for teaching the subject. Section 5.2.1 has mentioned briefly the definition of and function of Natural Science and general aims of basic education. In this document, the goals of Natural Science teaching in lower secondary school are elaborated. It is asserted that teaching and learning science in lower secondary school (institutional level) is designed to enable students to:

1. Enhance their awareness of environmental sustainability, of national pride, and of the greatness of God.
2. Understand scientific concepts and their inter-dependability
3. Develop rational thinking in solving their daily life problems
4. Develop scientific process skills to achieve scientific concepts as well as to develop student's scientific judgments.
5. Apply scientific concepts in producing simple technology relevant to human needs
6. Achieve basic knowledge for their preparation pursuing further education.

Furthermore, more specific goals, namely, learning goals for both biology and physics classes at each grade are given in this document and function as a benchmark for guiding the teacher to make lesson plans. For example, learning goals of Year 9 biology classes in the second term are as follows:

1. Students are able to make observations and to report the results in order to understand the animal reproductive system.
2. Students are able to infer, from their observations, results in order to understand hybridization concepts, and be able to apply the concepts in daily life.

Similarly, there are also two learning goals in Year 9 physics classes in second term:

1. Students understand magnetism and its influence, are able to do experiments to investigate magnetism properties and electromagnetism, and are able to solve problems related to simple technology products.
2. Students understand the electromagnetism induction by developing their ability to conduct experiments.

According to this document, the content coverage of school science in lower secondary school is presented in Table 5.2.

Table 5.2. Science Topics or Themes in the Indonesian Lower Secondary School

Class	Year	Topics (Themes)
Biology	7	Living things characters, living organism, living things varieties, ecosystem, interdependency and organism interactions
	8	Organ systems of living things
	9	Living things sustainability, hybridization, food production enhancement, health and nutrition, and population
Physics	7	Measurement, matter, mechanics principles, temperature and solar system
	8	Heat, sound and wave, earth and space, light and electricity
	9	Electric behaviour in a closed circuit, magnetism, and basic component of electronics

This document provides seven points as teaching indicators. First, *GBPP* contains a minimum competency that students should master in order to achieve both classroom goals and the intended learning outcomes goals. Second, all concepts (themes) in the *GBPP* have been ordered as they are; however, teachers are allowed to alter the order as long as they are still in the same school term. Third, the breadth and depth of the lesson content must be adhered to in accordance with the time allocation, while learning activities and teaching methods suggested are advisory and not mandatory. Fourth, time allocation is given in each school term. Teachers are given the opportunity to manage their time used for teaching each concept or theme. Fifth, learning activities should be directed to practical work which encourage students to develop their process skills such as making observations, designing and conducting experiments, measuring, classifying and inferring. Sixth, examples and concept application embedded in the science lessons should be harmonized with the school's environment to enable students to easily reach their understanding. Seventh, teachers are allowed to use supplementary textbooks that promote students' understanding of the concepts being studied (Ministry of Education and Culture, 1998c, 1998d).

5.2.3 Textbooks of Guidelines for Implementing Curriculum (Buku Pedoman Pelaksanaan Kurikulum)

There are four documents that provide teachers with the directions of how to implement the school science curriculum. These documents are *Direction for Implementing Teaching and Learning Processes* (*Petunjuk Pelaksanaan Proses Belajar dan Mengajar*), *Guidelines for Evaluation Processes* (*Petunjuk Pelaksanaan Penilaian*), *Guidelines for Guidance and Counselling Processes* (*Petunjuk Pelaksanaan Bimbingan dan Penyuluhan*) and *Technical Guidelines for Teaching Physics and Biology* (*Petunjuk Teknis Pelaksanaan Pengajaran Fisika dan Biologi*).

5.2.3.1 Direction for Implementing Teaching and Learning Processes (Petunjuk Pelaksanaan Proses Belajar dan Mengajar)

The first document entitled *Direction for Implementing Teaching and Learning Processes* functions as a benchmark for all educational practitioners in planning, organizing, conducting and evaluating teaching and learning activities. The book explains important concepts and definitions of, and methods and approaches in teaching and learning that teachers must take into account. Teaching and learning processes are defined as interaction activities between teacher–students and students-students. Teaching in a classroom refers to the teacher's creation in such a learning environment that stimulates students to think and learn. It is emphasized that teaching is not merely a transfer of knowledge from teacher to students. Learning is delineated as a process in which an individual, who can be student or teacher, acquires knowledge. This can be identified from the development of each individual's attitude and behaviour through regular assessment.

According to this book, there are five essential components of teaching and learning processes. These components are (1) goals, (2) teacher and students, (3) teaching and learning materials, (4) methods, and (5) assessment. An effective teaching and learning process occurs only if these components are fulfilled and they support each other. For example, an effective teaching and learning process happens when the students are motivated by a dedicated teacher, they interact with interesting and challenging teaching materials, the goals are clearly defined, and the results are easily assessed. Teaching and learning processes can be conducted during intra curriculum and extra curriculum activities. The former refers to the activities that are carried out in the classroom during the formal school period and is aimed to achieve a minimum competency for each concept being studied. The latter refers to the processes that are conducted at out of formal school periods and are aimed to develop students' views and abilities in applying their knowledge into real life situations.

Furthermore, this book suggests teaching approaches and methods to which teachers should adhere. It is recommended for all teachers, including science teachers, to apply a particular approach, namely, the process skill approach. This approach emphasizes how the students attain the skills to acquire and communicate the knowledge being learnt. More specifically, it is stated that teaching and learning science in lower secondary school is conducted through simple experiment and some practical activities focused on the development of students' processes skills (Ministry of Education and Culture, 1994b), p. 77). Accordingly, this book mentions that teaching and learning science must enable students to achieve eight process skills as listed in Table 5.3. In addition, four other teaching approaches in the science classroom also are suggested. These are the conceptual approach, the problem-solving approach, the inductive-deductive approach and the environmental approach. In using any of these approaches, teachers should consider the concepts being taught and the available resources. Various teaching methods for all lessons are described in this book. With regard to school science, five main teaching methods are recommended. These are the experimental method, the demonstration method, the discussion method, excursion method and the lecturing method. More detailed explanations of teaching approaches and methods are provided in Section 5.2.3.2.

Description of content coverage generally is provided in each GBPP for each subject matter. For example, Table 5.2 provides information of what should be taught in the science classroom. However, this book describes the science school content coverage in more detail. In addition to the content presented in Table 5.2, this document provides the teachers with four more aspects that should be taken into consideration during teaching science in both physics and biology classes. These aspects are process skills, technology, environment awareness and development of scientific values and attitudes. Table 5.3 summarizes these four aspects of teaching science and provides description of each aspect.

Table 5.3 Aspects Included in Teaching School Science

Aspects	Descriptions
Process skills	Observing, Inferring, Predicting, Planning and conducting experiment, Using equipment and material, Applying the concept, Communicating, Asking questions
Technology	Application of science concepts to produce a technology product such as yoghurt and '*tempe*'. Application of science concepts in solving daily problems, for example, how to find alternative energy sources.
Environmental awareness	Environment conservation, natural resources management and pollution.
Value and science related attitudes	Scientific attitude, nation pride, code of conduct towards environment, religious values.

(Ministry of Education and Culture, 1994b)

To some extent, the book is intentionally prepared for all teachers and all subjects. Therefore, the information in this book is more or less presented in a general sense and is not yet operational. Similarly, two other books, namely, *Guidelines for Evaluation Processes* and *Guidelines for Guidance and Counseling Processes* contain general directions. The former that is provided for all teachers and all subjects contains procedures of assessment. The information provided in this book is generic and must be adopted for all subjects including science. With regard to science subjects, details of assessment procedures are included in the *Technical Guidance for Teaching Physics and Biology*, which is explored in the following paragraph. On the other hand, the latter contain direction for guidance and counselling teachers (*guru bimbingan dan penyuluhan*) in conducting the practice of guidance and counselling. Although this book is solely aimed for specialist teachers, i.e., guidance and counselling, however, other teachers are welcome to consider these ideas and will benefit from reading it.

5.2.3.2 Technical Guidelines for Teaching Physics and Biology (Petunjuk Teknis Pelaksanaan Pengajaran Fisika dan Biologi)

The two other books are *Technical Guidance (Direction) for Teaching Physics and Biology*, respectively. As indicated by its title, each book contains technical details that are designed to help science teachers in preparing and teaching physics and biology. Chapters 1 and 2 of these books mention that the books are provided to assist science teachers in planning, developing lesson plans, and teaching science in accordance with Curriculum 1994 as explained in more detail in Chapters 3, 4 and 5 of these books.

Chapter 3 of each book discusses the principels of teaching science. It explains approaches and methods for teaching science, structure of teaching science, classroom and laboratory management, the use of question techniques and assessment. As mentioned in Section 5.2.3.1, six main approaches in teaching science are recommended. These are the conceptual approach, the process skill approach, the problem solving approach, the inquiry approach, the environmental approach, the historical approach and the inductive and deductive approach. The conceptual approach emphasizes how the teacher can assist students in making the concept being studied become meaningful by providing links among the concepts. It is expected that by applying this approach students will not memorize the concept but rather to understand it through interrelatedness of a concept with the other.

With regard to the process skill approach, eight main process skills, as depicted in Table 5.2, are explained further into 27 sub-process skills. These process skills are intended to help teachers at an operational level in planning teaching using this approach. For example, if the lesson is aimed to develop students' process skills in observation, then teachers should deliver the lesson that enable students to employ as many as his or her senses such as vision, taste, audio and smell, to gather relevant facts, to identify differences and similarities, and to classify things or data during observation activities. A complete description of process skills and sub-process skills of school science is provided in Table 5.3.

Table 5.3 Process Skills and Sub-Process Skills in School Science

Science Process Skills	Sub- Science Process Skills
Observation	1. Employ as many as possible student's senses
	2. Collect relevant facts
	3. Explore differences and similarities
	4. Classify things or data
Inferring observation results	5. Record every observation separately
	6. Connecting observation results
	7. Identify patterns in a serial of observation
	8. Draw a conclusion
Predicting	9. Predict based on the observation results
Using reagents and equipment	10. Competent in using reagent and equipment, and understand why and how to use it
Applying concepts	11. Apply concepts that had been learnt into a new situation
	12. Use the concepts to explain what is happening in the new situation
	13. Create hypotheses
Planning experiment	14. Select equipment, reagents and source for experiments
	15. Setting the variables
	16. Identify dependent and independent variables
	17. Determine what should be observed, measured or recorded
	18. Determine steps and procedures of experiment
	19. Determine how to process the data in order to draw a conclusion
Communication	20. Writing a report systematically and clearly
	21. Explain the experimental results
	22. Discuss the experimental results
	23. Describing the data using graph, table and figure
	24. Read table and graph
Questioning	25. Asking what, how and why questions
	26. Asking for explanation
	27. Propose questions related to hypothesis

(Ministry of Education and Culture, 1995a, 1995b)

It is suggested that all process skills should be accommodated and distributed in use throughout teaching time allocation. Whatever teaching method is being used should enable teachers to assist students develop and attain their science process skills (p. 26).

Another teaching approach recommended in this technical guide documents is the inquiry approach. This approach allows students to conduct their own experiments. It is explained that the inquiry approach consists of six steps which are (1) stating the problem; (2) posing the hypothesis; (3) planning the action, (4) executing the action; (5) gathering the data; and (6) drawing conclusions. Based on the teacher's involvement in each step, the inquiry process can be classified into free inquiry and guided inquiry. Free inquiry refers to inquiry that all six steps were taken by the student, whereas guided inquiry indicates the teacher's involvement in determining one or several steps. Table 5.4 shows various types of science inquiry.

Table 5.4 Types of Inquiry Approach

Steps	Guided Inquiry				Free Inquiry
	L1	L2	L3	L4	
1. Stating the problem	T	T	T	T	S
2. Creating a hypothesis	T	T	T	S	S
3. Planning the action	T	T	S	S	S
4. Conducting the action	S	S	S	S	S
5. Collecting the data	S	S	S	S	S
6. Drawing conclusions	T	S	S	S	S

Notes: L= level of inquiry; T = teacher; and S = student (Ministry of Education and Culture, 1995a)

L1 is the lowest level of inquiry in which students only carry out the action and collect the data based on the teacher's instruction. Teacher involvement decreased at the high level of guided inquiry and become nil in free inquiry.

The three other teaching approaches, namely, environmental, historical, and deductive-inductive approaches were briefly explained. The environmental approach emphasizes the interrelatedness of science lesson, daily life and the use of the environment in teaching and learning processes. The historical approach underlines student understanding that problem solving in nature always takes time and calls for patient and sacrifice. Discovery in science is unstable, and requires scientists to attribute themselves with scientific attitudes such as being open-minded, creative, willing to investigate, and being patient.

After these books have elaborated teaching approaches in the science classroom, the descriptions of teaching methods are presented. Five teaching science methods are considered and recommended. First, the experimental method is regarded as the most appropriate method in teaching science. Experiments can be done either in a group or by the individual dependent on the goal and the availability of resources. Second, the demonstration method is preferred after the experimental method. When the number of equipment and resource is very limited, this approach is appropriate. Third, the discussion method is a teaching strategy that allows students to discuss such a concept or topic either as group discussion or a whole class discussion. In order to achieve the effectiveness of discussion, teachers should provide students with a clear task orientation to ensure that students know what is to be solved or found throughout the discussion. It is believed that this teaching method has ample opportunity to develop students' process and social skills particularly in communicating with others and appreciating others' idea. The fourth teaching method is lecturing. It is asserted that lecturing is not the same as a traditional chalk-and-talk method. Lecturing here is referred to an interactive talk between teacher and students. Teachers should employ good questioning techniques to involve students during the teaching and learning processes. Finally, excursion is the last teaching method recommended in this document. This method is aimed to assist students in using the environment and nature as learning sources. Teachers should wisely choose relevant science topics when employing this method. Adequate and good preparation before excursions is required to avoid an ineffective and bewildering excursion programme. In order to keep students focused while on excursion, teachers may provide students with a worksheet and ask them to write a report. Similar to the discussion method, it is considered a relevant teaching method that facilitates students to develop science process skills as well as social skills.

The following section of these books explains the structure of teaching science both in the biology and physics classrooms. Regardless of the teaching approach and method being used, teaching science should be structured into three phases, namely, introduction, core activities and final discussion or closure. The introduction phase is crucial in all teaching. A good introduction will lead students into meaningful and interesting learning and vice versa. In this phase, teachers should ensure that students know pre-required knowledge and are motivated to learn. If needed, teachers must make sure that students are competent and know how to handle laboratory equipment. The core activities phase is when interactions among teacher-students-media take place. Most of teaching time allocation is devoted in this phase. The final phase, discussion, is a segment in which teacher and students engage in interactive discourse to achieve agreement on what has been learnt. Either the teachers or students can write down any conclusion drawn from the process. In this stage, teachers may check students' understanding of the concept or topic being learnt.

Classroom and laboratory managements are other topics that are presented in these books. It is asserted that a teacher's ability in managing the classroom and laboratory determines the effectiveness of teaching. Classroom management is defined as techniques to establish the classroom as an effective learning environment. It includes structuring the physical classroom environment, planning and maintaining good learning processes, controlling students' order and discipline, creating favorable learning environment characterized by good rapport between teacher and students and among the students, keeping students motivated and monitoring students' progress through routine evaluation. Similarly, laboratory management follows these procedures. However, particular attention was addressed in regard to safety issues during laboratory usage. Teachers should establish a set of rules for students when they work in the laboratory. Generic rules that contain 12 points are suggested in these books. Moreover, procedures for preventing any accidents in the laboratory are also provided. These suggested procedures consist of five points.

Another important aspect of teaching science that is presented in these books is the use of questioning techniques. It is believed that two things can affect students' participation during the teaching and learning processes. These are the teachers' techniques in asking questions and in responding to students' answers. With regard to the former, three suggestions were offered. First, teachers should first pose the question to the whole class first, not to an individual student. After students have had enough time to respond, the teacher can appoint a student to answer. Second, teachers should avoid closed questions such as true or false answers. Third, teachers should ensure that every student has an opportunity to answer. It is highly recommended that teachers avoid passing the question mainly to target students and ignore the rest in the classroom. On the other hand, four recommendations are offered in these books to deal with students' responses. First, if the students correctly answer the teacher's question, the teacher is advised to offer an incentive to the students using a gesture, for example, by rising up the thumb, or using verbal expression such as 'Excellent, that is the correct answer'. Second, when the teacher finds that the student's answer is totally wrong, it is suggested that the teacher wisely respond with an answer that will not let the student down. A diplomatic verbal expression such as 'that seems logical, however, that was not the answer' would be an appropriate response. Third, if the student's answer is incomplete it is better still for the teacher to praise the student for the effort but still emphasize that the answer is incomplete. In so doing, teachers may use the suggested expression like 'I agree with your answer, however, can you or anyone complete the answer, please?' Finally, when the teacher finds that the student's answer is totally wrong, the teacher is advised to restructure the question into a simpler one. If the student is still unable to answer, the teacher may provide relevant information or ask the student to open the textbook.

Assessment or evaluation is an integral part of teaching and learning processes. Several pages in each of these books are devoted to this topic. It is defined that evaluation is a set of procedure to obtain, analyze, and interpret data about processes and outcomes of students' learning, which is systematically and continuously conducted so that it becomes meaningful and useful information. The evaluation is aimed to determine to what extent the goals of teaching and learning as mandated in the *GBPP* have been achieved. The books provide teachers with the explanation of aspects, principles, and techniques of evaluation and a follow up of evaluation results.

There are seven principles in designing and conducting evaluation (Ministry of Education and Culture, 1995a). Teachers should fulfil and adhere to these principles in order to achieve the goals of evaluation. These principles are:

1. Continuity. In order to obtain a comprehensive results, evaluation of learning processes and learning outcomes should be conducted continuously.
2. Goal oriented. Content or items of evaluation should refer to teaching and learning objectives as mandated in the GBPP.
3. Objective. Evaluation results must be able to describe the extent to which students have attained the concepts or topics being learnt.
4. Open. All stakeholders including students, parents, and the schools principals have access to the process and results of evaluation.

5. Usefulness. Evaluation results must be useful for teacher, student, and school administration.
6. Appropriateness. Evaluation process should consider the teaching approach being used in the teaching and learning process. For example, if process skills approach is mainly used, process skills should be considered as the main content of evaluation instrument.
7. Educative. Evaluation result should be useful to motivate and guide students in improving their learning outcomes.

There are three aspects of learning outcomes, namely, cognitive, affective and psychomotor skills which teachers should consider. Referring to Bloom's (1956) taxonomy, the cognitive aspect consists of six levels - knowing, understanding, application, analysis, synthesis and evaluation - which are in rank order from the lowest to the highest cognitive activity. When conducting evaluation both in learning processes and learning outcomes, the evaluation format should cover these levels. Furthermore, affective aspects include science-related attitudes and scientific values. During the teaching and learning processes, particularly in practical sessions in the laboratory, the teacher has the opportunity to assess the third aspect, namely, psychomotor skills.

Considering these three aspects of evaluation, there are three techniques in conducting evaluation in science classroom. First, the paper and pencil test technique is the most common in use for assessing cognitive aspects. The test can be in multiple choices or essay form. However, teachers should combine these forms. Second, verbal evaluation is suggested to evaluate students' understanding during teaching and learning processes. Finally, practical evaluation is recommended to assess students' process skills and psychomotor skills.

In the Indonesian school context, students' progress and achievement is reported to parents at the end of each school term. Students' achievement is presented in a number scale from 1 to 10 with 10 being the highest achievement. Students' scores are counted from the evaluation results of summative and sub-summative tests. A sub-summative test is an assessment conducted after the completion of a theme or topics. There is a minimum of two-sub summative tests in each school term. A summative test is an assessment at the end of school term. The final score for each subject including science is the sum of proportion an average of sub summative score and two proportions of summative score divided by three. It can be seen that each student's score in summative tests determine the student's achievement score. Finally, the most important thing from the evaluation process is to follow up the results. Students are considered to have mastered the learning if their scores are equal or greater than 65%. On the other hand, a classroom is considered complete and to have achieved the learning goals if a minimum of 85% of the students obtain at least 65% score. If this condition is not attained, the teacher should employ a remedial or enrichment programme.

The last section of the books discusses teaching plans. The academic calendar, time allocation and lesson schedules are addressed in a general manner. The academic calendar is set by the educational administrative in each state or province, whereas time allocation and lesson schedules are set by the school administration and the teacher. At the beginning of school year, the teacher is advised to complete administrative procedures of teaching preparation. Administratively, there are four components that teachers need to address. As described in the last section of these books, the four components are Yearly Programme, Term or Semester Programme, Lesson Unit, and Lesson Plan. Examples of each programme are explained and provided in factual form. In designing the Term or Semester Programme, Lesson Unit and Lesson Plan, however, the teacher is advised to work cooperatively with other colleagues in the same subject such as in a forum of *Musyawarah Guru Mata Pelajaran or MGMP* (Forum of Teachers in the Same Subjects).

5.2.4 Content Analysis of Teaching Material for Biology and Phyiscs (Analisis Materi Pelajaran –AMP IPA Biologi dan Fisika untuk SLTP)

As mentioned in Section 5.2.2, the *GBPP* contains a minimum competency of the subject that students need to ascertain through the teaching and learning processes. At the operational level in the classroom, the teacher cannot use this document directly. Therefore, elaboration upon the GBPP is needed. Accordingly, the document called *Content Analysis of Teaching Material* (*Analisis Materi Pelajaran*) is provided for every subject. *Analisis Materi Pelajaran* has a general format as follows: Subject Identity, Learning goal, Concept(s) and subconcept(s), Time allocation, Elaboration of the concept(s) and subconcept(s), Instructional plans that include teaching strategy, teaching method, and teaching media, Teaching and learning activities, Learning outcomes, and List of references. Based on this document, the teacher then can develop lesson units and lesson plans.

Considering data collection processes particularly on classroom observations that were conducted during the second term of schooling in Year 9 science classrooms, the following Sections 5.2.4.1 and 5.2.4.2 elucidate the *Analisis Materi Pelajaran* for both biology and physics, respectively. In the second term of schooling when the classroom observations were conducted, the biology teacher of a Year 9 class should cover two main topics, namely, the reproductive system of animals and hybridisation, during 36 periods. On the other hand, the physics teacher of a Year 9 class should cover two main topics, magnetism and electromagnetic induction in the same time allocation (Ministry of Education and Culture, 1998c, 1998d).

5.2.4.1 Content Analysis of Teaching Materials for Biology

The topic of the reproductive system of animals is allocated 18 periods. As suggested in the learning goal 'students make observations and report the results in order to understand (comprehend) animal reproductive', this topic recommends teachers to employ experiments and demonstrations as the teaching methods. This topic consists of two subtopics, namely, generative and vegetative reproductive systems in animals. An explanation of each subtopic is provided followed by an alternative teaching activity strategy. Consistent with the recommendation in the Technical Guidance (Direction) for Teaching Physics and Biology documents, the teaching activity is structured into three main sections: introduction, core activities and closure. Expected learning outcomes of this topic include the product of learning (student attains the concepts being learnt) and student process skills such as ability to make observations, to draw a conclusion, and to communicate. Finally, a list of references refers the science teacher to suggested readings for preparation of teaching (Ministry of Education and Culture, 1998a).

Hybridization is the second topic that the biology teacher should cover in the second term of schooling in Year 9. This topic consists of three subtopics with a total time allocation of 18 periods. The first subtopic discusses the concept of trait, its determinant or gene inside the chromosome, and how a trait is inherited by the offspring. This topic is allocated four periods. The elaboration of the topic is described, including the linkage of the topic to previous concept (reproduction), and basic terminologies in hybridization such as homozygote, heterozygote, recessive, dominant, phenotype and genotype. Direct instruction is chosen as the teaching strategy with hands-on activities and class discussion as the teaching methods. The teacher is advised to use worksheets of monohybrid crosses. The expected learning outcomes are students' understanding of a concept 'gene as trait determinant' and students' process skills achievement such as discovering facts and communicating observational results. Furthermore, the second and third subtopics were allocated six and eight periods, respectively. The second topic, which describes monohybrid crosses with the dominant trait, is provided with two alternative instructional plans. The first alternative offers cooperative learning as the teaching strategy and experiment followed by group and whole class discussion as the teaching methods. The teacher can use genetic boxes as the teaching media for conducting experiments. The second alternative is lecturing in which the teacher gives students exercises and related tasks followed by class discussion. The differences between these two plans are in the teaching and learning activities and the expected learning outcomes. The former emphasizes more on the student being active both physically (involve in experiment) and mentally (data entry, interpretation of data, and communicating the results). On the other hand, the latter gives a balanced emphasis on both teacher and students. In addition, the expected learning outcomes of the first alternative include four aspects: product, process skills, psychomotor, and affective. The last two learning outcomes, however, are absent in the second alternative instructional plan. Similarly, the third topic that discusses hybridization with two different traits is also suggested with the two alternatives of an instructional plan as described above. The analysis of this document also found that a standard teaching structure that consists of introduction, core activities and closure, is always suggested in each subtopic.

5.2.4.2 Content Analysis of Teaching Materials for Physics

The first topic, magnetism, comprises three concepts that are allocated 22 periods including two sub-summative tests. Six periods are devoted to the first concept 'magnet can attract certain materials', which includes two periods for the sub-summative test and feedback. Three periods are allocated to the second topic 'a magnet has two different poles'. Eleven periods are used for teaching the third concept 'magnet produce magnetic field at the surrounding' and is followed by two periods for the second sub-summative test. The learning goals of this topic expect students to understand magnetism and its influence, to do experiments for investigating magnetism and electromagnetism properties, and to solve a problem related to the product of simple technology (Ministry of Education and Culture, 1998b). It can be interpreted that teaching this topic requires the teacher to employ various teaching approaches and methods. Accordingly, this document suggests the teachers use two main teaching approaches, namely, the process skills approach and the conceptual approach, and to employ teaching methods such as experiment, demonstration, discussion and lecturing that are appropriate to the teaching approach. The teachers are advised to use appropriate student worksheets that had been developed during the *MGMP* forum. As intended in its title, this document provides descriptions and developments of each concept into several subconcepts. These the descriptions are elaborated with the explanations of each subconcept and accompanied with appropriate figures.

The second topic, electromagnetic induction, is allocated 12 periods including two periods for the third sub-summative test. The learning goals of this topic expect students to understand electromagnetic induction by developing students' ability in conducting experiments. Again, teaching this concept calls for teachers to employ experiments or demonstrations as teaching methods and process skills as the teaching approach combined with discussion and information. Appropriate student worksheets are also recommended. Similar to the first topic, descriptions and elaborations of the main concept into four sub-concepts are displayed. The explanation of each sub-concept is accompanied by illustrations using diagrams and figures. These illustrations are expected to enable the teacher to use this document as a handy benchmark for achieving a minimum competency of the concepts. Finally, a list of references is offered, that may enable the teacher to find relevant readings to develop the content if needed.

5.2.5 Science Textbooks Analysis

During classroom observations, the researcher identified a number of Year 9 biology and physics textbooks that have been used in the classrooms. Textbooks provided by the Indonesian government via the Ministry of National Education are commonly used. The other textbooks are those written by various authors, who are commonly master teachers or instructors, and published by private publishers. The latter is generally used in urban schools. Two biology textbooks, one provided by the government and the other by a private publisher, for Year 9 students were selected for analysis purposes. Similarly, two physics textbooks were also chosen. The analysis is aimed to provide the general descriptions of each textbook by looking at six aspects as presented in Tables 5.5 and 5.6. The analysis is focused on the content being taught in the second term of schooling. The results are described in Sections 5.2.5.1 and 5.2.5.2 for biology and physics textbooks, respectively.

5.2.5.1 Biology textbooks analysis

Two biology textbooks, namely, *Biologi: Untuk SLTP/MTs Kelas 3* or Biology for Year 9 lower secondary school/Islamic lower secondary school (Sabariah, 2002) and *Biologi SLTP kelas 3* or Biology lower secondary school Year 9 (Suhartanti, Salamah, & Widyaningrum, 2000) were selected for analyses. Table 5.5 provides comparison between these two textbooks based on six aspects.

Table 5.5 Results of Biology Textbook Analysis

Aspect of analysis	Textbook 1	Textbook 2
Structure Does the structure of content adhere to the GBPP?	Yes	Yes
Content coverage How deep are the contents being presented?	Deep	Deep
Illustration Does the textbook contain graphics, figures for illustration purposes?	Yes	Yes
Activity Does the textbook provide practical activities?	Provided	Provided
Exercise and problem solving Does the book provide problem-solving exercises?	Yes	Yes
At the end of the chapter, does the textbook provide exercises for concept reinforcement?	Yes	Yes

Note: textbook 1 is *Biologi: Untuk SLTP/MTs Kelas 3* (Sabariah, 2002), and textbook 2 is *Biologi SLTP kelas 3* (Suhartanti et al., 2000)

The first textbook is provided by the government and intended for all schools, while the other is offered by a private publisher and is not obligatory to be used. Table 5.5 indicates that both textbooks have satisfactory criteria as a good textbook. The teachers can use both textbooks during the lessons.

5.2.5.2 Physics textbooks analysis

The physics textbooks selected for analysis are *Fisika 3 untuk SLTP kelas 3* or Physics for Year 9 lower secondary school (Purwono, 2002) and *IPA Fisika 3B* or Physical Science for Year 9 lower secondary school (Kanginan, 1996). The first textbook is provided by the government and it is recommended for teachers to use it. The second textbook is offered by a private publisher and it is optional for teachers to use it. The results are described in Table 5.6.

Table 5.6 Results of Physics Textbook Analysis

Aspect of analysis	Textbook 1	Textbook 2
Structure Does the structure of content adhere to the GBPP?	Yes	Yes
Content coverage How deep are the contents being presented?	Very Basic	Deep
Illustration Does the textbook contain graphics, figures for illustration purposes?	Limited	Plenty and informative
Activity Does the textbook provide practical activities?	No	Provided
Exercise and problem solving Does the book provide problem-solving exercises?	No	Yes
At the end of the chapter, does the textbook provide exercise for concept reinforcement?	No	Yes, many

Note: textbook 1 is *Fisika 3 untuk SLTP kelas 3* or Physics for Year 9 lower secondary school (Purwono, 2002) and textbook 2 is *IPA Fisika 3B* or Physical Science for Year 9 lower secondary school (Kanginan, 1996).

Table 5.6 shows that the textbook endorsed by the authority to be used in the classroom does not meet the satisfactory criteria. The textbook only presents very basic concepts and limited illustrations, provides no practical activities and neither problem solving nor exercises for concepts reinforcement. The textbook may be used in rural schools, but is inappropriate for urban schools.

5.2.5 Summary of curriculum documents analyses results

The results of curriculum document analyses show different levels of information provided by each document. The more general level information given by such a curriculum document, the less operational the content is. A summary of the information level provided by each curriculum document is presented in Figure 5.1.

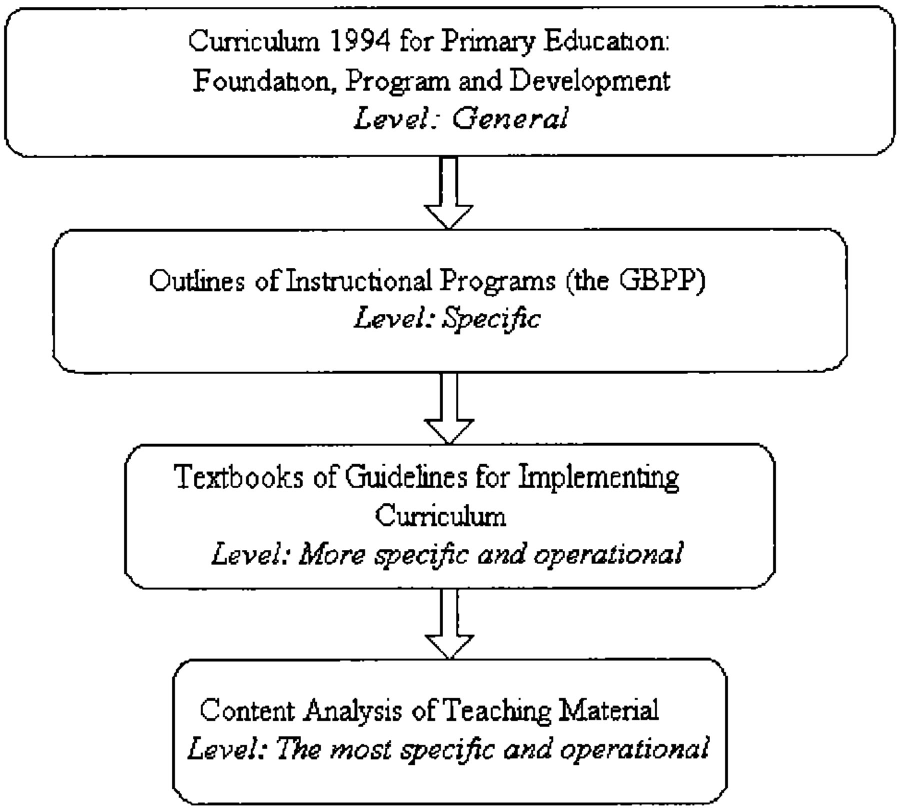

Figure 5.1 Curriculum Documents and the Level of Information Given

Figure 5.1 shows that the document, *Curriculum 1994 for Primary Education: Foundation, Programme and Development* (*Kurikulum Pendidikan Dasar 1994: Landasan, Programme dan Pengembangan*) provides basic and general information. All schooling in the Indonesian education context must refer to this document. The second document, namely, *Outlines of Instructional Programmes of Biology and Physics for lower secondary school* (*Garis-garis Besar Programme Pengajaran-*

GBPP Mata Pelajaran IPA Biologi dan Fisika untuk SLTP) provides science teachers with more specific information regarding content coverage. However, this information is not yet operational and needs further elaboration. Therefore, a package of documents entitled *Guidelines for Implementing Curriculum Textbooks* (*Buku Pedoman Pelaksanaan Kurikulum*) was offered. The information provided in this package is in detail and guides the teacher on what to do in his or her science teaching. Finally, *Content Analysis of Teaching Material for Biology and Physics* (*Analisis Materi Pelajaran –AMP IPA Biologi dan Fisika untuk SLTP*) provides the teachers with detailed and comprehensive information of the topics, teaching approach and method, learning goals and the expected learning outcomes.

5.3 Teachers' and superintendents' perceptions of the intended science curriculum in lower secondary schools

A study of curriculum evaluation in the Indonesian school context conducted by (Iriansyah & Wahyudi, In press) that investigated teachers' perceptions of curriculum documents found that 98% of 200 teachers confirmed that their schools have provided them with the Curriculum 1994 documents. Furthermore, this study also demonstrated that 97% of respondents stated that they have read and understood the content of Curriculum 1994 documents. However, this study also showed that the results of the teachers' cognitive tests related to the content of curriculum documents did not fully support their statements. The average scores and standard deviation were 48 on a 100 scale and 14.6, respectively. These results show unfavourable status of teachers' understanding of the content of the curriculum documents. Furthermore, investigations indicated that teachers have a good understanding of the Outlines of Instructional Programmes or GBPP and Guidelines for Implementing Curriculum Textbooks (*Buku Pedoman Pelaksanaan Kurikulum*), but poor knowledge on the document of Curriculum 1994 for Primary Education: Foundation, Programme and Development (*Kurikulum Pendidikan Dasar 1994: Landasan, Programme dan Pengembangan*). A sound explanation regarding this fact is that each of the documents provides different levels of information. The first two curriculum documents contain details and operational levels of information for the teacher to prepare and conduct teaching and learning activities. On the other hand, the latter contains only general information that is not related to classroom operations. Hence, teachers tend to be knowledgeable about the content of the former documents and less familiar with those of the latter (Iriansyah & Wahyudi, In press).

Of interest in this present study, however, teachers and superintendents' perceptions of the intended science curriculum were not explored using questionnaires. Alternatively, as explained at Section 3.3.2 in Chapter 3, teachers' and superintendents' perceptions of the intended science curriculum were explored using (Schubert, 1986) metaphors of curriculum. Within (Schubert, 1986) framework, eight curriculum metaphors are offered, of which four have been chosen through a pilot test (See Appendix 7). Therefore, within the context of this present study, teachers' and superintendents' perceptions of curriculum were framed within these four metaphors. Teachers and superintendents were asked to choose their preference of the four curriculum metaphors. These four metaphors were (1) Curriculum as Content or as Subject Matter (2) Curriculum as Programme Planned Activity or as Syllabus Design (3) Curriculum as Intended Learning Outcome, and (4) Curriculum as Discrete Tasks and Concepts. The results from data analysis confirmed that teachers and superintendents held different perceptions of curriculum. Further descriptions of the findings are organised under the related metaphor.

5.3.1 Metaphor 1: Curriculum as Content or as Subject Matter

Three teachers expressed their preference for this metaphor and provided their judgments for their choices. For example, teacher C of school 3 articulated:

> For me, curriculum is merely a framework that emphasises [minimum] content of the subject which needs to be delivered to students. However, it is still possible for teachers to develop these [content] dependent on teachers' skills and content knowledge. That is the basic concept of curriculum to which the teachers should adhere. That is about curriculum. (I.TC.S3.16.02.02)

In addition, two other teachers expressed similar reasons for choosing their perceptions. Teacher B of school 2, although hesitantly, argued:

> I prefer No. 1 [curriculum as content or subject matter] over the rest as it is mandated in the curriculum documents [GBPP]. My school also emphasises teachers

> to reach the curriculum target in each school term. So I agree with this metaphor. (I.TB.S2.06.02.02)

5.3.2 Metaphor 2: Curriculum as Programme Planned Activity or as Syllabus Design

None of the teachers involved in this study chose this metaphor as their perception. One of the superintendents (S2), however, confirmed his view of curriculum with this metaphor. Confidently he mentioned:

> In general, curriculum is a corridor that a teacher should adhere to when he or she conducted teaching processes. From these four metaphors, I tend to choose metaphor no. 2 [curriculum as programme planned activity or as syllabus design] because after a student has completed a particular level of study, we can identify [or measure] the competency that he or she has mastered as planned in the syllabus. (I.S2.10.04.02)

5.3.3 Metaphor 3: Curriculum as Intended Learning Outcome

Two teachers who taught both physics and biology held their curriculum perceptions as metaphor of curriculum as intended learning outcomes. Teacher F of school 6 stated:

> Curriculum is defined as principles or benchmarks that include goals of learning, content and teaching and learning activities or proses (of school science). However, among these four metaphors I think metaphor no. 3 [curriculum as intended learning outcome] is the most appropriate. Curriculum is focused on the intended goals. Processes can be modified dependent on students' conditions. (I.TF.S6.06.04.02)

Furthermore, teacher A of school 1 enthusiastically expressed his arguments in choosing the metaphor that best represented by his perception of the science curriculum. Teacher A's utterances can be extracted as follows:

> ...Learning outcomes...[he read through all the metaphors provided] that must be achieved...the end or the outcome is the most important, not only the process. So, I think my perception is similar to the third metaphor...[curriculum] as a set of learning outcomes that will be achieved. Products or students' learning outcomes as intended are the most important. I mean like this that [curriculum as]

> process is important as well, but this will limit teachers in conducting their teaching, because the teaching process can be influenced by classroom situation. I think learning outcomes is the priority, and just gives the process to the teacher. (I.TA.S1.14.02.02)

5.3.4 Metaphor 4: Curriculum as Discrete Tasks and Concepts

None of the teachers being interviewed chose this metaphor and only superintendent (S1) deliberately picked up this metaphor to represent his curriculum perception. Wisely, he explained his understanding of the curriculum definition as intended in the curriculum document and followed by his argument of choosing the preferred metaphor.

> Curriculum is a set of benchmarks for establishing education and teaching instructions in order to achieve educational goals. In our educational system, curriculum is designed in accordance with levels, types and units of education and considers the environment, student's development, science and technology, art, and national needs. For school science in particular, content coverage of the science curriculum as presented in the *GBPP* 1994 is emphasised by the students' ability to ascertain the principles of science and technology in accordance with environmental needs and national development. Furthermore, it is intended that students should ascertain logical and critical thinking in solving daily life problems.
>
> Among these four metaphors, the most appropriate is no. 4, curriculum as discrete tasks and concepts. You know, it is appropriate if we consider students as the agent of learning. Nevertheless, curriculum also should be considered as principles of educational processes. Therefore, curriculum must include the goals (curriculum as intended learning outcomes) and the content as well (curriculum as content or as subject matter) that students need to learn. (I.S2.06.04.02)

The results show various perceptions of the science curriculum based on curriculum metaphors. These varieties can be justified as a result of the differences of each respondent's priority in interpreting the curriculum definition. Curriculum in general is defined as 'a set of plans and policy about the content and lesson material as well as strategy used in conducting teaching and learning processes' (Ministry of Education and Culture, 1994a), p. 5). Several keywords can be extracted from this definition such as *a set of plan, content and lesson material*, and *strategy*. Degrees of respondents' preference to these keywords may lead to their interpretation of the curriculum definition, thus shaping their view of curriculum. If a respondent prefers to focus his interpretation on keywords such as lesson and content material, it can be expected that he or she would choose curriculum as subject matter to represent his or her perception of curriculum.

Often, respondents were faced by a situation in which they should choose between two metaphors that sound best to represent their perceptions. In dealing with this situation, they might support one metaphor and drop the other. For example, teacher A has balanced his choosing of curriculum metaphor between curriculum as intended learning outcomes and curriculum as programme planned activity. Although he agreed that teaching and learning activity or process was important, he did not support establishing a teaching activity as a fixed plan. When he was asked to elaborate his choice of metaphor, teacher A said:

> What matters for me are the outcomes. Yes, final results [students' learning outcomes]. We have...you know...that we have expectation from students. It means we want the concepts to be mastered by students. Regarding the process, ...I would rather give the choice of teaching processes to teacher. So, teaching processes must not be mandated as written in the document [curriculum]. (I.TA.S1.14.02.02)

Alternatively, respondents might hold several metaphors by ranking the order of preferences. An example of this case was shown by the response of Superintendent 2 who deliberately included all curriculum metaphors to represent his perceptions. He stated that despite his choice of curriculum as discrete tasks and concepts, he also considered two other metaphors, namely, curriculum as content and curriculum as intended learning outcomes to represent his views of curriculum.

5.4 Summary of the chapter

This chapter has addressed both Research Questions 3 and 4. Responses to Research Question 3 are depicted in Section 5.2. The findings reveal that curriculum documents provide science teachers with philosophical ideas that outline national education system and comprehensive information for preparing and implementing the science curriculum in the classroom. The different level of information given by each curriculum document as described in Figure 5.1 enable the teachers to prepare their actions in implementing the science curriculum.

Furthermore, with regard to the second term of schooling, teaching science at Year 9 in rural and urban lower secondary school should be directed to enable students to ascertain the concepts being taught and to facilitate students in developing their social and process skills. Within 36 periods in this term, biology teachers of a Year 9 class should deliver two main topics, namely, the reproductive system of animals and hybridisation whereas their counterpart physics teachers should cover two main topics, magnetism and electromagnetic induction in the same time allocation. Regarding these topics, recommended teaching approaches are mainly concept and process skills, accompanied with appropriate teaching methods that included experiments, demonstrations, discussion and lecturing.

Teachers' and superintendents' perceptions of the intended science curriculum are presented in Section 5.3. The findings, which are based on the perceptions of a small number of science teachers and superintendents, revealed that science teachers and superintendents involved in this study hold different perceptions of the science curriculum. Metaphor 'Curriculum as Content or as Subject Matter' was commonly perceived by three teachers who possess this view. 'Curriculum as intended learning outcome' is the second metaphor preferred in which two teachers hold this view for different reasons. None of the teachers chose the other two metaphors. In contrast, two superintendents expressed their preference for the metaphors 'Curriculum as discrete task and concepts' and 'Curriculum as programme planned activity', respectively.

Chapter 6. The Implemented and Achieved School Science Curriculum

6.1 Introduction

The descriptions of the intended science curriculum and teachers' perceptions of it have been elaborated in Chapter 5. This chapter, which is in response to the last two Research Questions 5 and 6, provides explanations on how the teachers implemented the existing science curriculum in the science classroom and examines the status of students' outcomes in school science. The descriptions of the science curriculum implementation in the classroom are elaborated in Section 6.2. The descriptions are mainly grounded on the interpretations of the data that emerged from a multiple site case study in six schools. These data included long-term classroom observations in two rural and two urban schools for biology and physics classrooms and a lesser number of classroom observations at an urban and a rural school. The status of students' outcomes in school science is discussed in Section 6.3. The outcomes consist of both cognitive and attitudinal measures and are also presented in tables and diagrams to enable easy and simplicity in interpreting the results. The chapter concludes in Section 6.4 by providing a brief summary of the chapter.

6.2 The implementation of the lower secondary school science curriculum

Curriculum implementation or curriculum in practice is far more complex than is prescribed in documents (Eisner, 1994). The findings from a multi-site case study in this research support this statement. In a centralised educational system such as in the Indonesian school context, teachers referred to the same curriculum document; however, they perceived and implemented it in different ways. In this section, results regarding the science curriculum implementation are described, based on the interpretations of data obtained from classroom observations and interviews. First, the status of the science curriculum implementation in urban schools is addressed in Section 6.2.1. Second, the condition of science curriculum practices in rural schools is elaborated in Section 6.2.2. The backgrounds of each school and each teacher are explained at the beginning of each section to provide the contexts of the multi-site case study.

6.2.1 Science curriculum implementation in urban schools

As explained at Section 3.3.5.2, classroom observations were conducted at three schools in an urban area in which two teachers were involved in prolonged observations and the other teacher participated in a lesser number of classroom observations. An overview of the subjects' backgrounds is presented in Section 6.2.1.1, followed by the descriptions of the science teaching in schools 3, 4 and 5 that are discussed in next three sections, respectively. The descriptions of science teaching practices were extracted from the classroom observations in a related school. To describe a particular science teaching practice, a selected classroom observation is presented in vignette form and this is followed by interpretive commentary. The selection was based on a deliberate consideration so that the teaching practice being observed was typical and might be representative of each teacher. The interpretive commentary is supported and elaborated with other data interpretations from the rest of the classroom observations. In addition, photo essays related to science teaching processes are provided in Appendices 6.1. Finally, the status of the science curriculum implementation in these schools is interpreted in Section 6.2.1.5.

6.2.1.1 Backgrounds of subjects

The schools

All urban schools that participated in the learning environment survey were located either in the capital city of the province or its municipalities. With the exception of a few schools, they shared common conditions that included a relatively good physical environment, adequate laboratory and its supply, and relatively rich library book collections. These schools can be reached by any transportation modes such as bicycle, motorcycle, car and public transport. Although all schools were provided with computers, these facilities are mainly for administrative purposes. Only a few schools have computers for teaching and learning purposes.

School 3 is located at the heart of 'Komplek Mulawarman'- an educational centre where a number of schools from primary to upper secondary levels and from general to vocational types of schools are established. Being the oldest school among other public lower secondary school in the province, this school began to renovate its buildings and improved the facilities. At the time of this study, the library and science laboratory were being renovated so that all laboratory-related activities mandated in the intended curriculum were modified and transformed into demonstrations. Computers for administrative purposes were provided. Other school facilities such as toilets, canteen, sports hall and nursing room were well maintained. A mushola or praying house for Moslem students and teachers was available too. The school has stated clearly its vision and mission that the teacher and the student should know. One of the school's missions is to improve the average of students' scores in the nation-wide examinations. The school principal is supported by around 50 teachers and staff to cater for around 900 students who were distributed into six parallel classes in Year 7, 8 and 9, respectively. Consequently, every class is occupied by on average 45 to 48 students.

On the other hand, school 4 is situated in the periphery of Banjarmasin, the capital of Kalimantan Selatan province. Students can reach the school by public transport, motorcycle, and bicycle, on walk or by water transportation, as the school is also located nearby the river. The school is relatively new as shown by the number attributed to its name (the 24th of all public lower secondary school) and by the appearance of the school building - a new semi-permanent construction. The school has 18 classes that were distributed into six parallel classes for each year level, a library and science laboratory. Both the library and laboratory were well managed. A schedule of laboratory usage for physics and biology classes was established and hangs on the wall. At the time of study, most biology teaching was taking place in the laboratory. Toilets, nursing room, and canteen were available and well maintained. However, the school does not have a sports hall for physical education. The only available area for physical education was the small field in front of the school. A mushola or small mosque and parking area for teachers' motorcycles are located nearby this field too. The school is supported by 45 fulltime teachers and four school administrators. When the researcher asked about school vision and mission, teacher D explained that these were still on going processes involving the school principal, the deputy and the teachers' representative.

School 5 is situated close to the city centre and is surrounded by other schools from primary to upper secondary levels. Similar to school 3, this school has renovated its building and upgraded the facilities. The school's visions and missions have been established and displayed so that all the school community knows and can become familiar with them. The school library has adequate book collections but was under renovation at the time of the study.

The laboratory, nursing room, canteen, and toilets were well maintained. During the classroom observations, science teaching and learning processes were conducted in the classrooms. Like the other schools, a mushola was established so that Moslem students and teachers are able to pray in the afternoon. The fact that almost every public school has a mushola indicates each school's concern to accommodate the needs of Moslem students and teachers. A combination of basketball and volleyball field was located at the centre of school building; in this area a ceremony was performed every Monday morning before the teaching and learning activities start. The school has a total of 21 classes that is distributed equally into each year level. Year 9 level has seven parallel classes with the total of 260 students. The average *Nilai Ebtanas Murni or NEM - the original score for science in the nation-wide examination*, was 4.86 in the academic year of 2001. The school was looked after by the principal who was supported with 39 fulltime teachers, seven part-timer teachers, and eight fulltime school administrators. Two computers were available for administrative purposes. A telephone line has been connected for faster communication with other schools and the office of the Ministry of Nation-wide Education at the district and provincial levels. Two overhead projectors were also available for all teachers for teaching and learning purposes.

The teachers

Teacher C of school 3 has 24 years of teaching experience and held a Baccalaureate degree (*S1-Strata 1*) in Physics Education. He has participated in teacher training at both regional and nation-wide levels. At the time of the study, he was appointed as key teacher to organise the *MGMP* for physics in the Kota Banjarmasin district.

Teacher D has been teaching for 21 years and obtained his Baccalaureate degree (*S1-Strata 1*) in Biology Education. He has participated in teacher training at both regional and nation-wide levels. During his teaching career, he has been involved in the teacher development programme conducted by the Ministry of Education and Culture (MOEC); his main roles ranged from key teacher (*guru inti*), instructor assistant and instructor for science subject. In 2000, he has participated in three months workshops for his science teachers at the Regional Centre for Education in Science and Mathematics (RECSAM) in Penang, Malaysia.

Teacher E of school 5 has 12 years of teaching biology experiences in this school and holds a Baccalaureate degree (*S1-Strata 1*) in Biology Education. The only professional development programme in which she has been involved is the local workshop for strengthening the work of teachers, called the SPKG.

The students

The student sample that represented those of urban schools consisted of 263 males and 381 females who mostly were 15-16 years old. These students come from various socio-economic family backgrounds but the majority were from families with a middle-upper income. Parents' occupations are commonly public servant, such as teachers and lecturers, businessmen or businesswomen, and other skilled white-collar workers. Their socio-cultural background also varies as depicted by the languages spoken at home, with 72.2% speaking *Bahasa Banjar*, only 2.0% speaking *Bahasa Jawa*, 11.2% speaking *Bahasa Indonesia*, and 14.6% speaking other languages such as *Bahasa Dayak, Maduranesse* and *Batak*. Nevertheless, students are fluent and confident in using *Bahasa Indonesia* as the language of instruction in the classroom.

6.2.1.2 Science teaching practices in School 3

Bicycle dynamo and physics (CO.TC.S3.21.01.02)

This is the first classroom observation that the researcher conducted at school 3. The classroom being observed consisted of 23 male and 20 female students during the topic of 'electromagnetism inductions'. Ideally, teaching this topic should employ experiments as the teaching method; however, due to the renovation of the laboratory building, the method was converted to a classroom demonstration.

After the researcher was seated on the backbench, teacher C began the teaching and learning process using a question technique to stimulate and motivate students. He brought in the bicycle dynamo and showed it to the whole class. '*What is it in my hand and what is it for?*' teacher C posed the question to the whole class. Of course, the chorus answers were given since the students were familiar with the bicycle dynamo. The class was lively with students talking of their experiences with their bicycles and the dynamos. However, when teacher C asked the next question: 'Do you know how it (the dynamo) works?' the class become silent. Teacher C used this moment to introduce the topic by writing it down on the blackboard.

Teacher C continued the lesson using a teacher-demonstration. He brought the electromagnetism induction kits from the laboratory which contained a multimeter test, two cables, a solenoid, and a magnet bar. He placed the multimeter on the top of desk supported by a box so that as many students as possible could see the movement of the indicator. After setting the kit, the teacher asked students to observe the indicator in the multimeter when he put the magnet bar into the solenoid. 'Ah, the indicator moves to the right', said a student. In the meantime, the students at the back gradually come closer to the front of the classroom. Teacher C allowed them to do so as long as other students were not inconvenienced. He continued asking the class, "What happens next if I pulled the magnet bar out of the solenoid?". The students looked happy when they observed that the multimeter indicator moved to the left. The lesson continued with active question-answer sessions from teacher to students. The questions included what was the meaning of the indicator movement, and what do the movement directions to the left and right mean. Students' understanding of the electric current and voltage as indicated by the movements of the multimeter indicator helped them understand how the dynamo works when the bicycle moved.

Teacher C continued the lesson by drawing the diagram of the electromagnetism induction kit and gave a necessary explanation. Students copied this diagram immediately. The next session teacher C wrote down the formula for calculating the electrical force (ε), which was followed by an exercise. Students were asked to work cooperatively in groups. Teacher C moved around to ensure all students were on task and provided assistance where necessary. Later, teacher C asked a student to voluntarily solve the problem in front of the class and this was followed by a whole class discussions. Not only did teacher C focus the activity on this exercise, but he also directed students to think about the implications of the concept being learnt in daily life. For example, he mentioned the application of the concept in an electrical energy plant for generating electricity.

During the last ten minutes of the lessons, teacher C guided the whole class to summarize the lesson. Teacher C also took this opportunity to check students' understanding of the concepts being learnt by asking related questions, and sought the students' clarifications, elaborations if necessary. Before the class was dismissed and another lesson was taken by another teacher who waited for us at the outside of the classroom, teacher C reminded the students about the next week's topic.

Interpretive commentary and assertions

To some extent, the researcher was impressed by the teacher C's teaching approach. Managing over 40 students in a crowded classroom and using a demonstration as a teaching method are challenging tasks. Nevertheless, teacher C was well organised and effectively performed his teaching. He broke down smoothly his teaching into three segments: introduction, main activity and closure as recommended in the curriculum document (Ministry of Education and Culture, 1994). Various teaching techniques were employed in each segment to ensure that the class was lively, to stimulate students' attention, to check students' understanding, and to bring those students back on task who were distracted. The clear and understandable explanations that teacher C provided on the main activity indicated his strong content knowledge, while effective classroom management designated his first-class pedagogical skills. The researcher considers his teaching practices as being of good quality, if not exemplary, when referring to the established literature on exemplary teaching practices as presented in Chapter 2, Section 2.3.2.

The researcher was aware that teacher C might have given his best effort in delivering the teaching practices due to the classroom observations. However, the following long-term classroom observations confirmed the evidence that his teaching practices were consistent as in the initial observations. Based on the classroom observation data, therefore, lists of assertions that describe the characteristic of teacher C's teaching practices are suggested as follows. First, teacher C used various teaching approaches and methods. These ranged from a conceptual approach with demonstrations (CO.TC.S3.21.01.02) to process skills with experiment, group and class discussion (CO.TC.S3.28.01.02 & 04.02.02). Second, teacher C maintained a standard teaching structure that consisted of introduction, main activity and closure. Third, teacher C managed classroom effectively by minimising students' disruptions and keeping them on task. Fourth, teacher C employed various questioning techniques to get students' attention, to check students' understanding, and to bring off-task students back on track. Finally, teacher C tried to keep his students active, both minds-on and hands-on, as much as possible.

6.2.1.3 Science teaching practices in School 4

Science in the last two periods (CO.TD.S4.24.01.02)

This was the first classroom observation that the researcher conducted in school 4. At a quarter past twelve, the researcher arrived at the school office and met with teacher D. We waited for the next period that started at 12.30 by having discussion about the school's academic and socio-economic profiles. At 12.25 we went to the laboratory wherein the biology lessons were held. On the way to the laboratory, a couple of proverbs such as 'discipline is the key for success' and 'honesty, respect and tolerance are the attributes of excellent students' were nicely hung on wall in the corridors. After the researcher was seated on the backbench in the laboratory, teacher D went to the classroom and asked students to move to the laboratory with all their belongings. When all students were seated, teacher D introduced the researcher, the purpose of his visit, and the duration of the classroom observations with the students. The students' responses were positive; some students waived their hands to the researcher while some of the others greeted him verbally. It took almost ten minutes before teacher D began the lesson.

The lesson's opener

Teacher D used the first 15 minutes (12.40–12.55) as an introduction session. To start with, teacher D reviewed materials being learnt during previous biology lessons by posing the reviewed questions to the students. Almost 95% of this session was devoted to interactive questions and answers between teacher and students. It seems that teacher D tried to use this method, in addition to the review questions on paper, to check students' understanding of the topic covered previously. Students' responses included their understanding of genetics terminologies and reproductive systems which were used as links to connect to the previous and the present lesson. Teacher D finished up the introduction session by emphasising the learning goals that students should achieve and the activity they would perform. Teacher D organised students into groups of four or five based on students' ability and gender (I.TD.S4.24.01.02).

Main activities (12.55-13.40)

After each student was seated in a group, teacher D distributed the students' worksheet and asked one student from each group to collect the genetic set kits. Teacher D asked students in each group to read the worksheet and to perform the suggested activities. The worksheet contained a summary of genetics and reproductive system terminologies, the goals, the procedures and questions that guided the learner to complete the topic. Two main topics were covered in two respected activities. The first activity was aimed to enable students' understanding of the hybridisation process whereas the second activity was intended to allow students to comprehend the hybridisation products. Referring to the curriculum document, this activity can be classified as guided inquiry level 4 in which the teacher provides the problems, goals, and procedures while students conduct the inquiry as prescribed in the worksheet.

The nature of learning activities as stipulated in the worksheet calls for students to work cooperatively. According to the worksheet, the activities required each group to have three main performers that are the executor, the reporter, and the recorder. As stated in the procedure, the activity asked each group to conduct repeated hybridisations from two boxes that contain gametes from male and female parents. It is the executor's duty to perform the activity. The reporter passed the results to the recorder for recording the evidence. To ensure that a group would perform as expected, a leader is appointed. Hence, the classroom became alive with students in each group negotiating among themselves about which role should be taken for each individual. Teacher D moved around the laboratory to check each group's abilities in facing and performing the tasks. During the first 15 minutes of this session, teacher D accommodated and facilitated the students' and the group's needs.

It is impossible to capture all transactions that occurred in each group. Nevertheless, the whole spirit of teaching and learning processes can be brought to light. The activities facilitated students as both an individual and as a member of a group to be physically (hands-on) and mentally (minds-on) active. The evidence of hands-on activities can be confirmed with students actively performing their roles in each group, while those of minds-on activities can be verified from students' discussion in a group to determine the genotype and phenotype of offspring yielded from the hybridisation processes. The overall classroom observation supported this statement, although one student was observed to be off-task. The researcher captured a scene in which one student of a corner group was enjoying drumming his desk with a pencil while the fellow students in his group were busy with their tasks. Teacher D was not aware of this instance due to the large size of the classroom and the nature of learning activity. However, teacher D was attentive to off-task students; it was observed that he always gently kept the inattentive students back on task, and encouraged the students to be focused on learning. 'I know guys that we were almost running out of energy. Yet, we were almost there. Please keep on that task' are the phrase or sentences that teacher D often used to keep the students motivated.

At 13.40, teacher D called for class discussion. Each group had finished both activities and had packed away the genetic set kits. Teacher D led the discussion and asked two groups to voluntarily answer the first two questions. The first question asked students to determine and write down the genotype representation, whereas the second one called for students to determine the phenotype. Teacher D used the answers provided by the volunteer groups as a point for discussion. He did not only simply ask for agreement or disagreement of the answers by the rest of the group, instead he asked the other groups to provide explanations of their answers. Knowing that the lesson time was almost finished, teacher D deliberately ended up the lesson by summarising the lesson and reminding students about the discussion of the results from the second activity for the next lesson.

Finally, the lesson was wrapped up with a prayer and the students were dismissed after they had greeted their teacher. The students were lined up to the exit door where teacher D stood up to shake his beloved students' hands.

Interpretive commentary and assertions

It is unarguable that keeping the lesson alive during the last two periods is a very challenging task. The students were already tired, sleepy and almost had no energy of the day that was characterised by high temperatures and very high humidity. Teacher D's efforts, however, to keep his class moving and cognitively and physically active were obvious. Using group activity enabled teacher D to involve all his students in learning activities. His effort in grouping students based on gender and ability allowed each group to make progress during the lesson. The use of fresh jokes and encouragement sentences lifted up the classroom spirit and helped the students to keep on task.

With regard to the teaching structure, this classroom observation identified teacher D's exertion to organise his teaching into a standardised structure that contained introduction, core activities and closure. These three elements were detected during the observation although the closure was abruptly performed due to the time constraint (FN.TD.S4.24.02.02). It is confirmed from further observations that teacher D consistently used this kind of teaching structure.

Teacher D's utilization of questioning techniques was remarkable. Mostly he used open-ended question to probe students' understanding during discussion session, to anchor the previous topic with the present one being taught in the introductory lesson segment and to guide students in achieving their learning goals at the closure.

Another aspect of teaching practices of teacher D that can be deemed as high quality is his classroom management skills. He moved around the classroom to ensure that each student was on task, to accommodate students' or the group's questions, and to gently keep the disrupting or distracted students back to the learning activity without humiliating them.

It is the researcher's awareness to raise this question to himself: 'Does the teacher perform as normal or does the teacher put in the best effort due to the observation?' This question helped the researcher to avoid the bias during data interpretation and to support the assertion being made. Consequently, the interpretations of a single impression must be followed and confirmed with those of other observations. Similarly, the researcher gathered the evidence from the other classroom observations to confirm or decline the claims being made. It is indicated that the subsequent long-term classroom observations confirmed the evidence that teacher D's teaching practices were consistent. The features attributed to teacher D's teaching practices included providing clear learning expectations at the outset of each lesson, the use of appropriate teaching methods that allowed optimum students' involvement during the lesson, the use of good questioning techniques, and the utilization of effective classroom management skills.

6.2.1.4 Science teaching practices in School 5

The inclusion of school 5, in which teacher E allowed her classes to be the subjects of classroom observations in this multi-site case study, was determined after the fieldwork began by using the strategy of opportunistic sampling as explained in Chapter 3, Section 3.3.5. In theses cases, classroom observations were conducted two weeks before the school term examination. During this time, teacher E had covered all topics required in the second term and used her time in science classrooms mostly for reviewing. A vignette derived from teacher E's biology classroom that is presented in the following paragraphs may provide more details of the picture of curriculum implementation in urban schools.

Let's prepare for the exams! (CO.TE.S5.18.02.02)

Teacher E took the researcher to classroom 3C (one of seven Year 9 parallel classes) on the second floor of the new building. The classroom was clean and tidy. The posters of Megawati and Hamzah Haz, the president and vice president of the Republic of Indonesia, were displayed at the front of the classroom wall. This is a standard display in a classroom. Other posters, such as famous scientists, the human body and organs, and national heroes were displayed. Although the classroom dimension is relatively large, however, the number of students who occupied it were so big, i.e., 48, to create an image of crowdedness. The researcher experienced this image when teacher E seated him at a student's desk by asking the student to share a seat with another student. After introducing the researcher to her students and asking them to act as normal, teacher E began the lesson.

Teacher E directly opened the lesson with the statement:

> *'We have completed all topics in this term. Today, we review particularly the topic that we will have a quiz next week. Feel free to ask any question that you still have doubts about'*

The last topic was dihybridisation. Teacher E continued by asking questions on basic terminology of genetics and hybridisation. Initially teacher E passed the questions to the whole class.

> *'All right students, let's begin the lesson. What does genotype mean?'*

The students hesitated (or were polite) to answer and for a moment the class was quiet. Teacher E tried to encourage her students to speak up.

> *'Come on guys, I know that you know the answer. Speak up, do not be shy'*

Eventually a student gave the answer:

> *' Genotype is an individual characteristic that is unseen'*

Teacher E accepted this answer and praised the student with a good comment. Teacher E continued asking other questions and the class became lively with more students participating. The questions that were recalling facts or definitions invited chorus responses from students. Attempting to avoid the choir responses, teacher E pointed to a student to answer before she asked the question.

Teacher E began the review with open-ended questions about the topic of dihybridisation. She wrote the problem, which was an essay, on the blackboard and gave the students 15 minutes to solve it. The problem was quoted as follows:

> Given a hybridisation between a rabbit with long brown hair and a rabbit with short black hair. It is known that short hair is dominant over long hair and that black colour is dominant over brown hair. The questions are: (1) What

> are the genotypes of the parental (P); (2) What are the genotypes and phenotypes of the first generation (F1)? and (3) If we hybridise between F1, what are the genotypes and phenotypes proportions of the F2?

The students were getting busy with this problem which looks challenging. Students spent more than 12 minutes as given by teacher E to work out their responses. After giving the extra time, and considering that no students voluntarily offered themselves to solve the problem, teacher E pointed to a student to supply the answer. The appointed student went to the blackboard and wrote down the answer. Teacher E looked happy with the answer, praised the student who responded and asked the whole class if they had any questions. No discussion was conducted. Teacher E gave another question for further review.

Approaching five minutes to the end of the period, teacher E tried to make a closure. She reminded her students about the quiz to be conducted during the next lesson.

Interpretive commentary

The teaching and learning activities were focused on reviewing previous lessons in order to prepare the students to face both the semester test and the nation-wide examination. The pressure felt by the teacher, which is related to the students' success in the nation-wide examination, was inevitable. Clearly, the school stated that one of its missions is to improve the average of students' scores in the nation-wide wide examination.

Teacher E used a varied questioning technique from closed to open question types and from recalling facts to reasoning levels. She tried to involve as many students as possible in the teaching and learning processes. In terms of the teaching structure, the observer noticed that teacher E structured her teaching into three segments, namely, introduction, core activity and closure. Teacher's E effort to maintain students' involvement was confirmed. She gave all students the opportunity to answer before she pointed to a student to respond. Based on further observations in teacher E's classroom, it was verified that she consistently maintained this typical teaching strategy.

6.2.1.5 Status of teaching science in urban lower secondary schools

Based on the data analysis that emerged from the practices of a small numbers of science teachers during several classroom observations in three urban schools, a summary of teaching practices of these three teachers is presented in Table 6.1 and followed by three assertions.

Table 6.1 A Summary of Teaching Practices in Science Classroom in Urban Lower Secondary Schools of Kalimantan Selatan, Indonesia

Aspects of Observations	Teacher C of School 3	Teacher D of School 4	Teacher E of School 5
Lesson plans	Available	Available	Available
Expectations	Clearly expressed; wrote down the learning goals on the blackboard	Verbally told the students what they should achieve in learning processes	Expected students to success at the school and the nation-wide examination
Teaching methods	Demonstrations, group discussion, and direct lecturing	Experiments, group and classroom discussions, and direct lecturing	Direct lecturing, reviewing with questions and answer
Teaching structure	Introduction; core activities; closure	Introduction; core activities; closure	Emphasised on core activities
Questioning techniques	Mainly using open ended questions to check student's understanding	Often used open ended questions to check student's understanding and sometimes using closed question to get students' attention	Used closed questions in a question and answer session, usually for facts-recalling and memorizing
Management of classroom	Maintained order	Maintained order	Maintained order
Moving around the classroom	Frequently during group activities	Constantly during group discussion	Not observed
Manage off-tasks students	Deliberately asked off-tasks students to back on business	Friendly asked the off-tasks students to get back on the track	Not observed

The first assertion that concerns the general status of science teaching in urban lower secondary schools is presented. Second, the characteristics of science teaching practices in urban lower secondary schools are described. These included the use of various teaching approaches and methods, the use of a clear teaching structure, having a clear expectation of students' outcomes and the establishment of good classroom management. Finally, assertions on factors that may influence the science-teaching practices in urban schools are explained.

Assertion 1

To some degree, generally, science-teaching practices in urban lower secondary schools have met the requirements as prescribed in the documents.

Based on these classroom observations, this study found that to some extent science teaching practices in urban lower secondary schools are in accordance with the suggestions provided in the curriculum documents. Teachers have used various teaching methods and approaches, used appropriate questioning techniques, and applied a standardised teaching structure. Both teacher C and teacher D employed a range of teaching strategies such as experiment, group discussion, demonstration, and direct lecturing. Both teachers tried to avoid traditional chalk-and-talk methods. However, teacher E, due to the circumstances, used direct lecturing mixed with questioning and answer session. All teachers who participated during classroom observations used various questioning techniques from closed types for recalling to open type question for reasoning, and employed a standard of teaching structure set by the curriculum document. Although the degree of the teaching structure varied, these teachers tended to structured their teaching into three main segments that included introduction, core activity and closure.

Assertion 2

Science teaching practices in urban lower secondary schools were characterised by good classroom management and clear expectation of students' outcomes.

This study highlighted that each of the urban schools' teachers who participated in the multi-site case study can be considered as an effective classroom manager. They regularly monitored their classes to ensure that all students were not off task and any disruptions were minimised. Both teachers C and D often moved around the classroom to ensure that each student was on task, to accommodate students' or the group's questions, and to gently bring the disrupted or distracted students back to the learning activity without humiliating them.

With regard to the outcomes expectation, these teachers always accentuated what students should achieve during teaching and learning activities. At the beginning of each lesson, both teachers C and D explained the learning objectives followed by the teaching structure. For example, teacher D provided the students with a worksheet in which learning goals, the teaching procedures and the students' activity were provided (CO.TD.S4.24.01.02). Teacher E on the other hand expressed her expectation to the students that they should be able to answer the test and nation-wide examination.

Assertion 3

Science-teaching practices in urban schools might be influenced by school's expectation on students' achievement in the nation-wide examination.

This assertion might be valid as the evidence emerged from classroom observations during the last two weeks of second term. As indicated in teacher E's classroom, teaching and learning activities were mostly reviewing the lessons or practicing the test to prepare the students for the school or the nation-wide examination. The pressure given by the school is clear as teacher E of school 5 stated:

> Personally, I do not agree with the statement that the average of students' scores at the nation-wide examination is an indication of the school's quality. However, it already becomes a strong public opinion that drives schools to achieve. Unavoidable, my school here has set it [the scores] as the priority. It means that teachers should focus their teaching to enable students to achieve good scores. As a result, teachers who teach Year 9 classes tend to use some of their allocation for practicing examinations. Therefore, I am doing this way too. (I.TE.S5.18.02.02)

Similarly, teacher C also admitted that the school gave teachers more pressure with its missions. However, the pressure became less evident in the normal teaching and learning processes since the school established a specific programme after school hours. Nevertheless, teacher C stated that he still believed that the pressure is there during normal lessons and might have influenced his teaching practices.

> Teaching and learning activity is as normal. I do not use my teaching allocation for drilling. The school has a special programme for that [examination preparation] after school hour three days a week, Tuesday, Thursday and Saturday.
>
> But you know...I often give my students tips how to answer a problem during teaching and learning processes. May be it is part of the pressure given by the school. (I.TC.S3.16.02.02)

It was obvious that to some extent the teaching and learning processes in the science classroom were examination driven. The school's expectation on students' achievement in the nation-wide examination may have influenced the teachers in conducting their teaching, although the degrees of influence might vary.

6.2.2 Science curriculum implementation in rural schools

The subjects of the multi-site case study that represented rural schools in this research comprise three schools as mentioned in Section 3.3.5.2. These schools with their appointed teachers are School 1 with Teacher A for biology classroom, School 2 with Teacher B for physics classroom and School 6 with Teacher F for both biology and physics classroom. Before the status of the science curriculum being implemented in these schools is presented, the descriptions of subjects' backgrounds in Section 6.2.2.1 and three selected vignettes of science teaching in schools 1, 2 and 6 are offered in the next three sections, respectively. Science teaching presented in each vignette was deliberately selected so that it represents typical practices in related schools.

6.2.2.1 Backgrounds of the subjects

The following paragraphs inform the backgrounds of the subject in this study that include general information of schools, teachers, and students. More specific information of the school background is embedded in each vignette that portrays typical science teaching practices in each school where the case study was conducted.

The schools

Six rural schools that participated in this study were drawn from three districts, namely, Kota Banjarmasin, Kabupaten Tanah Laut, and Kabupaten Barito Kuala. Most schools, which were established in the early 1990s, are located in villages that have various modes of transportation and relatively poor road conditions. On average, each school in a rural area has relatively small classes with 15 to 25 students per class. This class size is much less than that of urban schools that has more than 40 students per class. However, the schools share common conditions such as inadequate science laboratory equipment, lack of textbooks, and relatively poor physical environments. Most teachers in these schools live in the town or the capital city, and commute, only coming to the school when they teach according to the schedule set by the school.

School 1 is located at a strategic but relatively isolated area. It is strategic because the building is close to the main-road. It is isolated since there is no village in the radius of three or four kilometres and the swamps that surround the school increase the sense of isolation. Most students used their bicycle to reach the school. As a new school that was established in 1992, it has fairly good and adequate facilities that include a library and science laboratory. The school administration is equipped with three computers and a telephone line has been installed. The library was well maintained, although the number of books in the library collections was limited. The school's atmosphere that promotes learning encouragement can be identified. For example, in front of the library corridor, a slogan '*Belajar Kunci Kesuskesan*' meaning 'Learning is key for success' is displayed. Whereas next to the exit gate, students are reminded with the message '*Sesudah pulang sekolah buka kembali buku pelajaran*' that can be translated as 'Reopen your books at home after school'. The school vision that emphasises the importance of students' success in the nation-wide examination is displayed in the main entrance. The laboratory was well managed with scientific diagrams and pictures of students' hands-on activity products were displayed at the wall. The cleanliness and freshness inside the laboratory accentuated the quality of laboratory maintenance. Three school administrators, 21 fulltime teachers and five contract-teachers supported the school principal in operating the school.

School 2 is located in the new developed village. The first impression when visiting this school is the tranquillity and serenity provided by the nature in which green and shady tress surrounded the school building which is relatively new as can be seen by the date of establishment, i.e. in 1993. However, the physical school building displayed much older condition that it was. For example, the ceiling in the teachers' office, the front office and in several classrooms has worn out. The colour of the wall has faded and is dusty. The school operated three parallel classes for Year 7 and Year 8, and only two parallel classes of Year 9. The school has a science laboratory but this has not been functioning for six months and is in a relatively poorly maintained condition. The school library function well but has inadequate books and textbooks. Neither the canteen nor the nursing room could serve the school community better. The canteen was so small, whereas the nursing room was unequipped with the necessary first aid kits. The school was run by the almost retired principal who lives next to the school with the support of 23 full time teachers, four contract-teachers, and two school administrators. A computer has been installed for administrative purposes. No telephone line has been connected to this school due to the rurality of the area.

Although school 6 is under the administration of Kota Banjarmasin district in which the word 'kota' refers to urban area, however, its location is considered as remote or rural. Students can use bicycle, motorcycle and longboat (*kelotok*-a traditional water transportation) or walk to reach the school location. The school has nine classes that are distributed equally into each year level. The total students in Year 9 in 2002 academic year were 82 people. The average students' score in the nation-wide examination for the academic year of 2000/2001 was 5.09. The school was run by a dedicated principal who was supported by 20 fulltime teachers, two part-time teachers and four fulltime school administrators. A school science laboratory is available but is poorly equipped. The library was well managed by a teacher who was appointed as librarian, yet, the number of books is inadequate for the students in the school. Two computers were installed for administrative purposes. No telephone line was connected yet.

The teachers

Eleven science teachers in the six rural schools agreed to have one of their classrooms be observed for two periods and for their students to respond to the classroom learning environment questionnaire. However, only two science teachers from two different rural schools were involved in prolonged classroom observations. These two teachers, teacher A of School 1 and teacher B of School 2, agreed and expressed their willingness to become volunteers for case studies. In addition, teacher F of school 6 voluntarily offered her classes to be observed for extended periods for a total of eight periods in two weeks. Her availability for interviews led the researcher to decide to include her classes in an additional case study.

Teacher A has five years teaching experience and holds a Diploma III Certificate in Biology Teaching. Recently, he has taken the comprehensive examination from the Open University of Jakarta, Indonesia, to obtain his Baccalaureate degree (*S1-Strata 1*) in Biology Education. He has participated in teacher training at both regional and nation-wide levels. On the other hand, teacher B has 19 years teaching experience, and holds a Diploma III Certificate in Teaching General Science for lower secondary schools. The only professional development programmes that teacher B has participated in were *Sanggar Pemantapan Kerja Guru (SPKG)* – a forum for strengthening teacher practice, and *Musyawarah Guru Mata Pelajaran (MGMP)* - a forum of teachers from the same subject areas, at the district level. The teachers live in different locations, half an hour by motorcycle from the school. However, while teacher A enjoys living in the capital city of Banjarmasin, teacher B enjoys living with his family in a small town.

Teacher F of School 6 has 19 years of teaching experience of general science, mostly in rural schools. Before she was moved to School 6, she had been taught in a rural school in Pelaihari, in the Tanah Laut district. She holds her Baccalaureate degree (*S1-Strata 1*) in Biology Education. She has participated in teacher training at regional such as *Sanggar Pemantapan Kerja Guru (SPKG)* – a forum for strengthening teacher practice, as well as at nation-wide level, for example in

Latihan Kerja Guru Inti (LKGI) - a short course programme for key teachers. Like teacher A, teacher F lived in Banjarmasin and commutes to the school according to her teaching schedule.

The students

The student sample consisted of 130 males and 238 females, most of whom were 15-16 years old. Generally, the students come from middle-low socio-economic family backgrounds where their parents' occupations are traditional farmers, fishermen, and other unskilled labour workers. Their socio-cultural background also varies as depicted by the languages spoken at home, with 79.08% speaking *Bahasa Banjar*, 9.78% speaking *Bahasa Jawa*, 5.98% speaking *Bahasa Indonesia*, and 5.16% speaking other languages such as *Bahasa Dayak* and *Batak*. However, students are fluent and confident in using *Bahasa Indonesia* since the language of instruction in the classroom is *Bahasa Indonesia*.

6.2.2.2 Science teaching practices in school 1

After several classroom observations, the researcher was impressed by the teaching practices of teacher A. His ability in using various teaching methods was exceptional. To some extent, his teaching practices could be considered as exemplary. Initially the researcher assumed that teacher A's performance was due to the circumstance that he was scrutinised by the researcher. However, this assumption might have no ground, because teacher A continued to perform his extraordinary teaching practices as confirmed in the following vignette.

Vignette 1: Let us do Trade A Problem (TAP) (CO.TA.S1.29.01.02)

Today, Teacher A employed 'Trade A Problem' (TAP) as the teaching method. When other rural school's teachers might be comfortable using traditional teaching method such as chalk-and-talk, he tried to use this TAP method instead. As usual, he assigned his students into several groups of three or four. After greeting his students, teacher A spent the first 10 minutes explaining the TAP procedure. Each group was ordered to make/offer three problems related to the topic and each group had to provide the solution or answer as well, before they could trade their problems to another group. Each group was then given 15 minutes to complete its topic-related problems and the answers. Teacher A offered opportunities to students if they had any questions.

After each group was ready with the problems and answers, Teacher A asked them to trade the problems with those of another group. Teacher A gave six minutes to all groups to trade the problem.

In the next 15 minutes, each group tried to solve the problems they received from the trading. During this period, all students in each group were actively participating and no student was observed to be off task.

Teacher A called the whole class for discussion and spent the following 25 to 30 minutes on problem solving from the trader and discussion with the seller. Each group presented its answer to the trading problems, confirmed or refuted by the 'seller' who made the problem (and provided with the solution).

In the last ten minutes, teacher A resumed the lesson by emphasising the importance of agreement among the students' perceptions.

Interpretive commentary

The intention of presenting this vignette of teacher A's classroom was the teaching method that teacher A used. As explained before, instead of using lecturing as the teaching method, teacher A used the TAP, a teaching method he learnt from SPKG workshops. Informal discussion with teacher A after the lesson revealed his rationale for using this teaching approach. According to him, it is important to ensure that his students become active learners though he could use traditional methods to teach this concept. However, he employed this 'advanced' method despite the lack of facilities (in term of no textbooks) in the schools. Using the TAP method, according to teacher A, enabled students to learn more and learn cooperatively with their fellows. Moreover, through the TAP approach, the students have opportunities to read the textbook (related to the topic given) at least twice. First, when they solved their own problem, and second when they solved the trading problems from another group. Furthermore, when they discuss both within their group and in the whole class session, they should come to a more rigorous understanding of the topic or concept. Misconceptions might be overcome as well during the discussion.

Vignette 2: Genetics, heredity, and hybridisation (CO.TA.S1.05.02.02)

This was the fourth classroom observation. Usually, at the first period, the lesson began with a prayer led by a student. After the teacher and students greeted each other, teacher A started the lesson by reviewing the concepts (animal reproduction) learnt in a previous biology class and tried to link them with the present topic. Teacher A passed the following question to begin the lesson:

'Whom do you look like in your family: your father or your mother?'

The class become alive with various students' responses such as '*My father*', '*My grandfather*', and '*My mother.*'

'*All right, that's possible. Now the real question is how does it come about?*'

Again students' responses made the lesson lively. Teacher A then accommodated various but naive students' understanding of heredity and hybridisation by writing down the topic that would be covered. Teacher A also explained how the lesson would be. He grouped the students as usual into groups of three and four, so that there were five groups.

Before the discussion, teacher A briefly but clearly explained about the cell, chromosomes, genes and other basic terminologies related to heredity and hybridisation such as genotype, phenotype, parental (P) and filial (F) symbols, dominant, recessive, and allele. When students moved to their appointed group, teacher A wrote down the problem on the blackboard: 'Red flower was hybridised with white flower from the same species. If red is dominant, what are the genotype and phenotype of the first filial?'

Main activities

Teacher A asked the students to have a look at the problem and gave them about 15-20 minutes to discuss with their peers in the group. During the discussion, students firstly read the genetic concepts from the textbook they have to share, followed by the shared meaning in the group. Teacher A moved around to assist students as needed. To ensure that students fully understood the problem, teacher A asked several students the meaning of the word 'dominant'. Students' responses included the trait that rules the other, the trait that beats another, red colour covers white colour, and parental trait that is inherited by the filial. Teacher A accepted these responses and asked students to keep on discussing.

Students were still immersed, or maybe confused, in each group discussion when teacher A called for the answer. Each group representative come to the front of the class and wrote their answer at the blackboard. However, the results were not as expected. Most students/groups did not understand yet how to solve the problems. They did not know yet how to write the genotype representation of the parental and allele. To encounter this situation, teacher A explained step-by-step how to solve the problem. Furthermore, he continued by coaching the students with more practice on problem-solving activities.

Closure

Ten minutes before the lesson ended, teacher A made a closure and resumed by giving students homework with more problem solving practices about mono hybridisation and reminded students about next biology lesson.

Interpretive commentary and assertions

The teaching was about hybridisation. Teacher A used group discussion as the teaching method. The structure of his teaching paralleled the procedures as suggested in the curriculum document, which consisted of introduction, main activities and closure. Using daily phenomenon, teacher A tried to attract students' attention and link it with the lesson's topic. Before moving into the main activity, which is mono-hybridisation, teacher A explained terminologies and definitions related to hybridisation. The main activity was about group discussion in which each group should provide a solution to a problem given at the blackboard. Given that each group could not answer correctly, teacher A realised that he needed to coach them. Hence, the activity changed to teacher coaching. Teacher A resumed the lesson by providing the students with homework.

Other classroom observations in teacher A's classroom revealed similar a teaching structure. It can be claimed that to some degree and based on limited observations, that teacher A has maintained a standard teaching practice as recommended in the curriculum document. Furthermore, teacher A's efforts in using various teaching approaches and methods were noticeable and considered as exemplary.

6.2.2.3 Science teaching practices in school 2

No textbooks, inadequate laboratory (CO.TB.S2.06.02.02)

This was the fifth classroom observation in Teacher B's classroom. As usual, the researcher arrived at 7.35 am, twenty-five minutes before the school began when it was still quiet and peaceful. The researcher waited for teacher B at the teachers' office that was still unoccupied. Most teachers arrived on time or maybe later due to their locations; and only a few teachers did not arrive on time.

At 08.00, teacher B rang the bell signalling the school had begun. All students lined up in front of their classes and orderly, one by one, the students went to their classrooms. When teacher B came, all the students stood up and greeted him and the class was started with a prayer. Teacher B told the students that they would have a class in the laboratory and asked students to pack their notebooks and physics textbooks, if any, and go down to the laboratory.

We went to the laboratory that was located 300 metres from the classroom. It was dusty, the cobwebs were apparent at each corner of the walls and some posters that had colours faded were worn out. The students were busy cleaning up their desks spreading the dust around the laboratory and this prevented teacher B starting the lesson immediately. The lesson was not ready until quarter past eight.

08.15: teacher B open the lesson by asking questions related to last week's lesson, which was about electromagnetism induction. Students responded to the question by opening their notebooks. Teacher B used this occasion to prepare the students for the next topic, namely, the generator, by repeating his explanation on the electromagnetism induction processes.

08.20: teacher B wrote down the new topic being learnt that day. Being aware that only very few students had the textbook, he wrote down the lesson material on the blackboard and asked students to copy it; the female students were more enthusiastic and active than the male students. When the students finished copying the notes, teacher B explained the lesson and offered his students the opportunity to ask questions to clarify the details of the lesson.

08.40: teacher B used next five minutes to review the topic, before he moved to the new topic, namely, the generator. This time he asked question of the whole class rather than to individual students, with most questions requiring recall of facts and none required reasoning.

08.47: teacher B wrote down the topic entitled 'Generator' on the blackboard. Again, he gave lesson notes on the blackboard, asked the students to copy them, and explained them later. He drew a simple electric generator and asked the students to copy it. When the students finished copying, he then explained how the generator works

09.15: teacher B used the next five minutes for questions and answers related to the 'generator' topic. Teacher B read the questions from the textbook and the students responded. The questions asked included the definition of electric generator, a recall question. Again, the researcher noticed that male students were not as enthusiastic as female students. Teacher B asked a student to clean up the blackboard before the class commenced another topic, namely, the transformator.

09.25: teacher B continued the class with a new topic. He used a teaching aid, namely, trans-vision – a coloured printed transparency supplied by the government. However, he used it for a very short time due to the inadequate laboratory facilities that was not equipped with an overhead projector. As a result, teacher B just showed the transparency his students to glance at followed by a brief explanation. Although ten minutes later some students were not paying attention to the lesson, teacher B kept going with the lesson and ignored these students.

09.45: teacher B copied a table from the textbook that explained the correlation between input voltage, output voltage and the number of coils in a transformer. Based on the data presented, teacher B asked the students to find the pattern and to draw a conclusion. However, the observation confirmed that the students had difficulty in doing so. Teacher B tried to explain and show the pattern, and finally drew a conclusion in the form of a formula that showed the correlation between the number of coils and voltages of a transformer. He wrote down the formula: Vs/Vp = Ns/Np; V and N referred to voltage and numbers of coils, while s and p indicated input and output, respectively. Based on this formula, teacher B gave students an exercise to find the output voltage of a transformer if the input voltage and the number of both primary and secondary coils were given. However, even though teacher B had assisted the students by writing down the formula, and filled in the information given as (26 volt) x (400) = (240) x Vs, the students could not execute the problem. From the observations it was apparent that to some extent the students had difficulty with this mathematics-related problem.

10.10: teacher B gave more problems for homework and reminded the students about the next week's lesson before formally concluding the lesson.

Interpretive commentary and assertions

The teaching and learning activities being observed were about electromagnetic induction and the transformator. According to the lower secondary school science curriculum documents, ideally these topics should be taught using a process skills approach and an experiment as the teaching method. The observation confirmed that teaching practices performed by teacher B were far from ideal because the scarcity of textbooks and the inadequacy of the laboratory prevented him from teaching science as expected in the curriculum documents. Most of the teaching time was devoted to note taking activity. Teacher B dictated or wrote down the lesson materials on the blackboard, and the students copied them to their notebooks. To some extent, science teaching in his classroom was a one-way communication. Another factor that inhibited the teaching and learning activity of teacher B's classroom was the students' mathematics ability. As recorded during the observation, teacher B needed to re-explain the students about simple mathematics calculations.

Further classroom observations support this commentary in which most science teaching in teacher B's classroom was dominated by traditional chalk-and-talk. Seldom did he employ the suggested teaching methods such as experiment and demonstration.

6.2.2.4 Science teaching practices in school 6

Let us get ready for the school term test (CO.TF.S6.21.02.02)

It was a rainy morning when the researcher went to school 6 for another classroom observation in teacher F's classroom. The road condition, which was slippery and narrow, prevented both teachers and students to move along. Most students walked and blocked the only way to the school. Therefore, it was acceptable if teachers and students might come late.

A location far away from the road and close to the 'forest' provided school 6 with a tranquil and serene physical environment. Teacher F greeted the researcher and took him to the classroom. This was the second classroom observation conducted in a biology classroom. Teacher F was appointed to teach both biology and physics for Year 9 students. While teacher F prepared the lesson, the researcher explored the classroom physical environment from the backbench. Under the dim light from four 40-watts bulbs, the researcher was able to see the cobwebs at the front corners of the classroom. Pictures of national heroes and scientists were displayed at the walls, together with posters that accentuated the importance of reading the books such as '*Buku sumber ilmu*' (The books as sources of knowledge) and '*Membaca membuka jendela dunia*' (Reading opens the window of the world).

Teacher F opened the lesson by writing down the topic that is '*latihan ulangan umum*' that can be translated as 'practices for the school term test'. Students were asked to answer problems provided in the textbook. Teacher F encouraged students to provide themselves with a recommended textbook used during teaching and learning activities. Students who can afford the textbook shared it with other students. Teacher F asked students to open page 20 where they found multiple-choice items and an essay test for practice. Randomly, teacher F picked up a student's name from the list and asked her or him to answer a specific question.

Being aware that multiple-choice items gave students a chance to guess the answer, teacher F tried to go further by asking the student why he or she chooses the option. To some degree, teacher F tried to engage her students into reasoning rather than recalling levels. However, the observations recorded that this effort was hardly successful. In most instances, teacher F still played a significant role rather than the students doing the work to keep the lesson moving. The students remained passive in the process.

A problem that was unrelated to the topic arose such as students' ability in mathematics skills. Teacher F needed to explain the simple mathematics procedures when the students were stuck in solving a problem that involved calculations. It was similar to the case in teacher B's classroom. The students were struggling to find an unknown variable when the others were given in the problem, using the formula given: $Vs/Vp = Ns/Np$.

Teacher F offered students the opportunity to ask questions or clarify something related to the topic. However, none of the students took up this offer and politely they remained silent until the end of the period.

Teacher F concluded the lesson by reminding her students to prepare for the school

Interpretive commentary

The tension upon both teacher and students for achieving a good score in both the school tests and the nation-wide examination is obvious. Teacher F claimed that she had covered all the required topics as described in the curriculum document and used the remaining available time for reviewing and practising the test.

Regarding the teaching structure and teaching strategy, classroom observations showed that teacher F tried to use direct teaching and employed both closed and open questioning techniques. Although unsuccessful, her effort to bring the teaching and learning activities into a reasoning level was noticeable. Using question words 'why do you think so?', 'Can you explain further?' were presented to motivate her students in explaining their choice answer. The observation might suggest that teacher F has adhered to the recommended teaching structure, in which she formally began the classroom with apperception, provided a core activity, and concluded the lesson with a closure. The remaining observations verified that the comments derived from this classroom observation were similar.

6.2.2.5 Status of science teaching science in rural lower secondary schools

Descriptions of teaching practices in science classroom in selected rural lower secondary schools were provided in Sections 6.2.2.2, 6.2.2.3, and 6.2.2.4. For simplicity, a summary of teaching practices in science classrooms in these schools is provided in Table 6.2.

Table 6.2 A Summary of Teaching Practices in Science Classroom in Rural Lower Secondary Schools of Kalimantan Selatan, Indonesia

Aspects of Observations	Teacher A of School 1	Teacher B of School 2	Teacher F of School 6
Lesson plans	Available	Available	Available
Expectations	Clearly expressed; wrote down the learning goals on the blackboard	Not clear, seldom did teacher B express students' learning expectations	Expected students to success at the school test
Teaching methods	Experiments, demonstrations, group and classroom discussions, and direct lecturing	Mostly chalk-and-talk	Direct lecturing, reviewing with questions and answer session
Teaching structure	Introduction; core activities; closure	Directly went into core activities; closure	Introduction; core activities; closure
Questioning techniques	Often used open ended questions to check student's understanding and sometimes using closed question to get students' attention	Mostly used closed questions emphasised on memorizing and facts recalling	Used closed questions in a question and answer session. Tried to engage the students into reasoning level using open ended questions, but unsuccessful
Management of classroom	Maintained order	Order was less maintained.	Maintained order
Moving around the classroom	Frequently during group activities	Seldom	Sometimes move around to assist students
Manage off-tasks students	Not observed	Tended to ignored	Not observed

Based on this summary and on the data analysis that emerged from the practices of a small numbers of science teachers during several classroom observations in three rural schools, several assertions in three main areas regarding teaching science in rural schools are offered. First, the assertion on the general status of science teaching in rural lower secondary schools is examined. Second, the assertion with regard to the establishment of good or exemplary teaching science in rural school is confirmed. This assertion leads to a comparison of teaching practices between an exemplary and non-exemplary science teachers in those schools. The comparison covers several aspects including the associations between teachers' beliefs of their roles in the classrooms and of students' learning and their teaching practices, and the effect of teacher's content knowledge on teaching activities. Finally, the assertion on factors that influenced science education practices in rural schools is presented.

Assertion 1

Most science teaching practices in rural lower secondary schools are teacher-centred and are dominated by the traditional teaching method, namely, 'chalk-and-talk'.

Drawing from the short visits to six schools with a two-hour period of classroom observations in each school, and a sequence of prolonged classroom observations in the two case study schools, it is suggested that teaching quality, particularly in science classrooms, in rural lower secondary schools is somewhat disenchanting. With the exception of those teaching behaviours of one of the teachers, teaching science was a chalk-and-talk activity dominated by the teacher as the source of knowledge. Often, the teachers asked one of the students to copy a paragraph or more on the blackboard and have the rest of the class copy, before they explained the content of the paragraph (CO.TC.S2.13.02.02 & CO.TD.S3.09.01.02). Alternatively, the teachers dictated paragraphs and the whole class wrote these into their workbooks (CO.TE.S4.12.01.02; CO.TF.S5.12.01.02 & CO.TG.S6.21.02.02). These situations exist in schools where few or no textbooks are available for either teacher or students. Consequently, these practices are inconsistent with the methods and teaching approach as suggested in the intended curriculum. Teaching the topics such as magnetism in physics and genetics in biology during the school terms of the observation should ideally be delivered using laboratory activities. However, given the poor laboratory and facilities in most rural schools, it is understandable if the teachers fail to use the laboratory as a medium of teaching science. Not only have the laboratories inadequate facilities, but also even the facilities that did exist were not used by the teachers (FN.S2. 06.02.02 and CO.TB.S2.06.02.02). One of the teachers explained that the laboratory in his school had not been used for almost six months, and had changed its function to be a storage area:

> Previously, I used the laboratory to teach physics, so did the biology teacher(s). However, due to lack of equipment and resources as well as the time constraints in doing experiments, I am now conducting my teaching in the classrooms instead. It has been more than 6 months, I think, that the laboratory has been abandoned and not been used. We use the laboratory to store equipment (*that is not relevant to science teaching-add*), for example traditional music instruments. (I.TB.S2.06.02.02)

Assertion 2

Despite limited facilities, the teaching practices of teacher A were considered exemplary.

Drawing from the impressions of two periods of classroom observations in each of six rural schools and of the prolonged classroom observations of 36 periods in two rural schools, the science teaching practices were largely of a didactic nature. In contrast to his peers, one teacher's teaching practices can be considered as exemplary. This consideration was carefully drawn based on the theoretical framework, focusing on the features of exemplary teaching practices in both western and Indonesian educational contexts. Within the context of this study, comparison between exemplary and non-exemplary teaching practices was mainly based on the data from observations in teacher A's and teacher B's classrooms. Teaching practices of teacher A that was considered as exemplary were compared to those of teacher B and others participated in questionnaire survey.

Despite the limitation of resources, equipment, and school facilities as well as time constraints, teacher A of School 1 demonstrated and maintained his extraordinary teaching practice. Four features of his teaching practices that distinguish him from the other teacher observed are elucidated in the following paragraphs.

First, teacher A managed his classroom effectively. In most instances, teacher A organised his students into groups based on their academic ability and sometimes their preferences. His teaching generally involved three stages, namely, a perception to link the new concepts to be taught with the students' prior knowledge or daily occurrences; learning processes that comprised the main activity; and closure in which he checked students' understanding of the topic or resumed teaching. Overall, observations in his classroom, which mainly took place in the laboratory, confirmed that students were rarely off task (Prolonged CO.TA.S1. 36 periods). Furthermore, not only were the activities interesting for the students, but these were also challenging and enriching. For example, despite teacher A providing the students with a chart that consisted of a set of data to explain the proportions of genetics variations from reproduction, he asked his students to obtain the data by doing the same activity as presented in the textbooks. In groups of three or four, students were asked to obtain the proportion of new individuals produced from hybridisation of parents with two different traits. Each group had two cubes with a symbol of possible parental gamete in each of its surface. One cube represented male and the other represented female parents. Students were asked to throw these cubes and wrote down the genotype symbols and determined the phenotype of the 'individual' produced from the 'imaginary fertilisation'. Each group was asked to make up to a hundred 'imaginary fertilisations'. The activity was followed by whole class discussion in which teacher A facilitated the students to comprehend their findings, and directed them towards understanding the concept of hybridisation with two different traits that should be achieved (CO.TA.S1.19.02.02). Not only did the activity reach its objective of both genotype and phenotype proportions of offspring but also it enabled students to reinforce their understanding of writing down genotype representation and determine the phenotype.

In contrast, the other teachers, including teacher B, tended to utilise traditional teaching methods, being teacher-centred in a chalk-and-talk mode. For example, when teacher B employed small group discussion, the nature of the discussion was different from those of teacher A's class, being a *pseudo discussion activity*. As was confirmed during classroom observations, many students were off task due to unclear directions and the teacher's expectation of the activity and when teacher B was engaged with a group, the students in other groups were off task doing something else, such as chatting with peers within a group, playing with pencils, and daydreaming. During observation, the researcher was told by one student that a boy in his group was annoying the girl of the other group (CO.TB.S2.06.02.02).

Second, teacher A used various questioning techniques while the other teachers, including teacher B, tended to employ a single questioning technique with short, closed questions. This finding elaborates that of Reap (2000) in which exemplary teachers used creative questioning. Teacher A's class was enriched with diverse questions such as, 'what do you think?', 'why?', 'how?', 'can you explain to us?' Teacher A frequently asked the questions to ensure that students really understood the concepts of hybridisation that they have learned. Often, after the lesson was finished, the students asked him for further explanations of the topic or other matters related to the topic. For example, one student asked teacher A why some people like him (the student) 'suffers' from polyploidy (abnormal fingers-six instead of five in one hand or foot) (CO.TA.S1.14.02.02). On the other hand, teacher B's class was dominated by 'what' questions that only focused on recalling facts that has been rote learnt. (CO.TB.S2. 06.02.02 & 13.02.02)

The third feature was the different teaching approaches. Unlike teacher B, who was consistently using a traditional teaching method, teacher A tended to use a variety of teaching methods. When he considered that the topic was 'hard' and no other way was appropriate, teacher A used an enriched traditional approach which was a combination of teacher-centred and student-centred approaches. For example, when he introduced hybridisation as a new concept, he employed a lecture method for the first 15 minutes, followed by guided problem solving in the next 15 minutes, and finally involved the students in problem solving and discussion for the rest of the lesson (CO.TA.S1.14.02.02). In this instance, teacher A played his role as a source of knowledge, but at the same time as a motivator and a guide for his students to ascertain the concepts, by using various questioning techniques. Furthermore, it was confirmed that, in most instances, teacher A's teaching approach had a core characteristic, which was to always activate students physically and mentally. In contrast, students in teacher B's class seemed to be passive due to the nature of the teaching approach.

In addition, teacher A's effort in providing his students with a good learning opportunity could be considered as distinctive. For example, he sometimes used the computer, provided by the school for him as one of the vice principals, to enhance students' learning opportunities by his teaching. Using his own money, teacher A collected science education multimedia software which he used to facilitate students' learning about the reproduction process from a relatively abstract to an animated-observable level. The students were content with the teaching approach for science as captured in the following field notes:

> The students in each group were serious, yet looked like having fun as well, as they watched the animation in the computer. Some students expressed their satisfaction about the activity. After the lesson, informally I asked their opinions of using this kind of media. Most agreed that although they were not familiar yet with the computer, the presentation (computer animation of the reproduction system) gave them a clearer idea of the topic that cannot be obtained if they only read from the textbook or if the teacher only explained it verbally. 'It is really different experience' said one student. (FN.TA.S1.24.01.02)

Not only did the software bring the student thinking from the abstract to being more real, but it also introduced students to relatively advanced and new technology in their school context.

Fourth, teacher A maintained a more favourable classroom learning environment than did the other teachers. The first three features described above imply that teacher A's classroom had a relatively better learning environment than others. This implication is supported with the finding from a questionnaire survey using the Indonesian version of *What Is Happening In this Classroom* (WIHIC). The t-test results for independent samples as reported in Table 6.3 revealed that, on the whole, the students in teacher A's classroom perceived their learning environment more favourably than did the students' of the non-exemplary teachers. Statistically significantly differences were found on four scales, namely *Student Cohesiveness* ($p<0.01$), *Teacher Support* ($p<0.01$), *Involvement* ($p<0.01$), and *Cooperation*

($p<0.05$). These results confirm that students in teacher A's classroom experienced better student-student relationships, better teacher support, and greater involvement during teaching and learning activities, as well as more cooperation with class members than did students in other six rural schools. These data imply that teacher A managed his teaching activities better than did teacher B and the other teachers in the six rural schools involved in this study. This finding corroborates those of Deacon (1987), Fraser and Tobin (1989), Garnett (1987), Tobin and Fraser (1988), and Treagust (1987, 1991) regarding the classroom of exemplary teachers.

Table 6.3 Average Item Mean, Average Standard Deviation, and *t* Test Results for Independent Samples for Students' Perception of Their Classroom Environment Taught by Teacher A (n=37) and Other Teachers (n=364)

Scale	Teacher A's Classroom		Other Teachers' classroom		t value
	Mean	SD	Mean	SD	
Student Cohesiveness	3.85	0.45	3.65	0.54	-2.60**
Teacher Support	3.00	0.58	2.70	0.65	-2.91**
Involvement	2.80	0.45	2.51	0.67	-2.59**
Investigation	2.51	0.58	2.36	0.76	-1.17
Task Orientation	3.79	0.50	3.61	0.57	-2.15*
Cooperation	3.15	0.48	2.98	0.67	-1.53
Equity	3.52	0.64	3.39	0.82	-1.16

* p<0.05 and **p<0.01

Assertion 3

The exemplary teacher held strong and clear beliefs of his role and student roles in the classroom and possessed more content knowledge.

Interviews with teacher A and teacher B revealed the different beliefs each held about their roles in the classroom and the ability of each to explain practical implementation of the various roles. Teacher B stated that he believed that his role in the classroom should be as a guide and that the students should be active learners.

> The teacher's role in the science classroom should be as a guide for the students. The teacher should assist students in acquiring the concepts being studied. It is no longer acceptable to hold a view that the teacher acts as a source of knowledge who transfers it to students who then

> become passive receiver. Students must be active learners. (I.TB.S2.06.02.02)

However, classroom observation records showed the researchers that teacher B's teaching practices were relatively inconsistent with his beliefs. Although he believed that he should be a guide for his students and students should be active learners, most of his practices were as a director and he drove his students to be either passive or disruptive learners. In other words, teacher B's teaching practice was not consistent with his beliefs about teaching and students' learning. This finding is similar to the results of Kesler (1985), Parmelee (1992) and Zoest et al. (1994).

In contrast, teacher A possessed clear and strong beliefs about his and the students' roles in the classroom. Similar to teacher B's belief, he assumed that students should be active both physically and mentally during the learning process. Therefore, he believed that it is the teacher's role and responsibility to facilitate the students to become active learners. Accordingly, teacher A believed that his roles in the classroom should vary from coach, facilitator, guide, motivator and source of knowledge, depending on the contexts of learning.

> Initially, I believed that my role in the science classroom should be as a facilitator. It is my ideal role. However, through the teaching experiences I realised that I unconsciously play other roles, for example, as a coach, a guide, a trainer, and sometimes as a source of knowledge dependent on the classroom situation. Nevertheless, I believed that the role as a facilitator dominated my teaching practices. ...I see students as active learners....who construct their own understanding. I do not agree with a view that regards students as an empty glass [bottle] to be filled. (I.TA.S1.14.02.02)

His range of roles in his classroom was confirmed during a sequence of classroom observations. For example, a segment from classroom observation revealed that when teacher A considered that the topic was 'hard' and no other way was appropriate, he acted as a source of knowledge. He introduced hybridisation as a new concept, by employing a lecture method for the first 15 minutes. To ensure that his students had obtained the concept, teacher A employed his role as a guide by providing students with an example of problem solving in the next 15 minutes.

Finally, he acted as both facilitator and coach during problem solving and discussion for the rest of the lesson (CO.TA.S1.14.02.02). In this instance, teacher A played his role as a source of knowledge, but at the same time as a motivator and a guide for his students to ascertain the concept. Thus, it can be emphasised that the congruence of beliefs concerning role and the practice of teacher A as the exemplary teacher can affect, and is consistent with, a high quality of learning in the science classroom. This result replicates and affirms the assertions from previous studies such as those by Cronin-Jones (1991), Varella (1997), Farrow (1999), and King (2002).

With regard to the teachers' content or subject matter knowledge, this study also asserted that the exemplary teacher A possessed more content knowledge compared to the non-exemplary teacher B. In turn, this difference can influence the level of teacher confidence in delivering his or her teaching practices. It was confirmed that teacher A used various textbooks and other references in his teaching, while teacher B depended on one textbook provided by the school and another textbook as a sample sent by a publisher. Furthermore, the differences between these two teachers with regard to their content knowledge can be confirmed by their teaching practice. Teacher B limited his content coverage to that in the textbook he used, whereas teacher A often went beyond the textbooks and provided students with updates of scientific facts and developments relevant to the lesson topic.

Furthermore, observations in teacher F's classroom provide information of other aspects that may influence teaching practices in rural schools. First, similar to those of urban school, to some degree teaching practices in rural school were test-driven. Teacher F's effort in providing the students with a review for school test supported the evidence. Teacher F's statements also highlighted this assertion.

> From year to year, it becomes clear for me that the school requires teachers to make students success in the nation-wide examination. To improve the average score in the nation-wide examination is part of school's vision and mission. (I.TF.S6.06.04.02)

Secondly, students' backgrounds in rural school, which were from low-income family background, may have an effect on teacher F's teaching practices. Teacher F expressed:

> I believed that my role in the science classroom should be as a facilitator. I expect my students become active learners. However, teaching in rural schools is different. What can you expect with these roles when you realised that your students have lots of limitations. You have observed how we were stuck in a simple math problem. Often I had to teach 'math' first, before explaining concept in physics. (I.TF.S6.06.04.02)

These data explain why teacher F was unsuccessful when she tried to engage the students into reasoning level of learning. Teacher F never heard the answer when she passed the questions like 'Why do you think so?' and 'Can you explain further?'.

6.3 Students' outcomes of lower secondary school science curriculum

Two types of students' outcomes regarding the implementation of the science curriculum in Indonesian lower secondary schools were investigated in this study. These are students' cognitive outcomes, which were obtained from students' scores on the nation-wide examination, and students' attitudinal outcomes that were explored using questionnaire surveys. The results are organised into three subheadings. First, the validity and reliability of the instruments being used in measuring students' outcomes are discussed in Section 6.3.1. Particular attention was given to the questionnaire, namely, the Indonesian version of adapted TOSRA being used to measure students' science-related attitudinal outcomes. In this section, factor analyses of the questionnaire structures, Cronbach alpha coefficients for each scales and scales' ability to differentiate between students' perceptions from different groups are presented and elaborated. Second, the status of students' outcomes is presented in Section 6.3.2. Means and standard deviations for each outcome were counted, followed by t-tests procedure to measure the differences between rural and urban schools students' outcomes, and between male and female students' outcomes. Finally, the association between students' outcomes and the existing classroom learning environments as perceived by the students are explained in Section 6.3.3. Simple and multiple correlations between seven scales of the Indonesian WIHIC and both students' cognitive and attitudinal outcomes were counted.

6.3.1 Validity and Reliability of the Instrument for measuring student outcomes

As explained in Chapter 3, Sections 3.3.6.1 and 3.3.6.4, this study used students' scores of school science in the nation-wide examination. During this study, the Indonesian educational system requires all students in the final year of each school level (Year 6 for primary school, Year 9 for lower secondary school and Year 12 for upper secondary school) to sit for the nation-wide examination. With regard to lower secondary school, Year 9 students must do the nation-wide examination for School Science together with other five subjects, namely, Pancasila and Civic Education, Mathematics, *Bahasa Indonesia* (Indonesian Language), Social Studies and *Bahasa Inggris* (English for SLTP). The examination is mostly multiple choices with four options. The examination system has been established for almost two decades; therefore, it is assumed that the validity and reliability of the instrument/test had been achieved. Accordingly, the following section is mainly devoted to the inspection of validity and reliability of the Indonesian version of adapted TOSRA.

Before any claim can be made upon the results of students' attitudinal outcomes, it is essential to describe the validity of the instrument being used. Following the suggestions as elucidated in Chapter 3, Section 3.2.5.1.1, the criteria for questionnaire validity that included factor structure, scale internal consistency reliability, and ability to differentiate between the perceptions of groups were scrutinized. Considering the number of classes that is large enough for statistical analysis purposes, individual students' scores and class means were used as the unit of analysis. Results regarding the criteria mentioned above were subsequently explained in the following arrangements: factor structure of the Indonesian version of adapted TOSRA (Section 6.3.1.1); scale internal consistency reliability and ability to differentiate between the perceptions of groups (Section 6.3.1.2).

6.3.1.1 Factor Structure of the Indonesian Version of Adapted TOSRA

To investigate the robustness of the questionnaire construct of the Indonesian version of adapted TOSRA in this study, the procedures as explained in Section 4.2.1 were followed. Sixteen items of two scales of the questionnaire, namely, *Attitude to Scientific Inquiry* and *Enjoyment of Science Lessons* are the subjects of factorial analyses using a principal component factor analysis followed by varimax rotation. In this analysis, items that have factor loading less than 0.24 was omitted. The results are presented in Table 6.4.

Table 6.4 Factor Analysis Results of the Indonesian Version of the Adopted TOSRA

Item no.	Factor Loading	
	Attitude to Scientific Inquiry	Enjoyment of Science Lessons
1	0.63	
2	0.62	
3	0.24	
4	0.66	
5	0.51	
6	0.60	
7	0.49	
8	0.57	
9		0.72
10		0.73
11		0.53
12		0.78
13		0.75
14		0.65
15		0.67
16		0.66
% Variance	26.44	13.98
Eigen Value	4.23	2.24

Loading smaller than 0.3 excluded. n = 1188 in 72 classes of 16 schools.

These results inform that all items of two scales of the Indonesian adapted TOSRA have satisfactory factor loadings greater than 0.49, except item 3, which is 0.24. It means that the *a priori* two-factor structure of the Indonesian version of adapted TOSRA is replicated in which all items have a satisfactory factor loading on their *a priori* scale and no other scale. Hence, it may be concluded that all items in each scale measure a distinct construct of the scale and not on the other scale.

6.3.1.2 Scale Internal Consistency Reliability and the Ability of the Indonesian Adapted TOSRA to Differentiate Between the Perceptions of Groups

In order to investigate whether or not each item in a scale assessed a common construct, Cronbach's alpha coefficient for each scale was calculated using both individual scores and class means as the units of analysis. As expected, reliability estimates were higher in most instances when the class mean was employed as the unit of analysis. Further analysis, namely, a one-way analysis of variance (ANOVA) was conducted to determine if the Indonesian adapted TOSRA was able to differentiate significantly between the perceptions of students in different classrooms. This characteristic was examined for each scale with class membership as the main effect and using individual scores as the unit of analysis. A summary of Cronbach alpha reliability coefficients with two units of analysis and analysis of variance (ANOVA) *eta*^{2} results is presented in Table 6.3.

Table 6.5 Internal Consistency Reliability (Cronbach Alpha Coefficient) Using Individual Scores (n=1188) and Class Mean Scores (n=72) as the Unit of Analysis and ANOVA Results for the Indonesian Adapted TOSRA

Scale	No of Items	Unit of Analysis	Alpha Reliability	ANOVA *eta*^{2}
Attitude to Scientific Inquiry	8	Individual	0.67	0.103***
		Class Mean	0.70	NA
Enjoyment of Science Lessons	8	Individual	0.85	0.174***
		Class Mean	0.92	NA

***p<0.001

Table 6.5 shows that both scales of the Indonesian adapted TOSRA have satisfactory internal consistency reliability. Using both individual score as the unit of analysis, it is found that the Cronbach alpha coefficients were 0.67 and 0.85 for the *Attitude to Scientific Inquiry* and *Enjoyment of Science Lessons* scales, respectively. These values are even higher when class means were used as the unit of analysis. Considering the nature of the study, which is exploratory, and referring to the threshold of 0.5 given by Nunnally (1967, 1978), it is envisaged that the questionnaire is reliable in assessing students' perception of their attitudes towards science lessons. Furthermore, the investigation of the results of the analysis of variance (ANOVA) showed that both scales are capable of differentiating students' awareness of their attitude towards science lessons from different groups or classrooms. The *eta*^{2} values are 0.103 (p<0.001) and 0.174 (p<0.001) for the *Attitude to Scientific Inquiry* and *Enjoyment of Science Lessons* scales, respectively.

Considering the results of the factor analysis, of the internal consistency reliability calculation, and of the analysis of variance (ANOVA), it can be concluded that the Indonesian version of the adapted TOSRA that contain two eight-item scales is a valid and reliable instrument to assess students' science-related attitudes.

6.3.2 The Status of Students' Outcomes

In general, the students' outcomes on school science are still far from expected. With regard to attitudinal outcomes, the mean scores are 3.13 and 3.67 for the *Attitude to Scientific Inquiry* and *Enjoyment of Science Lessons* scales, respectively. These scores indicate that students' science-related attitudes are relatively positive; however, there is still an opportunity to increase these scores to the possible maximum score 5.00. Furthermore, students' cognitive outcomes as shown by the students' scores of School Science at the nation-wide examination is disappointing. The mean, which is 5.46 out of possible maximum score of 10.00, indicates the poor performance of students in learning School Science. A summary of the mean and standard deviation for the students' outcomes is provided in Table 6.6.

Table 6.6 Descriptive Statistics for Students' Outcomes on School Science (n=1188)

Scale	Mean	Standard Deviation
Attitude to Scientific Inquiry	3.13	0.53
Enjoyment of Science Lessons	3.67	0.58
Score on the Nation-Wide Examination	5.46	0.73

In order to obtain a more detailed picture of the status of students' outcomes on school science, the differences between urban and rural students' scores and between male and female students' scores were investigated using t-tests. A t-test with independent sample procedure was used in each calculation. Table 6.7 displays a summary of means, standard deviation, effect size, and t values for both cognitive (i.e., nation-wide examination) and attitudinal outcomes based upon school locality. Similarly, Table 6.8 summarizes means, standard deviation, effect size, and t values for both cognitive and attitudinal outcomes based upon students' gender.

Table 6.7 Mean, Standard Deviation, Effect Size and t Value from t-tests with Independent Samples for Differences Between Students' Outcomes of Rural (n=544) and Urban (n=644) Schools

Scale/Aspect	Mean		Standard Deviation		Effect Size	t-value
	Urban	Rural	Urban	Rural		
Cognitive score	5.73	5.14	0.70	0.62	0.89	-15.30***
Attitude to Scientific Inquiry	3.13	3.12	0.54	0.52	0.02	-0.25
Enjoyment of Science Lessons	3.65	3.70	0.56	0.60	-0.09	1.52

***p<0.001

Table 6.8 Mean, Standard Deviation, Effect Size and t Value from t-tests with Independent Samples for Differences Between Male (n=493) and Female (n=695) Students' Outcomes

Scale/Aspect	Mean		Standard Deviation		Effect Size	t-value
	Male	Female	Male	Female		
Cognitive score	5.47	5.44	0.71	0.74	0.04	1.15
Attitude to Scientific Inquiry	3.17	3.09	0.51	0.55	0.15	2.49*
Enjoyment of Science Lessons	3.67	3.68	0.59	0.58	-0.02	-0.29

*p<0.05

Table 6.8 shows that no statistically significantly differences were found on attitudinal outcomes scores between rural and urban students' perceptions. However, this study found that students' cognitive scores were statistically significantly different (p<0.001) between students in rural and urban schools in favour of urban schools. This result indicated that students' attitudinal outcomes might not correlate with their cognitive outcomes. On the other hand, male and female students' cognitive outcomes indicated no statistically significant differences. A statistically significantly difference (p<0.05) was only found on the *Attitude to Scientific Inquiry* in favour of the male students.

6.3.3 Association Between Students' Outcomes and Classroom Learning Environments

As mentioned in Chapter 3 Section 3.3.6.5, correlations between students' outcomes and students' perceptions of the science classroom learning environment were investigated. Simple and multiple correlations between each scale of the Indonesian WIHIC and both cognitive and attitudinal outcomes using individual scores as the unit of analysis (n=1118) were conducted. Simple correlations indicated the bivariate association between students' outcomes and each of the scales of the Indonesian WIHIC. On the other hand, multiple correlations or multiple regression analysis offer the joint and unique influence of each scale in the Indonesian WIHIC on students' outcomes. A significant beta weight confirms that a scale of the Indonesian WIHIC is related to students' outcomes when the six scales are mutually controlled. A summary of simple correlation (r), multiple correlation (R) and standardised regression coefficient (*β*) for the association between the science classroom learning environment and students' outcomes is presented in Table 6.9.

Table 6.9 Simple Correlation (r), Multiple Correlation (R) and Standardised Regression Coefficient (*β*) for Association Between Science Classroom Learning Environment and Student Attitudes and Cognitive Outcomes

WIHIC Scales	Strength of Students Outcomes-Environment Association					
	Attitudinal Outcomes				Cognitive Outcomes	
	Inquiry		Enjoyment			
	r	*β*	*r*	*β*	*r*	*β*
Student Cohesiveness	0.08**	0.00	0.11**	-0.06	0.14**	0.01
Teacher Support	0.15**	0.02	0.24**	0.08*	0.11**	-0.06
Involvement	0.16**	0.02	0.27**	0.14***	0.20**	0.15***
Investigation	0.20**	0.16***	0.25**	0.06	0.10**	-0.08*
Task Orientation	0.14**	0.04	0.25**	0.14***	0.18**	0.04
Cooperation	0.08**	-0.06	0.12**	-0.09*	0.18**	0.05
Equity	0.17**	0.10*	0.25**	0.12***	0.26**	0.21***
Multiple Correlations (R)	0.23***		0.35***		0.29***	

*p<0.05; **p<0.01; ***p<0.001

Table 6.9 shows that all scales of the Indonesian WIHIC are statistically significantly ($p<0.01$) associated with two scales of the Indonesian adapted TOSRA and students' cognitive scores. The multiple regression analysis produced a significant multiple correlation (R) of 0.23 ($p<0.001$) for students' attitude to scientific inquiry, of 0.35 ($p<0.001$) for students' enjoyment during science lessons, and of 0.29 ($p<0.001$) for students' cognitive score in school science. Furthermore, investigations of the value of β reveal that the value of *Investigation* (β=0.16, p<0.001) and *Equity* (β=0.10, p<0.05) scales of the Indonesian WIHIC are strong predictors of students' attitude towards scientific inquiry. Furthermore, students' enjoyment during science lessons is statistically significantly (p<0.05 and p<0.001) influenced by all seven scales, except *Student Cohesiveness* and *Investigation*, of the Indonesian WIHIC. With regard to students' cognitive outcomes, three scales, namely, *Involvement, Investigation,* and *Equity* were found as strong predictors.

Inspection of the β sign indicates some negative relationships exits between some scales of the Indonesian WIHIC and students' outcomes. Table 6.9 indicates that both students' enjoyment during science lessons and their attitude towards inquiry in science are greater in classrooms that have less cooperation and less student cohesiveness. This finding suggests that the Indonesian students tend to work individually rather than to cooperate with their fellow students both during the lesson and in their leisure time activities related to science. Table 6.9 also informs that students' achievement in school science is negatively statistically significantly (p<0.05) influenced by the investigation activity during science lessons. This finding in agreement with Keeves's (1992) finding that science classrooms that have greater emphasises on student participation have negative effects on science achievement. Students in a classroom that has more investigation activities tend to achieve lower scores in the examination.

6.4 Summary of the chapter

This chapter discusses the findings from science curriculum implementation and from curriculum achievement in lower secondary schools. The discussion is separated based on school locality.

Based on these limited number of classroom observations with limited number of schools and teachers who participated in this study, it can be asserted that curriculum implementation in urban schools is more favourable than that of rural schools. In general, science teachers in urban schools performed better than their counterpart did in rural schools, with the exception of teacher A. Urban school science teachers used a variety of teaching methods, employed good questioning techniques provided clear and high outcomes expectation and maintained effective classroom management. On the other hand, teachers in rural schools, with the exception of teacher A in school 1, tended to use traditional chalk-and-talk teaching methods, limited questioning techniques, and had relatively unclear outcomes expectation, and less effective classroom management skills.

These discrepancies are reflected as well in the curriculum achievement. Students in urban schools performed much better in the nation-wide examinations than did their counterparts in rural schools as reflected in the average score of science in the nation-wide examination. Moreover, urban school students perceived more positive attitudinal outcomes towards science than rural students did.

These findings together with the others as presented in Chapters 4 and 5 are discussed in a broader context in Chapter 7 and are followed by conclusions and recommendations for further study.

Chapter 7. Conclusions, Implications and Limitations

7.1 Introduction

The main purpose of this thesis was to describe, discuss and analyse the status of science education in Indonesian lower secondary schools by investigating the implementation of the science curriculum in rural and urban lower secondary schools. The research examined factors that may have influenced and been related to science curriculum implementation. These factors included teachers' perceptions of the science curriculum documents, teachers' perceptions of the school working environment, students' perceptions of their science classroom learning environment, and students' outcomes in school science.

This chapter is organised into six main sections. An overview of the research is presented in Section 7.2, following by an overview of the research design in Section 7.3. A summary of the major findings obtained through the study that have been discussed in Chapters 4, 5 and 6 is described in Section 7.4. A discussion of the limitations of the study is presented in Section 7.5. The implication of the study is described in Section 7.6. Finally, recommendations and the possibilities for future research are concluded in Section 7.7.

7.2 Overview of the research

This study investigated the status of the science educational practices and learning outcomes in rural and urban lower secondary schools in Kalimantan Selatan, Indonesia. The research was guided by four specific issues of interest and the related research questions.

The first issue that examined the existing school and science classroom learning environments was addressed by Research Questions 1 and 2:

1. How do students in rural and urban lower secondary schools perceive their classroom learning environments?

2. How do teachers in rural and urban lower secondary schools perceive their school working environments?

The second issue that scrutinized science curriculum documents and teachers' perceptions of these was addressed by Research Questions 3 and 4:

3. What is the intended science curriculum that exists in rural and urban lower secondary schools?
4. How do teachers perceive the intended science curriculum in rural and urban lower secondary schools?

The third issue, which is focused on the investigation of science curriculum implementation, was addressed by Research Question 5:

5. How do teachers implement the existing science curriculum?

Finally, the fourth issue that concerned with the students' outcomes on school science curriculum was investigated through Research Question 6:

6. What are students' achievements of the science curriculum in those schools?

7.3 Overview of the research design

This research consisted of two types of data, involved two phases of data collection, and employed two different methodologies. For the first stage, questionnaire surveys were used to gather students' and teachers' perceptions of their classrooms and working environment, respectively. The data gathered from this stage were mainly quantitative. The second phase of data collection employed a multiple site case study as the method to investigate the teaching and learning science processes and the outcomes at the willing and selected schools. The data collected in this stage were mainly qualitative.

Two questionnaires, namely, the Indonesian versions of WIHIC and SLEQ were developed and validated. The Indonesian version of WIHIC was used to investigate students' perceptions of science classroom environment whereas the Indonesian version of SLEQ was employed to investigate teachers' perception of school working environment. The development of the Indonesian version of these questionnaires followed standard procedures that included the translation of the original questionnaires into the Indonesian language, and back translation of the Indonesian versions into English. The Indonesian version of WIHIC was administered to around 1200 students in 16 schools whereas the Indonesian version of SLEQ was distributed to 131 teachers. The issues of instrument validity such as factor structure, scale internal consistency reliability, and ability of questionnaire to differentiate perceptions between groups was determined using SPSS software. Similarly, the data analysis that included mean, standard deviation, and t-test procedure were conducted using SPSS software as well. The data obtained from this stage were presented descriptively and supported with tables and graphics.

The second phase of the research used a multi-site case study as the method to collect both qualitative and quantitative data in response to the last four research questions. The method has flexibility in which various data collection strategies and multiple data sources can be used. Similarly, various strategies were used to ensure internal validity of the qualitative data obtained through the research.

In response to Research Question 3, the research employed mining documents as the data collection strategy and used science curriculum documents and textbooks as data sources. These included six curriculum documents and four textbooks as described in Chapter 5, Section 5.2. Internal validity and reliability of the obtained data were established through clarification of the researcher's judgments.

In addressing Research Question 4, the study used interviews as the data collection strategy. The interview was semi-structured; therefore, an interview protocol was developed to guide the interviewing processes. The targets of the interviews were the teachers who participated in classroom observations and the superintendents who were in charge. Member checking was used as the strategy to maintain credibility of the data yielded from the interview.

Research Question 5 has been addressed through long-term classroom observations conducted in six selected schools in urban and rural areas. Four science teachers participated in long-term classroom observations and two science teachers were involved in fewer numbers of classroom observations. The research used various techniques during classroom observations including observation schedules, photography and interview. To confirm credibility of the data obtained during the observations, two main actions were taken. First, at the outset the teachers were informed that during the observations the researcher would only act as a non-participant and not make any kind of personal value judgement about the quality of teaching. This approach was to ensure that classroom transactions occurred in the normal manner. Secondly, member checking was used as a way of ensuring validity of the data being collected. After classroom observations, interviews with the teachers or students regarding events captured in the classroom observations were conducted to clarify the researcher's judgement.

Finally, this study used mining documents and questionnaire survey as data collection strategies in response to Research Question 6. Mining documents was used to obtain students' cognitive outcomes. The research used students' science scores in the nation-wide examinations as data sources. The researcher's judgment of the data was confirmed through the long establishment of the nation-wide examination system. It has been reported that the quality of items in the nation-wide examination has improved from year to year and shows acceptable validity and reliability. Thus the credibility of the data on students' cognitive outcomes was ensured. On the other hand, students' attitudinal outcomes toward science were collected using the Indonesian version of the adapted TOSRA. The questionnaire technique was used following the same procedures in administering the Indonesian version of WIHIC. The validity and reliability of the data were obtained using the procedures as explained in the second paragraph of this section.

7.4 A summary of the major findings

In concluding this study, all research questions are answered and discussed. A summary of the major findings and discussion as responses to each research question is presented in the following sections.

7.4.1 Research Question 1: How do students in rural and urban lower secondary schools perceive their classroom learning environments?

The Indonesian version of WIHIC was developed, validated and used to measure students' perceptions of the science classroom environments. As discussed in Chapter 4 Section 4.2, the Indonesian WIHIC was proven as a reliable questionnaire having a robust factor structure with all items in each scale possessing satisfactory factor loadings. The scale reliability as indicated by Cronbach alpha coefficient ranged from 0.68 to 0.88 and from 0.70 to 0.88 for the actual and preferred versions, respectively, when individual scores were used as the unit of analysis; reliabilities were above 0.83 for both the actual and preferred versions when the class means were used as the unit of the analysis. The ability of the questionnaire to differentiate the perceptions between groups was also confirmed.

Assessment of students' views of their science classroom learning environment revealed some interesting findings. Generally, students held a more positive view on their preferred rather than on the actual classroom learning environment. Female students held better perceptions of the classroom-learning environment than did male students. Students in rural schools held less favourable perceptions than did their counterparts in urban schools. Finally, the findings also showed that teachers held more favourable views of the actual and preferred classroom learning environments than did their students.

7.4.2 Research Question 2: How do teachers in rural and urban lower secondary schools perceive their school working environments?

To measure teachers' perceptions of the school level environments, the Indonesian version of SLEQ was developed, validated and used. The findings as described in Chapter 4, Section 4.4 confirmed that the Indonesian version of SLEQ is a relatively good and reliable questionnaire. The Indonesian version of SLEQ possessed acceptable internal consistency reliability for all scales for both forms with a few exceptions. This study indicated that the Indonesian version of SLEQ had good discriminant validity and was able to differentiate between the perceptions of teachers in different schools.

Responses indicated that the teachers perceived the preferred working environment more favourable than they did on the actual one. This tendency occurs on all scales, except for *Staff Freedom* and *Work Pressure.* The teachers expected that their schools gave more restrictions and less pressure. The study found that teachers in rural schools experienced a more favourable working environment than did teachers at urban schools. The differences between biology and physics teachers views of their school environments were found in which biology teachers hold a more positive view on *Resource Adequacy*, *Staff Freedom* and *Work Pressure*, but less favourable on *Participatory Decision Making* and *Resource Adequacy* than physics teachers did.

7.4.3 Research Question 3: What is the intended science curriculum that exists in rural and urban lower secondary schools?

An analysis of science curriculum documents for lower secondary schools that was discussed in Chapter 5 provided the different levels of information of science education in lower secondary school. The documents provide science teachers with a range of information from philosophical ideas that outline the national education system to comprehensive information for preparing and implementing the science curriculum in the classroom.

School science functions to provide the students with knowledge of the natural environment, and to develop students' skills and technology awareness relevant to its application in daily life. Aiming to introduce the students to the basic concepts of science knowledge and emphasize the use of tools and equipment during the observations, science is compulsory for all students in lower secondary school of all Year levels. Science consists of physics and biology subjects that were taught separately; both subjects were given the same amount of classroom periods per week. The contents were organized into themes or topics in which similar themes were repeated at the higher Year levels but were taught at the deeper levels. The development of students' processes skills and students' attitude toward science and the environment should be addressed in teaching and learning processes.

The methodology sections in the curriculum documents expected science teachers in the Indonesian lower secondary schools to employ various teaching approaches and the appropriate teaching methods. The suggested teaching approaches include the conceptual approach, the problem-solving approach, the inductive-deductive approach and the environmental approach. The suggested teaching methods in science classroom are the experimental method, the demonstration method, the discussion method, the excursion method and the lecturing method.

The evaluation and assessment sections of the curriculum documents expected science teachers to systematically and continuously assess the students. Three techniques are suggested to conduct evaluation in science classroom. First, the paper and pencil test technique is the most common in use for assessing cognitive aspects. Second, verbal evaluation is suggested to evaluate students' understanding during teaching and learning processes. Finally, practical evaluation is recommended to assess students' process skills and psychomotor skills.

7.4.4 Research Question 4: How do teachers perceive the intended science curriculum in rural and urban lower secondary schools?

The research explored science teachers' and the superintendents' perceptions of the intended science curriculum using Schubert's (1986) metaphors of curriculum. The teachers' and superintendents' perceptions of the science curriculum are framed within four metaphors as described in Chapter 3, Section 3.3.7. Throughout the semi-structured interviews, the teachers and superintendents were asked to choose their preference for the four curriculum metaphors. The results that were presented in Chapter 5, Section 5.3 indicated that science teachers and superintendents involved in this study possessed different perceptions of the science curriculum as expressed in their preferences toward curriculum metaphors. The metaphor 'Curriculum as Content or as Subject Matter' was perceived by three teachers; 'Curriculum as intended learning outcome' was the second commonly preferred metaphor by two teachers who hold this view for different reasons. None of the teachers chose the other two metaphors. In contrast, the two superintendents expressed their preference for the metaphors 'Curriculum as discrete task and concepts' and 'Curriculum as programme planned activity', respectively.

7.4.5 Research Question 5: How do teachers implement the existing science curriculum?

In response to this research question, a multi-site case study that involved classroom observations was conducted in a limited number of schools and teachers as described in Chapter 6, Sections 6.2.1 and 6.2.2. In general, this study asserted that to some degree the implementation of school science curriculum in urban schools is more favourable than that of rural schools. Science teachers in urban schools performed better than their counterparts did in rural schools, with the exception of teacher A.

This study confirmed that science teaching practices in urban lower secondary schools were in agreement with those suggested in the curriculum documents. When conducting teaching, science teachers in urban schools tended to use a variety of teaching methods, employed good questioning techniques, provided clear and high outcomes expectation, and maintained effective classroom management.

On the other hand, this study also claimed that to some extent science teaching practices in rural lower secondary schools were not as expected in the curriculum document. Mostly, teachers in rural schools, with the exception of teacher A in school 1, tended to use traditional chalk-and-talk teaching methods, employed a limited questioning techniques, had relatively unclear outcomes expectation, and performed less effective classroom management skills.

7.4.6 Research Question 6: What are students' achievements of the science curriculum in those schools?

This study investigated students' cognitive and attitudinal outcomes and their associations with the existing classroom learning environments as perceived by the students regarding the implementation of the science curriculum in Indonesian lower secondary schools. The cognitive outcomes were obtained from students' scores on the nation-wide examination and the attitudinal outcomes were explored using questionnaire surveys. Simple and multiple correlations between seven scales of the Indonesian WIHIC and both students' cognitive and attitudinal outcomes were counted.

As explained in Chapter 6, Section 6.3, this study showed a less favourable status of the students' outcomes on school science. In general, students' attitudinal outcomes were not maximised and students' cognitive outcomes are disappointing. There were no statistically significantly differences on attitudinal outcome scores between rural and urban and between male and female students' perceptions. However, the study identified that students' cognitive scores were statistically significantly different between rural and urban schools; students in urban schools scored better in the nation-wide examination than did their counterparts in rural schools.

This study indicated associations between students' outcomes and the status of the classroom learning environments. Both simple analysis and multiple regression analysis procedures showed that all scales of the Indonesian WIHIC are statistically significantly associated with two scales of the Indonesian adapted TOSRA and students' cognitive scores. Science classrooms that are characterised by rich investigation activity and promoted equity to all students in both urban and rural Indonesian schools tended to enhance students' attitude to scientific inquiry, but to some degree it reduced students' enjoyment during science lessons. On the other hand, classrooms that have less cooperation and less student cohesiveness would likely be able to improve students' enjoyment during science lessons and their attitude to scientific inquiry. With regard to students' cognitive outcomes, three scales of the Indonesian version of WIHIC, namely, *Involvement, Investigation,* and *Equity* were strong predictors. Classrooms that promote equity and actively involve all students during learning processes tend to have students with better science scores in the nation-wide examination. However, a classroom that has more investigation activities may cause the students to achieve lower scores in the examination.

7.5 Limitations of the study

This study has investigated several aspects of science education in Indonesian lower secondary schools. While many of the findings of this present study may relate to other studies in science education in other places, caution should be taken in generalising the results due to the limitations of the study. The limitations relate to the study samples, the limited time frame, the instrument used and the presence of the researcher.

7.5.1 Limited study samples

The samples of this study were limited to a small number of schools in four of ten districts in Kalimantan Selatan province. Due to the constraints of time and funds available for travel, many remote schools were not included in the present study. Compared to the total number of schools and districts in the Kalimantan Selatan province, the number of schools in this study are far from ideal. Therefore, further research following this study that covers a larger number of students, schools and districts in the province is recommended.

7.5.2 A limited time frame

The research was conducted only in the second term of schooling in Year 9 classrooms. This limitation prevents the researcher to obtain information on other aspects of science curriculum implementation at the beginning and end of the school term when the tensions of external examination were different. If the research could be extended to the first and third school terms, the findings might reveal more details and complete aspects of science curriculum implementation in Year 9 classrooms.

7.5.3 Instruments used

This research has developed two instruments that were adapted from the well-established questionnaires in a Western context. Although the development processes followed a standardized procedure and the findings have confirmed that both instruments developed in this study were reliable and provide relatively valid data, however, the interpretations of the data may have limitations. The limitations are due to the context of this study, which is different from the context of where the original questionnaires were developed.

7.5.4 Presence of the researcher

During classroom observation, the influence of the researcher on how teachers taught and how students responded to instruction cannot be overlooked. The researcher might be aware that his presence in the classroom may have caused the teachers to be better prepared, to be careful in their content use and in their use of pedagogical approaches. In order to minimise this limitation, the non-participant observation method was chosen. The teachers and students were told that the research would not affect their performances and grades. Through the methods chosen, the research expected that the teaching and learning processes occurred as normal.

7.6 Implications of the study

This section discusses the implications that the research findings could have on science education in Indonesian lower secondary schools. This study is significant because, by informing authorities of outcomes, it may provide directions for present and future policy makers, science teachers and school principals to improve science education practices, the school working environment and the science classroom environment in Indonesian lower secondary schools. To be more specific, four levels of significance of this study can be drawn. The first is for the researcher as educator and teacher trainer; the second is for policy makers in the province of Kalimantan Selatan, Indonesia; the third is for school administrator and school principals, and the fourth is for science teachers. These implications are explained in Sections 7.6.1, 7.6.2, 7.6.3, and 7.6.4, respectively.

7.6.1 Implications for the researcher

From a personal perspective, this study has made it possible for the researcher to visit a sample of schools and science classrooms in both urban and rural area and has given him insights into the science teaching practices in these schools. Through observing science teachers in science classrooms and holding discussions with them, the researcher was able to recognize and document the complexity and difficulties of implementing the science curriculum, especially in rural schools. This awareness will help and enable the researcher to better understand the factors that affect science education processes.

7.6.2 Implications for policy makers

For policy makers, this study also has significance in that the research provides evidence of science curriculum implementation, school and classroom environment, and students' achievements in school science. The findings suggest that the disparities, in terms of school's infrastructure, science curriculum implementation and science curriculum achieved, that exist between urban and rural lower secondary schools can be used as a point of departure for the improvement. Policy makers need to give particular attention to rural schools that commonly lag behind their counterparts in urban areas.

7.6.3 Implications for schools' principals and administrators

The findings provided significant evidence that school administrators and school principals need to take into consideration. The research findings suggested that there were gaps between teachers' perceptions of the actual and the preferred working environment. The findings may help the school principals and administrators to facilitate the schools so that teachers' preferred working environment can be accommodated. It is expected that by having their preferred working environment, teachers may improve their teaching practices and in turn these may help the students to learn better. Furthermore, the findings can inform school principals and administrators about the status of how the science curriculum is implemented and how the science curriculum is achieved. School principals and administrators may use these as starting points for school improvement.

7.6.4 Implications for teachers

Similarly, the findings also suggested that there were discrepancies between students' perceptions of the actual and preferred classroom learning environments; and that the students' achievements in school science were influenced by particular aspects of the classroom learning environment. These findings imply that science teachers need to consider their teaching in order to create a classroom learning environment expected by the students. In terms of science curriculum implementation, the findings highlighted the fact that science-teaching practices in urban schools were more favorable than those in rural schools. However, although it was not typical, the findings also bring to light some extraordinary science teaching practices by one teacher in a rural school. An implication is that teachers can learn from their colleagues' practices regardless of their school's locality and they need to work hand-in-hand in order to improve their practices. However, for this to occur, the teaching timetable needs to be structured so that teachers can attend their colleagues' lessons.

7.7 Recommendations and possibilities for future research

In concluding this study, recommendations for improvement of science education in Indonesian lower secondary schools and suggestions for possible future research are offered. The recommendations focus on the importance of classroom learning environments and working environments whereas suggestions for further research are based on the limitations that emerged during this research and possibility to do the research in different contexts.

7.7.1 Recommendations

This study has shown the importance of the classroom learning environment toward students' achievement in school science as reflected in their science scores in the nation-wide examination. This study also revealed the influence of the school working environment upon teaching practices in science classroom. Therefore, the researcher has put forward both practical and policy recommendations. Practically, the teachers in both urban and rural schools should regularly assess students' perceptions of their classroom learning environment. The teachers can use the results as evaluation of and for improving their teaching practices. Similarly, school principals and administrators also need to conduct assessment of teachers' views of the school working environments. The results can inform how to help the teachers develop a better school atmosphere.

To enable teachers, school principals and administrators to conduct the assessment, therefore, a policy is needed that is concerned with the issues of the classroom learning environment and school working environment. The researcher suggests that it is necessary to include the topic of learning environment and working environment in educational programmes at both national and regional levels. For example, the *MGMP* programme can be used to introduce and learn about these issues. At the broader sense, the researcher suggests the inclusion of learning environment and working environment as either mandatory or elective subjects in teacher education programmes at university.

7.7.2 Suggestion for possible future research

Despite the limitations as described in Section 7.5, this study has broken new ground in investigating science curriculum implementation in Indonesian lower secondary schools in which the investigation included direct classroom observations and the assessment of classroom learning environments and school working environments. Although this study has produced several meaningful outcomes, the limitations discussed previously propose several suggestions for future research. The suggestions included the replication of the study within the province of Kalimantan Selatan but using larger samples and the replication of the study at other provinces.

Considering the geographical conditions of Kalimantan Selatan province, it is possible that the results generated from this study do not fully describe the picture of science education in lower secondary schools. A replication of this study with a larger sample of schools and districts may lead to a more complete and detail of science education in Kalimantan Selatan.

Similarly, the geography of Indonesia as described in Chapter 1 reflects the diversity of each province in establishing education programmes. Under the Decree No. 22 1999, local government has responsibility to handle the K-12 education programme. Consequently, each province implements its own educational programme. Therefore, it is worthwhile to replicate this study in other provinces as a comparative study. The more studies are conducted, the more results are generated and the more complete picture of science education in Indonesia is obtained.

Finally, this study suggested further research that focused on classroom learning environments, because this study has shown that students' achievement was statistically influenced by their perceptions of classroom learning environment. As a suggestion, further research can focus on how to improve aspects of the classroom learning environment that act as strong predictors for students' achievement in science.

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Appendices

Appendix A. The original items in What is Happening In this Classroom or WIHIC

1. I make friendships among students in this class.
2. I know other students in this class.
3. I am friendly to members of this class.
4. Members of the class are my friends.
5. I work well with other class members.
6. I help other class members who are having trouble with their work.
7. Students in this class like me.
8. In this class, I get help from other students
9. The teacher takes a personal interest in me.
10. The teacher goes out of his / her way to help me.
11. The teacher considers my feelings.
12. The teacher helps me when I have trouble with the work.
13. The teacher talks with me.
14. The teacher is interested in my problems.
15. The teacher moves about the class to talk with me.
16. The teachers' questions help me to understand.
17. I discuss ideas in class.
18. I give my opinion during the class discussions.
19. The teacher asks me questions.
20. My ideas and suggestions are used during classroom discussion.
21. I ask the teacher questions.
22. I explain my ideas to other students.
23. Students discuss with me how to go about solving problems.
24. I am asked to explain how I solve problems.
25. I carry out investigations to test my ideas.
26. I am asked to think about the evidence for my statements.
27. I carry out investigations to answer questions coming from discussions.
28. I explain the meaning of statement, diagram, and graphs.
29. I carry out investigation to answer question that puzzle me.
30. I carry out investigations to answer the teachers' questions.
31. I find out the answers to questions by doing investigations.

32. I solve problems by using information obtained from my own investigation.
33. Getting a certain amount of work done is important to me.
34. I do as much as I set out to do.
35. I know the goals for this class.
36. I am ready to start this class on time.
37. I know what I am trying to accomplish in this class.
38. I pay attention during this class.
39. I try to understand the work in this class.
40. I know how much work I have to do.
41. I cooperate with other students when doing assignment work.
42. I share my book and resources with other students when doing assignment.
43. When I work in a group in the class, there is teamwork.
44. I work with other students on projects in this class.
45. I learn from other students in this class.
46. I work with other students in this class.
47. I cooperate with other students on class activities.
48. Students work with me to achieve class goals.
49. The teacher gives us much attention to my questions as to other students' questions.
50. I get the same amount of help from the teacher as do other students.
51. I have the same amount of say in this class as other students.
52. I am treated the same as other students in this class.
53. I receive the same encouragement from the teacher as other students do.
54. I get the same opportunity to contribute to class discussions as the other students.
55. My work receives as much praise as other students' work.
56. I get the same opportunity to answer questions as other students.

Appendix B. The Indonesian version of modified WIHIC

Curtin

UNIVERSITY OF TECHNOLOGY

KUISIONER UNTUK SISWA

LINGKUNGAN PEMBELAJARAN DI KELAS

STUDI TENTANG
LINGKUNGAN PEMBELAJARAN IPA DI KELAS 3 SLTP
KALIMANTAN SELATAN
INDONESIA

Wahyudi

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Kuisioner untuk siswa

IKLIM LINGKUNGAN PEMBELAJARAN DI KELAS

Petunjuk

Kuisioner ini berisi pernyataan-pernyataan tentang kegiatan atau kejadian yang muncul di dalam kelas. Anda diminta untuk memikirkan dan menjawab pertanyaan sejauh mana kegiatan atau kejadian tersebut berlangsung selama proses kegiatan belajar dan mengajar (KBM) untuk bidang studi ***IPA (Biologi atau Fisika)***. Di sini tidak ada jawaban benar atau salah. Pendapat andalah yang diinginkan.

Bagian pertama dari kuisioner berisi informasi umum tentang diri anda dan sekolah. Bagian kedua berisi 56 pernyataan tentang kegiatan atau praktek yang muncul di dalam kelas dan lembar jawaban di samping pernyataan. Pada kolom jawaban ada 2 macam, yaitu untuk jawaban ***keadaan yang sebenarnya*** dan jawaban untuk ***keadaan yang diinginkan*** . Untuk mengisi bagian kedua ini, lingkarilah angka pada kolom-kolom jawaban sebagai berikut:

1 jika kegiatan/kejadian/praktek ***hampir tidak pernah,***

2 jika kegiatan/kejadian/praktek ***jarang-jarang***,

3 jika kegiatan/kejadian/praktek ***kadang-kadang,***

4 jika kegiatan/kejadian/praktek ***sering kali***, atau

5 jika kegiatan/kejadian/praktek ***hampir selalu*** berlangsung.

Jika anda berubah pikiran dan ingin mengganti jawaban, silanglah jawaban tersebut dan lingkari untuk jawaban yang baru.

Contoh:

Misalnya, untuk no 22, anda diminta memberikan pendapat tentang pernyataan '*Saya menerangkan ide saya kepada siswa lainnya*'. Jika anda ***merasa*** hal tersebut pada kenyataannya '***kadang-kadang***' terjadi, maka anda melingkari angka **3** pada kolom jawaban '***keadaan sebenarnya/aktual***'. Dan jika anda ***menginginkan*** hal tersebut ***akan sering berlangsung***, maka lingkarilah angka **4** pada kolom jawaban '***Keadaan yang diinginkan***'

Penyataan No	Di kelas ini,	Keadaan sebenarnya (actual)					Keadaan yang diinginkan (Preferred)				
22	Saya menerangkan ide saya kepada siswa lainnya	1	2	(3)	4	5	1	2	3	(4)	5

Bagian pertama: Informasi diri dan sekolah

Nama Sekolah			
Nama Siswa			
Kelas			
Jenis Kelamin	Laki laki	Perempuan	*) Coret yang tidak perlu
Mata Pelajaran	Fisika	Biologi	*) Coret yang tidak perlu
Nama Guru Pengajar			
Bahasa sehari-hari di rumah (lingkari nomer yang sesuai)	1 Indonesia 2. Banjar 3. Jawa 4. Madura		
	5 Dayak 6. lain-lain (sebutkan:)		

Bagian kedua

No	Pernyataan	Lembar Jawaban Untuk Keadaan Yang									
		Sebenarnya					Diinginkan				
1	Saya berkawan dengan semua siswa di kelas ini.	1	2	3	4	5	1	2	3	4	5
2	Saya kenal semua siswa di kelas ini.	1	2	3	4	5	1	2	3	4	5
3	Saya ramah terhadap anggota kelas ini	1	2	3	4	5	1	2	3	4	5
4	Siswa-siswa anggota kelas ini adalah teman saya	1	2	3	4	5	1	2	3	4	5
5	Saya bekerjasama dengan baik dengan anggota kelas ini	1	2	3	4	5	1	2	3	4	5
6	Saya menolong teman-teman yang mempunyai kesulitan dengan tugas mereka.	1	2	3	4	5	1	2	3	4	5
7	Siswa-siswa di kelas ini menyukai saya.	1	2	3	4	5	1	2	3	4	5
8	Di kelas ini saya mendapat pertolongan dari siswa lainnya.	1	2	3	4	5	1	2	3	4	5
9	Bapak/ibu guru dapat menarik perhatian saya secara khusus.	1	2	3	4	5	1	2	3	4	5
10	Bapak/ibu guru menolong saya secara khusus.	1	2	3	4	5	1	2	3	4	5
11	Bapak/ibu guru menghargai perasaan saya.	1	2	3	4	5	1	2	3	4	5
12	Bapak/ibu guru menolong saya ketika saya mendapat kesulitan dalam menyelesaikan pekerjaan saya.	1	2	3	4	5	1	2	3	4	5
13	Bapak/ibu guru berbicara kepada saya.	1	2	3	4	5	1	2	3	4	5
14	Bapak/ibu guru tertarik dengan masalah/kesulitan saya.	1	2	3	4	5	1	2	3	4	5
15	Bapak/ibu guru mau berkeliling di kelas sehingga dapat berbicara kepada saya.	1	2	3	4	5	1	2	3	4	5
16	Pertanyaan Bp/Ibu guru membantu saya untuk memahami pelajaran	1	2	3	4	5	1	2	3	4	5
17	Saya mendiskusikan ide-ide atau gagasan-gagasan	1	2	3	4	5	1	2	3	4	5
18	Saya memberikan pendapat saya selama diskusi kelas berlangsung.	1	2	3	4	5	1	2	3	4	5
19	Bapak/ibu guru mengajukan pertanyaan kepada saya	1	2	3	4	5	1	2	3	4	5
20	Ide-ide dan saran-saran saya dipakai selama diskusi berlangsung	1	2	3	4	5	1	2	3	4	5
21	Saya mengajukan pertanyaan kepada bapak/ibu guru	1	2	3	4	5	1	2	3	4	5
22	Saya menerangkan ide saya kepada siswa lainnya	1	2	3	4	5	1	2	3	4	5
23	Siswa lain/teman-teman berdiskusi dengan saya tentang cara menyelesaikan suatu masalah.	1	2	3	4	5	1	2	3	4	5
24	Saya diminta untuk menerangkan tentang cara menyelesaikan suatu masalah	1	2	3	4	5	1	2	3	4	5
	Di kelas ini										
[illegible]	Saya melakukan penyelidikan untuk menguji/men *test* ide-ide saya.	1	2	3	4	5	1	2	3	4	5
26	Saya diminta untuk memikirkan fakta-fakta yang mendukung suatu pernyataan	1	2	3	4	5	1	2	3	4	5
27	Saya melakukan penyelidikan untuk menjawab pertanyaan yang muncul dari diskusi diskusi kelas	1	2	3	4	5	1	2	3	4	5
28	Saya menjelaskan arti dari suatu pernyataan diagram dan grafik.	1	2	3	4	5	1	2	3	4	5
29	Saya melakukan penyelidikan untuk menjawab pertanyaan yang menjadi teka-teki atau masalah bagi saya.	1	2	3	4	5	1	2	3	4	5
30	Saya melakukan penyelidikan untuk menjawab pertanyaan guru.	1	2	3	4	5	1	2	3	4	5
31	Saya menemukan jawaban dari suatu masalah/pertanyaan dengan melakukan penyelidikan	1	2	3	4	5	1	2	3	4	5

32	Saya menyelesaikan masalah dengan menggunakan informasi yang saya dapat dari penyelidikan yang saya lakukan.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
[illegible]	[illegible]										
33	Berhasil dalam menyelesaikan tugas adalah penting bagi saya	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
34	Saya bekerja sesuai dengan tugas yang diberikan kepada saya	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
35	Saya tahu tujuan dari setiap topik pelajaran di kelas ini.	1	2	3	4	5	1	2	3	4	5
36	Saya siap untuk mengikuti pelajaran tepat pada waktunya.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
37	Saya tahu apa yang harus saya capai dalam setiap pelajaran.	1	2	[illegible]	[illegible]	[illegible]	1	2	3	4	5
38	Saya mengikuti pelajaran dengan penuh perhatian	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
39	Saya berusaha untuk mengerti tugas saya di kelas ini	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
40	Saya tahu seberapa banyak tugas yang harus saya lakukan	[illegible]	[illegible]	[illegible]	[illegible]	5	1	2	3	4	5
[illegible]	[illegible]										
41	Saya bekerjasama dengan siswa lain ketika mengerjakan tugas	[illegible]	[illegible]	[illegible]	[illegible]	5	1	2	3	4	5
42	Saya memakai bersama-sama buku dan fasilitas lain dengan siswa-siswa lainnya ketika mengerjakan tugas.	1	2	3	[illegible]	5	1	2	3	4	5
43	Ketika saya bekerja didalam grup, saya menemui kerjasama tim yang baik.	1	2	3	4	5	1	2	3	4	5
44	Saya bekerja dengan siswa lainnya dalam melakukan suatu proyek/tugas kelompok di kelas.	1	2	3	4	5	1	2	3	4	5
45	Saya belajar dari siswa lainnya di kelas ini.	1	2	3	4	5	1	2	3	4	5
46	Saya bekerja dengan siswa lainnya di kelas ini.	1	2	3	4	5	1	2	3	4	5
47	Saya bekerjasama dengan siswa lain dalam kegiatan kelas.	1	2	3	4	5	1	2	3	4	5
48	Saya bekerja dengan siswa lain untuk mencapai tujuan dari kelas ini	1	2	3	4	5	1	2	3	4	5
	Di kelas ini										
49	Bapak/ibu guru memberi perhatian yang sama terhadap pertanyaan saya seperti kepada pertanyaan siswa lainnya.	1	2	3	4	5	1	2	3	4	5
50	Saya mendapat bantuan bapak/ibu guru sama seperti siswa lainnya.	1	2	3	4	5	1	2	3	4	5
51	Saya mendapat kesempatan bicara yang sama seperti siswa lainnya	1	2	3	4	5	1	2	3	4	5
52	Saya mendapat perlakuan yang sama seperti siswa lainnya.	1	2	3	4	5	1	2	3	4	5
53	Saya mendapat dorongan yang sama seperti siswa lainnya.	1	2	3	4	5	1	2	3	4	5
54	Saya mendapat kesempatan untuk berpartisipasi dalam diskusi kelas seperti siswa lainnya.	1	2	3	4	5	1	2	3	4	5
55	Pekerjaan saya mendapat penghargaan seperti siswa lainnya.	1	2	3	4	5	1	2	3	4	5
56	Saya mendapat kesempatan yang sama untuk menjawab pertanyaan seperti siswa lainnya.	1	2	3	4	5	1	2	3	4	5

Terima Kasih Atas Partisipasi Anda

Appendix C. Back translation of the Indonesian version of WIHIC

Questionnaire for student

Learning Environment in Classroom

Instructions

This questionnaire is designed to gain information on activities and situations which occur in classroom during teaching and learning process. You are asked to describe how far the situation illustrated in each statement actually occurs in your class during Physics or Biology session. There is no right or wrong answer, but your opinion is what really matters.

The first section of the questionnaire seeks to find out general information about you and your school. The second section comprises 56 questions on activities or practices conducted in your class. On your answer sheet available beside every question or statement, there are two kinds of answers: one describing the actual situation and the other one describing a situation that you would prefer. To complete this section, you are asked to circle any number that best represents your opinion according to the following criteria:

1 if the situation/activity/practice is almost non-existent,
2 if the situation/activity/practice rarely occurs
3 if the situation/activity/practice sometimes occurs
4 if the situation/activity/practice often occurs
5 if the situation/activity/practice is almost always occurs

If you change your mind and want to change the answer, please cross the answer and circle your new answer.

Example:

Suppose you are asked to express your opinion toward this statement: 'I explain my ideas to other students'. If you believe this situation sometimes happens, circle number 3 to describe the actual situation on your answer sheet. If you want the situation to occur more frequently circle number 4 for the preferred situation on your answer sheet

Statement. In this classroom,	Actual					Preferred				
I explain my ideas to other students	1	2	(3)	4	5	1	2	3	(4)	5

First section: Personal information

School			
Year/grade			
Sex	1. Male	2 Female	*) Circle one
Subject	1. Physics	2. Biology	*) Circle one
Teacher's name			
Language used at home	1 Indonesian 2. Banjarese 3. Javanese 4. Maduranese		
	5 Dayak 6. Other (please mention:)		

Section two

No	Statements	Answer sheets									
		Actual					Preferred				
1	I make friends with every student in this class	1	2	3	4	5	1	2	3	4	5
2	I know every student in this class	1	2	3	4	5	1	2	3	4	5
3	I am friendly with every member of this class	1	2	3	4	5	1	2	3	4	5
4	Students in this class are my friends	1	2	3	4	5	1	2	3	4	5
5	I work well with every member of this class	1	2	3	4	5	1	2	3	4	5
6	I help friends who have difficulties with their assignments	1	2	3	4	5	1	2	3	4	5
7	Students in this class like mw	1	2	3	4	5	1	2	3	4	5
8	I receive assistance from other class members	1	2	3	4	5	1	2	3	4	5
9	The teacher attracts my interest	1	2	3	4	5	1	2	3	4	5
10	The teacher gives me special attention/assistance	1	2	3	4	5	1	2	3	4	5
11	The teacher respects my feelings	1	2	3	4	5	1	2	3	4	5
12	The teacher helps me when I have difficulty in completing my work	1	2	3	4	5	1	2	3	4	5
13	The teacher talks to me	1	2	3	4	5	1	2	3	4	5
14	The teacher has interest in my problems	1	2	3	4	5	1	2	3	4	5
15	The teacher is willing to go around the class so he or she can speak to me	1	2	3	4	5	1	2	3	4	5
16	The teacher's question help me understand the subject	1	2	3	4	5	1	2	3	4	5
17	I discuss my ideas and suggestions	1	2	3	4	5	1	2	3	4	5
18	I give my opinion during class discussion	1	2	3	4	5	1	2	3	4	5
19	The teacher ask me questions	1	2	3	4	5	1	2	3	4	5
20	My ideas and suggestions were used during class discussion	1	2	3	4	5	1	2	3	4	5
21	I ask question to the teacher	1	2	3	4	5	1	2	3	4	5
22	I explain my ideas to other students	1	2	3	4	5	1	2	3	4	5
23	Other students discuss with me how to solve a problem	1	2	3	4	5	1	2	3	4	5
24	I was asked to explain how to solve a problem	1	2	3	4	5	1	2	3	4	5
	[illegible]										
25	I do investigation to test my idea	1	2	3	4	5	1	2	3	4	5
26	I was asked to think about fact which support a statement	1	2	3	4	5	1	2	3	4	5
27	I conduct investigation to answer questions coming from class discussion	1	2	3	4	5	1	2	3	4	5
28	I explain meanings from statement, diagram and graph	1	2	3	4	5	1	2	3	4	5
29	I did investigation to answer question that has become a problem for me	1	2	3	4	5	1	2	3	4	5
30	I do investigation to answer teacher's questions	1	2	3	4	5	1	2	3	4	5
31	I found answer for question by doing investigation	1	2	3	4	5	1	2	3	4	5
32	I solve the problem by using information which I got from the investigation	1	2	3	4	5	1	2	3	4	5
33	Completing the task successfully is important to me	1	2	3	4	5	1	2	3	4	5
34	I work according the task given to me	1	2	3	4	5	1	2	3	4	5
35	I know the objective of every subject in this class	1	2	3	4	5	1	2	3	4	5
36	I am ready to attend the course on time	1	2	3	4	5	1	2	3	4	5

37	I know what to achieve in every course/subject	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
38	I follow the course with full attention	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
39	I try to understand with my tasks in this class	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
40	I know how much work that I have to do	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
41	I work together with other students while doing the tasks	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
42	I use books and other facilities together with other students when completing the tasks	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
43	When I am working in a group, I find a good teamwork	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	3	4	5
44	I work with other students when doing group projects in this class	1	2	3	4	5	1	2	3	4	5
45	I learn from other students in this class	1	2	3	4	5	1	2	3	4	5
46	I work with other students in this class	1	2	3	4	5	1	2	3	4	5
47	I work with other students in class activities	1	2	3	4	5	1	2	3	4	5
48	I work with other students to achieve the class objective	[illegible]	[illegible]	[illegible]	[illegible]	5	1	2	3	4	5
49	The teacher gives the same attention to my questions as she/he gives to other student's questions	1	[illegible]	[illegible]	[illegible]	5	1	2	3	4	5
50	I receive the same assistance from the teachers like other students get	1	2	3	4	5	1	2	3	4	5
51	I have the chance to speak like other students have	1	2	3	4	5	1	2	3	4	5
52	I receive the same treatment like other students get	1	2	3	4	5	1	2	3	4	5
53	I receive the same encouragement like other students	1	2	3	4	5	1	2	3	4	5
54	I have the opportunity to participate in class discussion like other students have	1	2	3	4	5	1	2	3	4	5
55	My work gets the same recognition as other students' work	1	2	3	4	5	1	2	3	4	5
56	I have the same chance to answer questions as other students have	1	2	3	4	5	1	2	3	4	5

Thank you for your participation

Appendix D. The English version of SLEQ

The Original Version of School Level Environment Questionnaire (SLEQ)

Direction

There are 56 items in this questionnaire. They are statements to be in the context of the school in which you work and your actual working environment.

Think about how well the statement describes the actual school environment.

Indicate your answer by circling:

SD	**if you strongly disagree with the statement;**
D	**if you disagree with the statement;**
N	**if you neither agree nor disagree with the statement or are not sure;**
A	**if you agree with the statement;**
SA	**if you strongly agree with the statement.**

If you change your mind about a response, cross out the old answer and circle the new choice.

Questions:

1	There are many disruptive, difficult students in the school.	SD D N A SA
2	I receive encouragement from colleagues.	SD D N A SA
3	Teachers discuss teaching methods and strategies with each other.	SD D N A SA
4	The school mission statement and its associated goals are well understood by school staff.	SD D N A SA
5	Decisions about the running of the school are usually made by the principal or a small group of teachers.	SD D N A SA
6	It is difficult to change anything in this school.	SD D N A SA
7	The school or department library includes an adequate selection of books and periodicals.	SD D N A SA
8	There is constant pressure to keep working.	SD D N A SA
9	Most students are helpful and co-operative to teachers.	SD D N A SA
10	I feel accepted by other teachers.	SD D N A SA
11	Teachers avoid talking with each other about teaching and learning.	SD D N A SA
12	The organisation of the school reflects its goals.	SD D N A SA
13	I have to refer even small matters to a senior member of staff for a final answer.	SD D N A SA
14	Teachers are encouraged to be innovative in this school	SD D N A SA
15	The supply of equipment and resources is inadequate.	SD D N A SA
16	Staffs have to work long hours to complete all their work.	SD D N A SA
17	Most students are pleasant and friendly to teachers.	SD D N A SA
18	I am ignored by other teachers.	SD D N A SA
19	Staff meeting are dominated by administrative matters rather than teaching and learning issues.	SD D N A SA
20	Teachers regularly refer to the mission of the school when addressing school issues	SD D N A SA
21	Action can be taken without gaining the approval of a senior member of staff.	SD D N A SA
22	There is a great deal of resistance to proposing curriculum change	SD D N A SA
23	Video equipment, tapes and films are readily available and accessible.	SD D N A SA
24	Teachers do not have to work hard in this school.	SD D N A SA
25	There are many noisy, badly behaved students.	SD D N A SA
26	I feel that I could rely on my colleges for assistance if I needed it.	SD D N A SA
27	Many teachers attend in-service and other professional development courses.	SD D N A SA
28	There is a high degree of consensus the staff with regard to what the school is trying to achieve.	SD D N A SA
29	Teachers are asked to participate in decisions concerning administrative policies and procedures.	SD D N A SA

30	Most teachers like the idea of change.	SD	D	N	A	SA
31	Adequate copying facilities and services are available to teachers.	SD	D	N	A	SA
32	There is no time for teachers to relax.	SD	D	N	A	SA
33	Students get along well with teachers.	SD	D	N	A	SA
34	My colleagues take notice to my professional views and options	SD	D	N	A	SA
35	Teachers show little interest in what is happening in other schools	SD	D	N	A	SA
36	My views of the overall mission of this school are very similar to other staff members.	SD	D	N	A	SA
37	I am encouraged to make decisions without reference to a senior member of staff.	SD	D	N	A	SA
38	New courses or curriculum materials are seldom implemented in the school.	SD	D	N	A	SA
39	Tape recorders and cassettes are available when needed.	SD	D	N	A	SA
40	You can take it easy and still get the work done.	SD	D	N	A	SA
41	Most students are well mannered and respectful to the school staff.	SD	D	N	A	SA
42	I feel that I have many friends among colleagues as at this school.	SD	D	N	A	SA
43	Teachers are keen to learn from their colleagues.	SD	D	N	A	SA
44	The operation of this school is consistent with its goals.	SD	D	N	A	SA
45	I am allowed to do almost as I please in the classroom.	SD	D	N	A	SA
46	There is much experimentation with different training and or teaching approaches.	SD	D	N	A	SA
47	Facilities are inadequate for catering for a variety of classroom activities and learning groups of different size.	SD	D	N	A	SA
48	Seldom are there deadlines to be met.	SD	D	N	A	SA
49	Very strict discipline is needed to control many of the students.	SD	D	N	A	SA
50	I feel lonely and left out things in the staff room.	SD	D	N	A	SA
51	Teachers show considerable interest in the professional activities of their colleagues.	SD	D	N	A	SA
52	Teachers agree on the school's overall goals.	SD	D	N	A	SA
53	I have little say in the running of this school.	SD	D	N	A	SA
54	New and different ideas are being tried in this school.	SD	D	N	A	SA
55	Class sets of important resource books are available when needed.	SD	D	N	A	SA
56	It is hard to keep up with your workload.	SD	D	N	A	SA

Appendix E. The Indonesian version of modified SLEQ

CURTIN

UNIVERSITY OF TECHNOLOGY

KUISIONER UNTUK GURU

IKLIM LINGKUNGAN KERJA DI SEKOLAH

(School Level Environment Questionnaire)

STUDI TENTANG

IKLIM LINGKUNGAN KERJA DI SLTP
KALIMANTAN SELATAN

INDONESIA

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Petunjuk pengisian

Kuisioner ini terdiri dari **2 (dua)** bagian. Bagian **pertama** tentang informasi diri dan sekolah. Bagian kedua berisi 112 pernyataan tentang iklim lingkungan kerja yang terbagi atas 56 pernyataan untuk keadaan ***sebenarnya*** (*A-Actual*) dan 56 pernyataan untuk keadaan yang ***diinginkan*** (*P-Preferred*). Bapak/ibu guru diminta untuk memberikan pendapat terhadap **keadaan aktual (sebenarnya)** dan ***keadaan yang diinginkan (preferred)*** tentang iklim lingkungan kerja rata-rata selama Bapak/Ibu bekerja/mengajar di sekolah ini, dengan cara melingkari jawaban pada kolom yang sesuai dengan pilihan sebagai berikut:

STS	Jika anda **sangat tidak setuju** terhadap pernyataan dimaksud
TS	Jika anda **tidak setuju** terhadap pernyataan dimaksud
TB	Jika anda **diantara setuju dan tidak setuju** terhadap pernyataan dimaksud
S	Jika anda **setuju** terhadap pernyataan dimaksud
SS	Jika anda **sangat setuju** terhadap pernyataan dimaksud

Contoh:

Untuk pernyataan no. 1 A 'Di sekolah ini banyak murid yang suka mengacau dan sulit diatur', jika pada kenyataannya bapak/ibu berpendapat setuju, maka lingkarilah huruf S pada kolom 'keadaan sebenarnya'. Untuk pernyataan no. 1 P 'Seharusnya di sekolah ini banyak murid yang suka mengacau dan sulit diatur', jika bapak/ibu sangat tidak setuju, maka lingkarilah kelompok huruf STS pada kolom jawaban yang sesuai.

Nomor		Pernyataan	Pilihan jawaban untuk keadaan:					
			Sebenarnya (A)					Diinginkan (P)
1	A	Di sekolah ini banyak murid yang suka mengacau dan sulit diatur.	STS	TS	TB	S	SS	
	P	Seharusnya di sekolah ini banyak murid yang suka mengacau dan sulit diatur.						

Jika ingin mengganti pendapat anda, silanglah pada jawaban semula dan lingkari pada pilihan yang baru.

Bagian pertama: Informasi diri dan sekolah

Bapak/Ibu guru diminta untuk mengisi pada kolom yang kosong dan memilih (melingkari) jawaban pada kolom yang telah disediakan.

Nama				Pend. Terakhir	D1	D2	D3	S1	S2	LL
Umur		tahun		Penataran diikuti	SPKG	PKG	LKGI	LKI	PGSJ	
Jenis Kelamin	L	P		Tugas di sekolah	Wakasek			Wali kelas		
Bidang studi					Pembina OSIS			Lain-Lain (LL)		
Lama mengajar		tahun		Nama sekolah						

Bagian kedua

IKLIM LINGKUNGAN KERJA

Nomor		*Pernyataan*	Pilihan jawaban untuk keadaan: Sebenarnya (A)	Diinginkan (P)
1	A	Di sekolah ini banyak murid yang suka mengacau dan sulit diatur.	STS TS TB S SS	
	P	Di sekolah ini *akan* banyak murid yang suka mengacau dan sulit diatur.		[redacted]
2	A	Saya selalu mendapat dorongan semangat dari teman-teman.	STS TS TB S SS	
	P	Saya akan selalu mendapat dorongan semangat dari teman-teman.		[redacted]
3	A	Para guru mendiskusikan metode dan strategi mengajar satu dengan yang lain.	STS TS TB S SS	
	P	Seharusnya para guru mendiskusikan metode dan strategi mengajar satu dengan yang lain		[redacted]
4	A	Saya sering diawasi untuk memastikan bahwa saya mengikuti aturan dengan benar.	STS TS TB S SS	
	P	Saya akan sering diawasi untuk memastikan bahwa saya mengikuti aturan dengan benar.		[redacted]
5	A	Keputusan tentang kebijaksanaan sekolah dibuat oleh kepala sekolah atau sekelompok staff	STS TS TB S SS	
	P	Keputusan tentang kebijaksanaan sekolah ***akan*** dibuat oleh kepala sekolah atau sekelompok staff.		[redacted]
6	A	Adalah sulit merubah apapun di sekolah ini.	STS TS TB S SS	
	P	Adalah akan sulit merubah apapun di sekolah ini.		[redacted]
7	A	Perpustakaan sekolah menyediakan buku-buku dan bacaan lain dalam jumlah memadai.	STS TS TB S SS	
	P	Perpustakaan sekolah akan menyediakan buku-buku dan bacaan lain dalam jumlah memadai.		[redacted]
8	A	Di sekolah ini ada tekanan atau dorongan untuk membuat guru dan staf tetap bekerja.	STS TS TB S SS	
	P	Di sekolah ini sebaiknya ada tekanan atau dorongan untuk membuat guru dan staf tetap bekerja.		[redacted]

9	A	Murid-murid suka menolong dan bekerja sama dengan guru	STS	TS	TB	S	SS	
	P	Murid-murid akan suka menolong dan bekerja sama dengan guru.						
10	A	Saya merasa kehadiran saya di sekolah ini diterima oleh guru dan staf.	STS	TS	TB	S	SS	
	P	Saya ingin kehadiran saya di sekolah ini diterima oleh guru atau staf.						
11	A	Para guru menghindari bicara satu dengan yang lain tentang proses belajar mengajar.	STS	TS	TB	S	SS	
	P	Para guru *akan* menghindari bicara satu dengan yang lain tentang proses belajar mengajar						
12	A	Saya tidak diminta untuk mengikuti/menggunakan gaya mengajar tertentu.	STS	TS	TB	S	SS	
	P	Saya akan tidak diminta untuk mengikuti/menggunakan gaya mengajar tertentu.						
13	A	Saya harus mengacu kepada guru senior untuk mengambil suatu keputusan akhir, meskipun dalam hal-hal kecil.	STS	TS	TB	S	SS	
	P	Saya ***akan*** selalu mengacu kepada guru senior untuk mengambil suatu keputusan akhir, meskipun untuk hal-hal kecil.						
14	A	Para guru di sekolah ini didorong untuk inovatif.	STS	TS	TB	S	SS	
	P	Para guru di sekolah ini akan didorong untuk inovatif.						
15	A	Penyediaan alat-alat dan bahan-bahan di sekolah ini ***tidak*** cukup.	STS	TS	TB	S	SS	
	P	Sebaiknya penyediaan alat-alat dan bahan-bahan di sekolah ini mencukupi.						
16	A	Guru selalu bekerja dalam waktu yang lama untuk menyelesaikan semua tugas sekolah.	STS	TS	TB	S	SS	
	P	Guru ***akan*** selalu bekerja dalam waktu yang lama untuk dapat menyelesaikan semua tugas sekolah.						
17	A	Kebanyakan murid di sini ramah dan suka terhadap guru.	STS	TS	TB	S	SS	
	P	Saya ingin akan lebih banyak murid di sini ramah dan suka terhadap guru.						
18	A	Saya diabaikan oleh guru dan staff.	STS	TS	TB	S	SS	
	P	Saya akan diabaikan oleh guru dan staff.						

19	A	Pertemuan/rapat para guru lebih didominasi dengan pembahasan tentang administrasi daripada pembahasan isu tentang proses belajar dan mengajar	STS	TS	TB	S	SS	
	P	Pertemuan/rapat para guru ***akan*** lebih didominasi dengan pembahasan tentang administrasi daripada pembahasan isu tentang proses belajar dan mengajar.						
20	A	Guru harus taat mengikuti silabus dan rencana pelajaran pada waktu mengajar.	STS	TS	TB	S	SS	
	P	Sebaiknya guru harus taat mengikuti silabus dan rencana pelajaran pada waktu mengajar.						
21	A	Di sekolah ini, sutau langkah dapat diambil tanpa memperoleh persetujuan dari guru senior	STS	TS	TB	S	SS	
	P	Di sekolah ini, sutau langkah ***akan*** dapat diambil tanpa memperoleh persetujuan dari guru senior.						
22	A	Di sekolah ini terdapat banyak sekali hambatan untuk merencanakan perubahan kurikulum	STS	TS	TB	S	SS	
	P	Di sekolah ini ***akan*** terdapat banyak sekali hambatan untuk merencanakan perubahan kurikulum.						
23	A	Perlengkapan OHP, video, kaset, dan film selalu siap tersedia dan dapat digunakan	STS	TS	TB	S	SS	
	P	Perlengkapan OHP, video kaset, dan film ***akan*** selalu siap tersedia dan dapat digunakan.						
24	A	Beban pekerjaan di lembaga sekolah ini tidak menuntut guru bekerja keras	STS	TS	TB	S	SS	
	P	Sebaiknya beban pekerjaan di lembaga sekolah ini tidak menuntut guru bekerja keras.						
25	A	Di sekolah ini ***banyak*** murid yang ribut dan berkelakuan jelek.	STS	TS	TB	S	SS	
	P	Saya ingin di sekolah ini ***tidak banyak*** murid yang ribut dan berkelakuan jelek.						
26	A	Saya dapat mengandalkan guru lain untuk mendapat bantuan jika saya memerlukan.	STS	TS	TB	S	SS	
	P	Saya ***akan*** dapat mengandalkan guru lain untuk mendapat bantuan jika saya memerlukan.						
27	A	Beberapa guru mengikuti pelatihan dan atau kursus-kursus pengembangan profesi lainnya	STS	TS	TB	S	SS	
	P	Saya ingin para guru akan mengikuti pelatihan dan atau kursus-kursus pengembangan profesi lainnya.						

28	A	Di sekolah ini terdapat banyak larangan atau aturan yang harus ditaati oleh guru.	STS	TS	TB	S	SS	
	P	Di sekolah ini *akan* terdapat banyak larangan atau aturan yang harus ditaati oleh guru.						
29	A	Di sekolah ini, guru dan staf diminta berpartisipasi dalam memutuskan hal yang berhubungan dengan kebijaksanaan administratif dan prosedur kerja lainnya.	STS	TS	TB	S	SS	
	P	Sebaiknya para guru dan staf diminta berpartisipasi dalam memutuskan hal yang berhubungan dengan kebijaksanaan administratif dan prosedur kerja lainnya.						
30	A	Sebagian besar guru senang dengan gagasan tentang perubahan.	STS	TS	TB	S	SS	
	P	Sebagian besar guru sebaiknya senang dengan gagasan tentang perubahan.						
31	A	Fasilitas dan pelayanan penggandaan (misalnya fotocopy) tersedia cukup bagi para guru.	STS	TS	TB	S	SS	
	P	Sebaiknya fasilitas dan pelayanan penggandaan tersedia cukup bagi para guru.						
32	A	Beban pekerjaan di sekolah ini mengakibatkan guru tidak memiliki waktu untuk bersantai	STS	TS	TB	S	SS	
	P	Sebaiknya beban pekerjaan di sekolah ini mengakibatkan guru tidak memiliki waktu untuk bersantai.						
33	A	Murid-murid dapat bergaul dan mengikuti guru dengan baik.	STS	TS	TB	S	SS	
	P	Murid-murid ***akan*** dapat bergaul dan mengikuti guru dengan baik.						
34	A	Guru atau staf lain jarang memperhatikan pandangan saya tentang profesi dan pilihan.	STS	TS	TB	S	SS	
	P	Saya ingin guru atau staf lain memperhatikan pandangan saya tentang profesi dan pilihan.						
35	A	Para guru menunjukkan sedikit ketertarikannya terhadap apa yang sedang terjadi di sekolah lain.	STS	TS	TB	S	SS	
	P	Para guru akan menunjukkan sedikit ketertarikannya terhadap apa yang sedang terjadi di sekolah lain.						
36	A	Saya boleh menggunakan pendekatan pembelajaran apa saja yang saya suka di dalam kelas	STS	TS	TB	S	SS	

	P	Saya akan dibolehkan menerapkan pendekatan pembelajaran apa saja yang saya suka di dalam kelas.						
37	A	Saya didorong untuk dapat mengambil suatu keputusan tanpa harus tergantung kepada guru senior.	STS	TS	TB	S	SS	
	P	Saya *akan* didorong untuk dapat mengambil suatu keputusan tanpa harus tergantung kepada guru senior						
38	A	Metode pembelajaran yang baru (alternatif) jarang dilaksanakan di sekolah ini.	STS	TS	TB	S	SS	
	P	Saya ingin metode pembelajaran baru (alternatif) akan diterapkan di sekolah ini.						
39	A	Tape recorder dan kaset-kaset tersedia ketika diperlukan.	STS	TS	TB	S	SS	
	P	Saya ingin tape recorder dan kaset-kaset tersedia ketika diperlukan.						
40	A	Di sekolah ini, beban pekerjaan guru selalu dapat diselesaikan dengan mudah.	STS	TS	TB	S	SS	
	P	Di sekolah ini, beban pekerjaan guru akan selalu dapat diselesaikan dengan mudah.						
41	A	Murid-murid di sekolah ini sopan santun dan hormat kepada staf sekolah.	STS	TS	TB	S	SS	
	P	Saya ingin murid-murid di sekolah ini sopan santun dan hormat kepada staf sekolah.						
42	A	Saya merasa bahwa saya mempunyai banyak teman diantara kolega di sekolah ini.	STS	TS	TB	S	SS	
	P	Saya merasa bahwa saya *akan* mempunyai banyak teman diantara kolega di sekolah ini.						
43	A	Di sekolah ini, para guru mau dan gemar belajar kepada rekan guru lainnya.	STS	TS	TB	S	SS	
	P	Di sekolah ini, para guru sebaiknya mau dan gemar belajar kepada rekan guru lainnya						
44	A	Saya diminta menggunakan buku dan bahan ajar yang telah ditentukan oleh sekolah	STS	TS	TB	S	SS	
	P	Saya *akan* diminta menggunakan buku bahan ajar yang telah ditentukan oleh sekolah.						
45	A	Saya diperbolehkan melalukan hampir semua yang saya suka di dalam kelas.	STS	TS	TB	S	SS	
	P	Saya *akan* diperbolehkan melalukan hampir semua yang saya suka di dalam kelas.						
46	A	Di sekolah ini terdapat banyak kegiatan uji coba tentang pendekatan mengajar yang baru.	STS	TS	TB	S	SS	
	P	Di sekolah ini akan ada banyak kegiatan uji coba tentang pendekatan mengajar yang baru dan berbeda						
47	A	Fasilitas di sekolah *tidak* mencukupi untuk menyelenggarakan kegiatan KBM di kelas yang bervariasi dan belajar berkelompok dengan jumlah anggota kelompok yang berbeda.	STS	TS	TB	S	SS	

No		Pernyataan					
	P	Saya ingin fasilitas di sekolah *akan* mencukupi untuk menyelenggarakan kegiatan KBM di kelas yang bervariasi dan belajar berkelompok dengan jumlah anggota kelompok yang berbeda.	STS	TS	TB	S	SS
48	A	Di sekolah ini jarang ditemukan guru dapat menyelesaikan pekerjaannya tepat waktu.	STS	TS	TB	S	SS
	P	Di sekolah ini ***akan jarang*** ditemukan guru dapat menyelesaikan pekerjaannya tepat waktu	STS	TS	TB	S	SS
49	A	Disiplin yang keras diperlukan untuk mengatur murid-murid di sekolah ini.	STS	TS	TB	S	SS
	P	Disiplin yang keras ***akan*** diperlukan untuk mengatur murid-murid di sekolah ini.	STS	TS	TB	S	SS
50	A	Saya merasa sendirian dan tersisih di ruang guru.	STS	TS	TB	S	SS
	P	Saya ***akan*** merasa sendirian dan tersisih di ruang guru.	STS	TS	TB	S	SS
51	A	Para guru menunjukkan minat yang besar terhadap aktivitas professional guru lainnya.	STS	TS	TB	S	SS
	P	Para guru akan menunjukkan minat yang besar terhadap aktivitas professional guru lainnya	STS	TS	TB	S	SS
52	A	Saya diminta untuk menerapkan kontrol dan disiplin yang sangat keras di dalam kelas.	STS	TS	TB	S	SS
	P	Saya ***akan*** diminta untuk menerapkan kontrol dan disiplin yang sangat keras di dalam kelas	STS	TS	TB	S	SS
53	A	Saya hanya punya hak bersuara yang ***sedikit*** tentang pengoperasian lembaga sekolah ini.	STS	TS	TB	S	SS
	P	Saya hanya ***akan*** punya hak bersuara yang ***sedikit*** tentang pengoperasian lembaga sekolah ini	STS	TS	TB	S	SS
54	A	Gagasan-gasasan baru sedang dicoba di sekolah ini	STS	TS	TB	S	SS
	P	Saya ingin gagasan-gasasan baru dicoba di sekolah ini	STS	TS	TB	S	SS
55	A	Pengelompokan buku-buku referensi/buku-buku sumber penting selalu tersedia ketika diperlukan.	STS	TS	TB	S	SS
	P	Sebaiknya pengelompokan buku-buku referensi/buku-buku sumber penting selalu tersedia ketika diperlukan.	STS	TS	TB	S	SS
56	A	Sangat berat bagi saya untuk menjaga agar tidak ketinggalan dalam menyelesaikan beban pekerjaan.	STS	TS	TB	S	SS
	P	Di sekolah ini, adalah ***akan*** sangat berat bagi saya untuk menjaga agar tidak ketinggalan dalam menyelesaikan beban pekerjaan.	STS	TS	TB	S	SS

TERIMA KASIH ATAS BANTUAN BAPAK DAN IBU

Appendix F. Back translation of items from the Indonesian version of modified SLEQ

First section (Bagian Pertama)

The actual form (Keadaan actual atau sebenarnya tentang iklim lingkungan kerja)

1 In this school there are many students who like to disturb and are difficult to control.
2 I am always encouraged by my friends.
3 Teachers discuss teaching methods and strategies one another.
4 School mission and goals are well understood by teachers.
5 Decision on school policy is usually made by principal or a group of staff.
6 It is difficult to change anything in this school.
7 School, especially school library provides adequate numbers of selected books and journals .
8 In this school there is always pressure so that teachers and other staff are encouraged to work.
9 Most students here like to help and cooperate with teachers.
10 I feel my presence in school is welcome by teachers and other staff.
11 Teachers avoid talking to each other about learning and teaching process.
12 School management always reflects the school goals.
13 Although it is about small matter, I always depend on a senior teacher for a final decision.
14 Teachers are encouraged to be innovative in this school.
15 The supply of equipments and materials in this school is not adequate.
16 To complete all work, teachers should always work for a long time.
17 Most students here are friendly and pleasant for teachers.
18 I am ignored by teachers and other staff.
19 Teachers' meeting is more dominated for discussing administration matters rather than discussing issues about learning and teaching process.
20 Teachers and other staff usually refer to the school mission when discussing school problems.
21 In this school an action can be taken with an agreement from senior teachers or staff.
22 In this school there are many constraints for planning a curriculum change.
23 Equipments such as OHP, videos, cassettes, and films are always available and can be used.
24 Work load in this institution does not demand teachers to work hard.
25 In this school, there are many students who are troublemakers and ill-mannered.
26 I feel I can rely on other fellow-teachers for help when I need.
27 Some teachers attend training and/or other courses on professional development.
28 In this school there is a strong commitment among teachers and other staff concerning what the school is trying to achieve.

29 Teachers and staff are asked to participate in making decision concerning problems related to administrative policy and other working procedures.
30 Most teachers are happy with an idea about change.
31 Facilities and printing service (such as photocopy) are adequately available for teachers.
32 Work load in this school causes teachers not to have enough time to relax.
33 Students can follow the teachers well.
34 Fellow-teachers and other staff seldom consider my views about profession and choice.
35 Teachers show a little interest in what is happening in other schools.
36 My views about the whole mission in this school are the same as other teacher or staff's views.
37 I am encouraged to make a decision with no rely on more senior teachers.
38 Results of staff or teacher training is seldom applied in this school.
39 Tape recorders and cassettes are available when needed.
40 Teacher's work load in this school can always be completed easily.
41 Students here are polite and show respect to school staff.
42 I feel I have many friends among colleagues in this school.
43 Teachers are keen on learning from other fellow teachers.
44 The operation of school institution is consistent with the school institutional goals.
45 I am permitted to do almost all I like in class.
46 In this school there are many try-out activities about different teaching approaches.
47 Facilities in school are not enough to run learning-teaching activities in a variety of classes and group learning with different numbers of group members.
48 It is hardly found teachers are able to finish the job on time.
49 Strong discipline is needed to control students in this school.
50 I feel alone and isolated in teachers room.
51 Teachers always show their great interest in other fellow teachers' professional activities.
52 Teachers agree with the school institutional goals as a whole.
53 I only have a little suffrage about the operation of the school institution.
54 New ideas are being tried out in this school.
55 Classification of reference books/important resource books are always available when needed.
56 It is very hard for teachers to keep up in order not to be late in completing the work load.

Second section (Bagian Kedua)
Preferred form (Keadaan ideal tentang iklim lingkungan kerja)

1 Ideally in this school there are many students who are troublemakers and difficult to control.
2 Ideally I am always encouraged by my friends.
3 Ideally teachers discuss teaching methods and strategies with one another.
4 Ideally school mission and goals are well understood by teachers.
5 Decision on school policy should usually be made by principal or a group of staff.
6 Ideally it is difficult to change anything in this school.

7 School, especially school library should provide adequate numbers of selected books and journals .
8 In this school there should always be a pressure so that teachers and other staff are encouraged to work.
9 Ideally most students here like to help and cooperate with teachers.
10 I feel my presence in school should be welcome by teachers and other staff.
11 Teachers should avoid talking to each other about learning and teaching process.
12 School management should always reflect the school goals.
13 Although it is about small matter, I should always depend on a senior teacher for a final decision.
14 Teachers should be encouraged to be innovative in this school.
15 The supply of equipments and materials in this school should not be adequate.
16 To complete all work, teachers should always work for a long time.
17 Most students here should be friendly and pleasant for teachers.
18 Ideally I am ignored by teachers and other staff.
19 Teachers' meeting should be more dominated for discussing administration matters rather than discussing issues about learning and teaching process.
20 Teachers and other staff should refer to the school mission when discussing school problems.
21 In this school an action should be taken without an agreement from senior teachers or staff.
22 In this school there should be many constraints for planning a curriculum change.
23 Equipments such as OHP, videos, cassettes, and films should always be available and can be used.
24 Work load in this institution should not demand teachers to work hard.
25 Ideally in this school, there are many students who are troublemakers and ill-mannered.
26 I should feel I can rely on other fellow-teachers for help when I need.
27 Some teachers should attend training and/or other courses on professional development.
28 In this school there should be a strong commitment among teachers and other staff concerning what the school is trying to achieve.
29 Teachers and staff had better be asked to participate in making decision concerning problems related to administrative policy and other working procedures.
30 Most teachers should be happy with an idea about change.
31 Facilities and printing/multiplication service (such as photocopy) had better be adequately available for teachers.
32 Ideally work load in this school causes teachers not to have enough time to relax.
33 Ideally students can follow the teachers well.
34 Fellow teachers and other staff will consider my views about profession and choice.
35 Teachers should show a little interest in what is happening in other schools.
36 My views about the whole mission in this school should be the same as other teacher or staff's views.
37 I should be encouraged to make a decision with no rely upon more senior teachers.
38 Ideally results of staff or teacher training is seldom applied in this school.

39 Tape recorders and cassettes should be available when needed.
40 Teacher's work load in this school will always be able to complete easily.
41 Ideally students here are polite and show respect to school staff.
42 I feel I will have many friends among colleagues in this school.
43 Teachers should be keen on learning from other fellow teachers.
44 The operation of school institution should be consistent with the school institutional goals.
45 Ideally teachers are permitted to do almost all they like in class.
46 It would be better if in this school there are many try-out activities about different teaching approaches.
47 It would be better if facilities in school are not enough to run learning-teaching activities in a variety of classes and group learning with different numbers of group members.
48 Teachers should be seldom found to be able to finish the job on time.
49 Ideally strong discipline is needed to control students in this school.
50 I will feel alone and isolated in teachers room.
51 Teachers should always show their great interest in other fellow teachers' professional activities.
52 Teachers should agree with the school institutional goals as a whole.
53 I only should have a little suffrage about the operation of the school institution.
54 It would better if new ideas are being tried out in this school.
55 Classification of reference books/important resource books should always be available when needed.
56 It will be very hard for teachers to keep up in order not to be late in completing the work load.

Appendix G. Interview protocol

Interview protocol (For Science Teacher)

Part A

This interview protocol is aimed to scrutinize the teacher's perception of the science curriculum. After introducing each other, the following questions will guide the interview to probe the teacher's perception of the established science curriculum.

1. What is your perception of the [science] curriculum? Could you please explain in detail?
2. There are lots of definitions of curriculum. None of them has been confirmed as rigorous definitions. Therefore, Schubert has offered *curriculum metaphors* instead to explain the meaning of curriculum. Here are some examples of curriculum metaphors:
    - Curriculum as Content or as Subject Matter
    - Curriculum as Program Planned Activity or as Syllabus Design
    - Curriculum as Intended Learning Outcome
    - Curriculum as Discrete Tasks and Concepts

   Among those, which one do you most prefer? Why?
3. Could you please create such a curriculum metaphor that, according to you, meet with the science curriculum that you should deliver in your classroom? (This question should also be directed to expose teachers' opinion on their teaching metaphors).

Part B

The following questions will be used in the interview to expose the teacher's opinion regarding the factors that either hamper or corroborate his/her teaching activities while he/she is delivering the science curriculum.

1. Why and how did you conducting your teaching activity?

2. What are the obstacles, if any, that inhibit you as teacher in implementing the official (ideal) science curriculum? Could you please describe to me in detail? How do you, or may be school, handle it?
3. What are there the factors, if any, that may assist you as teacher in implementing science curriculum?
4. In conjunction with the questionnaire survey that I administered to you (SLEQ), do you believe that schools environment has effect on your teaching activity? To what extent?

Part C

This group of questions will be used to render the teacher's view on how to improve students in achieving the best curriculum attainment.

1. I am aware that the quality of schools will be judged (by parents and community) based on students' scores on EBTANAS. How do you help students in achieving a good score? Is it your own effort or ordered by the schools?
2. What are your suggestions, for your schools or your colleagues, regarding the issue of improving students' score on EBTANAS?
3. Do you believe that students' scores on EBTANAS are influenced by the classroom learning environment? To what extent?

Interview protocol (For Superintendent)

After the introduction, the following questions were posed to two superintendents who are appointed to supervise rural and urban schools, respectively, to examine their perceptions of the science curriculum and in curriculum implementation.

1. What is (science) curriculum? Could you please explain in detail?
2. There are lots of definitions of curriculum. None of them has been confirmed as rigorous definitions. Therefore, Schubert has offered *curriculum metaphors* instead, to explain the meaning of curriculum. Here are some examples of curriculum metaphors. Among those, which one do you most prefer? Why?

3. Could you please make such a curriculum metaphor that meet with the science curriculum that the teachers have to deliver in science classrooms?
4. What is your belief about the teachers' understanding of the science curriculum? Do you agree that in general science teachers hold the same perception of the science curriculum? If yes, why? And if not, why?
5. What are there the obstacles, if any, that inhibit teachers in implementing the official (ideal) science curriculum? Could you please describe to me in detail? How do you, or may be school, help the teacher to handle it?
6. What are there the factors, if any, that may assist teachers in implementing science curriculum?
7. In conjunction with the questionnaire survey that I administered to the teachers (SLEQ), do you believe that the schools environment has any consequence on teacher's teaching activity? To what extent?
8. Apparently, parents and community believes that schools' quality is depicted on students' scores on EBTANAS. To what extend do you agree or disagree with this?

Appendix H. Classroom observation schedule

Classroom Observation Schedule

Identity

School's name	:
Subject	: Biology/Physics *)
Teacher's name	:
Topic	:
Time allocation	:
Date	:

*) Choose the appropriate one

No.	Description of activities	3-minute intervals																				Total	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
1	The student helps other class members who are having trouble with their work																						SC
2	The students work well with each other																						
3	Teacher moves about the class to talk with the students.																						TS
4	Teacher praises or encourages student's action or behaviour.																						
5	Teacher accepts or uses student's idea																						
6	Teacher answers student's questions																						
7	Teacher asks questions																						I
8	Students ask questions																						
9	Students response to teacher order																						TO
9	Students explain their ideas or experimental result to the class																						
10	The students cooperate with other students on class activity																						CO
11	The students work with other students in this class																						
12	Small group student activity																						
13	Students carry out investigation																						IV
14	Students explain the meaning of statement, graph and diagram																						
15	Students draw conclusion																						
16	Teacher gives students the same opportunity to answer questions																						E
17	Teacher gives particular attention to special student																						
18	Teacher ignores students' questions																						

Appendix I. Multiple Comparisons of Teachers' Perceptions of the Indonesian SLEQ Based on Subject Matters (N=131)

Tukey HSD

Dependent Variable (Scale)	(I) Controlled Subject	(J) Compared Subject	Mean Difference (I-J)	Std. Error	Sig.
Student Support	Biology	Physic	-2.5553E-02	8.779E-02	.954
		Non-science	-.3636(*)	.1007	.001
	Physic	Biology	2.555E-02	8.779E-02	.954
		Non-science	-.3380(*)	9.994E-02	.002
	Non-science	Biology	.3636(*)	.1007	.001
		Physic	.3380(*)	9.994E-02	.002
Affiliation	Biology	Physic	3.304E-02	7.951E-02	.909
		Non-science	-.1620	9.121E-02	.177
	Physic	Biology	-3.3042E-02	7.951E-02	.909
		Non-science	-.1951	9.052E-02	.079
	Non-science	Biology	.1620	9.121E-02	.177
		Physic	.1951	9.052E-02	.079
Professional Interest	Biology	Physic	2.950E-02	8.131E-02	.930
		Non-science	-.2847(*)	9.328E-02	.006
	Physic	Biology	-2.9498E-02	8.131E-02	.930
		Non-science	-.3142(*)	9.257E-02	.002
	Non-science	Biology	.2847(*)	9.328E-02	.006
		Physic	.3142(*)	9.257E-02	.002
Staff Freedom	Biology	Physic	.1253	.1088	.482
		Non-science	7.979E-02	.1248	.798
	Physic	Biology	-.1253	.1088	.482
		Non-science	-4.5541E-02	.1238	.928
	Non-science	Biology	-7.9789E-02	.1248	.798
		Physic	4.554E-02	.1238	.928
Participatory Decision Making	Biology	Physic	-.1277	.1057	.448
		Non-science	-.5228(*)	.1212	.000
	Physic	Biology	.1277	.1057	.448
		Non-science	-.3952(*)	.1203	.003
	Non-science	Biology	.5228(*)	.1212	.000
		Physic	.3952(*)	.1203	.003
Innovation	Biology	Physic	1.086E-02	9.803E-02	.993
		Non-science	-.4696(*)	.1125	.000
	Physic	Biology	-1.0861E-02	9.803E-02	.993
		Non-science	-.4804(*)	.1116	.000
	Non-science	Biology	.4696(*)	.1125	.000
		Physic	.4804(*)	.1116	.000
Resource Adequacy	Biology	Physic	-.4158(*)	.1435	.011
		Non-science	-.6873(*)	.1647	.000
	Physic	Biology	.4158(*)	.1435	.011
		Non-science	-.2715	.1634	.220
	Non-science	Biology	.6873(*)	.1647	.000
		Physic	.2715	.1634	.220
Work Pressure	Biology	Physic	.1437	9.318E-02	.271
		Non-science	-.4551(*)	.1069	.000
	Physic	Biology	-.1437	9.318E-02	.271
		Non-science	-.5988(*)	.1061	.000
	Non-science	Biology	.4551(*)	.1069	.000
		Physic	.5988(*)	.1061	.000

* The mean difference is significant at the .05 level.

Appendix J. An example of a teaching and learning science activity in an urban school

Photo essay

This picture portrays a typical activity in a science classroom of an urban lower secondary school being observed in this study. During the biology lesson, students worked in a group to accomplish certain tasks as provided in the student's worksheet. After finishing the tasks, the students discuss in a group followed by whole class discussion. The teacher's role was mainly as facilitator and, to some extent, this typical teaching and learning activity parallels the suggestions in the science curriculum documents.

Appendix K. An example of a distinctive teaching and learning science activity in a rural school

Photo essay

The picture shows a group of students in a rural school conducting a simulation of a hybridisation crossing. The teacher used a group activity instead of a direct lecturing teaching method. Using readily available resources (two boxes that represent male and female gametes), students were asked to do crossing and recorded the genetic representation of the offspring. The activities were followed up with group and whole classroom discussion. This teaching and learning activity was in agreement with those suggested in the science curriculum documents.

Appendix L. Example of transportation modes in rural schools

Photos essay

The pictures show two types of transportation modes in a rural area. Students in rural schools have to face this situation day-to-day while their counterparts in urban schools may enjoy the luxury of modern transportation and other resources. A good question for further research is that whether or not this condition correlates with achievement in science classroom.

Appendix M. An example of a biology and physics laboratory in a rural school

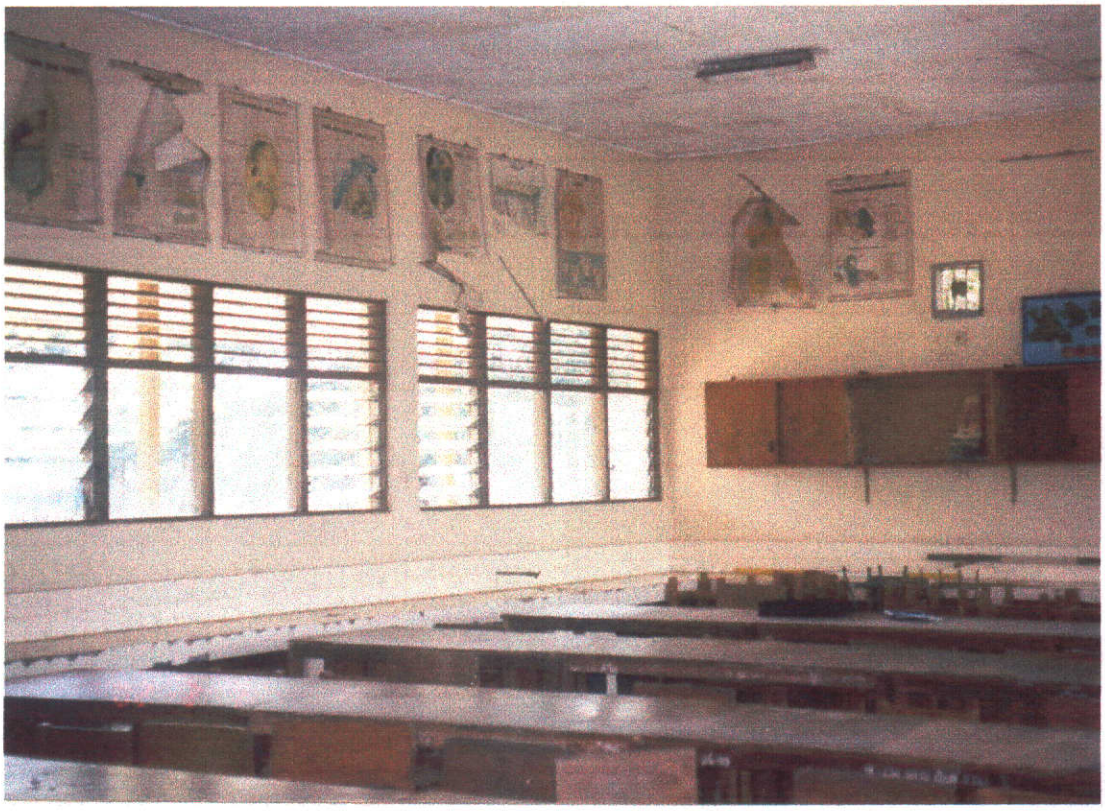

Photo essay

This picture displays a physical environment of a science laboratory in a rural school. An image of an abandoned place may best represent this picture. Unfortunately, to some degree, this picture is not typical in rural areas. However, a limited number of reagents and equipment combined with an inadequate numbers of textbooks and lack of time for preparation discourages science teachers, especially in rural schools, to use the laboratory as a place for teaching and learning.

Appendix N. Sample of an interview with a teacher

Interview with Mrs. Wulan (a pseudonym) of a rural school on 06-04-2002.

Wahyudi 'Mrs. Wulan, what do you understand by the science curriculum?'

Mrs. Wulan '[Curriculum] is a benchmark that consists of teaching goals, teaching materials, and recommended teaching and learning activities [of science], which consider students' developmental level, the environment, and the need of science and technology development as well as the need for national development.'

Wahyudi 'When and how did you get that definition?'

Mrs. Wulan 'During my participation at the MGMP.'

Wahyudi 'Among four Schubert's curriculum definitions or metaphors that I have showed to you, which one is best suited to your own perception?'

Mrs. Wulan 'I think the third metaphor. Curriculum as the Intended Learning Outcomes. Well, the [teaching and learning] processes can be adjusted with students' conditions.'

Wahyudi 'You told me that you have covered all science topic for the second term in Year 9 science classroom and you still have lots of time and will use it for drilling students with exercises. Can you explain why did you do that?'

Mrs. Wulan 'Because we were being asked by the school [principal] to cover all topics, even for the third term, by the end of this month [April 2002], and to give students more exercises in answering the items from the previous national examination. We want the students be prepare for this coming nation-wide examination.'

Wahyudi 'You also mentioned that you now tend to act as a 'trainer' because you give your students exercises with skills in answering items from the national examination, rather than you 'teaching' them how to acquire biology or physics concepts. When and how did you realise that changes?'

Mrs. Wulan 'Well, I told you that the school demanded us to prepare our students for doing the best in the national examination. Part of the school's vision is the improvement of students' scores in the [national] examination. I did not remember when it happened, but I realised that the school's demand has dragged me to act as a 'trainer' rather than as a 'teacher'.

Appendix O. Sample of an interview with a superintendent

Interview with Mr. Nono (a pseudonym), a superintendent for biology conducted on 06-04-2002.

Wahyudi	'Mr. Nono, what do you understand by the [science] curriculum?'
Mr. Nono	'Curriculum is a benchmark or corridor that must be adhered to by the teachers during the teaching and learning processes.'
Wahyudi	'When and how did you get that definition?'
Mr. Nono	'During my study at teachers' college [IKIP].'
Wahyudi	'Among four Schubert's curriculum definitions or metaphors that I have showed to you, which one is best suited to your own perception?'
Mr. Nono	'I think the second metaphor [Curriculum as Program Planned Activity or as Syllabus Design]. We can identify students' competency after they accomplished certain concepts or level of education, thus we should provide them with a planned program.'
Wahyudi	'What is your opinion about the work of teachers in the school under your supervision?'
Mr. Nono	'In general, most of the [science] teachers have not yet maximised their performance. They have not yet made a teaching preparation properly. Overall, they did not maximise their teaching preparation. You know, they just pass the time.'
Wahyudi	'Is there any significant difference between teachers' performance at urban and rural school?'
Mr. Nono	'I do think so. There is a significant different between them. In urban school, the teachers are being challenged how to get their students into the favourite [senior secondary] school when they graduate from the school. However, teachers in rural schools tend to teach as it is. You know, as if they teach because they have to, or as is mandatory, not because they want to. Mostly, teachers at rural school were under prepared when they taught.
Wahyudi	'When you supervised teachers in the classroom, what is your impression of the teachers' role during the teaching and learning processes?
Mr. Nono	'I noticed that mostly teaching and learning is as transferring knowledge. Teachers acted as informants, centres of information.'

Appendix P. Sample of the researcher's field notes

Field note 1
Date: 24-01-2002
School 1, Year 9, Class 3B, Topic: Embryo
Allocation: 1 period (45 minutes)

The teacher used a small group activity to discuss the topic (embryo). Generally, the teaching processes ran well, both teacher and his students were actively engaged in the discussion. Due to the limitations of the media, the teacher arranged the groups to use the media (computer and the software) simultaneously. When a group was given a chance to use the media and explore the reproduction animation (until the formation of an embryo), the other groups were still on task and busily discussed the problem related to the topic.

Impression of the media (computer + the software)
The students in each group were serious, yet looked like having fun as well as they watched the animation in the computer. Some students gave satisfaction comments about the activity. After the lesson, informally I asked their opinion of using this kind of media. Most of them agreed that although they were not familiar yet with the computer, the presentation (computer animation) gave them a clearer idea of the topic that cannot be obtained if they only read it from the textbook or if the teacher only verbally explained it. 'It is a really different experience' said one student. After each group had a chance to use the media, a whole class discussion was conducted which wrapped up the lesson with a summary conducted by both teacher and students together.

Fieldnote 2
Date: 19-02-02
School 1, Year 9, Class 3B, Topic: Embryo
2 periods (7.30-09.00)

Using gamete boxes, students in a group of 3 or 4 were conducting cross hybridisation. The activity was aimed to provide exercises for students in writing down the individual genotype that yielded from hybridisation and to obtain the proportion of individuals based on the characteristic as represented by the genotype and phenotype. Looked like the students were enjoying the activity. Observing their activity and having a little talk with some of students revealed a premature but surprising concept of the gene. When I asked one group the impression of the activity, the members agreed that it was enjoyable (lots of fun) and challenging as well (students must write down the genotype and determine the phenotype too). A student said that as if he was performing as *'penghulu'* (a priest in western context) who was marrying a man and a woman. The other students came to the idea that fertilisation is a kind of combining set of 'traits' not merely the merger between two gametes. I asked one student 'do you mean that a gene carries the information as a database?' She replied, 'Yes, sort of but I don't know how'. I ponder if the teacher realised and gave attention to these students' 'new-conceptions' for next discussion.

It was hard for the teacher to resume the class because students had difficulty in counting the proportion, which may be related to their math skills.