Science and Mathematics Education Centre

Learning Environment, Mathematics Achievement and Student Attitudes Among University Computing Students in Indonesia

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Abstract

This thesis reports the findings of a study of the influence of the classroom learning environment on students' cognitive and affective outcomes among 2,498 third-year computing students in 50 university-level classes in Indonesia. Students' perceptions of the classroom environment were measured using a modified Indonesian version of the *What Is Happening In This Class?* (WIHIC) questionnaire. To assess students' affective outcomes, a scale derived from the *Test of Science Related Attitudes* was adapted for use in higher education computing classes and translated into Indonesian. Students' final scores in their mathematics course (either linear algebra or statistics) were used as a measure of cognitive achievement. Secondary aims of the present study were to examine whether differences exist between (a) students' perceptions of the actual and preferred classroom learning environment, (b) the perceptions of male and female of the actual and preferred classroom environment and (c) students' perceptions of the actual learning environment in linear algebra and statistics courses. The results of this study make important contributions towards explaining why Indonesian students are achieving at less than desirable levels in their computing courses.

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 I hope that this research can help and be fruitful to all of us.

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BACKGROUND, CONTEXT AND RATIONALE

1.1   Introduction

In Indonesia, computer sciences and information technology are relatively new topics that are rapidly gaining in popularity in educational arenas. The present study involved the investigation of factors that could influence students' outcomes (achievement and attitudes) in a private computer-based university in Indonesia, including students' perceptions of the learning environment and their mathematical ability.

This chapter provides the background, a rationale and an overview to the present study under the following headings:

1.2   The Indonesian Context

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1.2   The Indonesian Context

This section provides a brief overview of the geographic and political state of Indonesia (Section 1.5.1) and a description of the education system (Section 1.5.2).

1.2.1   Geographical Location and Political State of Indonesia

Indonesia is considered part of South East Asia along with Malaysia, Singapore, Thailand, Myanmar, Cambodia, Vietnam, the Philippines, Japan and Korea. Indonesia consists of some 1,300 islands, spread along the equator, which vary greatly in size. The Java, Sumatra, Kalimantan, Sulawesi and Irian islands are the largest in both size and population, whereas the rest are relatively small. The climate of Indonesia is dictated largely by its equatorial position. This tropical country typically has two seasons each year, a wet season that lasts from September until early February and a dry season.

Indonesia has a population of approximately 200 million people, most of who live on the larger islands (particularly Java which has around 30% of the population). The majority of people in Indonesia are sustained through farming and fishing.

Indonesia was proclaimed as an independent nation on August 17, 1945 by President Soekarno. Prior to Soekarno's presidency, Indonesia was occupied by the Dutch (for nearly three and a half centuries) and the Japanese (for three and a half years).

During the 350 years of Dutch occupation, Indonesia was not established as one nation but, rather, it consisted of several islands called Oost Nederlands-Indie Colony. These islands were known as spice islands and provided a variety of spices for European consumption. The education system during this era was wrought with problems. The colonial government provided few schools and, for those that did exist, enrolment was restricted to the children of expatriates and high-ranking government officials. The policy for the education of the common citizen was to encourage the improvement and development of local and religious culture with the purpose of implementing a 'devide et impera' approach (that is, to break down and occupy). During these decades, the Indonesian people accepted the exploitation of all aspects of their life.

In 1942, the Japanese, who would occupy Indonesia for the next three and half years, ended the Dutch occupation. During this time, the education system was neglected completely. During the occupation, the Japanese were involved in the Asia Timur Raya war (Royal East Asia war). This war claimed the lives of thousands of young Indonesian men who were taken to other countries to build and develop the infrastructure required to support Japanese conquests. The men died from starvation, malaria plagues and other causes.

Independence of the Republic of Indonesia was proclaimed on August 17, 1945. The young nation was chaired by President Soekarno (the first president) for almost 20

years (1945-1965). The education systems implemented during the first period of President Soekarno's governance was inherited from the Dutch period. The system included an elementary school, which provided students from seven years old with an introduction to science, culture, history and language, a junior and senior secondary level and a tertiary level. During this time, there was only one tertiary institution (that was established during the final years of the Dutch occupation). Throughout the initial 20 years after the declaration of independence, many political and economic turbulences were to occur and little changed in the education system.

On October 1, 1965, a new Government was established, supported by the army and the students of universities. General M. Soeharto started his governance as the second president of Republic of Indonesia. During this period, a program for national development had been scheduled and implemented. The National Long Term Development Plan covered 25 years and was segmented into five-year national development plans (REPELITA) which involved the economic, political and educational aspects of the nation.

This period was one that saw the development and implementation of policies aimed at developing Indonesia. More than 75 public universities were established all over Indonesia during this period. Staff development programs aimed to increase the number of masters and doctoral degree holders at the primary and secondary education systems level. The implementation a national plan (the National Long Term

Development Plan, REPELITA II) had begun when an economic crisis hit the region of south-east Asia. President Soekarno ruled Indonesia for 20 years before being succeeded by a second president, H. M. Soeharto. This government replaced the old order (ORLA) with a new order (ORBA) through a military revolution.

Soeharto maintained his presidency for almost 32 years, despite his decree that a general election should be run every five years. Soeharto's military background and the full support of the army ensured that he ran the governance as a closed and controlled system. During the first two decades of his presidency, Indonesia's economic development rapidly grew. During this period, the education system was viewed as a means to develop the country.

During the 1960s, Indonesia, as with many developing countries, experienced a rapid growth in demand for education (Lewin, 1993). Up until this time, only 8.5% of the population was attending primary school. This increased pressure on the education system was to cause serious problems in terms of the quality of education. At this time, the curriculum in Indonesia was subject-oriented and encouraged a teacher-centred approach in the classroom.

Between 1976 and 1978, a new curriculum, known as Curriculum 75, was introduced progressively. The curriculum was aimed at encouraging a more student-centred approach to teaching. However, inadequately trained teachers, in addition to a lack of

resources, meant that traditional teacher-centred teaching styles continued to dominate the classrooms (Thomas, 1991). Professional development programs were implemented during this time to help to overcome the problems experienced in implementing the new curriculum, but large class sizes and heavy teaching loads made student-centred activities difficult for teachers to implement (van den Berg & Lunetta, 1984).

In 1979, a UNDP/UNESCO-assisted training program was set up to improve science and mathematics teaching in secondary schools in Indonesia in a bid to overcome the resilience of teachers to student-centred learning. By the 1990s, this program was to become the largest teacher in-service/on-service initiative in the world (Monk & Dillon, 1995).

During the third decade, the power of Soeharto's presidency grew stronger to the point where it became absolute, and the government and president became more autocratic. This absolute power led to widespread corruption at all levels of the national system. During this time, Soeharto, his children and other parties related to the Soeharto regime were involved in very many financially-advantageous aspects of business and economic activity within Indonesia.

As a result, systems within the education, business, economic and government sectors were often unproductive or inefficient. The distance between the rich and the poor

increased, leading to violence and, eventually, an uprising in 1997. Despite tight control of the government over publications and a lack of communication in the media, the uprising continued and succeeded in overthrowing the Soeharto regime.

At this time (1997), an economic crisis sent shock waves throughout South East Asia. The crisis was first realised in Thailand and was followed closely by South Korea and Malaysia. While other countries were fighting to overcome the crisis, Indonesians felt that the tightly-controlled system that gripped Indonesia could mean that the crisis would not affect them until it was too late. It took Indonesia some time to realise the full impact of the crisis.

The combination of both an economic and a political crisis crippled Indonesia. College and university students, empowered by the situation, demanded political change and economic recovery. The Soeharto regime fell and the third president, Professor Dr B J Habibie, took his place. During his time as president, Habibie started to reform the political state of Indonesia by introducing a democratic system. Supported by his background as a scientist, the third president conducted the first special general election differently from the way in which previous elections had been held. A system of multiple parties was introduced, in which all areas of the nation were free to select and establish a political party. The general election, which included about 55 parties, brought Indonesia into political euphoria and presented new ideas about democracy, autonomy and globalisation.

As a result of the first general election, held in 1999, parliament chose a new president, Mr Abdurachman Wahid, through a process of political bargaining and negotiation, with Madame Megawati of the Democratic Party of Indonesia (PDI) as his vice president. As the fourth president of Indonesia, Wahid had a unique background of Islamic religion and physical handicaps that many feared would constrain him from carrying out his presidential duties. A combination of factors, including the political and economic difficulties inherited by Wahid, criticisms of the way in which he subsequently handled political situations and continued political arguments, continued to affect the exchange rate, pulling down the value of the Indonesian currency, and influencing the price of oil and electricity. It appears that, overnight, Indonesia had become five times worse off and many found the situation hard to cope with.

After continued political turbulence and without any significant progress, either politically or economically, the citizens and parliament of Indonesia ran out of patience. The citizens of Indonesia felt that, for 22 months, they were given information that could not be proven right or wrong. The situation was worsened by natural and man-made disasters, such as the bombing of public facilities, floods, earthquakes and train accidents. On the fourth week of July 2001, as a result of increased pressure bought on by the economic and political situation of Indonesia, the head of the Parliament House called for special meeting of the Parliament (Sidang

Umum Istimewa MPR). This meeting was called to provide an opportunity for the President to defend himself and to provide an explanation for the current situation. Unable to do so adequately, the President was rejected and issued a Presidential Decree to close the House of Parliament. However, the Mahkamah Agung (National Justice) turned down the decree, and announced that, for the sake of democracy and justice, the President should step down and be replaced by the vice president, Madame Megawati.

Madame Megawati, the first female president of Indonesia, is now the fifth and current president. To date, it is difficult to say which of the five Indonesian presidents is either the best or worst. At present, development has slowed down, systems have been set back, and Indonesia has become a country in which poverty still needs to be overcome. Madame Megawati and her cabinet have a long hard road ahead, to bring about a better life and better future in Indonesia. Indonesians will be watching with interest to see how Madame Megawati and her cabinet respond to the latest international situation that commenced with terrorism and brought on global economic problems.

Fortunately, the Indonesian people, known locally as the Taft, are hard working. Decades of exploitation during the colonial era have taught the Indonesian people to be strong and patient in their fight to overcome all problems. Development and reconstruction of Indonesia are considered important by every member of the nation.

Education is seen as an essential component of this developmental process, and the education system, amazingly, has emerged relatively unscathed from the crisis. Despite the hardships endured by the Indonesian people, families still consider education to be a means of solving many of their problems and hence make it a priority. This could be why those universities and schools, which have the trust of the public, have grown so dramatically since the crisis.

The present study examined one such tertiary institution that has grown considerably since the crisis, particularly focusing the learning environments created in this institution and their impact on student outcomes.

1.2.2 The Education System in Indonesia

Education, at all levels in Indonesia is taught in the Indonesian language. Schooling in Indonesia begins at play group, an informal school for children from 2 to 4 years old, after which students attend pre-primary schooling until the age of 5 years. The play groups and pre-primary levels are optional, but primary school (attended by students from 6 to 12 years old) is compulsory. At 13 years old, students attend junior high school for 3 years and then, from 16 to 18 years old, they attend the senior high school level. Generally, students attending tertiary-level colleges will do so for 3 years, while those attending universities will do so for 4-5 years. At each level, students are able to attend either public or private education facilities, although tuition fees at private institutions are generally higher than for public institutions. Table 1.1 provides a

summary of the number of schools and students attending them at each level of education in Indonesia

As indicated in Table 1.1, students in Indonesia can choose to attend either a special secondary school (that specialises in a particular area such as pharmacy, nursing, hospitality or tourism) or a general secondary school. Also, students are able to select to attend either public or private universities.

Table 1.1   Number of Schools and Students for Each Level in Indonesia (Public and Private)

Level of Education	Number of Schools (1,000s)	Number of Students (1,000s)
Preprimary Schools and Playgroups	171	3,564
Primary Schools	45,897	124,5646
Junior Secondary Schools	2,987	321,606
General Senior Secondary Schools	2,258	228,478
Special Senior Secondary Schools	642	111,655
Public Universities	76	600
Private Universities	1,585	1,750

The number of students attending private universities far outnumber those attending public universities (see Table 1.1). Historically, establishing a public university has been difficult, as funding is borne by the government, while private universities are self-funded. As a result, public universities limit the number of students that they accept according to level of funding allocated for tuition fees by the government. On the other hand, private universities, where funds come from tuition fees, are continually attempting to increase the number of students in order to increase their income. Between 1978 and 1999, approximately 150 private institutions were

registered in tertiary education with an enrolment of approximately 75,000 students. The distribution of students in these institutions are not equal. The larger, more famous institutions tend to have more students, in many cases several thousands, while smaller institutions might have less than a thousand students. In Jakarta alone, there are about 30,000 students studying in 49 private tertiary computer studies institutions.

To be accepted into tertiary institutions, applicants are required to pass an entrance examination which includes mathematics, English and logical thinking ability. Before the entrance examination can be taken, the applicant is required to submit a Certificate of Graduation of Secondary School, an academic transcript of their secondary school results, and an initial grade for the Nilai Ebtanas Murni (NEM). The NEM consists of scores on six topics, including mathematics, English, Indonesian language, civics, natural science and social science. The decision to accept an applicant for enrolment depends on their entrance test score combined with their NEM score, while the academic transcript acts as an additional reference. The higher the applicant's entrance and NEM score, the higher the probability that the applicant will be accepted at the selected university of his/her choice and the lower the initial development fund that will be required of the student in addition to tuition fees and other expenses.

Experience shows that, despite passing the stringent entrance examination and the NEM, some students are still unable to cope with the learning process required in

these private universities. It would appear that many students experience problems during the transition from secondary to tertiary education and that, while some students overcome the problems associated with the transition, others never learn to cope. The present study involved an investigation of factors that could influence students' outcomes (achievement and attitudes towards lecturers) in private computing institutions in Indonesia, including students' perceptions of the learning environment and their mathematical ability.

1.3   Background: Field of Learning Environments

The influence of the learning environment on the process of education has received a great deal of attention from educational researchers during the last three decades (Fraser, 1994, 1998a). During this time, several approaches have been used in conducting research in the field of learning environments. The exploratory nature of the present study lent itself to the use of questionnaire data that were analysed to investigate associations between the learning environment and student outcomes.

In 1974, Moos developed the *Classroom Environment Scale* (CES), which was used to assess the environment in the school settings. Trickett and Moos (1974) used the CES to establish relationships between student satisfaction, their moods and their perceptions of their classroom environment.

In a study of students' preferences for different types of classroom environments, girls were found to prefer cooperation more than boys. Owens and Straton (1980) reported that boys preferred both competition and individualisation more than girls. In a similar study, Byrne, Hattie and Fraser (1986) found that boys preferred friction, competitiveness and differentiation more than girls did, whereas girls preferred teacher structure, personalisation and participation more than boys did.

Because the *What is Happening in this Class?* (WIHIC) questionnaire was used in the present study (see Chapter 3), past studies using the WIHIC are of particular relevance. The WIHIC has been used in Singapore (Chionh & Fraser, 1998; Fraser & Chionh, 2000), Brunei (Riah & Fraser, 1998), Australia and Taiwan (Aldridge & Fraser, 2000; Aldridge, Fraser & Huang, 1999), the USA (Allen & Fraser, 2002) and Canada (Zandvliet & Fraser, 1999). The findings of these studies have replicated those of past research, reporting associations between the learning environment and students' outcomes for most scales. These studies provide suggestions to educators regarding classroom environment dimensions that could be changed in order to improve student outcomes. The present study used the WIHIC in exploring associations between student outcomes and the classroom environment.

Early studies established the validity of classroom environment instruments translated into other languages for use in India (Walberg, Singh & Rasher, 1977) and Indonesia (Schibeci, Rideng & Fraser, 1987). These studies replicated associations between

students' outcomes and classroom environment perceptions. In Indonesia, Fraser, Pearse and Azmi (1982) and Fraser (1985) reported a study involving an Indonesian translation of a modified version of all scales in the *Individualised Classroom Environment Questionnaire* (ICEQ; Fraser, 1990) and four scales of the *Classroom Environment Scale* (CES; Moos, 1974). The sample consisted of 373 students in 18 coeducational social studies classes at the grade 8 and 9 levels in Padang. This study used student satisfaction and anxiety as outcomes and the results indicated that student satisfaction was found to be greater in classes perceived as having less independence and greater involvement, while anxiety was reduced in classes perceived as having greater differentiation, involvement and affiliation. The present study involved the first translation of the WIHIC into the Indonesian language.

At the university level, Fraser and Treagust (1986) developed and used an instrument to assess aspects of the learning environment. Using a sample of 127 Australian tertiary students, they reported that student satisfaction was greater in classes where students perceived higher levels of involvement, task orientation and innovation. Fraser, Giddings and McRobbie (1995) used the Science Laboratory Environment Inventory at the university level and found associations with students' attitudes. The present study is one of only a few in the field of learning environments at the tertiary level.

Past research has revealed interesting findings regarding teacher and student

perceptions of their classroom environment. Researchers have investigated differences between these perceptions of teachers and students and found that there is often a mismatch in perceptions. Research undertaken in several countries (Fraser, 1998a) has indicated that teachers' perceptions of the classroom environment usually are more positive than those of their students. This question was pursued in the present study.

Fisher and Fraser (1983) used actual and preferred forms of an instrument to explore whether students' outcomes were associated with person-environment fit (i.e., the match between students' preferences and their perceptions of the environment). The results indicated that the degree of similarity between perceptions of actual and preferred environment could be as important as the environment per se in predicting students' achievement of important affective and cognitive aims.

Past research has examined gender differences in students perceptions of the learning environment in a bid to understand why, in the past, boys have outperformed girls in science and technological courses (Bella & Gafni, 1996; Kahle & Meece, 1994). Past studies which have involved students in higher education reveal that males and females differ in their perceptions of classroom environments. For example, in a study involving 1,733 grade 10 students and the use of the *Individualised Classroom Environment Questionnaire* (ICEQ) to assess classroom environment in Singapore, Tock (1995) found that female students perceived higher levels of Participation and Independence, while male students perceived higher levels of Differentiation in their

actual classroom environment. Studies involving the use of the *Questionnaire on Teacher Interaction* (QTI) showed that girls perceived their teachers' interpersonal behaviours more favourably than did boys (Fisher, Fraser & Rickards, 1997). However, an exception to this pattern is Tamir and Caridin's (1993) finding of no sex differences in Israeli Arabic students' perceptions of the classroom environments when the *Learning Environment Inventory* (LEI) was administered to students. The present study also examined gender differences in students' perceptions of the learning environment and their outcomes.

1.4   Rationale and Significance of the Study

Development in Indonesia is currently an important issue, and education is considered an essential component of the developmental process. In education in Indonesia, computer sciences and information technology are rapidly gaining in popularity. Between 1978 and 1999, approximately 150 private institutions were registered in tertiary education with approximately 75,000 students. In Jakarta alone, there are around 30,000 students studying in 49 private tertiary computer studies institutions, providing a need for research involving the investigation of factors that could influence students' outcomes (achievement and attitudes) in Indonesia.

This study involving a large sample of computing students in a private university in Indonesia is significant in that it is one of few learning environment studies at any

level conducted in Indonesia and worldwide at the university level. Many students experience problems during the transition from secondary to tertiary education. While some students overcome the problems associated with the transition, others never learn to cope. The results of this study contribute towards explaining why students are achieving less than desirable scores in their computing courses and provides information regarding the process of achieving the goals of the course. The study is likely to be significant to instructors and administration staff by providing information that can be used to improve the learning environment in ways that are likely to enhance student achievement and attitudes.

The present study could provide insights into the field of learning environments in Indonesia where there have been few such studies undertaken in this area. The study provides a valuable, valid and widely-applicable learning environment instrument, namely, the *What is Happening in this Class?* (WIHIC) questionnaire (Fraser, Fisher, McRobbie, 1996) that can be used in Indonesia to measure a number of aspects of the learning environment at the tertiary level. The results of the research could help to identify numerous alterable factors that could affect the achievement and attitudes of Indonesian students in private computer studies institutions. Clearly, the study is of practical importance to private institutions because of its potential to provide evidence that can assist with the identification of problems (especially during the transition from secondary to tertiary education) and to guide improvement in students' outcomes.

The development of an actual and preferred form of a learning environment questionnaire in the Indonesian language will assist future researchers and instructors to obtain valuable information regarding students' perception at the tertiary level. Careful translation and extensive validation of the instruments ensure its suitability at the tertiary level. At the university level in Indonesia, information can be used to help to identify the types of learning environments in which student are more likely to achieve.

The results of the study could provide practical benefits to the students, teachers, the Vice-Chancellor, and administrative staff of the institution in which the data were collected. Feedback from the study provides information regarding the teaching and learning processes within the institution, in addition to assisting to identify the need for staff development programs that could be beneficial to staff and students at the institution.

1.5   Research Questions

In the first place, it was necessary to translate the *What Is Happening In this Class* (WIHIC) questionnaire into Indonesian and to modify it for assessing classroom learning environments at the university level. To ensure the reliability and validity of the Indonesian version, the first research question was developed:

Research Question #1

> *Is it possible to develop and validate an Indonesian-language version of the*
> *What is Happening in this Class? (WIHIC) questionnaire that has been*
> *modified to suit university computing students?*

To determine whether differences exist between students' perceptions of the actual and preferred learning environment in computing classes (statistics and linear algebra) at the university level in Indonesia, the second research question was developed:

Research Question #2:

> *Are there differences between students' perceptions of actual and*
> *preferred learning environments?*

To determine whether relationships exist between students' outcomes (achievement and attitude towards their course) and perceptions of the learning environment, the third research questions emerged:

Research Question #3

> *Is there a relationship between perceptions of the learning environment and the student outcome of:*
>
> a) *mathematics achievement?*
>
> b) *attitudes?*

To determine whether students attending two different computing courses and of different genders perceive their learning environment differently, the fourth research question was developed:

Research Question # 4

> *Are perceptions of the learning environment different for:*
>
> a) *students of different genders?*
>
> b) *students attending statistics and linear algebra courses?*

1.6   Overview of the Thesis

The thesis comprises five chapters. This first chapter introduces the study, providing a description of the geographical location, the political state and the Indonesian education system. Also provided is the background and rationale of the study, the research questions and an overview of the thesis. The chapter also provides a description of the purpose and significance of the study.

Chapter 2 reviews pertinent literature related to the field of learning environments and student attitudes. This chapter highlights research developments and findings over past 30 years, including instrument applications and research in Indonesia.

Chapter 3 provides insight into the procedural aspects of the present study, including the research design, a profile of the students involved, the development and translation of the instruments used, and details of the pilot project designed to field test the instruments (including the statistical procedures applied to the data collected). This chapter also reports each phase of the data collection, including both administration and analysis.

Chapter 4 reports the results of the study. This chapter provides evidence for the reliability and validity of the *What Is Happening In This Class?* (WIHIC) questionnaire for use in Indonesia. Analyses include factors and item analyses, internal consistency reliability (Cronbach alpha coefficient), ANOVA results for class membership differences, and an inter-correlation matrix to indicate scale independence. Also reported in this chapter are the results for simple and multiple regression analyses undertaken to examine associations between the learning environment and three student outcomes. The results for *t* tests for paired samples undertaken to examine differences in students' perceptions of their actual and preferred classroom and between male and female students are also reported.

Chapter 5 concludes the thesis with a summary of the present study. This chapter provides information regarding the implications of the findings of the study, as well as the constraints and limitations of the study. Recommendations for future research also are included in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

Few studies of the learning environment have been undertaken in Indonesia, particularly at the tertiary level. The present exploratory but pioneering study examined university students' perceptions of the learning environment in Indonesia and investigated relationships between the environment and students' outcomes. This chapter reviews literature relevant to this study of classroom learning environments, including the historical background to the field of learning environment (Section 2.2), methods used to assess the learning environment (Section 2.3), instruments used to assess the learning environment (Section 2.4) and different lines of past environment research (Section 2.5). Finally, because this study also involved the assessment of attitudinal outcomes, the final section reviews literature on student attitudes (Section 2.6).

2.2   Historical Background to the Field of Learning Environments

The word 'environment' has numerous meanings but, in the classroom context, it can be defined as the "shared perceptions of the students and sometimes the teachers in that environment" (Fraser, 1986, p. 1). Commonly, there are two aspects of classroom

environment, the physical environment (which includes the material setting of the classroom, as well furniture, lighting and all objects in the classroom) and the human environment (which involves the students and the teachers and their interactions with each other). The human environment refers to the psychosocial environment of the classroom, in which teachers, as facilitators of learning, and students play an important role in providing or creating a more conductive climate for student learning. Over the past 30 years, considerable progress has been made in conceptualising, measuring and investigating this aspect of the classroom (Chavez, 1984; Fraser, 1986, 1991, 1994, 1998a) and there is strong evidence that effective learning is related to a positive classroom environment (Brophy & Putnam, 1979).

Lewin (1936) and Murray (1938) laid the theoretical foundations of learning environment research more than 60 years ago. Lewin formulated his idea in the form of an equation, B=f(P, E), indicating that behaviour (B) is a function of the person (P) and his/her environment (E). Murray extended Lewin's work by proposing a needs-press model for explaining an individual's behaviour within an environment as the result of the interaction between personal needs and his/her external environment. In this needs-press model, personal needs are motivated by personality characteristics which represent an individual's tendency to move in the direction of certain goals, while the environmental press is a situation external to the person, which either supports or frustrates the expression of internalised personality needs. Murray also introduced the terms *alpha press* to differentiate between an environment as assessed by an external observer and *beta press* for an environment perceived by milieu

inhabitants. Stern, Stein and Bloom (1956) made a further distinction related to Murray's beta press between each person's unique view of the environment (*private beta pre*ss), and the collective opinion of the environment held by all the members in the environment concerned (*consensual beta press*), with each of these presses being distinct from the alpha press of the external observer.

In 1960, Getzels and Thelen (1960) developed a framework for the analysis of the classroom group as a unique social system. They suggested that group behaviour can be predicted from personality needs, role expectations and classroom environment. Later, Stern's (1970) theory of person-environment congruence explored how combinations of personal needs and environmental press might enhance student outcomes. Doyle (1986) pointed out that learning activities are always accompanied by interpersonal interaction, and proposed that the classroom could be considered from an ecological viewpoint. In this respect, Doyle (1986) proposed that the classroom could be viewed from an ecological point-of-view.

Walberg's (1981) multi-factor psychological model of educational productivity suggests that the psychosocial learning environment is one of nine factors in student learning. The model suggests that learning is a function of student age, ability and motivation; of the quality and quantity of instruction; and of the psychosocial environments of the home, the classroom, the peer group and the mass media.

In principle, any factor at a zero-point results in zero learning. Moreover, it does less good to raise a factor that already is high than to improve one that currently is the main constraint to learning. Empirical probes of the educational productivity model involved extensive research syntheses involving the correlations of learning with factors in the model (Fraser, Walberg, Welch & Hattie, 1987; Walberg, 1986) and secondary analyses of large data bases collected as part of the National Assessment of Educational Achievement (Walberg, 1986). Classroom environment and school environment were found to be strong predictors of both achievement and attitudes even when a comprehensive set of other factors in the productivity model was held constant.

Literature reviews on research related to classroom learning environments (Fraser, 1994, 1998a) reveal that Walberg (1976) and Moos (1974) independently laid the foundations for later work on educational environments. The success of Walberg and Anderson's Learning Environment Inventory (LEI), developed in conjunction with research and evaluation related to Harvard Project Physics (Anderson & Walberg, 1968), and Moos's (1973) conceptualisation of human environments, which was followed by development of the Classroom Environment Scale (CES) (Moos & Trickett, 1974; Trickett & Moos, 1973) have paved the way for numerous questionnaires.

Classroom environment assessments initially were used in the evaluation of curriculum innovations such as Harvard Project Physics (Anderson & Walberg, 1968;

Walberg, 1969) and the Australian Science Education Project (ASEP) (Fraser, 1979). Information obtained from past investigations is important because it provides feedback to teachers, curriculum developers and educational administrators about classroom environments in which teaching and learning occurs and that can be used as bases for further systematic actions.

Learning environment research has since become a distinctive and thriving field of study. The extensiveness of recent classroom environment research and the growing popularity of the field is reflected in a number of literature reviews (e.g. Chavez, 1984; Fraser, 1989, 1994, 1998a; Fraser & Wubbels, 1995), the establishment of a successful Special Interest Group (SIG) on the study of Learning Environments within the American Educational Research Association in 1984, and this group's sponsorship of an annual monograph (e.g., Fraser, 1986, 1987, 1988; Waxman & Ellett, 1990). Also, in 1998, Kluwer Academic Publishers initiated a new international journal called *Learning Environments Research* (Fraser, 1998b). Inspired by Walberg's and Moos's pioneering work, Fraser and his colleagues developed a number of new learning environment instruments (Fraser, 1990; Fraser, Giddings & McRobbie, 1993; Fraser, Fisher & McRobbie, 1996; Fraser, & O'Brien, 1985; Fraser & Treagust, 1986; Taylor, Dawson & Fraser, 1995; Teh & Fraser, 1993, 1995a), some of which are described in Section 2.4.

2.3 **Methods Used to Assess the Learning Environment**

In the past, the most common methods for studying learning environments have involved using students' and teachers' perceptions, or direct observations by external observers. Fraser (1994) contrasted the use of students' and teachers' perceptions with the method of direct observation for studying classroom learning environments. While perceptual measures require students and teachers to make a judgement in interpreting classroom events, direct observations rely on the external observer to code systematically classroom communication and events according to some category scheme. Rosenshine (1970) referred to perceptual measures as 'high inference' measures and to direct observation as 'low inference' measures. Because the study of classroom environment is more concerned with the socio-psychological context, or determinants of learning, using perceptual measures has been the common approach to studying learning environments. In this study, the socio-psychological contexts or determinants of learning are considered to include interpersonal relationships between students, relationships between students and their teacher, and relationships between students and both the subject studied and the method of learning (Fraser, Anderson & Walberg, 1982).

While perceptual measures provide a better understanding of the teaching and learning process in the classroom from a psychosocial perspective, they also have methodological advantages over direct observation techniques (Fraser & Walberg,

1981), as they are more economical and involve the pooled judgements of all students in a class.

In the present study, a choice was made to gather information about classroom environment by using a questionnaire to assess students' perceptions (see Section 3.2). Despite the advantages of perceptual measures, however, it has been recognised that a combination of quantitative perceptual measures with qualitative observation techniques and interviews is more desirable for capturing data and providing a more meaningful understanding of the teaching and learning process in classrooms than is any of the methods used independently (Fraser & Tobin, 1991; Tobin & Fraser, 1998).

2.4 Instruments Used to Assess the Learning Environment

Since learning environment research began in the late 1960s, a number of instruments have been developed for general classroom use, across various subjects and also for specific classroom contexts. This section provides a brief overview of 10 more commonly used instruments, including the Learning Environment Inventory (LEI), Classroom Environment Scale (CES), My Class Inventory (MCI), College and University Classroom Environment Inventory (CUCEI), Questionnaire on Teacher Interaction (QTI), Individualised Classroom Environment Questionnaire (ICEQ), Science Laboratory Environment Inventory (SLEI), Constructivist Learning Environment Survey (CLES), Geography Classroom Environment Inventory (GCEI) and What is Happening in this Class? (WIHIC) questionnaire.

Moos (1973) identified three broad dimensions of human social environments, which can be used to classify individual scales of learning environment instruments. The three dimensions are the Relationship Dimension (which assesses the nature and intensity of personal relationships within the environment and assesses the extent to which people are involved in the environment and support one another), the Personal Development Dimension (which assesses basic directions along which personal growth and self-enhancement tend to occur), and the System Maintenance and System Change Dimension (which involves the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

A summary of 10 instruments, designed to assess the learning environment, is provided in Table 2.1. The table shows the name and scales of each instrument, the level at which it can be used (primary, secondary, or higher education), the number of items in each scale, and the classification of each scale according to Moos's (1973) scheme for classifying human social environments.

Table 2.1   Overview of Scales Contained in 10 Classroom Environment Instruments (LEI, CES, ICEQ, MCI, CUCEI, SLEI, QTI, CLES, GCEI and WIHIC)

Instrument	Level	No. of Items	Scale Classified According to Moos's Scheme		
			Relationship Dimension	Personal Development Dimension	System Maintenance and Change Dimension
Learning Environment Inventory (LEI)	Secondary	7	Cohesiveness Friction Favouritism Cliqueness Satisfaction Apathy	Speed Difficulty Competitiveness	Diversity Formality Material Environment Goal Direction Disorganisation
Classroom Environment Scale (CES)	Secondary	10	Involvement Affiliation Teacher Support	Task Orientation Competition	Organisation Rule Clarity Teacher Control Innovation
Individualised Classroom Environment Questionnaire (ICEQ)	Secondary	10	Personalisation Participation	Independence Investigation	Differentiation
My Class Inventory (MCI)	Primary	6-9	Cohesiveness Friction Satisfaction	Difficulty Competitiveness	
College and University Classroom Environment Inventory (CUCEI)	Higher Education	7	Personalisation Involvement Student Cohesiveness Satisfaction	Task Orientation	Innovation Individualisation
Science Laboratory Environment Inventory (SLEI)	Upper Secondary Higher Education	7	Student Cohesiveness	Open-Endedness Integration	Rule Clarity Material Environment
Computer Laboratory Environment Inventory (CLEI)	Upper Secondary Higher Education	7	Student Cohesiveness	Open-Endedness Integration	Rule Clarity Material Environment
Questionnaire on Teacher Interaction (QTI)	Secondary	8-10	Helping/Friendly Understanding Dissatisfied Admonishing		Leadership Student Responsibility and Freedom Uncertain Strict
Constructivist Learning Environment Survey (CLES)	Secondary	7	Personal Relevance Uncertainty	Critical Voice Shared Control	Student Negotiation
Geography Classroom Environment Inventory (GCEI)	Secondary	8		Investigation	Innovation Resource Adequacy Gender Equity
What is Happening in this Classroom? (WIHIC)	Secondary	8	Student Cohesiveness Teacher Support Involvement	Investigation Task Orientation Cooperation	Equity

Adapted from Fraser (1998a)

A notable feature of the instruments in Table 2.1 and other recently developed instruments is that they come in two forms, namely, *actual* and *preferred*. The actual

form measures perceptions of the actual or experienced classroom environment, whereas the preferred form measures the preferred or ideal classroom environment. The preferred form is concerned with goals and values orientations and measures perceptions of the classroom ideally liked or preferred. Although both forms have similar wording for the items, each has different instructions for answering. Thus, the actual form requires students to answer in term of what they really feel about one of their specific current classroom environments, while the preferred form requires students to think about the classroom environment which they would prefer or ideally like. Availability of separate actual and preferred forms of the instruments enables researchers and teachers to study differences between the actual and preferred classroom environment experienced by students as well by teachers, and to investigate whether students achieve better in their preferred classroom environment.

In addition to actual and preferred forms, shorter versions of many of these instruments have been developed. For example, Fraser and Fisher (1986) developed a short version of the ICEQ, MCI and CES, while Wubbels (1993) developed a short version of the QTI. The main advantage of these shorter versions is that they can be more quickly administered and scored by hand. The availability of short versions of questionnaires has made classroom environment instruments more accessible to teachers who wish to assess and improve their classroom environments.

A further recent addition has been the development of a 'personal' form (Fraser, Giddings & McRobbie, 1992, 1995; Fraser, Fisher & McRobbie, 1996). Whereas the

traditional 'class' form measures an individual's perceptions of the class as a whole, the personal form measures an individual's perception of his/her own roles within the class. For example, an item that seeks opinions about class work, written in the class form, would read, "The work of the class is difficult". In contrast, the personal form would be written as "I find the work of the class difficult". The personal form of an instrument thereby distinguishes personal perceptions from class perceptions of the classroom environment. The main advantage of the personal form is that it is more sensitive for studying sub-environments within classes (e.g., target students or gender subgroups) and in case studies of individual students. Moreover, the personal form can be used to enrich data in qualitative studies of classroom environment at different 'grain sizes' (Fraser, 1999).

Some further details about each instrument listed in Table 2.1 are provided in the subsections below.

2.4.1   Learning Environment Inventory (LEI)

The Learning Environment Inventory (LEI) was developed in the late 1960s as a part of Walberg's research work in conjunction with Harvard Project Physics (Anderson & Walberg, 1968; Fraser, Anderson & Walberg, 1982). The final version of the LEI contains 15 scales, with 7 items per scale to make a total of 105 items. The LEI employs four response alternatives, namely, Strongly Agree, Agree, Disagree and Strongly Disagree. Whilst some of the scales included in this questionnaire might still

be applicable in today's settings, most are more suited to a traditional teacher-centred learning environment.

2.4.2   Classroom Environment Scale (CES)

The Classroom Environment Scale (CES) was developed by Trickett and Moos (1973) and grew out of a comprehensive research program at Stanford University (Fisher & Fraser, 1983; Moos, 1979) on assessing human environments in a number of social settings including psychiatric hospital, prisons, university residences and work milieus. Initially, the CES contained 242 items representing 13 scales. After several trials, the final version of the CES was reduced to nine scales with 10 items of True-False format in each scale. As with the LEI, this instrument was pioneering the field of learning environments. Some scales, however, might not be pertinent for classrooms in more student-centred classrooms.

2.4.3   Individualised Classroom Environment Questionnaire (ICEQ)

The Individualised Classroom Environment Questionnaire (ICEQ) was initially developed to assess individualised, open or inquiry approaches to learning (Fraser, 1990; Rentoul & Fraser, 1979). However, the instrument proved to be useful in measuring general classroom environment when used in conjunction with the LEI or CES (Fraser & Fisher, 1982b). The instrument has 50 items with 10 items in each scale. Each item has the response alternatives of Almost Never, Seldom, Sometimes, Often and Very Often. This important instrument was one of the first to consider the learning environment created in the more student-centred classroom. Although useful

at the secondary school level, some scales and items were not considered useful at the tertiary level.

2.4.4   *My Class Inventory (MCI)*

The My Class Inventory (MCI) is a simplified version of the LEI with a lowered reading level and a reduction in the number of scales from 15 to 5. The MCI is suitable for primary school children within the age range of 8 to 12 years (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982). It contains 38 items with 6 to 8 items per scale. It has Yes and No as response alternatives. The MCI requires responses on the questionnaire itself (thus avoiding possible errors in transferring responses from a questionnaire to a response sheet). An alternative response format for the MCI has been developed and used by Goh, Young and Fraser (1995) consisting of Seldom, Sometimes and Most of the Time. Recently, the MCI was used with a large sample of mathematics students in Brunei (Majeed, Fraser & Aldridge, 2001).

2.4.5   *College and University Classroom Environment Inventory (CUCEI)*

The College and University Classroom Environment Inventory (CUCEI) was developed for assessing classroom environment for a small group/class of students (about 30) studying at the tertiary level (Fraser & Fisher, 1982a; Fraser & Treagust, 1986; Fraser, Treagust & Dennis, 1986). The instrument consists of 49 items with 7 items in each scale. Each item makes use the four Likert-type of responses format of Strongly Agree, Agree, Disagree and Strongly Disagree. This CUCEI has many scales

that overlap with other and more recent instruments (particularly the WIHIC). Careful consideration of suitable scales for the Indonesian context revealed that the CUCEI's Order and Oganisation scale was considered applicable.

2.4.6   *Science Laboratory Environment Inventory (SLEI)*

The Science Laboratory Environment Inventory (SLEI) was designed specifically to assess the unique environment of a science laboratory classroom (Fraser, Giddings & McRobbie, 1992, 1995; Fraser & McRobbie, 1993). Its development was in response to the desire of science educators to know more about teaching and learning processes in laboratory classroom settings. The instrument has 5 scales with 7 items per scales to make total of 35 items. Each item has the response alternatives of Almost Never, Seldom, Sometimes, Often and Very Often. The SLEI was field-tested and validated simultaneously in six different countries (the USA, Canada, England, Israel, Australia and Nigeria) with 5,447 students in 269 classes. It was also cross-validated in Australia with 1,594 Australian students in 92 classes (Fraser & McRobbie, 1995), 489 senior high school biology students in Australia (Fisher, Henderson & Fraser, 1977) and 1,592 grade 10 Chemistry students in Singapore (Wong & Fraser, 1995). Recently, the SLEI has been used in other studies in Korea (Lee & Fraser, 2001), Singapore (Quek, Wong & Fraser, 1998) and Brunei (Riah & Fraser, 1998). This instrument was adapted for use in computer laboratories as explained in the next section.

2.4.7   Computer Laboratory Environment Scale (CLEI)

Newby and Fisher (1998) adapted the Science Laboratory Environment Inventory to create the Computer Laboratory Environment Inventory (CLEI) to assess students' perceptions of their computer laboratory environment. The same scales were used, but the wording was changed from 'science laboratory' to 'computer laboratory'. Although the sample selected for the present study consisted of students attending computing courses, this instrument was not considered suitable for the present study as these mathematics classes were not based in a computer laboratory.

2.4.8   Questionnaire on Teacher Interaction (QTI)

The Questionnaire on Teacher Interaction (QTI) was developed in the Netherlands to measure teacher-student interaction in classrooms (Wubbels, Creton & Hooymayers, 1985). It has been used in the USA (Wubbels & Levy, 1993), Australia (Fisher, Henderson & Fraser, 1995), Singapore (Goh & Fraser, 1996) and Brunei (Riah, Fraser & Rickards, 1997). Unlike other classroom environment instruments, its theoretical underpinnings draw upon a systems perspective on communication and a theoretical model of proximity (Cooperation – Opposition) and Influence (Dominance – Submission). Whereas the original version of the QTI has 77 items, the short version consists of 48 items with response alternatives varying from Never to Always. A primary school version of the QTI, based on the 48-item version, was developed and validated by Goh and Fraser (1998). Cresswell and Fisher (1997) and Fisher and Cresswell (1998) developed the Principal Interaction Questionnaire (PIQ), based on

the QTI, to measure teachers' perceptions of the principal on the same eight dimensions of the interaction between the principal and his/her teachers.

Research using the QTI has been used in a number of different contexts including a study of the professional development of teachers (Fisher & Cresswell, 1998; Fisher, Fraser & Cresswell, 1995), a cross-national study of the perceptions of interpersonal teacher behaviour in secondary science classrooms (Fisher, Goh, Wong, & Rickards, 1996), the assessment of teacher-student interpersonal relationship in mathematics classrooms (Fisher, Rickards & Fraser, 1996; Rickards & Fisher, 1996), the investigation of sex differences in biology students' perceptions of teacher-student relationships (Henderson, Fisher & Fraser, 1995), the relationship between teacher personality and interpersonal teacher behaviour (Kent, Fisher & Fraser, 1995), the relationships between science students' perceptions of their teachers' interpersonal behaviour, students' cultural background and gender (Rickards, Fisher & Fraser, 1997) and students' cultural environment and preferred student-teacher interpersonal behaviour (Waldrip & Fisher, 1996).

2.4.9 *Constructivist Learning Environment Survey (CLES)*

The Constructivist Learning Environment Survey (CLES) was developed from a constructivist perspective (Taylor, Dawson & Fraser 1995; Taylor, Fraser & Fisher, 1997; Taylor, Fraser & White, 1994). Constructivists view learning as a cognitive process in which an individual tries to make sense of the experiential world, based on the individual's existing knowledge by a process of active negotiation and consensus

building. The CLES was designed specifically to assist researchers and teacher to assess the degree to which a particular classroom's environment is consistent with constructivist epistemology, and to assist teachers to reflect on their epistemological assumptions and reshape their teaching practices. The CLES has 5 scales with 7 items in each scale. Each item has a five-point response format consisting of Almost Always, Often, Sometimes, Seldom and Almost Never. The CLES has been cross-validated in the USA with 1,600 students in 120 science classes (Dryden & Fraser, 1998), in two separate studies in Korea, one with 1,083 high school science students (Kim, Fisher & Fraser, 1999) and the other with 440 high school students (Lee & Fraser, 2001), in Taiwan with 1,879 high school science students (Aldridge, Fraser, Taylor & Chen, 2000) and in Singapore with 1,046 senior school English students (Wilks, 2001).

2.4.10 *Geography Classroom Environment Inventory (GCEI)*

The Geography Classroom Environment Inventory (GCEI) was developed specifically to assess computer-assisted learning (CAL) environments for geography classes (Teh & Fraser, 1993, 1995a). The GCEI can also be used to assess the learning environment of computer-assisted learning classes for subjects other than geography. The GCEI has three scales, which were adapted from existing instruments, together with a Gender Equity scale that was created by its developers to assess gender inequities in the use of computers in computer-assisted learning. The instrument was based on the Classroom Environment Scale (CES), the College and University Classroom Environment Inventory (CUCEI), the Individualised Classroom

Environment Questionnaire (ICEQ), the Learning Environment Inventory (LEI) and the Science Laboratory Environment Inventory (SLEI). The GCEI has 40 items with 10 items in each of four scales. The response alternatives for each item are Almost Never, Seldom, Sometimes, Often and Very Often.

2.4.11 What is Happening in this Class? (WIHIC)

Fraser, Fisher and McRobbie (1996) developed the *What Is Happening in This Class?* (WIHIC) questionnaire, a new general-purpose classroom environment instrument, to address contemporary issues in education such as equity and meaningful learning. It has been shown that the instrument is reliable and valid. Originally, the instrument had eight scales with each scale containing 10 items. As with many previous instruments, it employs a five-point response format (Almost Never, Seldom, Sometimes, Often, Almost Always). The WIHIC has been translated into Mandarin and validated for use in Taiwan using a sample of 1,879 students in 50 classes (Aldridge, Fraser & Huang, 1999). When the WIHIC was cross-validated with an Australian sample of 1,081 students in 50 classrooms who responded to the equivalent English version, this led to a final form of the WIHIC containing the seven eight-item scales, namely, Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity (Aldridge & Fraser, 2000). This version of the WIHIC has also been cross-validated with 2,310 high school students in Singapore (Chionh & Fraser, 1998), 644 high school students from 35 chemistry classes in Brunei (Riah & Fraser, 1998, 1999), 75 students in 6 classes in 4 English-speaking

high schools in Canada (Zandvliet & Fraser, 1999), 1055 students in Australia (Dorman, in press) and 364 students in the Unites States (Moss & Fraser, 2001).

The pertinence of the WIHIC scales in today's settings made it suitable for the present study of university-level learning environments. Its robust nature across different subjects, countries and languages also made it an appealing choice. The development, validation and use of the WIHIC in past studies, and its subsequent modifications and translation for use in the present study in Indonesia at the tertiary level, are described in detail in Chapter 3.

2.5   Different Lines of Past Learning Environment Research

This section provides an overview of some of the different lines of learning environment research that have been pursued in the past, including associations between classroom environment and student outcomes (Section 2.5.1), studies involving a person-environment fit perspective (Section 2.5.2), the use of learning environment instruments in attempts to improve the learning environments (Section 2.5.3) and the use of environment dimensions as dependent variables (Section 2.5.4). Finally, a separate section is devoted to the replication of Western studies and to cross-national studies in Asian countries, particularly Indonesia (Section 2.5.5)

2.5.1   Associations Between Classroom Environment and Student Outcomes

In classroom environment research, associations between classroom learning environment and students' cognitive and affective outcomes have been studied extensively. These studies have shown that students' perception account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics (Fraser, 1994). Fraser (1994) tabulated 40 past studies in developed and developing countries involving science students at various grade levels and grouped them according to the instrument used (LEI, CES, ICEQ and MCI). This tabulation of past studies shows that associations between outcomes measures and classroom environment perceptions have been replicated for a variety of cognitive and affective measures, a variety of classroom environment instruments and a variety of samples (ranging across numerous countries and grades levels).

In a synthesis of some of these studies, Haertel, Walberg and Haertel (1981) conducted a meta-analysis involving a collection of 12 studies of 10 data sets, 734 correlations, and 17,085 students in 823 classes in eight subject areas from four nations. The meta-analysis revealed that there were consistent and strong associations between posttest learning scores and regression-adjusted gains for students' cognitive and affective outcomes. In particular, it was found that better achievement on a variety of outcomes measures was found in classrooms in which students perceived greater Cohesiveness, Satisfaction and Goal Direction, and less Disorganisation and Friction. Another research synthesis by Fraser, Walberg, Welch and Hattie (1987) provided

further evidence of strong links between classroom environment and learning outcomes.

The study of associations between classroom environment dimensions and student outcomes also has been conducted in science laboratory settings. Fraser and McRobbie (1995) investigated the effect of laboratory classroom environment on students' outcomes. The study involved the use of the Science Laboratory Environment Inventory (SLEI) with 233 students in 56 classes in senior high schools in Australia. The study revealed that the Student Cohesiveness, Integration, Rule Clarity, and Material Environment scales of the SLEI showed relatively strong and consistent positive associations with students' attitudinal outcomes. When Waldrip and Wong (1996) examined associations between laboratory classroom environment and students' attitudes towards science in Singapore and Papua New Guinea, they found that Rule Clarity and Integration were consistently related to students' attitudes towards chemistry. These finding replicate other studies in Australia (Henderson, Fisher & Fraser, 1995; McRobbie & Fraser, 1993), Singapore (Quek, Wong & Fraser, 1998; Wong & Fraser, 1994), Korea (Lee & Fraser, 2001), Brunei (Riah & Fraser, 1998) and England (Fraser & Wilkinson, 1993). By using the SLEI, association with students' cognitive and affective outcomes have been established for a sample of approximately 80 senior high school chemistry classes in Australia (Fraser & McRobbie, 1995; McRobbie & Fraser, 1993), 489 senior high school biology students in Australia (Fisher, Henderson & Fraser, 1997), 1,592 grade 10 Chemistry students in Singapore (Wong & Fraser, 1996).

Studies such as these provide information to educators and classroom teachers as a basis for guiding systematic attempts to improve classroom environment to enhance students' cognitive and affective outcomes. By using an instrument suited for computer-assisted instruction classrooms, Teh and Fraser (1995b) established associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes in Singapore. By using the QTI, associations between student outcomes and perceived patterns of teacher-student interaction were reported for 489 senior high school biology students in Australia (Fisher, Henderson & Fraser, 1995), 3,994 high school science and mathematics students in Australia (Fisher, Fraser & Rickards, 1997), 1,512 primary school mathematics students in Singapore (Goh, Young & Fraser, 1995) and 440 high school chemistry students in Korea (Lee & Fraser, 2001).

The present study aimed to examine whether associations existed between students' perceptions of the learning environment and their cognitive and affective outcomes.

2.5.2   *Studies Involving a Person-Environment Fit Perspective*

Studies have used actual and preferred forms of educational environment instruments together to examine whether students achieve better when there is a higher similarity between the actual classroom environment and that preferred by students (Fraser & Fisher, 1983a, 1983b). Findings from past studies suggest that actual-preferred congruence (or person-environment fit) could be as important as the environment per

se in predicting student achievement of affective and cognitive aims. These findings suggest that changing the actual classroom environment in ways that make it more congruent with that preferred by the class is likely to enhance student outcomes.

Generally, past studies have indicated that, even when the current classroom environment is considered favourable to learning, students still prefer a more positive learning environment. In addition, these studies suggest that teachers and students differ in their perceptions of the same classrooms (Fisher & Fraser, 1983; Wong & Watkins, 1996). A practical implication of these studies is that information obtained from these questionnaires can help teachers to reflect on their teaching practices and their relationships with their students and guide them in improving their classroom environments (Sinclair & Fraser, 2001; Moss & Fraser, 2001; Thorp, Burden & Fraser, 1994; Yarrow, Millwater & Fraser, 1997).

In seeking an answer to the question of whether students achieve better in their preferred environment, past research on classroom environment investigated associations between actual classroom environment and students' outcomes. Investigations have revealed that some dimensions of classroom environment are good predictors of student outcomes. This line of research was extended further by adopting a person-environment interaction framework in classroom environment research (Fraser & Fisher, 1983d; Rentoul & Fraser, 1980). The adoption of this framework improved methodological aspects for investigating person-environment fit by controlling students' background characteristics and prior achievement.

In a person-environment fit study involving 116 eighth- and ninth-grade science classes from 33 schools in Australia, a total of 28 variables were used in exploring relationships between achievement, actual individualisation and actual-preferred interaction (Fraser & Fisher, 1983c). Student achievement was measured twice, one at the beginning of the school year and again at the end of the same year using six affective and three cognitive outcome measures. Students' perceptions of actual and preferred individualisation in the environment were obtained in the middle of the school year using the five dimensions of actual and preferred environment assessed by the Individualised Classroom Environment Questionnaire. In addition, students' general ability was measured. Using these data, the researchers predicted posttest achievement. It was found that actual-preferred interactions accounted for achievement variance for four of the nine learning outcomes beyond that attributable to pretest, general ability and actual individualisation. That is, scores on each of the four learning outcome measures increased with a higher congruence between actual and preferred individualisation.

In another study involving 180 randomly-selected secondary students aged 14-15 years and the use of the Classroom Environment Scale (CES) and Learning Process Questionnaire (LPQ) in Hong Kong, Chan and Watkins (1994) found that an actual classroom environment which students perceived as competitive and teacher controlled tended to encourage rote learning. On the other hand, a classroom environment that is perceived as having a friendly atmosphere, and with students and

teachers collaborating on a variety of interesting but challenging activities, tends to promote a deeper, more achievement-oriented approach to learning. This possibly explains why students achieve better in their preferred environment. However, Fraser (1991) cautioned that these finding cannot be used as a basis for moving an individual student to a classroom that matches his/her preferences in order to obtain better results, but rather for improving certain outcomes by changing the actual classroom environment to make it more congruent with the preferred environment of the class.

2.5.3 Use of Learning Environment Instruments to Improve Learning Environments

Because dimensions of classroom environment are related to students' outcomes, and because students favour more conducive learning environments, some practical attempts by teachers to improve classroom environments is desirable. The next section describes past classroom environment research that provides techniques and ideas about how teachers can improve their classroom environments to make them more conductive to learning.

In order to facilitate teachers' application of these techniques and ideas, Fraser and Fisher (1986) developed short versions of the actual and preferred forms of the Classroom Environment Scale (CES), Individualised Classroom Environment Questionnaire (IQEQ) and My Classroom Inventory (MCI), each containing approximately 25 items that are easy to hand score. Essentially, the steps involved are assessments of student perceptions of actual and preferred environments, followed by

reflecting on discrepancies between actual and preferred environments, introducing interventions to reduce those discrepancies, and assessment of actual environments after interventions to gauge if changes have occurred. Case studies have shown that these change studies are promising (Fisher, Fraser & Bassett, 1995; Fraser, 1989; Fraser & Fisher, 1986; Moss & Fraser, 2001; Sinclair & Fraser, 1998, 2001; Thorp, Burden & Fraser, 1994; Yarrow, Millwater & Fraser, 1997).

In a case study, a classroom teacher administered a short version of the actual and preferred forms of the MCI to her class of 26 grade 6 students in coeducational schools in Sydney (Fraser, 1989). After getting feedback from students on their perceptions of the actual and preferred classroom environment, she introduced interventions that aimed at reducing Competitiveness and enhancing Cohesiveness in her class over a period of two months before re-administering the actual form of MCI. The results showed that interventions not only decreased the discrepancies on Competitiveness and Cohesiveness significantly, but also led to change on other dimensions of the MCI in a positive direction.

Yarrow, Millwater and Fraser (1997) reported a study in which 117 preservice education teachers were introduced to the field of learning environment through action research. The study aimed, first, to improve the learning environment of the university teacher education classes and, second, to improve the learning environment of the primary school classes that the 117 teachers taught during teaching practice. The College and University Classroom Environment Inventory (CUCEI; Fraser & Treagust, 1986; Fraser, Treagust & Dennis, 1986) was used at the university level and

the My Class Inventory (MCI; Fisher & Fraser, 1981) was used at the primary school level. Improvements in classroom environment were observed, and the preservice teachers generally valued both the inclusion of the topic of learning environment in their preservice programs and the opportunity to be involved in action research aimed at improving classroom environments.

In contrast to the way in which the above teacher attempted to improve her classroom environment using students' perceptions of psychosocial aspects of classroom environment, the following example illustrates how teacher interpersonal behaviour was improved by using feedback about teachers' communication styles. Fisher, Rickards and Fraser (1996) described how teachers could use the QTI to improve the classroom environment systematically. Having received feedback based on students' perceptions of teacher interpersonal behaviours in the form of sector profiles, one teacher decided to improve her classroom environment by focusing on the students' need for clear verbal communication.

In classroom environment research, it is assumed that a positive classroom environment is educationally desirable in its own right and also that a positive classroom environment enhances learning outcomes. For these reasons, teachers are encouraged to strive to create conducive learning environment for their students. The above description illustrates how teacher could use feedback from students' perceptions, student interviews and classroom observation to change their classroom environments constructively and to become more reflective about their teaching.

The present study included the use of an actual and a preferred version of a learning environment instrument with a view to examining the congruence between students' views of the environment created by teachers and their ideal learning environment. In this exploratory study of university learning environments in Indonesia, such information was considered to be potentially useful to administrative staff for future professional development courses.

2.5.4   *Use of Environment Dimensions as Dependent Variables*

Classroom environment dimensions have been used as criterion variables in research aimed at identifying how the classroom environment varies with such factors as teacher personality, class size, grade level, subject matter, the nature of the school-level environment and the type of school (Fraser, 1994). For example, larger class sizes were found to be associated with greater classroom Formality and less Cohesiveness (Anderson & Walberg, 1972). Kent and Fisher (1997) established associations between teacher personality and classroom environment (e.g., extrovert teachers' classes having a high level of Student Cohesiveness). Knight (1992) reported differences in the classroom environment perceptions of American and Hispanic students, and cultural differences in students' perceptions of teacher-student interaction depending on place of birth and primary language spoken at home (Levy, Wubbels, Brekelmans & Morganfield, 1994).

Several studies have attempted to bring the fields of classroom environment and school environment together by investigating links between classroom and school environment (Fisher, Fraser & Wubbels, 1993; Fisher, Grady & Fraser, 1995; Fraser & Rentoul, 1982). In a study involving the administration of a classroom environment instrument to 2,211 students in 104 classes and a school environment instrument to 208 teachers of these classes, only weak associations were found between classroom environment and school environment (Dorman, Fraser & McRobbie, 1993, 1997). Although school rhetoric often would suggest that the school ethos would be transmitted to the classroom level, it appears that classrooms are somewhat insulated from the school as a whole.

In a study of students' preferences for different types of classroom environment, girls were found to prefer cooperation more than boys, but boys preferred both competition and individualisation more than girls (Owens & Straton, 1980). Another study found that boys preferred friction, competitiveness and differentiation more than girls, whereas girls preferred teacher structure, personalisation, and participation more than boys (Byrne, Hattie & Fraser, 1986). Several studies have revealed that female students generally hold perceptions of their classroom environments that are somewhat more favourable than the perceptions of males in the same classes (Fisher, Fraser & Rickards, 1997; Fraser, Giddings & McRobbie, 1995; Henderson, Fisher & Fraser, 1995).

At the tertiary level, Fraser and Treagust (1986) investigated aspects of the learning environment in higher education classes. Using sample of 127 tertiary students, their findings indicated that dimensions of the learning environment were linked with greater student satisfaction. Also, it was found that students were more likely to be satisfied in seminars and tutorials where they perceived higher levels of involvement, task orientation and innovation.

Classroom environment instruments have also been used as a source of process criteria in the evaluation of educational innovations (Fraser, Williamson & Tobin, 1987). Teh and Fraser (1994) used learning environment scales to evaluate the impact of computer-assisted learning (CAL) in geography classes in Singapore. The study found significant differences in students' perceptions between computer and non-computer groups for all dimensions of the learning environment instrument. These findings suggest that appropriately-designed CAL can be an effective instructional method in the classroom milieu. In the US, Dryden and Fraser (1998) used scales of the *Constructivist Learning Environment Survey* (CLES) to evaluate the effectiveness of an urban systemic reform initiative. The findings indicate that that there a lack success in achieving the desired constructivist-oriented reform in the curriculum (Dryden & Fraser, 1998).

In Australia, Maor and Fraser, (1996) used a questionnaire called the Computer Classroom Environment Inventory (CCEI) to evaluate the effectiveness of a computerised database which has the potential for promoting inquiry skills. The CCEI

was used to assess 120 students' and seven teachers' perceptions of their learning environment as they engaged in inquiry learning in their computer classrooms. The findings revealed that students perceived that their classes became more inquiry oriented during the use of the innovation.

Learning environment instruments have also been used to examine students' transition from primary school to the larger, less personal environment of the junior high school. Midgley, Eccles and Feldlaufer (1991) reported that students' perceptions of the classroom environment were less favourable when students moved from the primary schools to lower secondary schools. The authors suggest that less positive relations between students and teachers, in addition to reduced student opportunities for decision-making in the classroom, could contribute to the problem.

Ferguson and Fraser's (1999) study of 1,040 students from 47 feeder primary schools and 16 linked high school in Tasmania, also reported that students' perceptions of the classroom environment at the high school level were less favourable than at the primary school level. The findings of this study indicated also that, when students moved from the primary school to the high school, the experience was different for boys and girls and for different school size 'pathways'. It was found that students moving from small primary schools into larger secondary schools experienced the least favourable changes in the learning environments.

More recently, in South Australia, Hine and Fraser (2000) also found a deterioration in students' perceptions of classroom environment across the transition from primary to secondary schooling. In this study of 311 students in six schools in Grade 7 and 575 students in six schools in Grade 8, sizeable changes in students' perceptions of the classroom environment occurred. Also, differential transition experiences were found for different schools that could be linked to the enrolment profile and school context.

The present study used learning environment dimensions as dependent variables to explore whether differences exist between the perceptions of male and female students as well as differences in the perceptions of students attending different mathematics courses.

2.5.5   *Replication in Asian Countries*

It is clear that, although the field of learning environment research is rapidly growing in popularity throughout Asia, there is only a limited number of studies that have been conducted in this field in Indonesia. This is perhaps not surprising, considering the current climate in Indonesia and the problems that the country is yet to overcome politically and economically.

Despite the fact that the majority of learning environment instruments have been developed in the West, and that the majority of classroom environment studies ever undertaken involved Western students, there have been some important studies carried out in non-Western countries. Early studies established the validity of classroom

environment instruments that had been translated into the Indian (Walberg, Singh & Rasher, 1977) and Indonesian (Fraser, Pearse & Azmi, 1982; Schibeci, Rideng & Fraser, 1987) languages and replicated associations between student outcomes and classroom environment perceptions.

More recently, researchers working in Singapore (Chionh & Fraser, 1998; Fraser & Chionh, 2000; Goh, Young & Fraser, 1995; Khoo & Fraser, 1998; Quek, Wong & Fraser, 1998; Teh & Fraser, 1994, 1995a, 1995b; Wilks, 2001; Wong & Fraser, 1996), Brunei (Majeed, Fraser & Aldridge, 2001; Riah & Fraser, 1998; Scott & Fisher, 2000), Korea (Kim, Fisher & Fraser, 1999, 2000; Lee & Fraser, 2001), Japan (Hirata, Fraser & Fisher, 2001; Hirata & Saka, 1998) and Taiwan (Aldridge, Fraser & Huang, 1999) have conducted research similar to the present study and have made important contributions to the field of learning environments.

In Singapore, studies related to the field of learning environment have been conducted across different subjects including computing (Khoo & Fraser, 1998; Teh & Fraser, 1994), mathematics (Goh, Young & Fraser, 1995), science (Quek, Wong & Fraser, 1998; Wong & Fraser, 1996; Wong, Young & Fraser, 1997), English (Wilks, 2001) and geography (Chionh & Fraser, 1998; Fraser & Chionh, 2000). Also studies in Brunei have examined the learning environment in mathematics (Majeed, Fraser & Aldridge, 2001) and science (Scott & Fisher, 2000, 2001; Riah & Fraser, 1998, 1999). In all but one study (Scott & Fisher, 2000, 2001), these questionnaires were written in English and validated for use in an Asian country.

Of particular interest are those studies conducted in Asia that have used the WIHIC. The English version of the What is Happening in this Class? (WIHIC) questionnaire has been used in Singapore (Chionh & Fraser, 1998; Fraser & Chionh, 2000) and Brunei (Riah & Fraser, 1998, 1999), whilst a Mandarin version was used in Taiwan (Aldridge & Fraser, 2000) and Singapore (Chua, Wong & Chen, 2000). The findings of these studies replicated past research, reporting associations between the learning environment and students' outcomes for almost all scales. These studies provide suggestions to educators regarding learning environment dimensions that could be changed in order to improve students' outcomes.

Particularly relevant to this review are studies that have been conducted in Indonesia. In an early study of primary classrooms in Indonesia, Paige (1978, 1979) examined the relationship between classroom learning environment and the two outcomes of cognitive achievement and individual modernity. The sample was composed of a stratified random group of 1,621 sixth grade students in 30 rural and 30 urban schools in East Java using revised and translated instrument based on the nine CES scales and three of the LEI's scales after modification to fit East Javanese socio-cultural milieu. Specific findings included the trend that individual modernity was enhanced in classrooms perceived as having greater task orientation, competition and difficulty and less order and organisation, while achievement was enhanced in classes higher in speed and lower in order and organisation.

Fraser, Pearse and Azmi (1982) and Fraser (1985) reported a study in Indonesia involving an Indonesian translation of a modified version of all the ICEQ's five scales and four of the CES's nine scales. The sample consisted of 373 students in 18 coeducational social studies classes at the grade 8 and 9 levels in Padang. This study using student satisfaction and anxiety as the outcomes revealed that satisfaction was greater in classes perceived as having less independence and greater involvement, while anxiety was reduced in classes perceived as having greater differentiation, involvement and affiliation.

More recently, Irianto & Treagust (2001) reported a study involving 300 science teachers attending a series of teacher training programs. The study involved the use of an Indonesian version of the SLEI, modified to assess teacher' perceptions of the science laboratory learning environment created during the program. The results suggest that trainers in this program tend to use a style of instruction that involves fewer open-ended activities than the participants would like. The results also indicate that the participants, who came from different parts of the country, would prefer more opportunities to communicate with each other, thereby increasing the cohesiveness of the group.

In a cross-national study (Aldridge & Fraser, 2000; Aldridge, Fraser and Huang, 1999), six Australian and seven Taiwanese researchers worked together on a study of learning environments. The What is Happening in this Class? questionnaire (WIHIC; Fraser, Fisher & McRobbie, 1996) was administered to 50 junior high school science

classes in each of Taiwan (1,879 students) and Australia (1,081 students). Team members translated an English version of the questionnaire into Chinese, and this was followed by team members who were not involved in the original translation doing an independent back translation of the Chinese version into English again (Brislin, 1970). Qualitative data, involving interviews with teachers and students and classroom observations, were collected to complement the quantitative information and to clarify reasons for patterns and differences in the means in each country.

The largest differences in means between Taiwan and Australia occurred for the scales of Involvement and Equity, with Australian students perceiving each scale more positively than students from Taiwan. Data from the questionnaires guided the collection of qualitative data. Student responses to individual items were used to form an interview schedule to clarify whether students had interpreted items consistently and to help to explain differences in questionnaire scale means between countries. Classrooms were selected for observations on the basis of the questionnaire data, and specific scales formed the focus for observations in these classrooms. The qualitative data provided valuable insights into the perceptions of students in each of the countries, helped to explain some of the differences in the means between countries, and highlighted the need for caution when interpreting differences between the questionnaire results from two countries with cultural differences (Aldridge, Fraser & Huang, 1999).

Other recent studies that have involved the translation of classroom environment instruments into Asian languages have been undertaken in Korea (Kim, Fisher & Fraser, 2000; Lee & Fraser, 2001) and Brunei (Scott & Fisher, 2000).

In Indonesia, classroom environment research is fairly recent and has involved the investigation of associations between classroom environments and students' outcomes. The present study is consistent with, but extends, the traditions of past learning environment research begun in Indonesia by modifying and validating an Indonesian version of the widely-applicable What is Happening in this Class? questionnaire for use at the university level and by using it in a number of research applications. A distinctive feature of the present research is that it is one of only a few studies undertaken to examine the learning environment at the tertiary level in Indonesia.

2.6   Student Attitudes

In the present study, the researcher investigated whether associations exist between the classroom environment and student attitudes. Therefore, this section briefly reviews literature related to students' attitudes in terms of the definition of attitudes (2.6.1) and the evaluation of attitudes (2.6.2).

2.6.1   Definition of Student Attitudes

The definition of the terms associated with the study of students' affective outcomes has caused problems in the past. According to Peterson and Carlson (1979), terms

such 'interests' or 'attitudes' have been used loosely and without clarification. Krathwohl, Bloom and Masia (1964) went some way towards solving this difficulty when they developed a taxonomy in which affective behaviours were placed along a hierarchical continuum. This clarified some of the terms used to describe affective behaviours. Klopfer (1976) took this taxonomy one step further and developed a structure for the affective domain specifically related to science education. His structure involves four categories: events in the natural world (awareness and an emotive response to experiences that require no formal study); activities (students' participation in activities related to science, both informal and formal); science (the nature of science as a means of knowing about the world); and inquiry (scientific inquiry processes). The attitude scale used in the present study focuses on Klopfer's (1976) second category, which relates to students' attitudes towards their science activities.

2.6.2   *Evaluation of Student Attitudes*

Students' attitudes towards a subject have been measured using a variety of techniques, including interviews, open-ended questions, projective techniques, closed-item questionnaires and preference rankings (Laforgia, 1988). In the past, instruments have been designed to elicit the attitudes of students towards science (Fisher, 1973; Fraser, 1978, 1981; Mackay, 1971; Wubbels, Creton & Hoomayers, 1985). Many such instruments have been criticised on conceptual and empirical grounds (Gardner, 1975; Munby, 1980; Schibeci, 1984) and because of their inability to be used in different countries (Schibeci, 1986).

A review of literature revealed numerous scales for assessing science-related attitudes. Of particular interest to this study is the Test Of Science Related Attitudes (TOSRA) developed by Fraser (1978, 1981) to measure students' attitudes towards their science classes. Fraser based the scales of his instrument on Klopfer's (1976) taxonomy of the affective domain related to science education. Modified versions of the TOSRA have been used in previous studies in non-Western countries with a high degree of reliability (Goh, 1994; Goh & Fraser, 1995; Wong & Fraser, 1996).

For the present study, it was considered pertinent to modify and make use of the TOSRA to measure students' attitudes towards mathematics classes in Indonesia. TOSRA is discussed further in Section 3.3.4 of the methods chapter.

2.7   Summary

The major aim of this chapter was to review relevant literature on the study of classroom learning environments. The first section considered literature relevant to the historical background to the field of learning environments. An overview of the field's foundations explored the notion of learning environments and the conceptual contributions made to the field by the important earlier work of Murray (1938) and Lewin (1936) and later Getzels and Thelen (1960), Stern (1970), Walberg (1979) and Moos (1979).

An overview was provided of the more common methods used to assess the learning environment in past research. In particular, this section contrasted the use of perceptual measures with direct observations and explained some methodological advantages of using perceptual measures.

The third section reviewed literature related to 10 instruments developed since learning environment research began in the late 1960s, namely, the Learning Environment Inventory (LEI), Classroom Environment Scale (CES), My Class Inventory (MCI), College and University Classroom Environment Inventory (CUCEI), Questionnaire on Teacher Interaction (QTI), Individualised Classroom Environment Questionnaire (ICEQ), Science Laboratory Environment Inventory (SLEI), Constructivist Learning Environment Survey (CLES), Geography Classroom Environment Inventory (GCEI) and What is Happening in this Class? (WIHIC). A classification of the scales included in each instrument, according to Moos's scheme (1974), is provided for each instrument. In addition, a brief overview provides information about each of the instruments in terms of the purpose, the dimensions that it assesses, the response format and the number of items.

The final section reviewed literature pertinent to the different lines of past research that have been persued in the field of learning environment. This section examined the literature related to studies of associations between classroom environment and student outcomes, studies involving a person-environment fit perspective, the use of learning environment instruments to improve the learning environment, the use of

environment dimensions as dependent variables (including evaluation studies). Finally, studies of the learning environment undertaken at the tertiary level and a review of past studies in Asian countries, particularly Indonesia, were provided.

The literature revealed consistent associations between outcomes and dimensions of the learning environment. Also the review suggested that learning environment assessments should be used in addition to student learning outcomes measures to provide information about subtle but important aspects of classroom life. Teachers should be paying attention to students' feedback about classroom environment. An interesting finding from person-environment fit research is that the achievement of certain outcomes might be enhanced by attempting to change the actual classroom environment in ways which make it more congruent with that preferred by the class.

The review indicated that learning environment research provides a new lens through which the teaching and learning process in Indonesia can be viewed. The various instruments available for classroom environment research provide numerous possibilities for educators and curriculum developers to investigate the nature of the learning environment in classroom settings from the students' and teachers' perspective.

Few studies of the learning environment have been undertaken in Indonesia, particularly at the tertiary level. The present exploratory study made use of the WIHIC, modified and translated for use in Indonesia. The following chapter provides

details of the research methods used in the present study, including details of the original development of the WIHIC, its validation and its use in past studies. The chapter also explores the modification, translation and validation of the WIHIC to make it suitable at the tertiary level in Indonesia, its administration to students and teachers, and the methods of statistical analysis used to answer the research questions.

CHAPTER 3

RESEARCH METHODS

3.1   Introduction

Experience has shown that, shortly after the students commence their university programs, some students cope easily while others do not. It would appear that many students experience problems during the transition from secondary to tertiary education and, while some students overcome these initial problems over time, others do not. This situation raises some interesting questions about how prepared students are for university and how they perceive the learning environment created in different classes at the university.   These questions have become the starting point for the research in the present study involving a range of factors that influence student performance in private computer institutions in Indonesia.

The purpose of this exploratory study was to examine the learning environments created in university computing courses in Indonesia. To answer the research questions outlined in Chapter 1, data were collected from a large sample using a modified version of the *What is Happening in this Class?* (WIHIC) questionnaire, an attitude scale, and students' end-of-course mathematics scores. The questions focussed on students' perceptions of the actual and preferred learning environments and their associations with students' cognitive and affective outcomes.

This chapter reviews the research methods used in the present study under the following headings:

- Choice of Methods for Studying Classroom Environment (Section 3.2)

- Instrument Selection, Modification, Translation and Pilot Testing (Section 3.3)

- Sample for the Main Study (Section 3.4),

- Choice of Level of Statistical Analysis (Section 3.5)

- Data Collection for the Main Study (Section 3.6)

- Data Analysis (Section 3.7)

3.2 Choice of Methods for Studying Classroom Environment

In past research, there have been three common approaches to studying classroom environment, these being systematic observation, case studies, and assessing student and teacher perceptions. The use of perceptual measures forms a major focus in this thesis. Fraser and Walberg (1981) outline five major strengths of this approach: 1) paper-and-pencil measures are more economical than classroom observation techniques that involve the expense of trained outside observers; 2) perceptual measures are based on students' experiences over many lessons, while observational data usually are restricted to a very small number of lessons; 3) perceptual measures involve the pooled judgements of all students in a class, whereas observation techniques typically involve only a single observer; 4) as students' perceptions are the

determinants of student behaviour more so than the real situation, these can be more important than observed behaviours; 5) perceptual measures of classroom environment typically have been found to account for considerably more variance in student learning outcomes than do directly-observed variables. Although questionnaire surveys formed the main data-gathering method in this study, the advantages of combining quantative and qualitative methods in learning environment research are fully acknowledged (Tobin & Fraser, 1998).

3. 3   Instrument Selection, Modification, Translation and Pilot Testing

This section discusses the selection (Section 3.2.1), modification (Section 3.2.2), development of actual and preferred forms (Section 3.2.3), translation (Section 3.2.4) and pilot testing (3.2.5) of an instrument to assess the learning environment of tertiary computing students in Indonesia.

3.3.1 Selection of Learning Environment Instrument

Because a primary aim of the present study was to examine students' perceptions of the learning environment, it was necessary to select an appropriate classroom environment instrument. From an extensive list of existing classroom environment instruments – including the *Learning Environment Inventory* (LEI), *Classroom Environment Scale* (CES), *My Class Inventory* (MCI), *Questionnaire on Teacher Interaction* (QTI), *Individualised Classroom Environment Questionnaire* (ICEQ), *Science Laboratory Environment Inventory* (SLEI), *College and University*

Classroom Environment Inventory (CUCEI), *Constructivist Learning Environment Survey* (CLES) and *What Is Happening in This Class?* (WIHIC) questionnaire – the WIHIC was selected.

Careful examination of the scales contained in each of the questionnaires, in addition to literature reviews, revealed the What Is Happening in This Class? (WIHIC) questionnaire to be most suitable. The WIHIC, developed by Fraser, Fisher and McRobbie (1996), incorporates important scales from a wide range of existing learning environment instruments, together with scales assessing dimensions of current educational concern scales such as equity. This parsimonious learning environment instrument includes both a class form (which measures a student's perceptions of the class as a whole) and a personal form (which measures a student's perceptions of his/her role in the classroom).

The original version of the WIHIC was developed in Australia with a total of 90 items (nine scales, ten items per scale). The original scales were Student Cohesiveness, Teacher Support, Involvement, Autonomy/Independence, Investigation, Task Orientation, Cooperation, Equity and Understanding. A five-point frequency response format (Almost Never, Seldom, Sometimes, Often, and Almost Always) is used.

The WIHIC evolved through two versions. In the first field testing, both a personal and a class form were administered to 355 students in 17 Grade 9 and 10 mathematics and science classrooms in five Australian schools (Fraser, Fisher & McRobbie, 1996).

After a series of statistical analyses, however, only 54 out of 90 items survived. The Autonomy/Independence and Understanding scales were entirely excluded. The new instrument was revised and administered for the second time. In the second testing, with a revised Autonomy/Independence scale added, 54 items that survived the previous statistical analyses, plus additional items, were combined to make an 80-item version of the revised instrument. With the inclusion of Autonomy/Independence in the revised instrument, this version of the WIHIC contained eight scales, namely, Student Cohesiveness, Teacher Support, Involvement, Autonomy/Independence, Investigation, Task Orientation, Cooperation and Equity. Fraser, Fisher and McRobbie (1996) reported the outcomes of field testing of the first version. The WIHIC displayed satisfactory factorial validity, internal consistency reliability and discriminant validity, and each scale was capable of differentiating between the perceptions of students in different classrooms. Another cross-validation of the WIHIC by Rawnsley and Fisher (1997) involving 490 Grade 9 students in 23 mathematics classes in Australia attested to the reliability and validity of the instrument for studying classroom environment in mathematics classes.

Further validation of the second version of the WIHIC was carried out in a cross-national study involving junior high school science students in Taiwan and Australia (Aldridge, Fraser & Huang, 1999). In this cross-national study, the 70-item English version of the personal form of WIHIC (without the Autonomy/Independence scale) was translated into Chinese and then back-translated into English by people who were not involved in the original translation. The Australian researchers checked the back

translation and, for some items, modification was necessary either to the English version, the Chinese or both versions. After modification to some items of the WIHIC, the questionnaire was tried out in several Australian Grade 7-10 science classes. This was followed by student interviews conducted by the researchers. Similar trials including student interviews were also conducted in Taiwan. The 70-item version was administered to a sample of 1,081 Grade 8 and 9 general science students from 50 classes in 25 schools in Western Australia and 1,879 Grade 7-9 students from 50 classes in 25 schools in Taiwan.

Data collected from the two countries were analysed to establish the reliability and validity of the questionnaire (Aldridge & Fraser, 2000). Principal components factor analysis followed by varimax rotation resulted a seven-factor structure of the WIHIC for both countries, thus supporting the seven a priori scales of the questionnaire. The results for the reliability coefficients using the class mean as unit of analysis ranged from 0.87 to 0.97 for the Australian sample and from 0.90 to 0.96 for the Taiwanese sample. The mean correlation of a scale with other scales using class mean as the unit of analysis varied between 0.41 to 0.58 in Taiwan and between 0.44 to 0.59 in Australia. Analyses of variance (ANOVA), with class membership as the independent variable and WIHIC scales as dependent variables, revealed that the eta^2 statistic (the proportion of variance in an environmental scale accounted for by class membership) ranged from 0.07 to 0.15 in Australia and from 0.07 to 0.36 in Taiwan.

The WIHIC was also validated in Singapore (Chionh & Fraser, 1998; Fraser & Chionh, 2000). The Singaporean sample consisted of 2,310 geography and mathematics students from 75 randomly-selected intact Grade 10 classes in 38 schools. Each student responded to the actual and preferred class form of the WIHIC separately for his/her geography classroom and mathematics classroom. When principal components factor analysis with varimax rotation was conducted, it was found that the seven-factor a priori structure of the WIHIC was supported. The internal consistency reliability (Cronbach alpha coefficient) for the actual form of the WIHIC scales ranged from 0.88 to 0.92 for geography and from 0.87 to 0.93 for mathematics using the individual student as the unit of analysis, and ranged from 0.94 to 0.97 for geography and from 0.92 to 0.98 for mathematics using the class mean as the level of analyis. Analyses of variance (ANOVA) with class membership as the independent variable and the WIHIC scales as dependent variables revealed that the eta^2 statistic varied between 0.14 and 0.21 for geography and between 0.11 and 0.29 for mathematics.

The results of the validation from cross-national study in Australia and Taiwan indicated that both the Chinese and English version have a similar seven-factor structure for the WIHIC (Aldridge & Fraser, 2000). This result was supported by the Singapore study. Thus, it can be concluded that the 8-item 7-scale version of the WIHIC is a reliable and valid instrument for use in classroom environment research.

The WIHIC has subsequently been used and validated in a number of countries and in different subject areas. Dorman, Adams and Ferguson (in press) have used the WIHIC questionnaire in Australia, Canada and England. The WIHIC questionnaire has been used successfully in Singapore (Chionh & Fraser, 1998; Khoo & Fraser, 1998), Brunei (Riah & Fraser, 1998), Canada (Zandvliet & Fraser, 1999), the USA (Allen & Fraser, 2002) and Korea (Lee & Fraser, 2001). The WIHIC has also been shown to be reliable when used in a variety of subjects, including geography and mathematics (Chionh & Fraser, 1998), science (Riah & Fraser, 1998) and computing (Khoo & Fraser, 1998).

The versatility and reliability of the WIHIC under a range of circumstances made it appealing to the researcher. Close scrutiny of scales and individual items revealed that, with modification, this instrument would be suitable for assessing the learning environment of university-level computing classes.

3.3.2   *Modification of the WIHIC*

Close scrutiny of the seven scales of the WIHIC (Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity) revealed that, with the exception of the Investigation scale, all other scales were suitable for use at the university level in Indonesia. The Investigation scale was replaced with a scale from the Classroom Environment Scale, which was developed by Rudolf Moos at Stanford University (Fisher & Fraser, 1983; Moos & Trikett, 1974; Trikett & Moos, 1973). Order and Organisation was considered to be appropriate for the local situation in Indonesian universities. Table 3.1 provides the name and a

description of each scale of the WIIHC as used in the present study. A sample item for

each scale is provided in Table 3.2 for the student version and the teacher version.

Table 3.1 Description of Scales in the Indonesian Version of the *What is Happening in this Class*?
(WIHIC) Questionnaire

Scale Name	Scale Description
	The extent to which …
Student Cohesiveness	students know, help and are friendly towards each other.
Teacher Support	the teacher helps, befriends, trusts and is interested in students.
Involvement	students participate actively and attentively in class discussions and activities.
Order and Organisation	Teachers emphasise that students' behave in an orderly, quiet and polite manner, and on the overall organisation of classroom activities.
Task Orientation	it is important to complete activities planned and to stay on the subject matter.
Cooperation	students cooperate with other students, working together and sharing resources.
Equity	students are treated in a fair and equitable manner by the teacher.

Items within the questionnaire were examined to ensure their suitability for university-

level computing classes in Indonesia. In some cases, individual words were changed

(e.g., the word 'teacher' was replaced with the word 'tutor') and, less frequently,

phrases not common in Indonesia were replaced (e.g., "The tutor goes out of his/her

way to help me" was replaced with "The tutor respects me").

The student response sheet was changed from a manual response sheet to an optically-

readable sheet. This format provided the researcher with the opportunity to collect and

enter a large amount of data. Using this particular response format, the only difference was that students marked their responses on a separate sheet using a 2B pencil.

3.3.3   Development of Different Forms

Once the WIHIC had been modified for use in Indonesian computing classes at the university level, the questionnaire was then modified to provide a separate teacher version to allow comparison between tutors' and students' perceptions of the learning environment. Using the student version of the WIHIC, the teacher version was developed. The wording of the student and teacher versions are almost similar. Table 3.2 provides an example of an item in the student and teacher forms for each scale.

Table 3.2   Sample Item for the Student and Teacher Versions for each WIHIC Scale

Scale	Sample Item for Student Version	Sample Item for Teacher Version
Student Cohesiveness	I know other students in this class.	The students know other students in this class.
Teacher Support	The teacher helps me when I have trouble with the work.	I help students when they have trouble with the work.
Involvement	I give my opinion during class discussions.	The students give their opinions during class discussions.
Order and Organisation	The teacher decides which students should work together.	I decide which student should work together.
Task Orientation	I know the goals for this class.	The students know the goals for this class.
Cooperation	I share my books and resources with other students when doing assignments.	The students share their books and resources with other students when doing assignments.
Equity	The teacher gives as much attention to my questions as to other students' questions.	I give as much attention to one students' questions as to other students' questions.

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Each of these versions was then modified to create an actual and a preferred form. The actual form is used to identify students' or teachers' perceptions of the existing learning environment, whereas the preferred form assesses the learning environment that students' and teachers' would prefer. The preferred versions of questionnaires were based on items contained in the actual versions. For example, an item such as "Students of this class know each other" in the actual version was reworded as "Students of this class would know each other" in the preferred version. The general pattern of item wording could be said to be more or less similar for both versions, but the instructions for responding differ slightly. Table 3.3 provides an example of an item for the student actual and preferred forms of the WIHIC. The instructions for each of the questionnaires can be viewed in Appendix 1.

Table 3.3   Sample Item for the Student Actual and Preferred Forms of each WIHIC Scale

Scale	Item for Actual Form	Item for Preferred Form
Student Cohesiveness	I am friendly to members of this class.	I would be friendly to members of this class.
Teacher Support	The teacher goes out of his/her way to help me.	The teacher would go out of his/her way to help me.
Involvement	I discuss ideas in class.	I would discuss ideas in class.
Order and Organisation	I carry out investigations to test my ideas.	I would carry out investigations to test my ideas.
Task Orientation	I do as much as I set out to do.	I would do as much as I set out to do.
Cooperation	I share my books and resources with other students when doing assignments.	I would share my books and resources with other students when doing assignments.
Equity	I am treated the same as other students in this class.	I would be treated the same as other students in this class.

3.3.4 Attitude Scale

To measure students' attitudes towards their computing classes, a modified version of a scale from Fraser's (1981) *Test of Science Related Attitudes* (TOSRA) was used. The scale comprises eight items measuring the extent to which students enjoy, are interested in and look forward to science lessons. An example of an item is, "I enjoy science classes". Items 3, 4 and 7 are scored in reverse. The English and Indonesian versions of the attitude scale, as used in this study, are shown in Appendix 4.

In Fraser's original of the TOSRA, the responses were Strongly Agree, Agree Undecided, Disagree and Strongly Disagree. These were changed, however, to provide the same response format for both instruments to facilitate administration.

The WIHIC, modified for the Indonesian context, and the eight-item attitude scale were then translated into the Indonesian language, as discussed in the following section.

3.3.5 Translation of the WIHIC and Attitude Scale

The questionnaires were translated into the Indonesian language using a rigorous process of back-translation (Brislin, 1970). Each item was translated into Indonesian by the researcher, and then translated back into English by a person not involved in the study. Items of the original English version and the back-translated version then were compared to ensure that translations conveyed the same intentions as the original version. This process involved a number of revisions to the original and translated

items. In some cases, rewording of items was necessary as direct translations were not possible (e.g., for Task Orientation, the item "I know what I am trying to accomplish in this class" was reworded to read "I know what is expected from me in this class").

After several iterations, the Indonesian version of the WIHIC questionnaire was considered to be ready for pilot testing, which is described in the next section.

3.3.6   Pilot Study

A pilot study, with 50 students from 5 classes and their 5 teachers, was conducted to:

- make sure that the modified version of the WIHIC was applicable to the university level in Indonesia;

- ensure that the Indonesian version of the WIHIC was consistent with the English version of the WIHIC;

- check that students' understandings of individual items were consistent with the researchers' understandings;

- provide a guide regarding the amount of time required to administer the questionnaire.

To ensure that the instrument was applicable to the Indonesian context, the Indonesian version of the WIHIC and attitude scale were pilot tested with 50 university computing students and 5 university lecturers. Each person was asked to complete both the actual and preferred form of either the student or teacher version of the

questionnaires. The process involved interviews with university students and lecturers and observations of classes.

To check students' understanding of items and the consistency of the back translation, 50 students from 5 different statistics classes and their teachers were asked to respond to the actual form of both the English and Indonesian version of the questionnaires. On the following day, they repeated the same procedure for the preferred form for both the English and Indonesian versions. Analysis of the responses revealed that both teachers and students had very similar responses for both the English and Indonesian versions. The intention of the interview process based on the questionnaires responses was to obtain first-hand feedback from students and teachers about the readability, comprehensibility and suitability of the questionnaires. On the basis of these interview results, fine-tuning to individual items was made. Where discrepancies were found, interviews with teachers and students were held to help to understand why. For example, the word 'teacher' in Indonesia was translated into 'guru' which is not commonly used at the tertiary level. Therefore, the word was changed to 'dosen', which in English means tutor or lecturer. The interviews revealed that students' understandings of the items were consistent with those of the researcher.

Interviews with teachers and observations of classes were used to ensure that each item of the Indonesian version of the WIHIC was appropriate and suitable to the Indonesian context. Observations took place in all pilot study classes and these

indicated that student responses tended to reflect practices that were taking place in the classroom.

During the study, it appeared that completing the Indonesian version of the questionnaire took students around 4 minutes, while for the English version took students around 9 minutes to complete each questionnaire.

Appendix 1 provides the final actual and preferred versions of the WIHIC questionnaire in English. Appendices 2 and 3 provide the final version for actual and preferred versions of the WIHIC questionnaire modified for Statistics (Appendix 2) and Linear Algebra (Appendix 3) classes (in Indonesian), as used in the present study.

3.4   Sample for the Main Study

The present study was largely quantitative in nature using questionnaire surveys as the main form of data collection. The sample was drawn from several campuses of one private university, one located in Jakarta and five located in areas around Depok. Questionnaires were administered to approximately 2,500 students enrolled in the third semester of their computing course. On the whole, these students were aged between 19 and 20 years and had earned an average of 40 credits towards their degree. 90% of the sample consisted of students from Central and South Jakarta, Depok and the Bogor area. Because of the relatively high tuition fees charged by this university, it is likely that the sample is made up of students mainly from middle and upper class

families. As many students are from cities all over Indonesia (not just Jakarta), it is likely that they are from reasonably wealthy families and can afford, not only tuition fees, but also the high cost of living and transportation in Jakarta.

2,498 students were drawn from 50 classes, of which 24 were statistics classes and 26 were linear algebra classes. A total of 1,245 students were attending statistics classes and 1,253 were attending linear algebra classes. The researcher selected statistics and linear algebra classes as they are compulsory subjects for all students wishing to enrol in computer systems courses. Although the selection of individual classes within these subjects was made on the bases of the availability and willingness of the teachers, there is no reason to suspect that the sample is unrepresentative of the population of students.

3. 5   Data Collection for the Main Study

Data for the main study were collected using the *What is Happening in this Class?* (WIHIC) questionnaire to assess students' perceptions of the learning environment at the university level in Indonesia. As one of the major purposes of the present study was to determine whether there was a relationship between students' perceptions of the learning environment and student cognitive and affective outcomes, data were also collected using an 8-item attitude scale, modified from the Test of Science Related Attitudes (TOSRA, Fraser, 1981) to assess students' attitudes towards their university classes (either statistics or linear algebra). The university database was used to access

details concerning students' course scores for the statistics or linear algebra courses. It was important to collect data mid-semester to ensure that the responses could be used alongside the end-of-semester scores recorded on the university database.

Organisation of the administration of questionnaires to 2,498 students and 50 teachers was based on the results of the pilot test, which indicated that questionnaires took an average of 4 minutes for students to complete. To maximise the quality of the data-collection process, for the most part, the researcher administered the questionnaires personally. However, there were occasions when, logistically, this was not possible. In these cases, a research assistant, cognisant of the procedures, administered the questionnaires on the researcher's behalf.

Prior to administration of the questionnaires, the researcher provided a brief explanation of the aims and expected outcomes of the research. The students and tutors were told that completion of the questionnaire was purely voluntary and that they would not be disadvantaged in any way should they choose not to respond. Students were informed of the confidentiality involved in the study, but were asked to quote an identification number to enable matching, for the purposes of statistical analysis, between actual and preferred questionnaires and information extracted from the university database. Additional instructions, related to the use of the optical mark reader forms, were also given prior to the administration. The entire process took around 15 minutes, after which teachers were able to resume their normal activities.

In all cases, students and teachers were asked to complete the actual form of the questionnaire during the first sitting. Two weeks after administration of the actual form, a similar process was used to collect data using the preferred form. Each teacher was provided with feedback based on the actual and preferred responses of their students. However, as these were not the focus of the present study, they are not reported. In addition, all students and teachers involved in the study were presented with a small token of appreciation.

At the end of the semester in which data collection took place, the student's final score for their selected topic (statistics and linear algebra) were taken from the university data-base.

3.6   Choice of Level of Statistical Analysis

In learning environment research that makes use of high inference measures as a method of gathering data, the choice of unit of analysis is crucial for two reasons. First, from a theoretical perspective, each person has a unique view of the environment (private beta press) (Stern, Stein & Bloom, 1956), which could differ from the shared view of the environment (consensual beta press) of the group as a whole. Therefore the researcher can choose as the unit of analysis either individual perceptions or group shared perceptions of classroom environment. Clearly, if a study focuses on individual students, the appropriate unit of analysis usually would be the individual student's scores. However, if the study focuses on class characteristics or

teacher effects, then the class mean usually would be the preferred unit of analysis (which is obtained by averaging the individual students' score within the class). Furthermore, Sirotnik (1980) suggested that the choice of unit is also important at the time of validating scales.

The second reason why the choice of unit of analysis is critical is from a statistical perspective. Fraser (1984) observed that the choice of unit of analysis can lead to several interpretations. Measures having the same operational definition can have different interpretations with different levels of aggregation. Relationships obtained using one unit of analysis could have different magnitudes or even signs from relationships obtained using another unit. The use of the individual as the unit of analysis when the class is the primary sampling unit violates the requirement of independence of observations and calls into question the results of statistical significance tests. Finally, the use of different units of analysis could be testing hypotheses that are conceptually different. In past classroom environment research, often two units of analysis have been employed within the same study so that comparisons can be made with previous studies which involved individual scores or class means as the unit of analysis (Fraser, Giddings & McRobbie, 1995; Khoo & Fraser, 1998; McRobbie & Fraser, 1993; Waldrip & Wong, 1996).

3.7   Data Analysis

Data collected during the present study were analysed to answer the research questions outlined in Chapter 1. This section described the analysis of the data under the following headings:

- Validation of the Indonesian Version of the WIHIC (Section 3.7.1)

- Descriptive Analysis (Section 3.7.2)

- Difference between Perceptions of Actual and Preferred Environment (Section 3.7.3)

- Associations between Student Outcomes and Classroom Environment (Section 3.7.4)

- Sex differences in Perceptions of University Learning Environments (Section 3.7.5)

- Differences Between Statistics and Linear Algebra Classroom Environments (Section 3.7.6)

3.7.1   Validation of the Indonesian Version of the WIHIC

Research Question #1

Is it possible to develop and validate an Indonesian-language version of the What is Happening in this Class? (WIHIC) questionnaire that has been modified to suit university computing students?

It was necessary to determine whether the Indonesian version of the WIHIC questionnaire, modified to ensure its suitability at the university level and translated into Indonesian for the present study, was valid and reliable. To do this, a number of statistical analyses were conducted. Students' responses were analysed to furnish evidence regarding the factor structure, scale internal consistency reliability, and each scale's ability to differentiate between students in different classrooms. Both factor and item analyses were conducted. A principal components factor analysis with varimax rotation was used to determine whether all of the items from the six scales of the original WIHIC (Student Cohesiveness, Teacher Support, Involvement, Task Orientation, Cooperation and Equity) and single scale from the CUCEI (Order and Organisation) formed seven independent measures of the psychosocial learning environment. That is, purpose of the factor analysis was to ascertain whether each item loaded on its *a priori* factor and no other (see results in Chapter 4).

The Cronbach alpha coefficient was computed for each scale of the WIHIC as an estimate of the internal consistency reliability. The discriminant validity of each scale was determined by calculating the mean correlation of each scale with the other scales. These analyses were performed at both the individual student and the class levels (see Section 3.6).

An ANOVA (with class membership as the independent variable) was used to determine the ability of each WIHIC scale to differentiate between classes. The eta^2

statistic (the ratio of 'between' to 'total' sums of squares) was used to describe the proportion of variance in WIHIC scale scores accounted for by class membership.

3.7.2 Descriptive Analysis

To describe the learning environment of university classes in Indonesia, descriptive analysis, based on students' and teachers' responses to the actual and preferred forms of the environment questionnaire, were used. The average item mean, or the scale mean divided by the number of items in a scale, was used as the basis for fair comparison between different scales of the WIHIC which could contain differing numbers of item. Gaphical representations of students' average perceptions of their learning environment for the sample as a whole were used to describe differences.

3.7.3 Differences Between Student Perceptions of Actual and Preferred Learning Environment

Research Question #2:

Are there differences between students' perceptions of actual and preferred learning environments?

The use of separate actual and preferred learning environment instruments has permitted the investigation of differences between students in their perceptions of the same actual classroom environment and of differences between the actual environment and that preferred by students. Past research into differences between forms has found that, generally, students prefer a more positive classroom

environment than is actually present (Fisher & Fraser, 1983). In the past, person-environment fit studies (Fraser & Fisher, 1983c, 1983d) have found that, if the discrepancy between students actual and preferred learning environments are reduced, then student outcomes are likely to improve.

The present study examined student perceptions of the actual and preferred learning environment in their university-level computing courses. To investigate the difference between students' perceptions of the actual and preferred learning environment, students' responses to the two different forms were matched. These two sets of responses were then used to perform a multivariate analysis of variance (MANOVA) with repeated measures, followed by t tests for paired samples to determine whether differences were statistically significant for each WIHIC scale.

3.7.4   Associations Between Student Outcomes and the Learning Environment

Research Question #3

> *Is there a relationship between student perceptions of the learning environment and the student outcomes of:*
>
> a) *mathematics achievement?*
>
> b) *attitudes?*

One of the strongest traditions in past classroom environment research has involved investigation of associations between students' cognitive and affective learning outcomes and their perceptions of the learning environment (Fraser, 1998a).

Numerous studies have shown that students' perceptions of the learning environment can account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics. In the present study, associations between student outcomes (student attitudes and course achievement score) and aspects of the learning environment as assessed with the WIHIC were investigated. To investigate associations between student outcomes and the nature of the learning environment, simple correlations, multiple correlations and standardised regression coefficients were calculated at both the student and class levels.

3.7.5   *Sex Differences in Perceptions of University Learning Environments*

Over the past two decades, numerous researchers have studied the topic of gender differences in education (Parker, Rennie & Fraser, 1996). To examine sex differences in classroom environment perceptions in the present study (Research Question 4a), data were analysed with a one-way MANOVA for repeated measures and using the within-class gender subgroup mean as the unit of analysis. Sex was the repeated measures factor, and the WIHIC scales formed the set of dependent variables. Because the multivariate test produced statistically significant results, a *t* test for correlated samples was used for each individual WIHIC scale to investigate whether males and females had different perceptions of their classrooms. As males and females are not found in equal number in every class, the within-class gender mean was chosen as the unit of analysis. The within-class gender mean provides a matched pair of means – one within-class mean for males and one within-class mean for girls.

This reduces confounding in that, for each group of boys within a particular classroom, there is a corresponding group of girls in the same class.

3.7.6   Differences Between Statistics and Linear Algebra Classroom Environments

The final research question (Research Question 4b) involves differences between the learning environments of statistics and lenear algebra classes. Multivariate analysis of variance (MANOVA) was performed in order to investigate department differences in environment dimensions as assessed by the WIHIC.

3.8   Summary

The aims of the present study were to investigate students' perceptions of the learning environment at the university level in Indonesia. The present study is one of only a few learning environment studies to be conducted at the university level in Indonesia. As such, the study was largely an exploratory one, lending itself to more quantitative research methods.

After careful consideration of a number of learning environment questionnaires, the researcher selected and modified a widely-applicable perceptual measure, namely, the What is Happening in this Class? (WIHIC). In the past, the WIHIC has been validated and used in research involving several countries and across a number of subject areas. The versatility of the WIHIC, coupled with its validity and reliability established in past research, provided a good starting point in the present study.

The WIHIC was adapted to suit the university-level and modified slightly to suit the Indonesian context. One scale of the WIHIC, Investigation, was removed as it was considered irrelevant for university classes in Indonesia and replaced with a more relevant scale from the Classroom Environmental Scale (CES), namely, Order and Organisation. Individual items and phrases were closely scrutinised for suitability prior to translating the WIHIC into the Indonesian language. A rigorous process of back translation was used in which the English version was translated into Indonesian and then translated back into English by an independent party, allowing comparison of the two English versions for equivalence in meaning.

An important next step in the development of the Indonesian version of the WIHIC was a pilot test that included 50 university-level computing students and 5 university lecturers. In the first place, the pilot study was used to examine how long it took students to complete each version of the questionnaire and to ensure that instructions were clear. In the second place, the researcher wanted to ensure that individual items of the WIHIC were clear and unambiguous and that respondents comprehended them in the way in which the researcher intended. To do this, the researcher asked respondents to mark items about which they were unclear and, during the interviews that followed, discussed these difficulties. In addition, the researcher asked respondents to explain why they had responded to items in a particular way and, where possible, provide examples. University lecturers were asked about the suitability of items in their teaching situation. Based on the pilot test, it was found that

students took approximately four minutes to complete each version of the questionnaire and some minor revisions to wording were made in cases where the meanings appeared ambiguous.

The Indonesian version was administered to 2,498 computing students in 50 classes, 24 of which were statistics classes and 26 of which were linear algebra classes. Administration took place mid-semester, with students and teachers responding to the actual version two weeks prior to responding to the preferred version. In most cases, the researcher administered the questionnaires personally to ensure the confidentiality of responses. In cases in which this was not logistically possible, a research assistant was trained and administered the questionnaires in the researcher's place.

To enable the researcher to examine associations between perceptions of the learning environment and student outcomes, information was also gathered from the university database regarding students' course achievement score at the end of the semester. As well, information about student attitudes was gathered by administering a questionnaire that was adapted from the *Test of Science-Related Attitudes* and translated into Indonesian.

To permit the comparison of results with prior research in the field of learning environments, two units of analysis were used (the individual and the class mean) for most analyses in the present study.

The data collected from the 2,498 students in 50 classes were analysed to answer the research questions outlined in Chapter 1. A major thrust of the present study was to explore the reliability and validity of the WIHIC for use in Indonesia at the university level. To determine whether the Indonesian version of the WIHIC was valid and reliable, the factor structure, scale internal consistency reliability and ability to differentiate between students in different classrooms were examined.

Another research question involved examining differences between students' perceptions of actual and preferred learning environment. Data were analysed using MANOVA with repeated measures and *t* tests for paired samples.

A further research question involved outcome-environment relationships. To examine whether there is a relationship between student attitudes and achievement and their perceptions of the learning environment, simple correlations, multiple correlations and standardised regression coefficients were calculated.

Another research question involved examining sex differences in students' perceptions of the university environment and attitudes towards their computing courses. Data were analysed with a one-way MANOVA for repeated measures and using the within-class gender subgroup mean as the unit of analysis. The within-class gender subgroup mean was used as the unit of analysis to reduce confounding so that, for each group of females within a particular classroom, there was a corresponding group of males in the same classroom.

The following chapter reports the findings and results for the analyses of the data.

CHAPTER 4

ANALYSES AND RESULTS

4.1   Introduction

This chapter is devoted to describing the findings of the present study. Data for the present study were collected at a private university located in Indonesia. During the pilot project and data-collecting process, formal and informal classroom observations were conducted. In addition, the researcher has 20 years of teaching experience at the university level and has been the president of the university for the past 12 years. Based on the researcher's experience and these observations, a general description of linear algebra and statistics classes at Gunadarma University has been compiled.

Gunadarma University is based at eight campuses (A to H). Lectures in statistics and linear algebra run at parallel times and can be timetabled at any time between 7:30am and 9:30 pm, depending on the availability of classrooms, lecturers and students. For each 60-minute session, students are awarded 1 credit. On the whole, each lecture usually lasts for 120 minutes.

Students whom have registered as participants in a particular subject undertake to attend all lectures, complete assignments and sit a mid-semester and end-of-semester examination.

Statistics and linear algebra are both compulsory subjects that are each conducted over one semester. Students are expected to attend three hours of classroom lectures, three hours of small-group discussions and three hours preparing assignments each week. To be eligible to sit the mid-semester and final examinations, students must attend at least 70% of lectures.

Classrooms at Gunadarma University are generally large (approximately 8 x13m) and are arranged to provide seating for around 80 students. Generally, however, student numbers in each class rarely exceed 50. Each classroom has a stage to elevate the teacher and a podium. Classrooms are equipped with central sound systems to ensure that students are able to hear the lecture clearly from any position in the room.

Lectures at the university pride themselves on starting classes promptly. Lessons often begin with a quiz to test students' understanding of the previous lesson. Once the quiz is finished, lecturers generally provide an opportunity for students to raise questions, which are often related to their assignments or to the previous lesson. Once the teacher starts to teach the topic for the day, the lesson becomes much more teacher-centred with few opportunities for students to become involved. The teacher generally stands at the front of the class and uses the microphone provided to ensure that she or he is heard. The overhead projector is the main teaching aide used by the teachers and, as a result, dictates where the teacher will stand. The lesson will generally conclude with

another quiz to help the teacher to assess whether the students have grasped the basic concepts.

Departments generally provide teachers with minimal teaching materials that they are expected to supplement. A major problem experienced at the university has been ensuring that teachers attend classes. To assist with this, the university provides an incentive and monitoring system that is implemented by the staff.

Teaching salaries in Indonesia are generally low and many teachers are known to 'moonlight' or take on additional work at other institutions to boost their take-home pay. Gunadarma University has recognised this as a significant problem and has attempted to address this situation. Staff members of Gunadarma University are employed on the understanding that they do not moonlight in other institutions, although they may teach with in Gunadarma additional courses up to 40 credits a week in faculties other than the one in which they are working. This strategy has become known as resource sharing. In return, staff members are provided with additional facilities such as a car or housing allowance. To provide an incentive to teachers to attend their lectures, teachers are given a variable salary. If they are present for 80-100 % of their time in their classes (averaged over a month), then they get an additional 70% their salary. This strategy is effective in terms of ensuring that the lecturers stay in their classroom during their timetabled lessons.

The study made use of a widely-applicable questionnaire, the *What is Happening in this Class?* (WIHIC), to assess students' perceptions of the learning environment, and an eight-item scale to assess students' attitudes towards their class. The questionnaires, originally developed in English, were modified to suit the university level and, particularly, the Indonesian context. After their translation into the Indonesian language, using a rigorous process of back translation (described in Chapter 3), actual and preferred versions of the WIHIC were developed. The WIHIC and attitude scale were administered to 2,498 students attending a computing course in 50 classes. These classes were all selected from the mathematics components of the computing course, 24 of which were statistics classes and 26 of which were linear algebra classes.

Analyses of the data collected using these instruments were used to answer the research questions, which were delineated in Section 1.5. The findings are reported in this chapter under the following headings:

4.2   Validity and Reliability of the WIHIC and Attitude Scale;

4.3   Associations between the Learning Environment and Student Outcomes;

4.4   Differences between Students' Perceptions of Actual and Preferred Learning Environment;

4.5   Gender Differences in Learning Environment Perceptions and Attitudes; and

4.6   Differences between Students' Learning Environment and Attitudes Score in Statistics and Linear Algebra Classes.

4.2   Validity and Reliability of the Indonesian Version of the WIHIC

The *What is Happening in this Class?* (WIHIC) questionnaire was originally developed in English. Because of the widely-applicable nature of the instrument and the consistent results in past studies throughout Asia (Aldridge & Fraser, 2000; Fraser & Chionh, 2000; Lee & Fraser, 2001), the present study sought to assess students' perceptions of the learning environment using the WIHIC. Before the instrument could be used in the present study, it was important to ensure the suitability of the WIHIC for use at the university level. Modifications also were made to the instrument to make certain that it was suitable for the Indonesian context. The WIHIC was then translated into Indonesian and pilot tested with a group of 50 students and five lecturers.

For the purpose of the present study, a 56-item version of the WIHIC was used. With the exception of the Investigation scale, which was replaced with the Order and Organisation scale from another questionnaire, all items were retained for this study.

Before data collected with the Indonesian version of the WIHIC could be used with confidence in the present study, it was important to ensure that the original structure of the instrument holds up empirically. The data collected from 2,498 students, therefore, were analysed to provide statistical validation to answer the first research question:

Research Question #1

Is it possible to develop and validate an Indonesian-language version of the What is Happening in this Class? (WIHIC) questionnaire that has been modified to suit university computing students?

Analyses of the data were used to determine the validity and reliability of the instruments including: factor structure (Section 4.2.1); internal consistency reliability (Section 4.2.2); ability to differentiate between classrooms (Section 4.2.3); and discriminant validity (mean correlation of a scale with the other scales) (Section 4.2.4). In the last subsection (Section 4.2.5), the reliability of the Indonesian version of the student attitude scale is reported.

4.2.1   Factor Structure of WIHIC

As a first step, item and factor analyses were conducted to identify those items whose removal would improve the internal consistency reliability and factorial validity of the WIHIC scales. Item analysis of the 56 items showed that all the items in the seven environment scales had sizeable item-remainder correlations (i.e. correlations between a certain item and the rest of the scale excluding that item).

A principal components factor analysis with varimax rotation was used to examine the internal structure of the 56 items of the WIHIC and to generate orthogonal factors for the data set. Table 4.1 shows the factor loadings, percentage of variance and

eigenvalue for each scale of the actual form of the WIHIC questionnaire for the whole sample of 2,498 students using the individual student as the unit of analysis.

There are 392 possible loadings in Table 4.1 (56 items x 7 scales = 392). In only four of the possible 392 cases is the original seven-factor structure not replicated. Items 6, 9, 26 and 34 each has a loading of less than 0.40 on its own scale.

Therefore, the *a priori* seven-factor structure of the final version of the WIHIC questionnaire is replicated, with nearly all items having a factor loading of at least 0.40 on their *a priori* scale and no other scale (see Table 4.1). Previous studies conducted in Singapore, Australia and Taiwan have reported similar factor structures for the WIHIC questionnaire (Aldridge & Fraser, 2000; Fraser & Chionh, 2000), thus further supporting this factor structure. The percentage of variance varies from 1.8% to 18.5% for different scales, with the total variance accounted for being 38.2%. Eigenvalues vary from 1.2 to 10.0 for the different scales. Based on the factor and items analysis, Items 8 and 25 were removed in subsequent analysis, leaving a total of 54 of the 56 items.

Table 4.1   Factor Loadings for the Actual Form of the Modified WIHIC for the Whole Sample

Item No.	Factor Loading						
	Student Cohesiveness	Teacher Support	Involvement	Order and Organisation	Task Orientation	Cooperation	Equity
1	0.60						
2	0.45						
3	0.57						
4	0.46						
5	0.41						
6	–						
7	0.53						
9		–					
10		0.54					
11		0.53					
12		0.47					
13		0.47					
14		0.63					
15		0.43					
16		0.42					
17			0.55				
18			0.66				
19			0.44				
20			0.62				
21			0.46				
22			0.57				
23			0.47				
24			0.61				
26				–			
27				0.45			
28				0.49			
29				0.61			
30				0.49			
31				0.40			
32				0.44			
33					0.40		
34					-		
35					0.55		
36					0.54		
37					0.73		
38					0.54		
39					0.50		
40					0.54		
41						0.50	
42						0.50	
43						0.46	
44						0.60	
45						0.63	
46						0.64	
47						0.69	
48						0.61	
49							0.37
50							0.66
51							0.77
52							0.67
53							0.71
54							0.74
55							0.58
56							0.75
% Variance	2.1	2.7	4.5	1.8	3.3	5.3	18.5
Eigenvalue	1.15	1.48	2.45	0.98	1.80	2.89	10.00

Loadings smaller than 0.40 omitted.

N=2,498 students in 50 classes.

Items 8 and 25 were omitted

Four further factor analyses similar to those reported in Table 4.1 for the actual form for the whole sample were repeated separately for the actual and preferred forms and separately for statistics and linear algebra students. Table 4.2 shows the factor analysis results separately for (1) statistics students' perceptions of the actual environment, (2) statistics students' perceptions of the preferred environment, (3) linear algebra students' perceptions of the actual environment and (4) linear algebra students' perceptions of the preferred environment for all 56 items in the WIHIC. The sample sizes are 1,245 students in 24 statistics classes and 1,253 students in 26 linear algebra classes.

The results in Table 4.2 provide further strong support for the factor structure of the Indonesian version of the WIHIC in either its actual or preferred form and either with statistics of linear algebra classes. Of the possible 1,568 loadings in Table 4.2 (56 items x 7 scales x 4 samples), there are only 16 cases (1%) for which the factor loading is not at least 0.40 on its own scale and smaller than 0.40 on all other scales.

Table 4.2 Factor Loadings for the Actual and Preferred Forms of the Modified WIHIC for the Statistics and Linear Algebra Classes

Factor Loading

Item No.	Student Cohesiveness				Teacher Support				Involvement				Order & Organisation				Task Orientation				Cooperation				Equity			
	Stat Act	Stat Pref	Alg Act	Alg Pref	Stat Act	Stat Pref	Alg Act	Alg Pref	Stat Act	Stat Pref	Alg Act	Alg Pref	Stat Act	Stat Pref	Alg Act	Alg Pref	Stat Act	Stat Pref	Alg Act	Alg Pref	Stat Act	Stat Pref	Alg Act	Alg Pref	Stat Act	Stat Pref	Alg Act	Alg Pref
1	0.59	0.59	0.63	0.73																								
2	0.62	0.67	-	0.62																								
3	0.70	0.74	0.60	0.61																								
4	0.61	0.69	0.51	0.75																								
5	0.52	0.62	-	0.68																								
6	-	0.57	-	0.46																								
7	0.60	0.57	0.52	0.54																								
8	0.40	0.50	-	0.46																								
9					-	0.61	-	0.59																				
10					0.63	0.70	0.43	0.77																				
11					0.56	0.62	0.54	0.70																				
12					0.63	0.61	-	0.69																				
13					0.48	0.77	0.51	0.73																				
14					0.70	0.82	0.61	0.76																				
15					0.57	0.72	0.60	0.72																				
16					0.50	0.59	-	0.53																				
17									0.63	0.62	0.61	0.52																
18									0.64	0.44	0.71	0.55																
19									0.59	0.55	0.49	0.55																
20									0.72	0.42	0.62	0.45																
21									0.50	0.55	0.62	0.61																
22									0.58	0.55	0.62	0.73																
23									0.50	0.56	0.53	0.69																
24									0.52	0.42	0.68	0.68																
25													-	0.44	0.49	0.73												
26													-	0.41	-	0.70												
27													0.58	0.74	0.55	0.54												
28													0.42	0.62	0.66	0.56												
29													0.65	0.75	0.74	0.55												
30													0.60	0.41	0.57	0.64												
31													0.41	0.54	0.44	0.44												
32													0.68	0.59	-	-												

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
33																	0.51	0.44	-	0.65								
34																	0.44	0.54	0.48	0.47								
35																	0.60	0.51	0.67	0.49								
36																	0.60	0.70	0.54	0.53								
37																	0.69	0.73	0.78	0.43								
38																	0.51	0.55	0.55	-								
39																	0.59	0.64	0.51	0.44								
40																	0.67	0.60	0.64	0.47								
41																					0.62	0.58	0.65	0.71				
42																					0.61	0.59	0.61	0.72				
43																					0.45	0.50	0.55	0.42				
44																					0.54	0.60	0.73	0.53				
45																					0.67	0.66	0.64	0.58				
46																					0.67	0.68	0.67	0.68				
47																					0.56	0.64	0.75	0.50				
48																					0.46	0.64	0.71	0.68				
49																									0.71	0.57	0.60	0.81
50																									0.78	0.72	0.71	0.77
51																									0.80	0.82	0.79	0.77
52																									0.56	0.82	0.72	0.82
53																									0.57	0.79	0.80	0.78
54																									0.69	0.69	0.77	0.79
55																									0.77	0.69	0.56	0.68
56																									0.79	0.70	0.78	0.77
% variance	21.46	38.11	18.38	29.34	6.18	6.71	7.04	8.05	33.05	4.62	6.33	5.01	4.41	4.31	4.58	4.62	3.98	3.10	4.37	3.27	3.42	2.88	3.62	3.13	3.37	2.61	3.21	3.09
Eigen-value	12.02	21.34	10.29	16.43	3.46	3.76	3.94	4.51	3.03	2.59	3.54	2.81	2.47	2.41	2.56	2.59	2.23	1.73	2.44	1.83	1.91	1.61	2.03	1.75	1.89	1.46	1.80	1.73

Loadings smaller than 0.4 omitted.
 N= 1,245 students in 24 statistics classes and 1,253 students in 26 linear algebra classes

4.2.2 *Internal Consistency Reliability of WIHIC*

The internal consistency reliability was used to indicate whether each item in a scale assesses a similar construct. The Cronbach alpha reliability coefficient was used as an index of scale internal consistency. Table 4.3 reports the Cronbach alpha coefficient of each of the seven scales of the actual form for the WIHIC for two units of analysis (individual and class mean) for the whole sample. The scale reliability estimates range from 0.65 to 0.87 for the individual as the unit of analysis and from 0.68 to 0.92 for the class mean as the unit of analysis. These internal consistency indices are comparable to those obtained when the WIHIC was used with an Australian sample (Fraser, Fisher & McRobbie, 1996), which ranged from 0.67 to 0.88.

4.2.3 *Ability of WIHIC to Differentiate Between Classrooms*

As further evidence of the validity of the Indonesian version of the learning environment instrument, a one-way ANOVA was used to indicate whether each scale of the questionnaire was able to differentiate significantly between the perceptions of students in different classes. The results reported in Table 4.3 suggest that only the Teacher Support and Task Orientation scales were able to do so. The eta^2 statistic (an estimate of the strength of association between class membership and the dependent variable) ranged from 0.02 to 0.05, and was statistically significant for two scales. On the whole, these figures are lower than those for the original WIHIC (Fraser, Fisher & McRobbie, 1996), which ranged from 0.18 to 0.35 for high school science classes. This could be due to the nature of university classrooms, which could be more uniform than high school classrooms.

Table 4.3   Internal Consistency Reliability (Cronbach Alpha Coefficient) Discriminant Validity (Mean Correlation with other Scales) and Ability to Differentiate Between Classrooms (ANOVA Results) for Two Units of Analysis for the Modified WIHIC

WIHIC Scale	No of Items	Unit of Analysis	Alpha Reliability		Discriminant Validity		ANOVA Eta^2
			Actual	Preferred	Actual	Preferred	
Student Cohesiveness	7	Individual	0.74	0.85	0.37	0.49	0.02
		Class Mean	0.68	0.93	0.55	0.79	
Teacher Support	8	Individual	0.77	0.91	0.37	0.53	0.05*
		Class Mean	0.92	0.98	0.67	0.87	
Involvement	8	Individual	0.83	0.89	0.38	0.55	0.03
		Class Mean	0.86	0.97	0.63	0.83	
Order and Organisation	7	Individual	0.65	0.72	0.24	0.51	0.02
		Class Mean	0.64	0.80	0.44	0.86	
Task Orientation	8	Individual	0.79	0.87	0.35	0.57	0.03*
		Class Mean	0.86	0.95	0.44	0.75	
Cooperation	8	Individual	0.85	0.91	0.35	0.58	0.03
		Class Mean	0.84	0.95	0.61	0.82	
Equity	8	Individual	0.87	0.94	0.32	0.53	0.05
		Class Mean	0.92	0.96	0.72	0.84	

* $p < 0.05$
The sample consisted of 2,498 students in 50 classes.
The eta^2 statistic (which is the ratio of 'between' to 'total' sums of squares) represents the proportion of variance explained by class membership.

4.2.4   Discriminant Validity of WIHIC

Finally, the scale intercorrelations were examined to check discriminant validity (i.e. whether each scale assesses a separate construct). The mean correlation of a scale with other scales was used as a convenient index of discriminant validity (see Table 4.3). For the actual form, the mean correlation of a scale with other scales ranged between 0.24 and 0.37 for the individual as the unit of analysis and between and 0.44 and 0.72 for the class mean as the unit of analysis. For the preferred form, the mean correlation of a scale

with other scales ranged between 0.14 and 0.56 for the individual as the unit of analysis and between 0.79 and 0.87 for the class mean as the unit of analysis. The results suggest that raw scores on scales in the Indonesian version of the WIHIC questionnaire measure distinct, if somewhat overlapping, aspects of the learning environment. However, the factor analysis results support the independence of factor scores on the seven WIHIC scales.

4.2.5   *Reliability of the Student Attitude Scale*

The internal consistency reliability for the Indonesian version of the Attitude scale is 0.77 with the individual as the unit of analysis and 0.87 with the class mean as the unit of analysis. Item analysis showed that each of the eight items in this scale had a sizeable and positive item-remainder correlation.

4.3   Associations Between the Learning Environment and Student Outcomes

This section reports the strength and statistical significance of associations between students' perceptions of the learning environment and student outcomes. Analyses involving simple correlations, multiple regression and multiple correlations were used to answer the third research question:

Research Question #3

> *Is there a relationship between student perceptions of the learning*
>
> *environment and the student outcomes of:*
>
>   *a) mathematics achievement?*
>
>   *b) attitudes?*

All students were selected from mathematics classes in a computing course (either statistics or linear algebra). Their achievement score at the end of this course, obtained from the University's database, was used as a measure of achievement. Also, attitude scale was used as a student outcome measure. Simple correlation and multiple regression analyses, for two units of analysis (the individual student and the class mean), were used to determine whether associations exist between students' perceptions of the learning environment and each student outcome measure.

The results of the simple correlation analysis (reported in Table 4.4) suggest a statistically significant ($p<0.01$) association between students' mathematics achievement and four of the seven learning environment scales with the individual as the unit of analysis, namely, Student Cohesiveness, Order and Organisation, Task Orientation and Equity. Five of the seven scales have a statistically significant ($p<0.01$) simple correlation with mathematics achievement with the class mean as the unit of analysis: Teacher Support, Involvement, Task Orientation, Cooperation and Equity.

Table 4.4   Simple Correlation and Multiple Regression Analyses for Associations Between Two Student Outcomes and Scores on the Modified WIHIC for Two Units of Analysis

Scale	Unit of Analysis	Mathematics Score		Student Attitude	
		r	β	r	β
Student Cohesiveness	Individual	0.05**	0.07**	0.37**	0.06**
	Class Mean	0.12	-0.08	0.22	-0.30**
Teacher Support	Individual	-0.04	-0.10**	0.37**	0.09**
	Class Mean	0.59**	-0.15	0.65**	-0.06
Involvement	Individual	0.03	0.06*	0.41**	0.19**
	Class Mean	0.81**	1.04**	0.80**	0.46**
Order and Organisation	Individual	-0.05**	-0.04*	0.20**	-0.04
	Class Mean	0.12	-0.33	0.34	-0.01*
Task Orientation	Individual	-0.07**	-0.12**	0.56**	0.43**
	Class Mean	0.47**	-0.07	0.64**	-0.28
Cooperation	Individual	0.03	0.02	0.29**	0.01
	Class Mean	0.55**	0.08	0.64**	0.01
Equity	Individual	0.11**	0.13**	0.31**	0.04*
	Class Mean	0.56**	0.12	0.82**	0.93**
Multiple Correlation (R)	Individual		0.19**		0.62**
	Class Mean		0.88**		0.92**

*$p<0.05$
**$p<0.01$

N=2,498 students in 50 classes

The results of the simple correlation analysis in Table 4.5 also suggest a statistically significant ($p<0.01$) and positive association between students' attitudes and all seven scales of the learning environment instrument with the individual as the unit of analysis. With the class mean as the unit of analysis, there are statistically significant ($p<0.05$) simple correlations between student attitudes and all learning environment scales with the exception of Student Cohesiveness.

Multiple correlation analysis was undertaken using the set of seven scales of the WIHIC questionnaire as independent variables and either mathematics achievement or attitude as the dependent variable. This analysis provides more parsimonious information about relationships between correlated independent variables and reduces the risk of a Type I error often linked with simple correlation analysis. A multiple regression analysis was performed separately using the individual student and class mean as the unit of analysis.

The results for the multiple regression analysis (β), using the individual as the unit of analysis (reported in Table 4.4), indicate that all of the WIHIC scales except Cooperation uniquely account for a significant ($p<0.05$) proportion of the variance in achievement. Using the class mean as the unit of analysis, two of the seven learning environment scales account for significant ($p<0.05$) amount of variance in students' achievement beyond that attributable to other environment scales; these are Involvement and Order and Organisation. The multiple correlation (R) between students' perceptions of the learning environment and students' mathematics achievement is 0.19 for the individual as the unit of analysis and 0.88 for the class mean as the unit of analysis, and is statistically significant in both cases ($p<0.01$). Involvement and Equity appear to be particularly strong and consistent predictors of student achievement.

For the attitude outcome, the multiple regression analysis using the individual as the unit of analysis (reported in Table 4.4) indicates that all learning environment scales except Cooperation uniquely account for a significant ($p<0.05$) proportion of variance in attitude beyond that attributable to other environment scales. Using the class mean as the

unit of analysis, three of the seven learning environment scales account for a significant (p<0.01) proportion of attitude variation, namely, Student Cohesiveness, Involvement and Equity. The multiple correlation (R) between students' perceptions of the learning environment and students' attitudes is 0.62 for the individual as the unit of analysis and 0.92 for the class mean as the unit of analysis and is statistically significant for both (p<0.01). It would appear from these results that students' attitudes are most strongly related to the extent to which classes emphasise Teacher Support, Involvement, Task Orientation and Equity.

These results replicate those of past studies in numerous countries (Fraser, 1998a) and generally suggest that the learning environment perceived by students is related to their achievement and especially their attitudes. Although most associations between environment and outcomes are positive in Table 4.4, the presence of some negative relationships suggests the desirability of replicating the present study and employing qualitative methods to seek explanations for any replicated negative relationships in future studies.

4.4 Differences Between Students' Perceptions of Actual and Preferred Learning Environment

During the collection of data, all students completed a questionnaire to determine their perceptions of their actual classroom environment. One week later, these same students

also completed a parallel questionnaire related to their preferred or ideal classroom environment. The actual form was used to assess students' perceptions of the existing learning environment, whilst the preferred form was used to assess the type of learning environment that students would prefer. By using of these two forms of the *What is Happening in this Class?* (WIHIC) questionnaire, the researcher was able to determine whether differences exist in students' perceptions to answer the second research question:

Research Question #2:

Are there differences between students' perceptions of actual and preferred

learning environments?

To examine differences between students' perceptions of the actual and preferred classroom environment, data were analysed with a one-way MANOVA for repeated measures. The set of WIHIC scales constituted the dependent variables and the form of the questionnaire (actual/preferred) was the repeated measures factor. Student responses to the actual and preferred forms were matched to allow the data collected from 2,498 students to be analysed. Because the multivariate test produced statistically significant results (Wilks' lambda), a *t* test for paired samples was used for each individual WIHIC scale to investigate whether students had different perceptions of their actual and preferred classroom learning environments. All analyses were performed twice, once at the student level of analysis and once with the class mean as the unit of analysis Student

responses to the actual and preferred forms also were used to generate graphical profiles of students' perceptions of their actual and preferred learning environments (Figure 4.1).
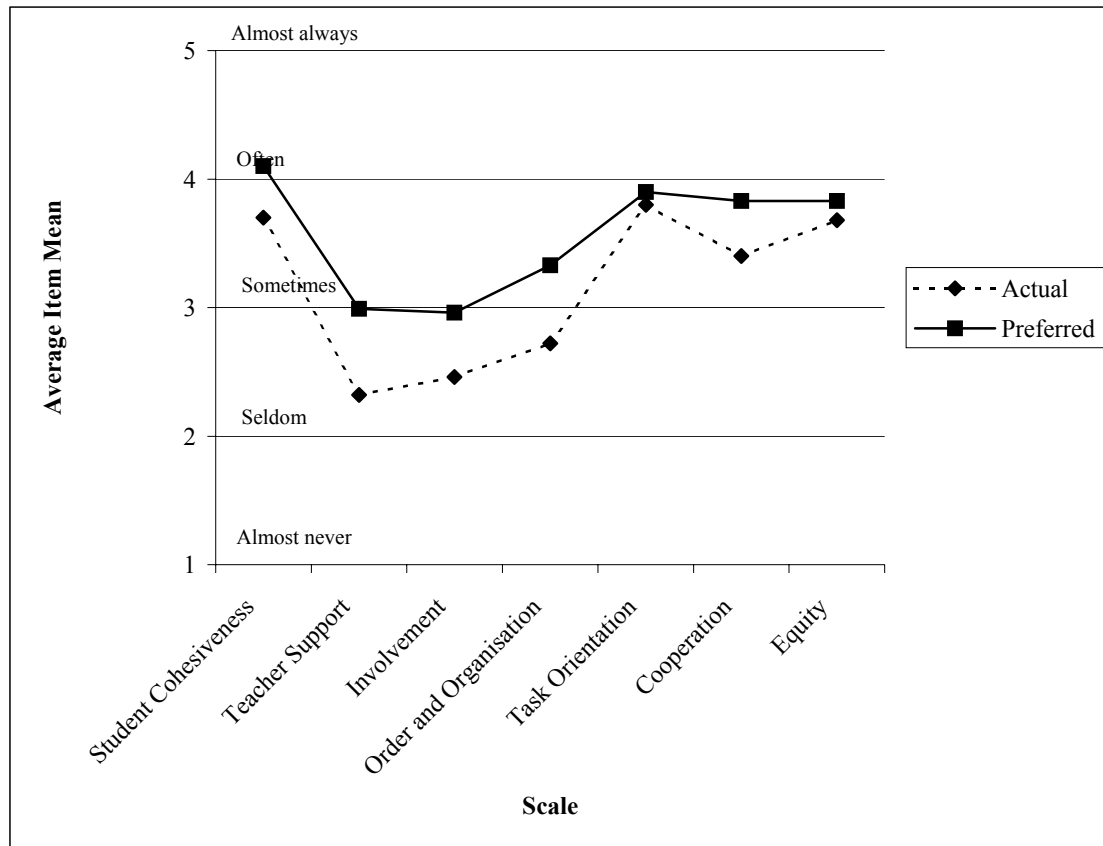
Figure 4.1   Differences in Students' Perceptions of the Actual and Preferred Learning Environment on the WIHIC

The results reported in Table 4.5 indicate a statistically significant difference ($p<0.01$) between actual and preferred scores exist for all seven learning environment scales for both units of analysis. To estimate the magnitude of the differences between students' scores on the actual and preferred forms of the WIHIC, effect sizes were calculated. The effect size for each of the WIHIC scales, reported in Table 4.5, range between approximately one fifth of a standard deviation (0.17) and one standard deviation (0.97)

for the individual as the unit of analysis and between approximately one standard deviation (0.87) and six standard deviations (6.20) with the class mean as the unit of analysis. These results suggest that there large differences between students' perceptions of the actual and preferred environment.

Table 4.5   Average Item Mean, Average Item Standard Deviation, Effect Size and *t* Test for Paired Samples for Differences between Actual and Preferred Perceptions on the Modified WIHIC for Two Units of Analysis

WIHIC Scale	Unit of Analysis	Average Item Mean		Average Item Standard Deviation		Difference Between Actual and Preferred	
		Actual	Preferred	Actual	Preferred	Effect Size	*t*
Student Cohesiveness	Individual	3.70	4.10	0.58	0.61	0.67	-29.56**
	Class Mean	3.70	4.11	0.08	0.14	3.73	-22.45**
Teacher Support	Individual	2.32	2.99	0.57	0.81	0.97	-39.99**
	Class Mean	2.33	3.00	0.12	0.22	3.94	-28.48**
Involvement	Individual	2.46	2.96	0.64	0.72	0.74	-33.23**
	Class Mean	2.47	2.97	0.10	0.18	3.57	-29.53**
Order and Organisation	Individual	2.72	3.33	0.67	0.65	0.92	-39.32**
	Class Mean	2.72	3.34	0.09	0.11	6.20	-31.60**
Task Orientation	Individual	3.80	3.90	0.54	0.63	0.17	-8.17**
	Class Mean	3.80	3.90	0.09	0.14	0.87	-5.50**
Cooperation	Individual	3.40	3.83	0.71	0.72	0.60	-25.62**
	Class Mean	3.41	3.83	0.11	0.17	3.00	-19.52**
Equity	Individual	3.68	3.83	0.77	0.78	0.19	-8.56**
	Class Mean	3.69	3.84	0.17	0.15	0.94	-6.78**

**$p<0.01$
N=2,498 student in 50 classes

The average item mean (or the scale mean divided by the number of items in that scale) for students' scores on the actual and preferred forms are tabulated in Table 4.5 and graphed in Figure 4.1.   The reason for using the average item mean is to provide

meaningful comparisons between the means of scales containing differing numbers of items. Figure 4.1 shows that students would prefer a much more positive learning environment than the one they presently perceive on all WIHIC dimensions. This finding has important practical implications for university teachers and administrators in Indonesia.

Students would prefer activities associated with WIHIC items to occur 'often' (average item mean of 4 in Figure 4.1) for the Student Cohesiveness, Task Orientation, Cooperation and Equity scales, and to occur approximately 'sometimes' (average item mean of 3) for Teacher Support and Involvement and to occur between 'sometimes' and 'often' for Order and Organisation. However, Figure 4.1 also shows that the level of each WIHIC dimension perceived to be actually present is lower for every scale. The lowest average item mean in Figure 4.1 occurs for Teacher Support, which is perceived to occur approximately 'seldom'. The improvement of Teacher Support appears to be a high priority in these Indonesian university students' opinions.

4.5 Differences Between Male and Female Perceptions of the Learning Environment and Attitudes

This section reports the differences and similarities between male and female students' perceptions of the learning environment and their attitudes towards their mathematics classes. Analyses involving MANOVAs and *t* tests were used to answer the first part of the fourth research question:

Research Question # 4a

Are perceptions of the learning environment different for students of different genders?

To examine sex differences in classroom environment perceptions in the present study, data were analysed with a one-way MANOVA for repeated measures and using the within-class gender subgroup mean as the unit of analysis. Sex was the repeated measures factor, and the WIHIC scales and the attitude scale formed the set of dependent variables. Because the multivariate test produced statistically significant results using Wilks' lambda criterion, a *t* test for paired samples was used for each individual WIHIC scale and the attitude scale to investigate whether males and females had different perceptions of their classrooms and different attitudes. As males and females are not found in equal numbers in every class, the within-class gender mean was chosen as the unit of analysis to provide a matched pair of means — one within-class mean for males and one within-class mean for females. This reduces confounding in that, for each group of males within a particular classroom, there is a corresponding group of females in the same classroom.

Table 4.6 reports the average item mean and average item standard deviation for male and female students for each actual WIHIC scale, each preferred WIHIC scale and the attitude scale. Also, the results of the *t* test and effect sizes are reported in Table 4.6. The means generated using male and female scores on each actual WIHIC scale and the attitude scale were used to draw the graphical profile provided in Figure 4.2.

Table 4.6   Average Item Mean, Average Item Standard Deviation, Effect Size and *t* Test for Paired Samples for Differences between Male and Female Scores on WIHIC Actual, WIHIC Preferred and Attitude Scales Using the Within-Class Gender Mean as the Unit of Analysis

WIHIC Scale	Form of Questionnaire	Average Item Mean		Average Item Standard Deviation		Difference Between Males and Females	
		Male	Female	Male	Female	Effect Size	*t*
Student Cohesiveness	Actual	3.69	3.71	0.09	0.12	0.19	0.81
	Preferred	4.07	4.15	0.13	0.17	0.53	-4.83**
Teacher Support	Actual	2.33	2.32	0.12	0.15	0.07	-0.02
	Preferred	2.97	3.03	0.15	0.25	0.30	-3.05**
Involvement	Actual	2.47	2.46	0.11	0.13	0.08	-1.06
	Preferred	2.96	2.98	0.16	0.25	0.36	-0.79
Order and Organisation	Actual	2.67	2.76	0.11	0.14	0.72	3.44**
	Preferred	3.32	3.35	0.12	0.14	0.23	-1.14
Task Orientation	Actual	3.72	3.88	0.07	0.15	1.45	6.83**
	Preferred	3.86	3.93	0.12	0.20	0.44	-2.86**
Cooperation	Actual	3.50	3.32	0.11	0.14	1.44	10.14**
	Preferred	3.80	3.87	0.14	0.21	0.40	-3.55**
Equity	Actual	3.73	3.65	0.24	0.16	0.40	-2.12*
	Preferred	3.82	3.86	0.13	0.21	0.24	-1.74
Attitude		3.42	3.40	0.18	0.10	0.14	-0.74

  **$p<0.01$ *$p<0.05$
  N=2,498 students in 50 classes

The results in Table 4.6 indicate that, while the magnitudes of the differences between male and female students' perceptions of the actual learning environment are small, female students perceived significantly ($p<0.01$) more actual Order and Organisation, Task Orientation and Cooperation than did male students. Male students, on the other hand, perceived significantly ($p<0.01$) more actual Equity than their female counterparts (see Figure 4.2). The effect size for each actual scale of the WIHIC (calculated to provide an approximation of the magnitude of the differences) ranged between

approximately 0.07 and one and a half standard deviations (1.45) for different scales. Four of the actual learning environment scales, Order and Organisation, Task Orientation, Cooperation and Equity, had an effect size of over one third of a standard deviation (0.40), suggesting that the magnitude of differences between male and female perceptions on these scales is educationally important.
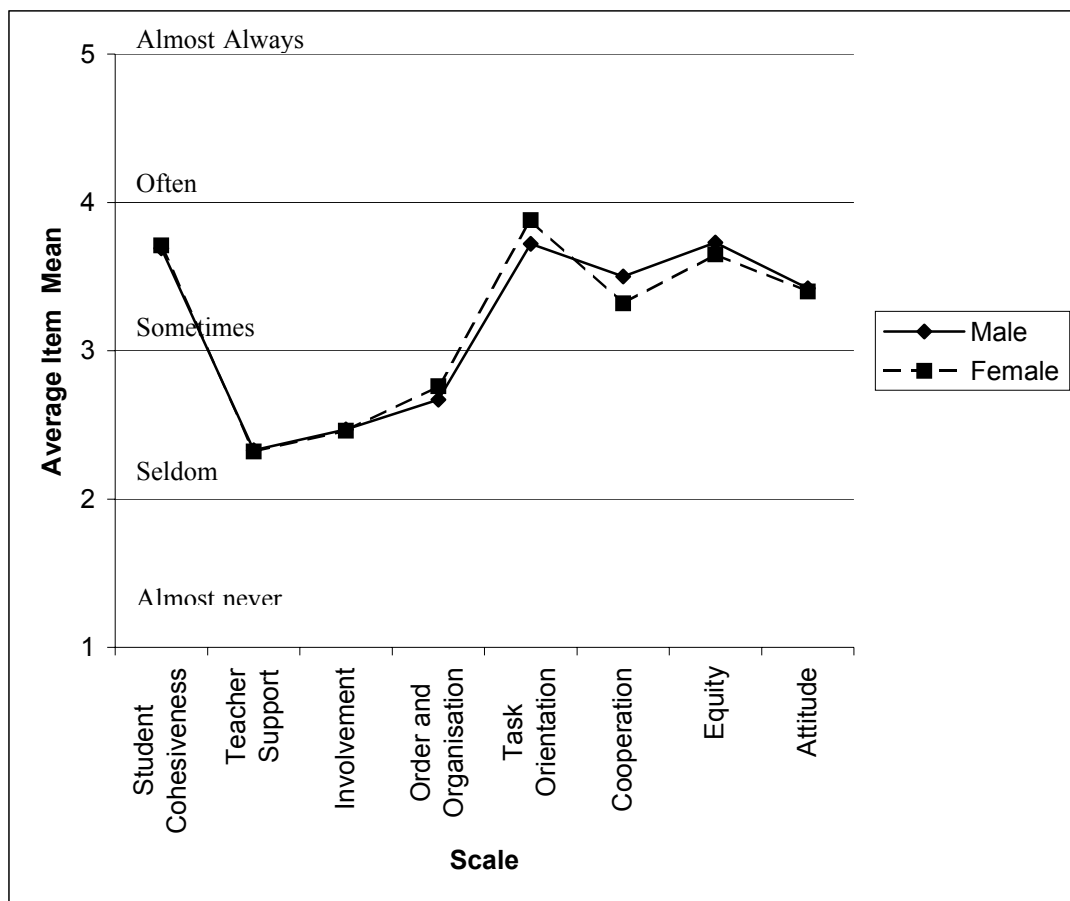
Figure 4.2   Differences between Male and Female Students' Scores on the Actual Form of the WIHIC and the Attitude Scale

Table 4.6 shows that females preferred a more favourable classroom environment than did males in terms of more Student Cohesiveness, Teacher Support, Task Orientation and Cooperation. Effect sizes for the preferred WIHIC scales range fro 0.23 to 0.53.

Gender differences in student attitudes also were explored. The results reported in Table 4.6 suggest that male and female students have similar attitudes towards their lectures and that the difference in attitudes is statistically nonsignificant.

4.6   Differences Between Students' Learning Environment and Attitude Scores for Statistics and Linear Algebra Classes

This section reports the findings for differences between students' perceptions of the learning environments in two different mathematics courses taken during their computing course, in response to the second part of the fourth research question:

Research Question # 4b

Are perceptions of the learning environment different for students attending statistics and linear algebra courses?

The WIHIC and attitude scale were administered to 1,245 students in 24 statistics classes and 1,253 students in 26 linear algebra classes. A MANOVA was calculated to determine whether differences exist between the scores of students in statistics and linear algebra classes in terms of scores on the actual form of the WIHIC and the attitude scale. Because the MANOVA produced statistically significant results, t tests for

independent samples were calculated to determine the extent of the differences between

the scores of students attending statistics and linear algebra classes on each WIHIC scale

and the attitude scale for two units of analysis (Table 4.7).

Table 4.7   Average Item Mean, Average Item Standard Deviation, Effect Size and t Tests for Independent Samples for Differences Between Statistics and Linear Algebra Classes on the WIHIC and Attitude Scale for Two Units of Analysis

WIHIC Scale	Unit of Analysis	Average Item Mean		Average Item Standard Deviation		Difference Between Linear Algebra and Statistics Classes	
		Statistics	Algebra	Statistics	Algebra	Effect Size	t
Student Cohesiveness	Individual	3.70	3.70	0.55	0.62	0.00	-0.17
	Class Mean	3.70	3.70	0.11	0.05	0.00	0.03
Teacher Support	Individual	2.24	2.40	0.57	0.56	0.28	-6.47**
	Class Mean	2.26	2.39	0.14	0.05	1.37	-4.45**
Involvement	Individual	2.38	2.54	0.65	0.62	0.25	-6.23**
	Class Mean	2.39	2.54	0.09	0.05	2.43	-7.46**
Order and Organisation	Individual	2.72	2.71	0.69	0.64	0.02	0.21
	Class Mean	2.72	2.72	0.11	0.07	0.00	0.23
Task Orientation	Individual	3.75	3.84	0.56	0.50	0.17	-4.04**
	Class Mean	3.76	3.84	0.10	0.06	1.00	-3.41**
Cooperation	Individual	3.33	3.47	0.77	0.64	0.20	-5.05**
	Class Mean	3.34	3.47	0.12	0.06	1.44	-5.06**
Equity	Individual	3.57	3.79	0.77	0.75	0.29	-7.14**
	Class Mean	3.58	3.79	0.19	0.06	1.68	-5.12**
Attitude	Individual	3.30	3.50	0.64	0.56	0.33	-8.24**
	Class Mean	3.30	3.50	0.08	0.07	2.67	-9.34**

**$p<0.01$

N= 1,245 Students in 24 statistics classes and 1,253 students in 26 linear algebra classes

A graphical representation of the perceptions of the learning environment in different

courses is presented in Figure 4.3. This graph and Table 4.7 indicate that students in

linear algebra classes had more favourable perceptions of their learning environments

than students in statistics classes on all WIHIC scales with the exception of Student Cohesiveness and Order and Organisation (for which differences were insignificant). The results of the *t* tests (reported in Table 4.7), for both the individual and class mean as the unit of analysis, indicate that, whilst the size of the differences are small, there are statistically significant differences ($p<0.01$) in the way in which the students perceive their classes for five of the seven learning environment scales, namely, Teacher Support, Involvement, Task Orientation, Cooperation and Equity. Each of these scales are perceived more favourably by students attending linear algebra classes than their counterparts attending statistics classes. The effect size (approximate magnitude of difference) ranged from zero to one third of a standard deviation (0.29) for the individual as the unit of analysis and ranged from zero to over two standard deviations (2.43) with the class mean as the unit of analysis.

Also, for the attitude scale, a statistically significant ($p<0.01$) difference was found between the attitudes of students attending the statistics and linear algebra classes. The effect size for course differences between perceptions on the attitude scale was approximately one third (0.33) of a standard deviation for the individual as the unit of analysis and two and two thirds (2.67) standard deviations for the class mean as the unit of analysis. Students attending the linear algebra classes have more favourable attitudes than those attending statistics classes. This result is consistent with the students' tendency to see linear algebra classes as rather closer to basic science than statistics classes, which are considered as applied science.
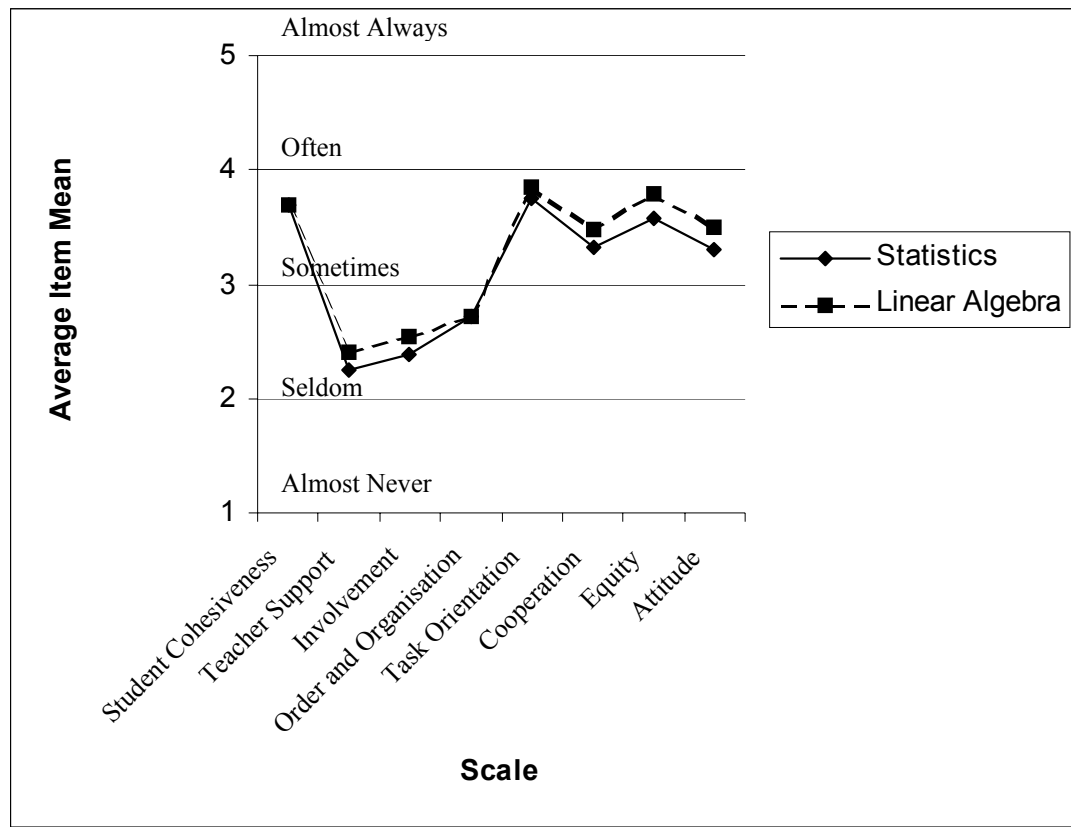
Figure 4.3   Differences Between Statistics and Linear Algebra Classes in Scores on the WIHIC and Attitude Scale

4.7   Summary

This chapter reported the findings of a study into students' perceptions of the their actual and preferred learning environments at the university level in Indonesia. The Indonesian version of the WIHIC and an attitude scale were administered to a sample 2,498 computing students in 24 statistics and 26 linear algebra classes. The data were analysed initially to determine the validity and reliability of the WIHIC questionnaire, in terms of its factor structure, internal consistency reliability and ability to differentiate between classrooms.

The *a priori* factor structure for the actual form of the WIHIC was replicated with nearly all items having a factor loading of at least 0.40 on their *a priori* scale and no other scale. The internal consistency reliability estimate (Cronbach alpha coefficient) for each of the seven scales of the WIHIC, using both the individual and the class mean as the unit of analysis, was comparable with past studies. Using one-way ANOVAs, two of the seven scales were able to differentiate between the environments of different classes. Overall, the validation information provides support for the confident future use of the Indonesian version of the WIHIC at the university level. This replicates validation studies in other countries (Aldridge & Fraser, 2000; Chionh & Fraser 2000). The *a priori* factor structure was also replicated for separately linear algebra classes for the actual form, for linear algebra classes for the preferred form, for statistics classes for the actual form and for statistics classes for the preferred form.

To determine whether differences exist between students' perceptions of actual and preferred learning environments, a MANOVA for repeated measures was calculated. Statistically significant differences between students' perceptions of their actual learning environment and the one that they would prefer were found for all seven learning environment scales for two units of analysis (the student and the class mean). The results indicate that students would prefer more of each WIHIC dimension than is currently perceived in their classes. Effect sizes for the seven scales of the WIHIC (calculated to provide an approximation of the magnitude of differences between students responses to the actual and preferred forms) ranged between 0.17 and 0.97 of a

standard deviation for the individual as the unit of analysis and between 0.87 and 6.20 standard deviations for the class mean as the unit of analysis. These results replicate findings of numerous past studies in different countries (Fraser, 1998a). These large discrepancies between the actual classroom environment and what is preferred by students has important practical implications for university teachers and administrators in Indonesia.

To determine whether students' perceptions of their learning environment were related to their achievement and their attitudes towards their classes, the data were analysed using simple and multiple correlation analyses for two units of analysis (the student and the class mean.

Past research (Fraser 1998a) generally was replicated in that statistically significant associations were found between the nature of the classroom learning environment and students' achievement and attitudes. However, also, in line with past research, outcome-environment associations were stronger for attitudes than for achievement. For example, the multiple correlation for the set of WIHIC scales for achievement was 0.19 at the student level and 0.88 at the class level. For attitudes, the multiple correlation was 0.62 at the student level and 0.92 at the class level.

Achievement was linked most consistently and strongly with and emphasis on classroom Involvement and Equity. On the other hand, student attitudes were consistently found to be more positive in classes perceived to have higher Teacher

Support, Involvement, Task Orientation and Equity. These patterns of findings provide important tentative information about how to improve student achievement and attitudes through changing the classroom environment in Indonesian universities.

The present results replicate research in other Asian countries including Singapore (Chionh & Fraser, 1998; Chua, Wong & Chen, 2000), Brunei (Riah & Fraser. 1998), Taiwan (Aldridge & Fraser, 2000) and Korea (Kim, Fisher & Fraser, 2000). However, because some outcome-environment associations were found to be negative for certain WIHIC scales, it will be important to conduct further research that attempts to replicate the present study and to use qualitative methods to try to explain any negative relationships that might be replicated.

To examine whether students of different genders perceive the learning environment differently and hold different attitudes, a MANOVA for repeated measures were used. The within-class gender mean provided a matched pair of means – one for males and one for females. It was found that female students perceived significantly more Order and Organisation, Task Orientation and Cooperation than did male students, whereas male students' perceived significantly more Equity than did female students. Also, relative to boys, females preferred significantly more Student Cohesiveness, Teacher Support, Task Orientation and Cooperation. These findings replicate past research in other countries (Byrne, Hattie & Fraser, 1986; Fisher, Fraser & Rickards, 1997; Fraser, Giddings & McRobbie, 1995; Henderson, Fisher & Fraser, 1995;Owens & Straton, 1980).

To examine whether students in statistics and linear algebra classes perceive their learning environments differently, MANOVA was used. The results revealed statistically significant differences for five of the seven learning environment scales, with students in linear algebra classes perceiving significantly more Teacher Support, Involvement, Task Orientation, Cooperation and Equity. This finding made sense in the Indonesian context, as students tend to view linear algebra classes, as well as being basic science classes, as being more prestigious and difficult than other classes.

Statistically significant differences were also found for students' attitudes towards their mathematics classes, with students in linear algebra classes holding significantly more favourable attitudes than their counterparts attending statistics courses. The effect sizes also suggest an educationally important difference between the attitudes of students in the two courses (one third of a standard deviation for the individual as the unit of analysis and over two standard deviations for the class mean as the unit of analysis).

The following chapter provides a discussion of the findings as well as information regarding the significance and limitations of the study and suggestions for future research.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

5.1   Introduction

Computer sciences and information technology are relatively new topics in Indonesia, which are rapidly gaining in popularity in educational arenas. The present study involved the investigation of factors that could influence students' outcomes (achievement and attitudes) in private computer institutions in Indonesia. This exploratory study involved a large scale collection of data to examine students' perceptions of the learning environment and their mathematical ability at the tertiary level. This study is one of the first in the field of learning environments in Indonesia, particularly at the tertiary level. The main aims of this study were to cross-validate the What Is Happening in this Class? (WIHIC) questionnaire for use with students at the university level of education in Indonesia, investigate the relationship between student outcomes and the learning environment, and to explore differences and similarities between students' perceptions of the learning environment.

This chapter opens by providing an overview of the thesis in Section 5.2. The major findings of the study are summarised in Section 5.3, and the significance of the study is discussed in Section 5.4. Section 5.5 probes the constraints and limitations to the

study, while in section 5.6 recommendations and suggestions for future research in Indonesia are made.

5.2   Overview of the Thesis

The opening chapter of the thesis provides background to the study. This chapter sought to provide the reader with information regarding the Indonesian context, including a brief historical review to provide economic and political information that has shaped the present communities of Indonesia today. Also, this section provides information regarding the education system of Indonesia and, in particular, the development and prolific growth of the private university system.

To date there have been few studies of the learning environment in Indonesia and none at the higher education level. This exploratory study aimed to provide information regarding students' preferred and actual learning environment for students attending a computing course at the university level in Indonesia. Included in Chapter 1 are a brief history of the field of learning environments and a rationale for the present study, whilst Section 1.3 delineates the research questions for the present study as being:

Research Question #1

Is it possible to develop and validate an Indonesian-language version of the What is Happening in this Class? (WIHIC) questionnaire that has been modified to suit university computing students?

Research Question #2

Are there differences between students' actual and preferred perceptions of the learning environment?

Research Question #3

Is there a relationship between each of the student outcomes of (1) achievement and (2) attitudes and

    a) *their mathematics achievement in their third semester at university?*

    b) *perceptions of the learning environment?*

Research Question # 4

Are perceptions of the learning environment different for:

    a) *students of different genders?*

    b) *students attending statistics and linear algebra courses?*

Chapter 2 reviews literature pertinent to the present study. The study examines the different methods used to explore the learning environments in a number of studies and reviews a variety of instruments used to assess the learning environment. The chapter goes on to examine past studies of the learning environment that have been carried out in Indonesia and other Asian countries and the different research methods used in each study.

The literature review examines different lines of past learning environment research with particular emphasis on research carried out at the university level. Finally, Chapter 2 concludes with a review of literature related to student attitudes, one of the student outcomes measured in the present study.

Chapter 3 outlines the research methods used in the present study. The chapter acknowledges the benefits of using mixed methods in learning environment research and provides an explanation for why the present study, exploratory in nature, is suited to quantitative research methods. The chapter reviews the selection of the What is Happening in this Class? questionnaire for use in the present study, and its development, use and validity in past studies in Australia and Asia.

Section 3.3 provides information on the selection, modification and careful translation and back translation of the WIHIC for use at the university level in Indonesia. The pilot testing of the new instrument was considered an important phase of the

construction of an Indonesian version of the WIHIC, providing feedback from students and lecturers on the suitability of individual items in the Indonesian context. Section 3.4 describes the sample size, method of selection and details of the administration and data entry. Finally, Sections 3.5, 3.6 and 3.7 discuss the choice of unit of analysis, the collection of the data for the main study and the statistical analysis used, respectively.

Chapter 4 provides details of the findings and results. Analyses of the data collected from 2,498 students attending a computing course in 50 classes were undertaken to provide information to support the reliability and validity of the questionnaire. Once the validity of the Indonesian version of the WIHIC, modified for use at the university level, had been established, further analysis was undertaken to explore associations between students' perceptions of the learning environment and student outcomes, differences between students' perceptions of the actual and preferred learning environments, gender differences in perceptions, and differences in the learning environment for students in linear algebra and statistics classes. (Major findings from these analyses are discussed below in Section 5.3.)

5.3   Major Findings of the Study

The major findings of the present study are discussed under the following headings:

- Validity and reliability of the WIHIC and attitude scale (Section 5.3.1)

- Associations between the learning environment and student outcomes (Section 5.3.2)

- Differences between students' actual and preferred perceptions on the WIHIC (Section 5.3.3)

- Differences between male and females perceptions on the WIHIC (Section 5.3.4)

- Differences between linear algebra and statistics students' perceptions on the WIHIC (Section 5.3.5)

5.3.1   *Validity and Reliability of the WIHIC and Attitude Scale*

The Indonesian version of the WIHIC, along with an attitude scale, were administered to a sample of 2,498 computing students in 26 linear algebra and 24 statistics classes. The data were analysed to determine the validity and reliability of the WIHIC questionnaire, in terms of its factor structure, internal consistency reliability and ability to differentiate between classrooms.

The *a priori* factor structure for the actual form of the WIHIC was replicated with nearly all items having a factor loading of at least 0.40 on their *a priori* scale and no other scale. The *a priori* factor structure was also replicated for four separate samples, namely, linear algebra actual, linear algebra preferred, statistics actual, and statistics preferred.

The internal consistency reliability estimate (Cronbach alpha coefficient) for each of the seven scales for both the actual and preferred forms of the WIHIC, using both the individual and the class mean as the unit of analysis, was comparable with past studies.

The discriminant validity (mean correlation of scale with other scale) results suggest that each WIHIC scale measures a distinct although somewhat overlapping aspect of classroom environment. The results of one-way ANOVAs indicate that two of the seven scales were able to differentiate between the environments of different classes. Overall, the validation provides support for the confident future use of the Indonesian version of the WIHIC at the university level. This replicates validation studies in other countries (Aldridge & Fraser, 2000; Chionh & Fraser, 2000).

5.3.2   *Association Between Students Outcomes and the Learning Environment*

Simple correlation and multiple regression analyses were used to determine whether associations exist between students' perception of learning environment and students' attitude towards their lectures and towards their mathematics classes and their final achievement score.

With the student as the unit of analysis, the results of the simple correlation analyses indicate that a statistically significant and positive association exists between students' attitudes towards their mathematics classes and all seven learning environment scales. The multiple regression results indicate all but one (Cooperation) of the seven learning environment scales uniquely account for a significant amount of variance in students' attitude beyond that attributable to the other environment scales. The multiple correlation between students' perceptions of the learning environment and students' attitude also is positive and statistically significant. These results suggest that the learning environment created by teachers at the university level could well have an

effect on their attitude towards that subject. The results suggest that teachers wishing to improve the learning environment of their mathematics classes at the university level should provide lessons that give attention to improving the learning environment and, in particular, provide lessons that include more Student Cohesiveness, Teacher Support, Involvement, Order and Organisation, Task Orientation and Equity.

With the class as the unit of analysis, the simple correlation results indicate a positive and significant association between student achievement and two of the seven learning environment scales, namely, Task Orientation and Equity. The multiple regression results indicate that one of the seven learning environment scale, Equity, uniquely accounts for a significant amount of variance in student achievement beyond that attributable to other environment scales. The multiple correlation between students' perceptions of the learning environment and student achievement is positive and statistically significant. The results of the simple and multiple correlation analysis suggest that, to improve student achievement, teachers should be encouraged to increase the amount of Task Orientation and Equity in their classes.

5.3.3 *Differences between Students' Actual and Preferred Perceptions on the WIHIC*

MANOVA, effect sizes and *t* tests for paired samples were used to investigate any differences in scale scores between students' perceptions of the actual learning environment and their preferred learning environment. The results indicated that there was a significant difference for all seven learning environment scales, which students

preferring a more positive learning environment than the one they presently perceive on all WIHIC dimensions.

The findings indicate that the present classroom environment, as perceived by students, is different from that which they would prefer. Past studies have indicated that, when there is more congruence between the students' actual and preferred learning environment, student outcomes are likely to be improved (Fisher & Fraser, 1983). These results could be used as the basis for changing the learning environment with the view to improving student outcomes. By changing dimensions of the learning environment to more closely match the environment preferred by students, students' outcomes could be improved, thereby encouraging teachers to improve their own teaching strategies.

5.3.4   *Differences between Males' and Females' Perceptions on the WIHIC*

MANOVA for repeated measures, effect sizes and *t* tests for paired samples, using the within-class gender mean as the unit of analysis, were used to investigate differences between male and female students' perceptions of their learning environment. The results indicate that female students perceive significantly more Order and Organisation, Task Orientation and Cooperation than do male students, whereas male students' perceive significantly more Equity than do female students. These results for Equity make sense in the Indonesian context. Ninety percent of the population of Indonesia are Moslem, a religion in which males are given more freedom and independence in all aspects of their lives than females. This cultural background carries over from family life into the

education of students, making such a difference in the degree of Equity perceived by male and female students very plausible. Overall, the finding that Indonesian university students generally perceive and prefer a more favourable classroom environment replicates past research in Western primary and secondary schools (Fraser, 1998a).

5.3.5 *Differences between Statistics and Linear Algebra Students' Perceptions on the WIHIC*

MANOVA, effect sizes and *t* tests for independent samples were used to determine whether differences exist between statistics and linear algebra classes on dimensions of the actual and preferred forms of the WIHIC and the attitude scale for two units of analysis. The result indicate that students attending linear algebra classes perceived significantly more Teacher Support, Involvement, Task Orientation, Cooperation and Equity. In Indonesia, linear algebra is considered to be one of the basic science classes, which are rated highly by students. These results reflect students' preferences for this subject. The results also indicate that students attending linear algebra classes held significantly more favourable attitudes towards their classes than their counterparts attending statistics classes.

5.4   Distinctive Contributions of the Present Study

The present study is distinctive in that it is one of only a few studies in the field of learning environments to be carried out in Indonesia and one of the first studies in the field of leanring environments to be carried out at the university level in Indonesia.

This exploratory study is significant in that it provides future researchers in Indonesia with base line data, collected from a large sample of students, that can be used as the basis for assessing the success of curriculum reform, new teaching strategies and other attempts at improving teaching and learning.

The study also has modified and carefully translated (using a process of back translation) a widely-applicable learning environment questionnaire for use in Indonesia at the university level. The large sample size (2,498 students in 50 classes) has enabled an extensive validation of this general questionnaire for assessing the learning environment from the students' perspective. Therefore, a major contribution of the research is that it provides a widely-applicable, economical and valid learning environment instrument which is likely to prove to be a potentially powerful tool that lecturers can use to guide the improvement of the learning environment in their classes.

The study also provides important practical information that can be used by university teachers and administrators in Indonesia. The finding of large discrepancies between the actual classroom environment and that preferred by students suggests the need to change classroom environments in order to improve the actual-preferred match and, subsequently, student outcomes. Also, the present results tentatively suggest that Indonesian educators wishing to improve student achievement should emphasise

classroom Involvement and Equity, whereas improved student attitudes might be achieved in classes that emphasise Teacher Support, Involvement and Equity.

5.5   Constraints and Limitations of the Study

In interpreting the finding of the present study, there are a number of factors that should be considered. First, whilst it is possible to generalise the findings of the present study to other groups of tertiary students, it would be inappropriate to generalise the findings to populations in others disciplines, government universities, or those universities outside of Jakarta. Caution should be used because the sample selected for the study was restricted to a single, private university in Jakarta, Indonesia, thereby limiting the generality of the findings (Campbell & Stanley, 1963). However, it should be noted that, in countries where the WIHIC has been validated and used, such as Australia and Taiwan (Aldridge, Fraser & Huang, 1999), it might be possible to generalise the findings from the present study outside Indonesia to include students with the same sample characteristics.

Second, the present study encountered time constraints in the collection of data. The survey sample consisted of third semester students with a heavy workload. The actual and preferred forms of the questionnaires were distributed on two separate days (one week apart) during class time. Although the delay between students' completion of the two forms was one week, it would have been more suitable if the delay could have been longer to ensure that the students didn't remember responses to the actual form.

Third, in an examination-oriented society like Indonesia, the data collected from the present study could be subjected to biasing influences such as 'demand characteristics' (whereby subjects respond in accordance with their perceptions of the expectations of the researcher) or 'impression management' (whereby subjects 'manage' their responses to present them in a specific pattern) (Hersen & Barlow, 1976). Thus, the findings from the present study should be interpreted with prudence.

Finally, the findings of some unexpected significant negative outcome-environment correlations are a limitation that suggests the need for further research in the future.

Despite the quantitative nature of the present study, the collection of important qualitative research was used during the initial development of the questionnaires. The importance of such data cannot be understated. It is recommended that future studies at the university-level in Indonesia include the collection of data at different 'grain sizes' as recommended by Fraser (1999). Therefore, it is desirable for future quantitative research to be complemented by qualitative study (Fraser & Tobin, 1991; Tobin & Fraser, 1998). The richness of such data has been explored in studies that have incorporated the combination of qualitative and quantitative data, including Aldridge and Fraser (2000), Hine and Fraser (2000) and Wilks (2001).

5.6   Recommendations and Suggestions for Future Research

Classroom learning environment research in Indonesia is still in its infancy at present. This study was distinctive because it modified and validated the WIHIC for use at the university level. Despite this significant contribution to the field of learning environments, further validation in other university institutions throughout Indonesia (both government and private) would be desirable. A larger and more diverse sample would provide further evidence to support the reliability and validity of the actual and preferred forms of the Indonesian, university-level version of the WIHIC.

The present study was restricted to investigating students' perceptions of the learning environment. It would be desirable for future research to include the perceptions of lecturers and administrators across a variety of universities and discipline areas.

The results of the present study indicate that positive associations exist between students' perceptions of the learning environment and student achievement. The achievement measure used in the present study was limited to the course score. It would be meaningful for future studies to include other achievement outcomes.

The results indicate positive associations between student outcomes (attitude and achievement) and students' perceptions of the learning environment. Clearly this finding supports the importance of giving more attention to the quality of the learning environment in tertiary education. Even though currently Indonesia is in the middle of

a national crisis, education still is the first priority of most families and hence it is important to improve the system of education, perhaps by increasing awareness of the importance of the quality of the learning environment.

5.7   Concluding Comments

The critical importance of giving attention to the quality of the learning environment in Indonesian universities is summarised in a recent graduation speech in Indonesia (Fraser, 2001):

> For many university graduates in the audience, you have spent nearly 20,000 hours in educational institutions by the time that you complete your university course. Therefore, students certainly have a great interest in what happens to them at school and university and students' reactions to and perceptions of their educational experiences are important. However, despite the obvious importance of what goes on in school and university classrooms, teachers and researchers have relied heavily and sometimes exclusively on the assessment of academic achievement and other learning outcomes. Although no-one would dispute the worth of achievement, it cannot give a complete picture of the educational process. (p. 1)

> Given the ready availability of questionnaires, the importance of classroom environment on student outcomes, and the value of environment assessments in guiding educational improvement, it seems very important that researchers and teachers begin to include classroom environment in evaluations of educational effectiveness. Although educators around the world pay great attention to student achievement and

only a little attention to the environment of school and university classrooms, research on classroom environment should not be buried under a pile of achievement tests. Hopefully, this speech will encourage and guide important research and practical applications involving classroom environment. As Riorden (1982, p. 310) aptly notes, "constructive educational climates may be so vitally important that priorities should be drastically rearranged. (p. 4)

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Appendix 1

WHAT IS HAPPENING IN THIS CLASS?

STUDENT ACTUAL AND PREFERRED FORMS

(English Version)

Appendix 1A
WHAT IS HAPPENING IN THIS CLASS?
STUDENT ACTUAL FORM
(English Version)

DIRECTIONS

This is NOT a test.

This questionnaire contains statements about practices which could take place in *your actual class.*

There are no 'right' or 'wrong' answers. Your opinion is what is wanted.

Think how well each statement describes *what your actual class* is like for students.

Draw a circle around

1.	if the practice takes place	Almost Never
2.	if the practice takes place	Seldom
3.	if the practice takes place	Sometimes
4.	if the practice takes place	Often
5.	if the practice takes place	Almost Never

Do nor worry if some statement in this questionnaire are fairly similar.

Give your opinion to all statement.

If you change your mind on a number, simply cross out the number and circle another number.

EXAMPLE

Statement: Member of this class do favours for one another.

You would need to decide whether your thought that students in this class do favours for one another
' Almost Never', 'Seldom', 'Sometimes', 'Often' or'Almost Always'.

If you selected 'Often', you would circle the number 4 on your questionnaire.

Name: Class: Students' Number:

Remember you are rating your actual class

Student Cohesiveness	Almost never	Seldom	Some-times	often	Almost always
1. I make friendships among students in this class.	1	2	3	4	5
2. I know other students in this class.	1	2	3	4	5
3. I am friendly to members of this class.	1	2	3	4	5
4. Members of the class are my friends.	1	2	3	4	5
5. I work well with other class members.	1	2	3	4	5
6. I help other class members who are having trouble with their work.	1	2	3	4	5
7. Students in this class like me.	1	2	3	4	5
8. In this class, I get help from other students	1	2	3	4	5

Teacher Support	Almost never	Seldom	Some-times	often	Almost always
9. The lecturer takes a personal interest in me.	1	2	3	4	5
10. The lecturer goes out of his / her way to help me.	1	2	3	4	5
11. The lecturer considers my feelings.	1	2	3	4	5
12. The lecturer helps me when I have trouble with the work.	1	2	3	4	5
13. The lecturer talks with me.	1	2	3	4	5
14. The teacher is interested in my problems.	1	2	3	4	5
15. The lecturer moves about the class to talk with me.	1	2	3	4	5
16. The lecturers' questions help me to understand.	1	2	3	4	5

Involvement	Almost never	Seldom	Some-times	Often	Almost always
17. I discuss ideas in class.	1	2	3	4	5
18. I give my opinion during the class discussions.	1	2	3	4	5
19. The lecturer asks me questions.	1	2	3	4	5
20. My ideas and suggestions are used during classroom discussion.	1	2	3	4	5
21. I ask the lecturer questions.	1	2	3	4	5
22. I explain my ideas to other students.	1	2	3	4	5
23. Students discuss with me how to go about solving problems.	1	2	3	4	5
24. I am asked to explain how I solve problems.	1	2	3	4	5

Order and Organization	Almost never	Seldom	Some-times	Often	Almost always
25. This is a well organized class.	1	2	3	4	5
26. The class is noisy.	1	2	3	4	5
27. I am told what will happen if I am break any rule.	1	2	3	4	5
28. I know all the rule in this class...	1	2	3	4	5
29. Students who break the rules get into trouble.	1	2	3	4	5
30. Students who work faster than other move on to the next topic.	1	2	3	4	5
31. The lecturer decides which students should work together.	1	2	3	4	5
32. Student are punished if they behave badly in the class.	1	2	3	4	5

Task Orientation	Almost never	Seldom	Some-times	Often	Almost always
33. Getting a certain amount of work done is important to me.	1	2	3	4	5
34. I do as much as I set out to do.	1	2	3	4	5
35. I know the goals for this class.	1	2	3	4	5
36. I am ready to start this class on time.	1	2	3	4	5
37. I know what I am trying to accomplish in this class.	1	2	3	4	5
38. I pay attention during this class.	1	2	3	4	5
39. I try to understand the work in this class.	1	2	3	4	5
40. I know how much work I have to do.	1	2	3	4	5

Cooperation	Almost never	Seldom	Some-times	Often	Almost always
41. I cooperate with other students when doing assignment work.	1	2	3	4	5
42. I share my book and resources with other students when doing assignment.	1	2	3	4	5
43. When I work in group in the class, there is teamwork.	1	2	3	4	5
44. I work with other students on projects in this class.	1	2	3	4	5
45. I learn from other students in this class.	1	2	3	4	5
46. I work with other students in this class.	1	2	3	4	5
47. I cooperate with other students on class activity.	1	2	3	4	5
48. Students work with me to achieve class goals.					

Equity	Almost never	Seldom	Some-times	often	Almost always
49. The teacher gives us much attention to my questions as to other students' questions.	1	2	3	4	5
50. I get the same amount of help from the teacher as do other students.	1	2	3	4	5
51. I have the same amount of say in this class as other students.	1	2	3	4	5
52. I am treated the same as other students in this class.	1	2	3	4	5
53. I receive the same encouragement from the teacher as other students do.	1	2	3	4	5
	1	2	3	4	5
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.	1	2	3	4	5
56. I get the same opportunity to answer questions as other students.	1	2	3	4	5

Appendix 1B
WHAT IS HAPPENING IN THIS CLASS?
STUDENT PREFERRED FORM
(English Version)

DIRECTIONS

This is NOT a test.

This questionnaire contains statements about practices which could take place in *your student preferred class.*

There are no 'right' or 'wrong' answers. Your opinion is what is wanted.

Think how well each statement describes *what your preferred class* is like for student.

Draw a circle around

1.	if the practice takes place	Almost Never
2.	if the practice takes place	Seldom
3.	if the practice takes place	Sometimes
4.	if the practice takes place	Often
5.	if the practice takes place	Almost Never

Do nor worry if some statement in this questionnaire are fairly similar.

Give your opinion to all statement.

If you change your mind on a number, simply cross out the number and circle another number.

EXAMPLE

Statement: Member of this class do favours for one another.

You would need to decide whether your thought that students in this class do favours for one another
' Almost Never', 'Seldom', 'Sometimes' ,'Often' or Almost Always'.
If you selected 'Often', you would circle the number 4 on your questionnaire.

Name: Class touch:

Remember you are rating your preferred class

Student Cohesiveness	Almost never	Seldom	Some-times	often	Almost always
1. I would make friendships among students in this class.	1	2	3	4	5
2. I would know other students in this class.	1	2	3	4	5
3. I would friendly to members of this class.	1	2	3	4	5
4. Members of the class would be my friends.	1	2	3	4	5
5. I would work well with other class members.	1	2	3	4	5
6. I would help other class members who are having trouble with their	1	2	3	4	5
work.	1	2	3	4	5
7. Students in this class would like me.	1	2	3	4	5
8. In this class, I would get help from other students	1	2	3	4	5

Teacher Support	Almost never	Seldom	Some-times	often	Almost always
9. The lecturer takes a personal interest in me.	1	2	3	4	5
10. The lecturer would go out of his / her way to help me	1	2	3	4	5
11. The lecturer considers my feelings.	1	2	3	4	5
12. The lecturer would helps me when I have trouble with the work.	1	2	3	4	5
13. The lecturer would talk with me.	1	2	3	4	5
14. The lecturer would interested in my problems.	1	2	3	4	5
15. The lecturer moves about the class to talk with me.	1	2	3	4	5
16. The lecturers' questions would help me to understand.	1	2	3	4	5
		2			

Involvement	Almost never	Seldom	Some-times	Often	Almost always
17. I would discuss ideas in class.	1	2	3	4	5
18. I would give my opinion during the class discussions.	1	2	3	4	5
19. The lecturer would ask me questions.	1	2	3	4	5
20. My ideas and suggestions would used during classroom discussion.	1	2	3	4	5
21. I would ask the lecturer questions.	1	2	3	4	5
22. I would explain my ideas to other students.	1	2	3	4	5
23. Students would discuss with me how to go about solving problems.	1	2	3	4	5
24. I would be asked to explain how I solve problems.	1	2	3	4	5

Order and Organization	Almost never	Seldom	Some-times	Often	Almost always
25. This would be a well organized class.	1	2	3	4	5
26. The class would not be noisy.	1	2	3	4	5
27. I would know what will happen if I am breaking any rule.	1	2	3	4	5
28. Student would know all rules in the class..	1	2	3	4	5
29. Student would know who breaking thr rules get into trouble.	1	2	3	4	5
30. Student would work faster than other move to the next topic.	1	2	3	4	5
31. The lecturer would decide which student should work together.	1	2	3	4	5
32. Student would be punished if they behave badly in the class	1	2	3	4	5

Task Orientation	Almost never	Seldom	Some-times	Often	Almost always
33. Getting a certain amount of work done would important to me.	1	2	3	4	5
34. I would do as much as I set out to do.	1	2	3	4	5
35. I would know the goals for this class.	1	2	3	4	5
36. I would ready to start this class on time.	1	2	3	4	5
37. I would know what I am trying to accomplish in this class.	1	2	3	4	5
38. I would pay attention during this class.	1	2	3	4	5
39. I would try to understand the work in this class.	1	2	3	4	5
40. I would know how much work I have to do.	1	2	3	4	5

Cooperation	Almost never	Seldom	Some-times	Often	Almost always
41. I would cooperate with other students when doing assignment work.	1	2	3	4	5
42. I would share my book and resources with other students when doing assignment.	1	2	3	4	5
43. When I work in group in the class, there would **a** teamwork.	1	2	3	4	5
44. I would work with other students on projects in this class.	1	2	3	4	5
45. I would learn from other students in this class.	1	2	3	4	5
46. I would work with other students in this class.	1	2	3	4	5
47. I would cooperate with other students on class activity.	1	2	3	4	5
48. Students would work with me to achieve class goals.	1	2	3	4	5

Equity	Almost never	Seldom	Some-times	Often	Almost always
49. The lecturer would give us much attention to my questions as to other students' questions.	1	2	3	4	5
50. I would get the same amount of help from the lecturer as do other students.	1	2	3	4	5
51. I would have the same amount of say in this class as other students.	1	2	3	4	5
52. I would be treated the same as other students in this class.	1	2	3	4	5
53. I would receive the same encouragement from the lecturer as other students do.	1	2	3	4	5
54. I would get the same opportunity to contribute to class discussions as the other students.	1	2	3	4	5
55. My work would receive as much praise as other students' work.	1	2	3	4	5
56. I would get the same opportunity to answer questions as other students.					

Appendix 2

WHAT IS HAPPENING IN THIS STATISTICS CLASS?

STUDENT ACTUAL AND PREFERRED FORMS

(Indonesian Version)

Appendix 2A
WHAT IS HAPPENING IN THIS STATISTICS CLASS?
STUDENT ACTUAL FORM
(Indonesian Version)

PETUNJUK

Ini bukan sebuah test.

Pernyataan- pernyataan berikut ini membahas mengenai *'kenyataan'* pada pelaksanaan mata kuliah *Statistik* yang telah anda ikuti.

Tidak ada jawaban *'benar'* atau *Salah* . Yang diharapkan adalah *'Pendapat'* anda.

Pertimbangkanlah baik-baik pernyataan-pernyataan berikut ini dan bandingkan seberapa jauh kenyataan yang ada dikelas anda sehari-hari sebagai '*seorang mahasiswa'.*

Lingkarilah angka-angka sebagai berikut:

1.	Apabila pada kenyataan	Hampir tidak pernah
2.	Apabila pada kenyataan	Jarang
3.	Apabila pada kenyataan	Kadang-kadang
4.	Apabila pada kenyataan	Sering
5	Apabila pada kenyataan	Hampir selalu

Jangan menjadi ragu apabila ada beberapa pernyataan yang hampir sama.

Berikan pendapat anda pada semua pernyataan yang ada.

Apabila anda berubah pendapat, berilah **'tanda silang'** pada angka yang dibatalkan dan *' lingkarilah '* angka pengganti yang anda pilih.

CONTOH

Pernyataan: Anggauta kelas ini saling tolong-menolong.

Yang perlu anda lakukan adalah mempertimbangkan apakah para mahasiswa yang ada dikelas anda saling tolong menolong satu sama lain
'Hampir tidak pernah', *Jarang , 'Kadang-kadang', Sering','Hampir selalu'.*

Apabila anda berpendapat hal itu Sering terjadi, maka lingkarilah angka 4 pada kuestioner yang anda isi.

Nama: Kelas: Npm: L/P (jenis kel):

Terimakasih atas kerjasamanya, selamat bekerja
Ingatlah bahwa anda sedang memberi pendapat mengenai kelas Statistik anda

SC	Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
1. Saya berkawan dengan semua mahasiswa di kelas.	1	2	3	4	5
2. Saya tahu semua mahasiswa di kelas ini.	1	2	3	4	5
3. Saya merasa familiar dengan anggauta kelas ini.	1	2	3	4	5
4. Semua anggauta kelas ini adalah teman saya.	1	2	3	4	5
5. Saya bekerjasama dengan baik dengan anggauta kelas ini.	1	2	3	4	5
6. Saya menolong anggauta kelas saya (kawan2 saya) apabila mereka mempunyai kesulitan dalam pekerjaan mereka.	1	2	3	4	5
7. Semua mahasiswa dikelas ini menyukai saya.	1	2	3	4	5
8. Dikelas ini saya dapat mendapat bantuan / pertolongan dari mahasiswa lainnya.	1	2	3	4	5
TS					
9. Dosen dapat menarik perhatian saya secara khusus.	1	2	3	4	5
10. Dosen menolong saya secara khusus.	1	2	3	4	5
11. Dosen menghargai perasaan saya.	1	2	3	4	5
12. Dosen menolong / membantu saya ketika saya mendapat kesulitan dalam menyelesaikan pekerjaan saya.	1	2	3	4	5
13. Dosen berbicara kepada saya	1	2	3	4	5
14. Dosen menaruh perhatian / tertarik terhadap masalah saya.	1	2	3	4	5
15. Dosen mengatur / merubah kelas agar dapat berbicara kepada saya	1	2	3	4	5
16. Pertanyaan dosen membantu saya untuk mengerti.	1	2	3	4	5

I	Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
17. Saya mendiskusikan ide2 / gagasan2 dikelas.	1	2	3	4	5
18. Saya memberikan pendapat saya selama diskusi dikelas berlangsung.	1	2	3	4	5
19. Dosen bertanya kepada saya.	1	2	3	4	5
20. Ide dan saran saya dipakai selama diskusi berlangsung.	1	2	3	4	5
21. Saya menanyakan pertanyaan kepada Dosen.	1	2	3	4	5
22. Saya menerangkan ide saya kepada mahasiswa lainnya	1	2	3	4	5
23. Para mahasiswa (kawan2) berdiskusi dengan saya tentang cara menyelesaikan masalah.	1	2	3	4	5
24. Saya diminta untuk menerangkan tentang cara menyelesaikan masalah.	1	2	3	4	5
OO					
25. Kelas ini tertib dan teratur dengan baik.	1	2	3	4	5
26. Kelas ini sangat ribut.	1	2	3	4	5
27. Saya diberi tahu apa yang akan terjadi apabila saya tidak menurut pada aturan.	1	2	3	4	5
28. Saya mengetahui semua aturan dikelas ini.	1	2	3	4	5
29. Mahasiswa yang melanggar aturan akan mendapat kesulitan.	1	2	3	4	5
30. Mahasiswa yang menyelesaikan tugasnya lebih cepat dari yang lain , segera dilanjutkan dengan topik selanjutnya.	1	2	3	4	5
31. Dosen menentukan siapa-siapa yang akan bekerja dalam satu grup.	1	2	3	4	5
32. Para mahasiswa akan dihukum apabila berperilaku buruk dikelas.	1	2	3	4	5
TO					
33. Dapat menyelesaikan suatu tugas adalah suatu hal yang penting bagi saya.	1	2	3	4	5
34. Saya bekerja sebanyak yang sudah saya tentukan untuk dikerjakan.	1	2	3	4	5
35. Saya tahu tujuan dari pada pelajaran / topik ini.	1	2	3	4	5
36. Saya siap untuk memulai pelajaran / topik ini tepat pada waktunya	1	2	3	4	5
37. Saya tahu apa yang harus saya capai dalam pelajaran /topik ini.	1	2	3	4	5
38. Saya menaruh perhatian sepanjang pelajaran / topik ini.	1	2	3	4	5
39. Saya berusaha untuk mengerti pekerjaan/ tugas di kelas / pelajaran ini.	1	2	3	4	5
40. Saya tahu berapa besar / banyak tugas yang saya harus lakukan.	1	2	3	4	5
CO					
41. Saya bekerjasama dengan mahasiswa lain ketika mengerjakan tugas dan pekerjaan saya.	1	2	3	4	5
42. Saya memakai bersama-sama buku dan fasilitas lainnya dengan mahasiswa lainnya ketika mengerjakan tugas.	1	2	3	4	5
43. Ketika bekerja didalam grup, terdapat kerjasama yang baik.	1	2	3	4	5
44. Saya bekerja dengan mahasiswa lainnya dalam proyek di kelas ini.	1	2	3	4	5
45. Saya belajar dari mahasiswa lain dalam kelas ini.	1	2	3	4	5
46. Saya bekerja dengan mahaiswa lainnya di kelas ini.	1	2	3	4	5
47. Saya bekerjasama dengan mahasiswa lainnya dalam kegiatan kelas.	1	2	3	4	5
48. Saya bekerja dengan para mahasiswa lainnya untuk mencapai tujuan dari kelas ini.	1	2	3	4	5
EQ					
49. Dosen memberi perhatian yang sama terhadap pertanyaan saya seperti kepada mahasiswa lainnya.	1	2	3	4	5
50. Saya mendapat bantuan yang sama dari Dosen seperti mahasiswa lainnya.	1	2	3	4	5
51. Saya mendapat kesempatan bicara yang sama dengan mahasiswa lainnya dikelas.	1	2	3	4	5
52. Saya mendapat perlakuan yang sama seperti mahasiswa lainnya dikelas.	1	2	3	4	5
53. Saya mendapat dorongan yang sama seperti mahasiswa lainnya.	1	2	3	4	5
54. Saya mendapat kesempatan untuk berpartisipasi dalam diskusi kelas seperti mahasiswa lainnya.	1	2	3	4	5
55. Pekerjaan saya mendapat penghargaan seperti mahasiswa lainnya.	1	2	3	4	5
56. Saya mendapat kesempatan yang sama untuk menjawab pertanyaan seperti mahasiswa lainnya.	1	2	3	4	5

Appendix 2B

WHAT IS HAPPENING IN THIS STATISTICS CLASS
STUDENT PREFERRED FORM
(Indonesian Version)

PETUNJUK

Ini bukan sebuah test.

Pernyataan- pernyat
aan berikut ini membahas mengenai *keinginan / harapan* pada pelaksanaan mata kuliah *Statistik* yang telah anda ikuti.

Tidak ada jawaban *'benar'* atau *Salah*. Yang diharapkan adalah *'Pendapat'* anda.

Pertimbangkanlah baik-baik pernyataan-pernyataan berikut ini dan bandingkan *keinginan dan harapan* anda sebagai
'*seorang mahasiswa'*.

Lingkarilah angka-angka sebagai berikut:

1.	Apabila anda ingin / berharap	Hampir tidak pernah
2.	Apabila anda ingin / berharap	Jarang
3.	Apabila anda ingin / berharap	Kadang-kadang
4.	Apabila anda ingin / berharap	Sering
5	Apabila anda ingin / berharap	Hampir selalu

Jangan menjadi ragu apabila ada beberapa pernyataan yang hampir sama.

Berikan pendapat anda pada semua pernyataan yang ada.

Apabila anda berubah pendapat, berilah *tanda silang* pada angka yang dibatalkan dan *lingkarilah* angka pengganti yang anda pilih.

CONTOH

Pernyataan: *Anggauta kelas ini akan selalu tolong-menolong.*

Yang perlu anda lakukan adalah mempertimbangkan apakah para mahasiswa yang ada dikelas anda saling tolong menolong satu sama lain
'Hampir tidak pernah', *'Jarang 'Kadang-kadang','Sering','Hampir selalu'.*

Apabila anda *berharap / berkeinginan* hal itu Sering terjadi, maka lingkarilah angka 4 pada kuestioner yang anda isi.

Nama: Kelas: Npm: L/P (jenis kel):
Terimakasih atas kerjasamanya, selamat bekerja
Ingatlah bahwa anda sedang menilai apa yang menjadi harapan / keinginan anda dikelas Statistik anda

SC		Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
1.	Saya akan dapat berkawan baik dengan mahasiswa lainnya dikelas ini.	1	2	3	4	5
2.	Saya akan dapat mengenal mahasiswa lainnya dikelas ini.	1	2	3	4	5
3.	Saya akan merasa tidak asing dengan para mahasiswa dikelas ini.	1	2	3	4	5
4.	Semua mahasiswa dikelas akan menjadi kawan saya.	1	2	3	4	5
5.	Saya akan dapat bekerja dengan baik bersama mahasiswa dikelas.	1	2	3	4	5
6.	Saya akan menolong mahasiswa lainnya yang mengalami kesulitan dalam pekerjaannya.	1	2	3	4	5
7.	Para mahasiswa dikelas akan menyukai saya.	1	2	3	4	5
8.	Dalam kelas ini, saya akan dapat mendapat pertolongan / bantuan dari mahasiswa lainnya.	1	2	3	4	5
TS						
9.	Dosen dapat menarik perhatian saya secara khusus.	1	2	3	4	5
10.	Dosen akan membantu saya dengan caranya sendiri.	1	2	3	4	5
11.	Dosen akan menghargai perasaan saya.	1	2	3	4	5
12.	Dosen akan menolong saya bila saya mendapat kesulitan dalam pekerjaan.	1	2	3	4	5
13.	Dosen akan berbicara kepada saya.	1	2	3	4	5
14.	Dosen akan tertarik kepada masalah saya.	1	2	3	4	5
15.	Dosen akan merubah / mengatur kelas agar dapat berbicara dengan saya.	1	2	3	4	5
16.	Pertanyaan Dosen akan membantu saya untuk mengerti.	1	2	3	4	5

IN	Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
17. Saya akan mendiskusikan ide dikelas.	1	2	3	4	5
18. Saya akan memberikan pendapat saya selama diskusi kelas berlangsung.	1	2	3	4	5
19. Dosen akan menanyakan pertanyaan kepada saya.	1	2	3	4	5
20. Ide dan saran2 saya akan dipergunakan selama diskusi dikelas berlangsung.	1	2	3	4	5
21. Saya akan bertanya kepada Dosen.	1	2	3	4	5
22. Saya akan menerangkan ide saya kepada mahasiswa lainnya.	1	2	3	4	5
23. Para mahasiswa akan berdiskusi dengan saya tentang cara memecahkan masalah.	1	2	3	4	5
24. Saya akan diminta untuk menerangkan bagaimana cara saya menyelesaikan masalah.	1	2	3	4	5
OO					
25. Kelas ini akan menjadi kelas yang tertib dan baik.	1	2	3	4	5
26. Kelas ini tidak akan ribut.	1	2	3	4	5
27. Saya akan tahu apa yang akan terjadi apabila saya tidak menuruti aturan.	1	2	3	4	5
28. Para mahasiswa akan mengetahui semua aturan dikelas ini.	1	2	3	4	5
29. Para mahasiswa akan mengetahui bahwa siapa yang tidak mengikuti peraturan akan mendapat kesulitan.	1	2	3	4	5
30. Para mahasiswa yang menyelesaikan tugasnya lebih cepat dari lainnya akan beralih ketopik selanjutnya.	1	2	3	4	5
31. Dosen akan memutuskan / menentukan mahasiswa mana yang akan bekerja bersama.	1	2	3	4	5
32. Para mahasiswa akan dihukum apabila berperilaku tidak baik dikelas.	1	2	3	4	5
TO					
33. Dapat menyelesaikan sejumlah pekerjaan tertentu akan sangat penting bagi saya.	1	2	3	4	5
34. Saya akan bekerja seperti yang telah saya rencanakan / tentukan.	1	2	3	4	5
35. Saya akan tahu tujuan dari kelas ini.	1	2	3	4	5
36. Saya akan siap untuk memulai kelas ini tepat pada waktunya.	1	2	3	4	5
37. Saya akan tahu apa yang saya coba / usahakan untuk saya capai dikelas ini.	1	2	3	4	5
38. Saya akan memberi perhatian selama kelas ini berlangsung	1	2	3	4	5
39. Saya akan berusaha untuk mengerti pekerjaan dikelas ini	1	2	3	4	5
40. Saya akan tahu berapa banyak pekerjaan yang harus saya lakukan.	1	2	3	4	5
CO					
41. Saya akan bekerjasama dengan mahasiswa lain ketika mengerjakan tugas dan pekerjaan saya.	1	2	3	4	5
42. Saya akan memakai bersama-sama buku dan fasilitas lainnya dengan mahasiswa lainnya ketika mengerjakan tugas	1	2	3	4	5
43. Ketika bekerja didalam grup, akan terdapat kerjasama yang baik.	1	2	3	4	5
44. Saya akan bekerja dengan mahasiswa lainnya dalam proyek di kelas ini.	1	2	3	4	5
45. Saya akan belajar dari mahasiswa lain dalam kelas ini.	1	2	3	4	5
46. Saya akan bekerja dengan mahasiswa lainnya di kelas ini.	1	2	3	4	5
47. Saya bekerjasama dengan mahasiswa lainnya dalam kegiatan kelas.	1	2	3	4	5
48. Saya bekerja dengan para mahasiswa lainnya untuk mencapai tujuan dari kelas ini.	1	2	3	4	5
EQ					
49. Dosen akan memberi perhatian yang sama terhadap pertanyaan saya seperti kepada mahasiswa lainnya.	1	2	3	4	5
50. Saya akan mendapat bantuan yang sama dari Dosen seperti mahasiswa lainnya.	1	2	3	4	5
51. Saya akan mendapat kesempatan bicara yang sama dengan mahasiswa lainnya dikelas.	1	2	3	4	5
52. Saya akan mendapat perlakuan yang sama seperti mahasiswa lainnya dikelas.	1	2	3	4	5
53. Saya akan mendapat dorongan yang sama seperti mahasiswa lainnya.	1	2	3	4	5
54. Saya akan mendapat kesempatan untuk berpartisipasi dalam diskusi kelas seperti mahasiswa lainnya.	1	2	3	4	5
55. Pekerjaan saya akan mendapat penghargaan seperti mahasiswa lainnya.	1	2	3	4	5
56. Saya akan mendapat kesempatan yang sama untuk menjawab pertanyaan seperti mahasiswa lainnya.	1	2	3	4	5

Appendix 3

WHAT IS HAPPENING IN THIS LINEAR ALGEBRA CLASS?

STUDENT ACTUAL AND PREFERRED FORMS

(Indonesian Version)

Appendix 3A
WHAT IS HAPPENING IN THIS LINEAR ALGEBRA CLASS?
ACTUAL FORM
(Indonesian Version)

PETUNJUK

Ini bukan sebuah test.

Pernyataan- pernyataan berikut ini membahas mengenai *'kenyataan'* pada pelaksanaan mata kuliah *Aljabar Linier* yang telah anda ikuti.

Tidak ada jawaban *'benar'* atau *Salah* . Yang diharapkan adalah *'Pendapat'* anda.

Pertimbangkanlah baik-baik pernyataan-pernyataan berikut ini dan bandingkan seberapa jauh kenyataan yang ada dikelas anda sehari-hari sebagai *'seorang mahasiswa'*.

Lingkarilah angka-angka sebagai berikut:

1.	Apabila pada kenyataan	Hampir tidak pernah
2.	Apabila pada kenyataan	Jarang
3.	Apabila pada kenyataan	Kadang-kadang
4.	Apabila pada kenyataan	Sering
5	Apabila pada kenyataan	Hampir selalu

Jangan menjadi ragu apabila ada beberapa pernyataan yang hampir sama.

Berikan pendapat anda pada semua pernyataan yang ada.

Apabila anda berubah pendapat, berilah '*tanda silang'* pada angka yang dibatalkan dan *' lingkarilah '* angka pengganti yang anda pilih.

CONTOH

Pernyataan: Anggauta kelas ini saling tolong-menolong.

Yang perlu anda lakukan adalah mempertimbangkan apakah para mahasiswa yang ada dikelas anda saling tolong menolong satu sama lain
'Hampir tidak pernah', *'Jarang'* , *'Kadang-kadang'*, *'Sering'*, *'Hampir selalu'*.

Apabila anda berpendapat hal itu Sering terjadi, maka lingkarilah angka 4 pada kuestioner yang anda isi.

Nama: Kelas: Npm: L/P (jenis kel):

Terimakasih atas kerjasamanya, selamat bekerja
Ingatlah bahwa anda sedang memberi pendapat mengenai kelas Aljabar Linier anda

SC	Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
1. Saya berkawan dengan semua mahasiswa di kelas.	1	2	3	4	5
2. Saya tahu semua mahasiswa di kelas ini.	1	2	3	4	5
3. Saya merasa familiar dengan anggauta kelas ini.	1	2	3	4	5
4. Semua anggauta kelas ini adalah teman saya.	1	2	3	4	5
5. Saya bekerjasama dengan baik dengan anggauta kelas ini.	1	2	3	4	5
6. Saya menolong anggauta kelas saya (kawan2 saya) apabila mereka mempunyai kesulitan dalam pekerjaan mereka.	1	2	3	4	5
7. Semua mahasiswa dikelas ini menyukai saya.	1	2	3	4	5
8. Dikelas ini saya dapat mendapat bantuan / pertolongan dari mahasiswa lainnya.	1	2	3	4	5
TS					
9. Dosen dapat menarik perhatian saya secara khusus.	1	2	3	4	5
10. Dosen menolong saya secara khusus.	1	2	3	4	5
11. Dosen menghargai perasaan saya.	1	2	3	4	5
12. Dosen menolong / membantu saya ketika saya mendapat kesulitan dalam menyelesaikan pekerjaan saya.	1	2	3	4	5
13. Dosen berbicara kepada saya	1	2	3	4	5
14. Dosen menaruh perhatian / tertarik terhadap masalah saya.	1	2	3	4	5
15. Dosen mengatur / merubah kelas agar dapat berbicara kepada saya	1	2	3	4	5
16. Pertanyaan dosen membantu saya untuk mengerti.	1	2	3	4	5

I	Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
17. Saya mendiskusikan ide2 / gagasan2 dikelas.	1	2	3	4	5
18. Saya memberikan pendapat saya selama diskusi dikelas berlangsung.	1	2	3	4	5
19. Dosen bertanya kepada saya.	1	2	3	4	5
20. Ide dan saran saya dipakai selama diskusi berlangsung.	1	2	3	4	5
21. Saya menanyakan pertanyaan kepada Dosen.	1	2	3	4	5
22. Saya menerangkan ide saya kepada mahasiswa lainnya	1	2	3	4	5
23. Para mahasiswa (kawan2) berdiskusi dengan saya tentang cara menyelesaikan masalah.	1	2	3	4	5
24. Saya diminta untuk menerangkan tentang cara menyelesaikan masalah.	1	2	3	4	5
OO					
25. Kelas ini tertib dan teratur dengan baik.	1	2	3	4	5
26. Kelas ini sangat ribut.	1	2	3	4	5
27. Saya diberi tahu apa yang akan terjadi apabila saya tidak menurut pada aturan.	1	2	3	4	5
28. Saya mengetahui semua aturan dikelas ini.	1	2	3	4	5
29. Mahasiswa yang melanggar aturan akan mendapat kesulitan.	1	2	3	4	5
30. Mahasiswa yang menyelesaikan tugasnya lebih cepat dari yang lain , segera dilanjutkan dengan topik selanjutnya.	1	2	3	4	5
31. Dosen menentukan siapa-siapa yang akan bekerja dalam satu grup.	1	2	3	4	5
32. Para mahasiswa akan dihukum apabila berperilaku buruk dikelas.					
TO					
33. Dapat menyelesaikan suatu tugas adalah suatu hal yang penting bagi saya.	1	2	3	4	5
34. Saya bekerja sebanyak yang sudah saya tentukan untuk dikerjakan.	1	2	3	4	5
35. Saya tahu tujuan dari pada pelajaran / topik ini.	1	2	3	4	5
36. Saya siap untuk memulai pelajaran / topik ini tepat pada waktunya.	1	2	3	4	5
37. Saya tahu apa yang harus saya capai dalam pelajaran /topik ini.	1	2	3	4	5
38. Saya menaruh perhatian sepanjang pelajaran / topik ini.	1	2	3	4	5
39. Saya berusaha untuk mengerti pekerjaan/ tugas di kelas / pelajaran ini.	1	2	3	4	5
40. Saya tahu berapa besar / banyak tugas yang saya harus lakukan.	1	2	3	4	5
CO					
41. Saya bekerjasama dengan mahasiswa lain ketika mengerjakan tugas dan pekerjaan saya.	1	2	3	4	5
42. Saya memakai bersama-sama buku dan fasilitas lainnya dengan mahasiswa lainnya ketika mengerjakan tugas.	1	2	3	4	5
43. Ketika bekerja didalam grup, terdapat kerjasama yang baik.	1	2	3	4	5
44. Saya bekerja dengan mahasiswa lainnya dalam proyek di kelas ini.	1	2	3	4	5
45. Saya belajar dari mahasiswa lain dalam kelas ini.	1	2	3	4	5
46. Saya bekerja dengan mahaiswa lainnya di kelas ini.	1	2	3	4	5
47. Saya bekerjasama dengan mahasiswa lainnya dalam kegiatan kelas.	1	2	3	4	5
48. Saya bekerja dengan para mahasiswa lainnya untuk mencapai tujuan dari kelas ini.	1	2	3	4	5
EQ	Almost never	Seldom	Some-times	Often	Almost always
49. Dosen memberi perhatian yang sama terhadap pertanyaan saya seperti kepada mahasiswa lainnya.					
50. Saya mendapat bantuan yang sama dari Dosen seperti mahasiswa lainnya.	1	2	3	4	5
51. Saya mendapat kesempatan bicara yang sama dengan mahasiswa lainnya dikelas.	1	2	3	4	5
52. Saya mendapat perlakuan yang sama seperti mahasiswa lainnya dikelas.	1	2	3	4	5
53. Saya mendapat dorongan yang sama seperti mahasiswa lainnya.	1	2	3	4	5
54. Saya mendapat kesempatan untuk berpartisipasi dalam diskusi kelas seperti mahasiswa lainnya.	1	2	3	4	5
55. Pekerjaan saya mendapat penghargaan seperti mahaiswa lainnya.	1	2	3	4	5
56. Saya mendapat kesempatan yang sama untuk menjawab pertanyaan seperti mahasiswa lainnya.	1	2	3	4	5

Appendix 3B
WHAT IS HAPPENING IN THIS LINEAR ALGEBRA CLASS?
PREFERRED FORM

(Indonesian Version)

PETUNJUK

Ini bukan sebuah test.

Pernyataan- pernyataan berikut ini membahas mengenai *keinginan / harapan* pada pelaksanaan mata kuliah *Aljabar Linier* yang telah anda ikuti.

Tidak ada jawaban *'benar'* atau *Salah* . Yang diharapkan adalah *'Pendapat'* anda.

Pertimbangkanlah baik-baik pernyataan-pernyataan berikut ini dan bandingkan *keinginan dan harapan* anda sebagai '*seorang mahasiswa'.*

Lingkarilah angka-angka sebagai berikut:

1.	Apabila anda ingin / berharap	Hampir tidak pernah
2.	Apabila anda ingin / berharap	Jarang
3.	Apabila anda ingin / berharap	Kadang-kadang
4.	Apabila anda ingin / berharap	Sering
5	Apabila anda ingin / berharap	Hampir selalu

Jangan menjadi ragu apabila ada beberapa pernyataan yang hampir sama.

Berikan pendapat anda pada semua pernyataan yang ada.

Apabila anda berubah pendapat, berilah *tanda silang* pada angka yang dibatalkan dan *lingkarilah* angka pengganti yang anda pilih.

CONTOH

Pernyataan: *Anggauta kelas ini akan selalu tolong-menolong.*

Yang perlu anda lakukan adalah mempertimbangkan apakah para mahasiswa yang ada dikelas anda saling tolong menolong satu sama lain
'Hampir tidak pernah', *'Jarang,' 'Kadang-kadang', 'Sering', 'Hampir selalu'.*

Apabila anda *berharap / berkeinginan* hal itu Sering terjadi, maka lingkarilah angka 4 pada kuestioner yang anda isi.

Nama: Kelas: Npm: L/P (jenis kel):

Terimakasih atas kerjasamanya, selamat bekerja
Ingatlah bahwa anda sedang menilai apa yang menjadi harapan / keinginan anda dikelas Alin anda

SC	Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
1. Saya akan dapat berkawan baik dengan mahasiswa lainnya dikelas ini.	1	2	3	4	5
2. Saya akan dapat mengenal mahasiswa lainnya dikelas ini.	1	2	3	4	5
3. Saya akan merasa tidak asing dengan para mahasiswa dikelas ini.	1	2	3	4	5
4. Semua mahasiswa dikelas akan menjadi kawan saya.	1	2	3	4	5
5. Saya akan dapat bekerja dengan baik bersama mahasiswa dikelas.	1	2	3	4	5
6. Saya akan menolong mahasiswa lainnya yang mengalami kesulitan dalam pekerjaannya.	1	2	3	4	5
7. Para mahasiswa dikelas akan menyukai saya.	1	2	3	4	5
8. Dalam kelas ini, saya akan dapat mendapat pertolongan / bantuan dari mahasiswa lainnya.	1	2	3	4	5
TS					
9. Dosen dapat menarik perhatian saya secara khusus.	1	2	3	4	5
10. Dosen akan membantu saya dengan caranya sendiri.	1	2	3	4	5
11. Dosen akan menghargai perasaan saya.	1	2	3	4	5
12. Dosen akan menolong saya bila saya mendapat kesulitan dalam pekerjaan.	1	2	3	4	5
13. Dosen akan berbicara kepada saya.	1	2	3	4	5
14. Dosen akan tertarik kepada masalah saya.	1	2	3	4	5
15. Dosen akan merubah / mengatur kelas agar dapat berbicara dengan saya.	1	2	3	4	5
16. Pertanyaan Dosen akan membantu saya untuk mengerti.	1	2	3	4	5

IN	Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
17. Saya akan mendiskusikan ide dikelas.	1	2	3	4	5
18. Saya akan memberikan pendapat saya selama diskusi kelas berlangsung.	1	2	3	4	5
19. Dosen akan menanyakan pertanyaan kepada saya.	1	2	3	4	5
20. Ide dan saran saya akan dipergunakan selama diskusi dikelas berlangsung.	1	2	3	4	5
21. Saya akan bertanya kepada Dosen.	1	2	3	4	5
22. Saya akan menerangkan ide saya kepada mahasiswa lainnya.	1	2	3	4	5
23. Para mahasiswa akan berdiskusi dengan saya tentang cara memecahkan masalah.	1	2	3	4	5
24. Saya akan diminta untuk menerangkan bagaimana cara saya menyelesaikan masalah.	1	2	3	4	5
OO					
25. Kelas ini akan menjadi kelas yang tertib dan baik.	1	2	3	4	5
26. Kelas ini tidak akan ribut.	1	2	3	4	5
27. Saya akan tahu apa yang akan terjadi apabila saya tidak menuruti aturan.	1	2	3	4	5
28. Para mahasiswa akan mengetahui semua aturan dikelas ini.	1	2	3	4	5
29. Para mahasiswa akan mengetahui bahwa siapa yang tidak mengikuti peraturan akan mendapat kesulitan.	1	2	3	4	5
30. Para mahasiswa yang menyelesaikan tugasnya lebih cepat dari lainnya akan beralih ketopik selanjutnya.	1	2	3	4	5
31. Dosen akan memutuskan / menentukan mahasiswa mana yang akan bekerja bersama.	1	2	3	4	5
32. Para mahasiswa akan dihukum apabila berperilaku tidak baik dikelas.	1	2	3	4	5
TO					
33. Dapat menyelesaikan sejumlah pekerjaan tertentu akan sangat penting bagi saya.	1	2	3	4	5
34. Saya akan bekerja seperti yang telah saya rencanakan / tentukan.	1	2	3	4	5
35. Saya akan tahu tujuan dari kelas ini.	1	2	3	4	5
36. Saya akan siap untuk memulai kelas ini tepat pada waktunya.	1	2	3	4	5
37. Saya akan tahu apa yang saya coba / usahakan untuk saya capai dikelas ini.	1	2	3	4	5
38. Saya akan memberi perhatian selama kelas ini berlangsung.	1	2	3	4	5
39. Saya akan berusaha untuk mengerti pekerjaan dikelas ini.	1	2	3	4	5
40. Saya akan tahu berapa banyak pekerjaan yang harus saya lakukan.	1	2	3	4	5
CO					
41. Saya akan bekerjasama dengan mahasiswa lain ketika mengerjakan tugas dan pekerjaan saya.	1	2	3	4	5
42. Saya akan memakai bersama-sama buku dan fasilitas lainnya dengan mahasiswa lainnya ketika mengerjakan tugas.	1	2	3	4	5
43. Ketika bekerja didalam grup, akan terdapat kerjasama yang baik.	1	2	3	4	5
44. Saya akan bekerja dengan mahasiswa lainnya dalam proyek di kelas ini.	1	2	3	4	5
45. Saya akan belajar dari mahasiswa lain dalam kelas ini.	1	2	3	4	5
46. Saya akan bekerja dengan mahasiswa lainnya di kelas ini.	1	2	3	4	5
47. Saya bekerjasama dengan mahasiswa lainnya dalam kegiatan kelas.	1	2	3	4	5
48. Saya bekerja dengan para mahasiswa lainnya untuk mencapai tujuan dari kelas ini.	1	2	3	4	5
EQ					
49. Dosen akan memberi perhatian yang sama terhadap pertanyaan saya seperti kepada mahasiswa lainnya.	1	2	3	4	5
50. Saya akan mendapat bantuan yang sama dari Dosen seperti mahasiswa lainnya.	1	2	3	4	5
51. Saya akan mendapat kesempatan bicara yang sama dengan mahasiswa lainnya dikelas.	1	2	3	4	5
52. Saya akan mendapat perlakuan yang sama seperti mahasiswa lainnya dikelas.	1	2	3	4	5
53. Saya akan mendapat dorongan yang sama seperti mahasiswa lainnya.	1	2	3	4	5
54. Saya akan mendapat kesempatan untuk berpartisipasi dalam diskusi kelas seperti mahasiswa lainnya.	1	2	3	4	5
55. Pekerjaan saya akan mendapat penghargaan seperti mahaiswa lainnya.	1	2	3	4	5
56. Saya akan mendapat kesempatan yang sama untuk menjawab pertanyaan seperti mahasiswa lainnya.	1	2	3	4	5

Appendix 4

STUDENT ATTITUDE SCALE

STATISTICS AND LINEAR ALGEBRA CLASS FORMS

(English and Indonesian Versions)

Appendix 4A
ATTITUDE SCALE (Statistics Class)
(English Version)

Attitude	Almost never	Seldom	Some-times	often	Almost always
1. I like my (particular) major/class.	1	2	3	4	5
2. After graduation, I will get work easily.	1	2	3	4	5
3. I think my major is prestigious.	1	2	3	4	5
4. Statistics classes are interesting.	1	2	3	4	5
5. I would consider a future career in statistics to be good.	1	2	3	4	5
6. I enjoy reading statistics publications at the University.	1	2	3	4	5
7. I like statistics program on TV.	1	2	3	4	5
8. I think statistics is an easy subject.	1	2	3	4	5

Appendix 4B
ATTITUDE SCALE (Linear Algebra Class)
(English Version)

Attitude	Almost never	Seldom	Some-times	often	Almost always
1. I like my (particular) major/class.	1	2	3	4	5
2. After graduation, I will get work easily.	1	2	3	4	5
3. I think my major is prestigious.	1	2	3	4	5
4. Mathematics classes are interesting.	1	2	3	4	5
5. I would consider a future career in mathematics to be good.	1	2	3	4	5
6. I enjoy reading mathematics publications at the University.	1	2	3	4	5
7. I like mathematics program on TV.	1	2	3	4	5
8. I think mathematics is an easy subject.	1	2	3	4	5

Appendix 4C
ATTITUDE SCALE (Statistics)
(Indonesian Version)

ATT	Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
1. Saya menyukai bidang saya.	1	2	3	4	5
2. Setelah lulus saya akan mudah mendapat pekerjaan.	1	2	3	4	5
3. Menurut saya bidang saya bagus dan bergengsi.	1	2	3	4	5
4. Pelajaran statistik menarik.	1	2	3	4	5
5. Karir dibidang statistik akan baik dimasa datang.	1	2	3	4	5
6. Saya menyukai penerbitan statistik di Universitas.	1	2	3	4	5
7. Saya menyukai programa statistik di TV	1	2	3	4	5
8. Menurut saya statistik bukanlah bidang yang sulit.	1	2	3	4	5

Appendix 4D
ATTITUDE SCALE (Linear Algebra)
(Indonesian Version)

ATT	Tidak Pernah Terjadi	Jarang Terjadi	Kadang-Kadang Terjadi	Sering Terjadi	Sangat Sering Terjadi
41. Saya akan menyukai bidang saya.	1	2	3	4	5
42. Setelah lulus saya akan mudah mendapat pekerjaan.	1	2	3	4	5
43. Menurut saya bidang saya akan bagus dan bergengsi.	1	2	3	4	5
44. Pelajaran matematik akan menarik.	1	2	3	4	5
45. Karir dibidang matematik akan baik dimasa datang.	1	2	3	4	5
46. Saya akan menyukai penerbitan Matematik di Universitas.	1	2	3	4	5
47. Saya akan menyukai programa matematik di TV.	1	2	3	4	5
48. Menurut saya matematik bukanlah bidang yang sulit.	1	2	3	4	5