LEARNING ENVIRONMENT AND STUDENTS' OUTCOMES IN SCIENCE CLASSES IN INDONESIAN LOWER SECONDARY SCHOOLS

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This study reports research findings on assessment of the science classroom learning environment and its association with two student outcomes—attitudes toward science and national examination scores. Modified versions of the WIHIC and TOSRA questionnaires in the Indonesian language were administered to 1400 students and their teachers. This study sought to find out the nature of science classroom learning environment and the association between learning environments and students' outcomes in Indonesian lower secondary schools. The findings were summarised into five assertions. First, significant differences between students' perceptions of the actual and preferred learning environments were found: Students tended to prefer more favourable classroom learning environments than they actually perceive. Second, differences exist between male and female students' perceptions of their science classroom learning environment: Female students held slightly more positive perceptions on both the actual and preferred learning environment. Third, disparities between students' and teachers' perceptions of the science classroom learning environments were found: Students held less favourable perceptions on both versions than did their teachers. Fourth, students in rural schools held less favourable perceptions of the actual classroom environments than did students in urban

and suburban schools for all seven scales. Finally, this study identifies the association between students' perceptions of the learning environments and both their attitudes toward science and scores in the national examination.

INTRODUCTION

Learning is a unique process that is directly and indirectly influenced by variables such as teachers' beliefs, teaching instruction, students' attitudes and the classroom learning environment. The working environment or school climate may also influence teachers in conducting teaching, thus determining student learning and student outcomes. The notion that the learning environment plays an important role can be found in the Science Curriculum Documents of Indonesian Lower Secondary Schools. Explicitly, it is stated that along with teachers, teaching methods, curriculum, and resources, the learning environment (natural, social and cultural) determines teaching and learning processes, and thus in turn influences students' outcomes (Ministry of Education and Culture, 1994).

To date, ongoing efforts of the Indonesian government are to establish educational equity and to enhance educational quality for all citizens. Equity in education means that regardless of ethnicity, gender, religion and tribe, every citizen has the right to education. To some degree, this effort has been successfully achieved. For example, the illiteracy has decreased and the number of student enrolments has increased. Yet, with regard to quality, the government is still struggling to ensure that schools are able to provide students with a good education. To overcome this, the Ministry of National Education has developed and conducted programs which focus on teachers' professional development. Yet the results of the programs are far from what was expected with regard to the improvement of students' average scores in the national examination. It is suspected that while the programmes

focus on teachers' skills enhancement, such as teaching approach, learning theory, and administration matters, they do not include the enhancement of the learning environment as part of the discourse. Therefore, it can be questioned whether the failure of the programs to improve students' average scores in national examinations is due to the neglect of the classroom learning environment.

THEORETICAL UNDERPINNING

The importance of learning environments

The importance of the learning environment has gained recognition from findings of many studies. Research on education that focuses on students' conceptual change asserts that effective teaching approaches which aim for students' conceptual change require learning environments that are sensitive to learners' needs, feelings, and ideas (Scott, Assoko & Driver, 1992). White's (1989) study emphasised that the context in which learning takes place must be supportive and comfortable and free from any form of repression. In more detail, the assertions from robust learning environment studies support those claims; first, an effective learning process calls for learning environments characterised by high levels of personalisation, involvement, order and organisation and task orientation to promote cognitive and affective outcomes (Fraser, 1994; Fraser, Rennie & Tobin, 1990; Fraser & Tobin, 1991). Second, these findings are consistent with assertions of Haertel, Walberg, and Haertel's (1981) meta-analysis of 12 studies of learning environment-students' outcome relationships that involved 17,805 students in four nations. These authors argued that students' effective learning is positively related to the levels of cohesiveness, satisfaction, and task orientation in the classroom, and negatively related to levels of friction and disorganisation. Therefore, it is suggested, for the sake of students' effective learning, that teachers

must establish a classroom learning environment within which students feel confident and are able to express and discuss their opinions freely. Educational research in this area is needed to assist teachers and principals or school administrators to enhance their learning and working environments.

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

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

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

PAST LEARNING ENVIRONMENT STUDIES IN INDONESIA

Over a period of nearly four decades, there have been a limited number of studies in Indonesian classrooms devoted to learning environment issues. Reviewing those studies (Fraser, Pearse, & Azmi, 1982; Irianto & Treagust, 2001; Mangindaan, Sembiring, & Livingstone, 1978; Margianti & Fraser, 2000; Margianti, Fraser, & Aldrige, 2001; Paige, 1978; Rideng & Schibeci, 1984; Schibeci, Rideng & Fraser, 1987; Soeharto, 1998; Soerjaningsih, Fraser, & Aldrige, 2001) confirm that the classroom learning environment determines school achievement and should be taken into account. However, no serious attempt has been made to consider the learning environment as a unit or discourse component in the educational development programs. For example, in the PKG (*Peningkatan Kerja Guru*-Teacher Development Program) and MGMP (*Musyawarah Guru Mata Pelajaran*-Forum for Subject Matter Teacher) established by the government, the focus is on teaching skills and administration matters, such as developing *Program Tahunan* (yearly plan), *Program Catur Wulan* (quarterly plan), *Program Satuan Pelajaran* (unit lesson plan) and *Rencana Pengajaran* (teaching plan). Furthermore, the discontinuity of the studies over four decades suggests that the status of learning environment studies in Indonesia is promising yet neglected, and that there is room for further study. Accordingly,

this study was conducted to provide evidence of the nature of the classroom learning environments in rural and urban lower secondary schools in the Indonesian educational context.

THE OBJECTIVES OF THE STUDY

The major objective of this study is to provide evidence of the status of science classroom learning environment and its association with student outcomes in Indonesian lower secondary schools. More specifically, the objectives are formulated in the following research questions:

1. What are students' perceptions of their science classroom-learning environment?
2. Are there any significant differences between male and female students' perception of their science classroom-learning environment?
3. How do students in different school areas perceive their science classroom learning environment?
4. What are, if any, the differences between students' and their teachers' perceptions of science classroom learning environments?
5. Are there any correlations between students' perceptions of the classroom environment and students' outcomes?

SIGNIFICANCE OF THE STUDY

None of the studies on the learning environment in the Indonesian educational context has involved rural school students. Moreover, this study is distinctive in the way that it brings teachers', principals', and school administrators' attention to the importance of the learning environment to enhance educational practice at their schools. This study is significant because there has been no research

on learning environments of urban and rural lower secondary schools in Indonesia. The findings can be used by the Ministry of National Education (MONE) to formulate policy and help principals and teachers improve their practice in conducting science education. In addition, the research can be used to assist classroom teachers to enhance their classroom-learning environment by identifying the aspects of learning environment associated with students' outcomes.

RESEARCH METHODS

Instruments

Fraser (1994; 1998a; 1998b) has documented the development and use of salient instruments for assessing the classroom learning environment. Questionnaires are common and economical instruments to assess students' perceptions of their classroom-learning environment and their attitudes toward science. Thus, in this study we used the Indonesian version of two questionnaires, namely, *What Is Happening In this Classroom or WIHIC* (Fraser, Mc Robbie & Fisher, 1996; Aldridge, Fraser & Huang, 1999) and *Test of Science Related Attitude* or TOSRA (Fraser, 1981) to gather the data. There were three reasons in choosing these questionnaires. First, these questionnaires are suitable for the secondary school level. Second, all statements in these questionnaires are non-threatening. Third, these questionnaires have proven to be robust and reliable. Finally, the questionnaires have been successfully used for cross-cultural study and are suitable with the goals of this study. Cross validation of the Indonesian version of these two questionnaires have been reported by Wahyudi and Treagust (2003).

DATA COLLECTION

The Indonesian versions of WIHIC and of TOSRA questionnaires were used as the major method to collect data about the classroom learning environment and student attitudinal outcomes in this study. In addition, classroom observations of some classes were conducted as a way of triangulation so that the data would portray an accurate picture of the learning environment. The focus of the classroom observations was on the aspects that corresponded to items on the scales in the instruments. Students' cognitive outcomes data were drawn from students' science scores in Year 9 National Examination in the 2001/2002 academic year. The test comprised items with multiple choices that have a single right answer. The score's range was 0 to 100.

SAMPLING

Purposive or purposeful sampling (Merriam, 1990, p. 48) as a non-probabilistic sampling method was used in selecting the sample for the study. This choice was based on the assumption that the researcher wanted to discover, understand, and gain insight and that the researcher chose the sample which will lead to most understanding (Merriam, 1990, p. 48). Purposive sampling permits the researcher to decide prior the study who and what schools are to be included in the data collection. In so doing, a consultation with the Ministry of National Education, Kalimantan Selatan, was sought. The samples involved in this main study included the willing and chosen participation of 1188 students from 72 classes and their science teachers in 16 lower secondary schools in urban, suburban and rural areas of Kalimantan Selatan, Indonesia.

FINDINGS AND DISCUSSION

In the following sections, the data are organised into five assertions to explore the nature of the science classroom learning environments and associations with students' attitude toward science and their cognitive outcomes.

Assertion 1:

There were significant differences between students' perceptions of the actual and preferred learning environments: Students tended to prefer more favourable classroom learning environments than they actually perceive.

Results from *t* tests for paired samples showed that there are significant differences ($p<0.01$) between students' perception of their actual and preferred learning environment on all scales except the *Involvement* scale. A summary of the average item means and average standard deviation for the two versions of the questionnaire is reported in Table 1 and the same data graphed in Figure 1.

Table 1
Average Item Mean, Average Standard Deviation, and t Test Results for Paired Samples for Differences Between the Actual and Preferred Perceptions (n=1188)

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

**$p<0.01$

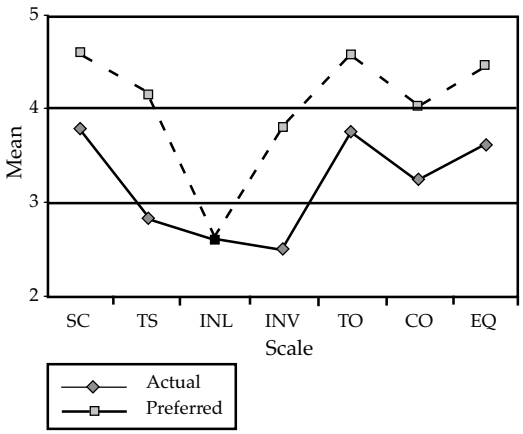

Figure 1: Comparison Between Students' Perceptions of the Actual and Preferred Science Classroom Learning Environments

The results, which are consistent with previous studies (Fisher & Fraser, 1983), suggest that most students would prefer a learning environment which is characterised by having more teacher support, enhancing students' cohesiveness, providing clearer task orientation, doing more investigations, and ensuring greater cooperation as well as more equity during class sessions. Teachers or principals can use these discrepancies in actual and preferred scales as a focus for improving their classrooms in keeping with Fraser's (1989) five stages for learning environment enhancement.

Interestingly, students perceived the same level on the *Involvement* scale for both the actual and preferred versions. This anomaly warrants further investigation. This scale's mean of 2.62 shows that students have classroom experiences that constitute involvement that is between 'seldom' and 'sometimes'. Therefore, it can be inferred that students were accepting of a classroom atmosphere that allows them to be passive. This finding is an interesting reflection on Thair and Treagust's (1997) results which

assert that the teacher in the Indonesian classroom has absolute authority and gives students little chance to participate.

Assertion 2:

The differences between male and female students' perceptions of their science classroom learning environment existed: Female students held slightly more positive perceptions on both the actual and preferred learning environment.

Part of the tradition in learning environment studies is the investigation of differences between male and female perceptions. In line with this tradition, this study explored those scales, upon which male and female students perceived the classroom learning environment significantly differently. Using the paired sample test procedure, the average class mean of items was used as the unit of analysis. Since the number of male and female students was not equal, the data were broken into 144 cases, 72 cases for each group of male and female students. These pairs of data then were matched for further analysis and the results are depicted in Table 7. For comparison purposes, the average item means for both actual and preferred versions for males and females are provided in Figure 2.

Table 2
Average Item Mean, Average Item Standard Deviation, and t Test for Independent Samples for Differences Between Male and Female Students' Perceptions of Science Classroom-Learning Environment (n=72)

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

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

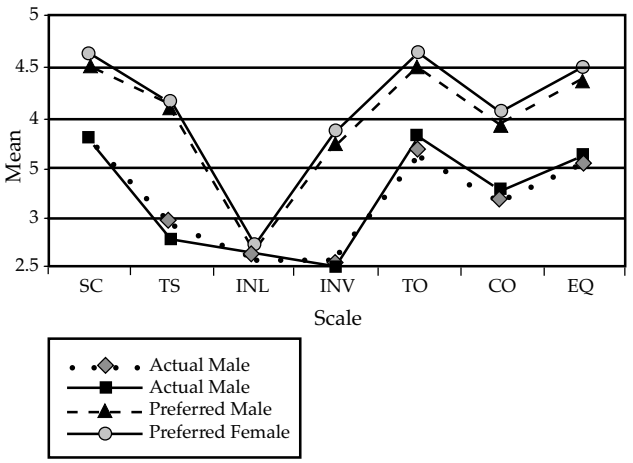

Figure 2: Comparison Between Males' and Females' Perceptions of the Actual and Preferred Science Classroom Learning Environments

The results of this study maintain the assertions yielded from previous studies (Goh & Fraser, 1995; Riah, 1998), in which females hold better perceptions of the classroom learning environment than do males. Table 4 and Figure 2 suggest that generally females have perceptions slightly more favourable than the males on the actual science classroom-learning environment. While the magnitudes of the differences between male and female students' views of the classroom learning environment are small, significant differences occur on two scales, namely *Teacher Support* and *Task Orientation*. Males perceived that their teachers' support was more favourable than did females. On the other hand, males perceived task orientation set by their teachers less positively than did females. Furthermore, females tended to have higher preference of seven scales toward their ideal science classroom-learning environment than the males. In detail, significant differences ($p<0.05$) exist for

four scales, namely *Student Cohesiveness, Investigation, Task Orientation, and Cooperation*.

Assertion 3:

There were statistically significant differences of students' perceptions on the actual classroom learning environments with regard to school locality: Students in rural schools held less favourable perceptions than did students in urban and suburban schools on all seven scales.

To investigate the differences between students' perception of the actual learning environment based on schools locality, a one-way between groups ANOVA with post-hoc comparisons was carried out. All seven scales were placed as the dependent variables, whereas the schools locality variable was placed as the determinant variable. Tukey's honesty significant difference (HSD) multiple comparison test used in this procedure shows that there are significant differences for all seven scales between rural students' and both urban and suburban students' perceptions of the actual science classroom learning environment; two scales, namely, *Teacher Support* and *Cooperation*, are perceived by students in suburban and urban schools significantly differently. Students in urban schools viewed their classrooms as having greater cooperation yet less teacher support than did students in suburban schools. Figure 3 provides the average item means for seven scales for urban, suburban, and rural schools.

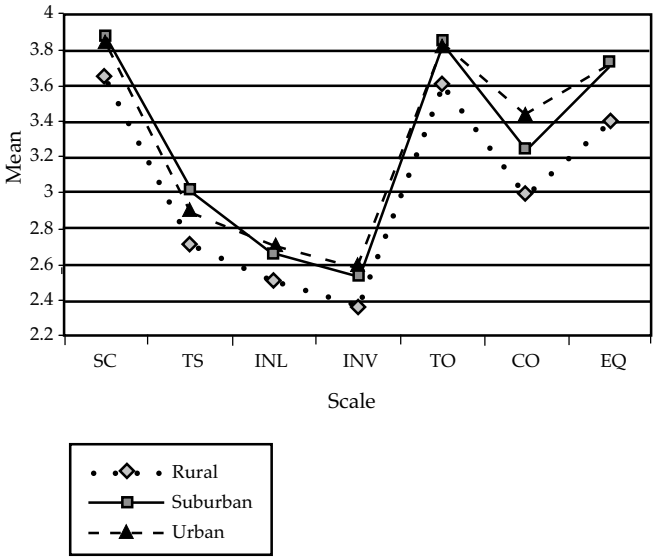

Figure 3: Comparison of Students' Perceptions of the Actual Science Classroom Learning Environments Based on Schools' Locality

Figure 3 shows that students in rural schools held less favourable perceptions than did students in both urban and suburban schools for all seven scales. This fact can be confirmed with findings from the classroom observations. In most cases, classroom transactions in rural schools were more dominated by teacher-centred methods, having less investigation or laboratory activities, and students being less sure of teacher's expectations. Frequently in rural schools, students were told to copy notes from the blackboard before the teacher explained them. Consequently, students in rural schools did not have a chance to develop a better learning environment. Interviews with the superintendent also supported this assertion. One superintendent informed the first researcher that most rural

schools are deprived due to lack of resources and teachers. Consequently, it is common that a teacher handles more than one or two subjects in which he or she is not competent, resulting in relatively poor teaching performance in these subjects.

Assertion 4:

There were disparities between students' and teachers' perceptions of the science classroom learning environments: Students held less favourable perceptions on both versions than did their teachers.

In line with previous studies, an investigation of differences between students' and teachers' perceptions was carried out using class means as the unit of analysis. A summary of the average item means and average standard deviations of each scale for both actual and preferred versions is reported in Table 3. The average item means are displayed in Figure 4 to show the differences between students' and their teachers' perceptions, on both the actual and preferred classroom learning environment questionnaires.

Table 3
Average Item Mean, Average Item Standard Deviation, and t Test for Independent Samples for Differences Between Students' and Teachers Perceptions of Science Classroom-Learning Environment (n=72)

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

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

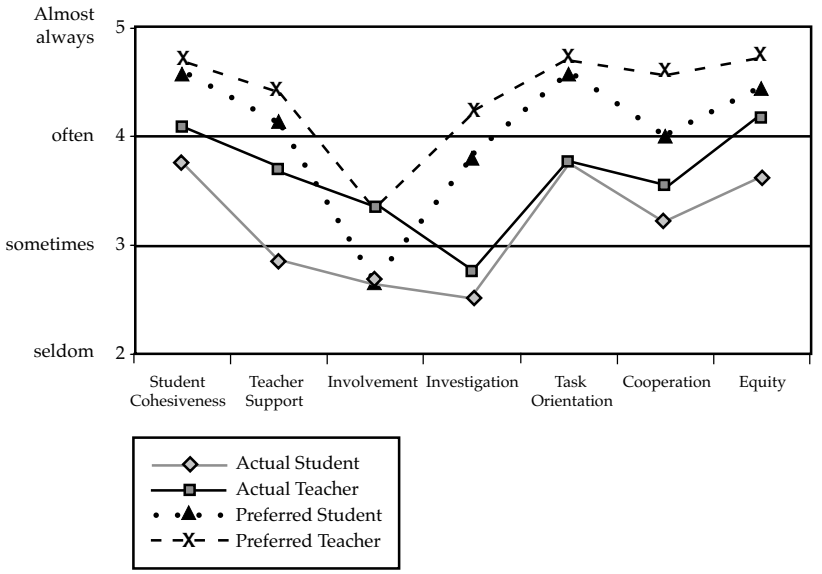

Figure 4: Comparison Between Students' and Teachers' Perceptions of the Actual and Preferred Science Classroom Learning Environments

In most cases, teachers hold more favourable views of the actual classroom learning environments than do their students, with the exceptions of the *Task Orientation* scale in which both students and teachers views are in agreement. Table 4 reveals that students and their teachers perceived their science classroom learning environment significantly differently on five of the seven scales, namely, *Student Cohesiveness* ($p<0.05$), *Teacher Support* ($p<0.01$), *Involvement* ($p<0.01$), *Cooperation* ($p<0.05$), and *Equity* ($p<0.01$). These findings corroborate previous results (Fisher & Fraser, 1983) in that the teachers' views of the science classroom learning environments are more positive than those of students.

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

Figure 4 shows that teachers' and students' views on the *Involvement* scale were equal for both actual and preferred versions, although the means were significantly different for those two groups. Instead of claiming that both students and teachers may be content from their perceptions based on the *Involvement* scale, a careful analysis shows that both are content but have different perceptions. While the teachers might be content in their views about students' involvement, students' responses are somewhere in between 'seldom' and 'sometimes' occurrences. Therefore, if the teachers desire their students to experience more involvement in the learning process, which is what teachers perceive, teachers need to reconsider the way they teach. This study suggests that teachers should consider teaching strategies that naturally improve students' involvement such as that reported by Wahyudi and Treagust (2001) in chemistry classes.

Assertion 5:

Students' perceptions of their science classroom learning environments were associated with their attitude toward science and their score in the final examinations.

To answer the last research question, simple and multiple correlations between each scale of Indonesian WIHIC and of TOSRA using individual scores as the unit of analysis (n=1118) were conducted. In addition, correlations between each scale of WIHIC and students cognitive outcomes were also examined using school scores as the unit of analysis (n=16). The results are reported in Table 4.

Table 4
Simple Correlation (r), Multiple Correlation (R) and Standardised Regression Coefficient (β) for Association Between Science Classroom Learning Environment and Student Attitudes and Cognitive Outcomes

WIHIC Scales	Strength of Students Outcomes-Environment Association							
	Attitudes Outcomes						Cognitive Outcomes	
	Inquiry		Enjoyment		Leisure Interest			
	r	*β*	*r*	*β*	*r*	*β*	*r*	*β*
Student Cohesiveness	0.08**	0.00	0.11**	-0.06	0.06	-0.07*	0.63**	0.11
Teacher Support	0.15**	0.02	0.24**	0.08*	0.19**	0.05	0.38	-0.14
Involvement	0.16**	0.02	0.27**	0.14*)	0.24**	0.15*)	0.46	0.47
Investigation	0.20**	0.16*)	0.25**	0.06	0.21**	0.06	0.38	-0.75
Task Orientation	0.14**	0.04	0.25**	0.14*)	0.23**	0.18*)	0.50*	-0.11
Cooperation	0.08**	-0.06	0.12**	-0.09*	0.04	-0.14*)	0.77**	1.07*
Equity	0.17**	0.10*	0.25**	0.12*)	0.19**	0.08*	0.48	0.04
Multiple Correlations (*R*)		0.23*)		0.35*)		0.32*)	0.85	

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

Simple correlations indicate the bivariate association between students' outcomes and each of the scales of the Indonesian WIHIC. On the other hand, multiple correlations or multiple regression analysis offer the joint and unique influence of each scale in the Indonesian WIHIC on students' outcomes. A significant beta weight confirms that a scale of the Indonesian WIHIC is related to students' outcome when the six scales are mutually controlled.

Table 4 shows that all scales of the Indonesian WIHIC are statistically significantly (p<0.01) associated with three scales of the Indonesian TOSRA, except the *Leisure Interest in Science* scale, in which the *Student Cohesiveness* and *Cooperation* scales were not statistically significantly correlated. The multiple regression analysis

produced a significant multiple correlation (R) of 0.23 (p<0.001) for students' scientific inquiry attitude, of 0.35 (p<0.001) for students' enjoyment during science lessons, and of 0.32 (p<0.001) for students' leisure interest in science. Furthermore, investigations of the value of β reveal that *Investigation* and *Equity* scales are strong predictors of students' scientific inquiry attitude. Students' enjoyment during science lessons is significantly (p<0.05 and p<0.001) influenced by all seven scales, except *Student Cohesiveness* and *Investigation*, of the Indonesian WIHIC. With the exception of *Teacher Support* and *Investigation*, all the Indonesian WIHIC scales strongly influence students' leisure interest in science. The negative relationship in Table 4 indicate that both students' enjoyment during science lessons and their leisure interest in science are greater in classrooms that have less cooperation and less student cohesiveness. This finding suggests that the Indonesian students tend to work individually, rather than to cooperate with their fellows students both during the lesson and in their leisure time activities related to science.

Despite the small size of the school sample (n=16 of schools), data analysis on the relationship between learning environment and student cognitive outcome show that students' achievement in science examinations is significantly related to *Student Cohesiveness* (p<0.01), *Task Orientation* (p<0.05), and *Cooperation* (p<0.01). In addition, although multiple correlation analysis did not show significant association between the learning environment and students' cognitive outcomes, investigation on individual b values found that *Cooperation* is a strong predictor of students' cognitive achievement. It can be predicted that students in these classrooms in which there is greater cooperation will achieve higher scores in the science examination than students in the classrooms where there is less group work.

CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

Based on the assertions, several comments can be made. First, there is a gap between the actual and preferred perceptions held by the students at all schools regardless of locality. Obviously, students were not content with the actual learning environment as indicated in their preferred view of what kind of learning environment should be created by the teacher. Students would prefer a learning environment that has more teacher support, better student cohesiveness, clearer task orientation, more investigation, and greater cooperation, as well as greater equity during class sessions. Therefore, for the sake of improving the teaching and learning processes, classroom teachers or policy makers may use this information as a point of departure to enhance teaching and learning practices in science classroom. In so doing, teachers and policy makers may consider Fraser's (1989) strategies that consist of five stages for improving the classroom-learning environment which strongly reflect the finding of this research. These can be used as a direction for future research.

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

Third, disparities also arose between perceptions of students in rural schools and of students in urban and suburban schools. In most cases, students in rural schools experienced a less positive learning environment than did their counterparts in urban areas. This finding warrants teachers in rural schools and policy makers

considering what should be done to provide better services, with respect to classroom learning environment, in those schools.

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

Fifth, the study documented that students' perceptions of their actual learning environment are correlated with their attitudes and cognitive outcomes. In general, all aspects of a classroom learning environment play significant roles in shaping and influencing students' attitude toward science and scores in the examination. However, teachers should be aware of the contradiction that is found in this study. This study noticed the two contradictory roles of the *Cooperation* scale upon students' outcomes. On the one hand, this scale is positively associated with and is a strong predictor of students' achievement in the subject examination. However, this scale is negatively correlated with and a good predictor of students' enjoyment and leisure interest in science activity. Therefore, teachers need to consider to what degree they should maintain cooperative activities during science lessons, so that both students' positive attitude toward science and a higher achievement in the examination can be attained.

Finally, further research that employs this questionnaire for different subjects and other levels of education such as upper primary and upper secondary schools, is recommended in conjunction with the efforts for dissemination of research in this area and for improving Indonesian classroom learning environments.

AUTHORS' NOTE

The first author would like to thank to the students and teachers for their participations in this study, and to the Australian Agency for International Development (*AusAID*) for providing the scholarship to enable him to complete his studies in Australia.

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