

A Study of Learning Environments in Agricultural Science Classrooms in Nigeria

Suleiman Idiris and Barry J. Fraser

Science and Mathematics Education Centre
Curtin University of Technology
GPO Box U1987
Perth Western Australia 6001

Paper presented at the annual conference of the
Australian Association for Research in Education (AARE),
The University of Newcastle, New South Wales, November 1994

Although the study of learning environments over the past quarter of a century has spanned many different countries (Fraser, 1994), this line of research has been almost nonexistent in Nigeria, with the only three examples of prior studies being a cross-national study of science laboratory classroom environment settings (Fraser, Okebukola & Jegede, 1992), a study of the socio-cultural environment (Jegede, Fraser, Agada & Okebukola, in press), and an investigation of associations of student attitudes with classroom and school psychosocial environment (Akindehin, 1993). Recent literature reviews (e.g., Fraser, 1994; Fraser & Walberg, 1991) suggests that previously no learning environment study has been conducted specifically in agricultural science classrooms in any country. Consequently, the present study aimed to develop a valid classroom environment instrument for Nigerian agricultural science classes, and to use this new instrument to investigate some determinants and effects of classroom environment.

Background

Agricultural Science Education in Nigeria

The total population of Nigeria is over 88 million, with approximately 75% of people living in rural agricultural communities. Agriculture has been the mainstay of economic development in Nigeria since independence in 1960. With the first development plan (1962-1968) and the second development plan (1970-1974), the agricultural sector accounted for two thirds of the national gross revenue. From 1975, oil revenue exceeded that of agriculture and became the main source of Nigeria's revenue. However, current government policy has shifted again towards the agricultural sector. Within this

context, it is not surprising that agricultural science occupies a central place within school curricula in Nigeria, and that it is a compulsory subject for all junior secondary school students (i.e., at the compulsory education level).

The school agricultural science curriculum is structured around the three major concepts of production, protection and economics, with topics classified as basic concepts, crop production, animal production, agricultural ecology and systems, agricultural engineering and agricultural economics. Despite agricultural science's pride of place, research has suggested that Nigerian students often have negative attitudes to the study of agricultural science and low levels of achievement in it (Idiris, 1988, 1990; Mohapelon, 1973; Olaitan, 1984). The central place occupied by agricultural science in the Nigerian school curriculum, together with the reports indicating disappointing student outcomes, justify the decision to conduct the present study of the learning environments of Nigerian agricultural science classes, their determinants, and the effects of these environments on student attitudes and achievement.

Fraser (1989) discusses background information about the field of classroom environment and its focus upon students' and teachers' perceptions of psychosocial aspects of the learning environment which pervade school classrooms, and provides compelling evidence that the classroom environment is a potent determinant of student outcomes that should not be ignored by those wishing to improve the effectiveness of schools. The use of students and teachers' perceptions can be contrasted with the method of direct observation which involves external observers in systematic coding of classroom communication and events according to some category scheme (Dunkin & Biddle, 1974).

Walberg began developing early versions of the globally-used Learning Environment Inventory as part of the research and

evaluation activities of Harvard Project Physics (Walberg & Anderson, 1968). Simultaneously, Moos was developing the first of his world-recognised social climate scales, including those for use in psychiatric hospitals (Moos & Houts, 1968) and correctional institutions (Moos, 1968), which ultimately resulted in the development of the well-known Classroom Environment Scale (Moos & Trickett, 1987). A perspective germinated from Moos and Walberg's research, and this has influenced the ways of conceptualising, assessing and investigating classroom environment (Chavez, 1984; Fraser, 1994; Fraser & Walberg, 1991; MacAuley, 1990; Moos, 1979; Walberg, 1979). Numerous questionnaire have been developed to assess classroom environment in specific settings such as elementary schools (Fraser & O'Brien, 1985), universities (Fraser & Treagust, 1986), science laboratories (Fraser, McRobbie & Giddings, 1993), individualised settings (Fraser, 1990), constructivist classes (Taylor, Fraser & White, 1994) and computer-assisted instruction classrooms (Teh & Fraser, in press).

The most common line of classroom environment research has involved investigation of the effects of classroom environment on student outcomes (Fraser & Fisher, 1982; McRobbie & Fraser, 1993). In fact, considerable research has replicated the findings that the nature of the classroom environment affects student achievement and attitudes (Haertel, Walberg & Haertel, 1981). The practical importance of this research is that student outcomes can be improved by emphasising those classroom

environment dimensions found empirically to be linked with better achievement. Furthermore, in person-environment fit research, it was found that student outcomes were enhanced in classrooms in which the actual classroom environment was similar to that preferred by students (Fraser & Fisher, 1983).

Classroom environment perceptions have been employed not only as predictor variables in research on the effects on class room environment, but also as criterion variables in studies of determinants of classroom environment. For example, when classroom environment instruments have been used as a source of process criteria in curriculum evaluation, studies involving the Australian Science Education Project (Fraser, 1979a) and Harvard Project Physics (Welch & Walberg, 1972) revealed that classroom environment variables differentiated revealingly between alternative curricula when measures of student achievement of cognitive and attitudinal goals have shown little sensitivity.

Studies in the USA (Moos, 1979), Australia (Fisher & Fraser, 1983), the Netherlands (Wubbels, Brekelmans & Hooymayers, 1991) and Israel (Hofstein & Lazarowitz, 1986) compared students' and

teachers' perceptions of actual and preferred classroom environment. It was found that, first, both students and teachers preferred a more positive classroom environment than they perceived as being actually present and, second, teachers tended to perceive the classroom environment more positively than did their students in the same classrooms.

Fraser (1994) has provided a table which summarises studies aimed in identifying how the classroom environment varies with such factors as teacher personality, subject matter and the type of school. For example, in a study involving students' preferences for different types of classroom environments, girls were found to prefer cooperation more than boys, but boys preferred both competition and individualisation more than girls (Owens & Straton, 1980). In other studies, it was found that classroom environment varies with school type (Trickett, 1978), class size (Anderson & Walberg, 1972) and grade level (Welch, 1979), and between Catholic and government schools (Dorman, Fraser & McRobbie, 1994). Another determinant of classroom environment which is highly relevant to the present study in Nigeria is school environment. A limited amount of past research has investigated links between school and classroom environment (Fraser & Rentoul, 1982).

The links between classroom, school, family and other environments on students' outcomes have been explored (Moos, 1991). Classroom environment has been incorporated as one factor in a multifactor model of educational productivity (Fraser, Walberg, Welch & Hattie, 1987). Researchers have begun exploring ways in which classroom environment instruments and ideas can be used by school psychologists (Burden & Fraser, in press) and incorporated into teacher education (Fisher & Fraser, 1991a). Other recent studies have focused on changes in classroom environment during the transition from primary to high school (Midgley, Eccels & Feldlaufer, 1991) and incorporating the evaluation of classroom environment in teacher assessment schemes (Heroman, Loup, Chauvin & Evans, 1991). In research which originated in The Netherlands, a learning environment questionnaire has been developed to enable teacher educators to give preservice and inservice teachers advice about the nature and quality of the interaction between teachers and students

(Wubbels, Brekelmans & Hooymayers, 1991). Case studies of attempts to improve classroom environments (Thorpe, Burden & Fraser, in press) have demonstrated the usefulness of teachers employing classroom environment instruments to provide meaningful information about their classrooms and a tangible basis to guide improvements in classroom environments.

Another important contemporary trend in classroom environment research involves combining qualitative and quantitative methods (Fraser & Tobin, 1991). Studies of exemplary teachers (Fraser & Tobin, 1989), higher-level cognitive learning (Tobin, Kahle & Fraser, 1990) and the ethos of Catholic schools (Dorman, Fraser & McRobbie, 1994) clearly illustrate the benefits from combining qualitative and quantitative methods in learning environment research.

Aims

The aims of the present paper are to report:

1. the development and validation of a classroom environment instrument specifically suited to assessing the emphasis on constructivist and individualised approaches in secondary school agricultural science classes in Nigeria;
2. the nature of the actual and preferred environments of Nigerian agricultural science classes;
3. an investigation of the effect of classroom environment on students' attitudes and inquiry skills;
4. a study of some determinants of classroom environment (namely, aspects of the school-level environment).

Method

Sample

The sample consisted on 1175 students in 50 junior secondary and senior secondary agricultural science classes in 20 different schools in 8 states of Nigeria and the Federal Capital Territory. The sample was representative of schools from the northern and southern regions, and of urban and rural areas. Of the 20 schools, 13 were in urban areas and 7 in rural areas and, in terms of location, 7 were from southern states, 11 were from northern states and 2 were from the Federal Capital. The locations of the eight states involved are shown in Figure 1.

Each school was asked to provide at least two agricultural science classes for the study. In addition, the teachers of the two or more classes in each school, together with any other interested agricultural science teachers, were asked to respond to a school environment instrument. Altogether, 64 teachers from the 20 schools were involved in the study.

Instruments

Because there was particular interest in the present study in the degree of constructivism and individualisation in agricultural science classes, student perceptions of classroom environment were assessed with an instrument which initially encompassed the four scales of Negotiation, Prior Knowledge,

Autonomy, and Student-Centredness from the 1991 version of the Constructivist Learning Environment Survey (Taylor & Fraser, 1991) and the two scales of Investigation and Differentiation from the Individualised Classroom Environment Questionnaire (Fraser, 1990). However, the Prior Knowledge scale was omitted following item analysis procedures. Each classroom environment scale was amended to maximise its suitability for use in agricultural science classes in Nigeria. Students responded both to an actual and a preferred version using the response categories of Almost, Never, Seldom, Sometimes, Often and Very Often.

Figure 1. Map of Nigeria and States and the Federal Capital Territory Involved in the Study

Teachers' perceptions of school-level environment were assessed with a version of the School-Level Environment Questionnaire (Fisher & Fraser, 1991b; Rentoul & Fraser, 1982) which had been adapted somewhat to enhance its suitability for use in Nigerian secondary schools.

Student achievement of enquiry skills was assessed with a 14-item instrument based on the Test of Enquiry Skills (Fraser, 1979b), while the assessment of students' attitudes towards the learning of agricultural science involved 14 items adapted from the Test of Science Related Attitudes (Fraser, 1981). For the present sample, the alpha reliability coefficient for the inquiry skill measure was 0.66 and 0.87, respectively, with the individual and the school mean as the unit of analysis. The corresponding reliability figures for the attitude instrument were 0.63 and 0.83, respectively.

Data Collection

The data collection was somewhat complex and time-consuming. Several months were spent in Nigeria collecting data, and every school was visited several times to explain the purposes of the research to teachers and to clarify data collection procedures. Because of the magnitude of the data-collection task, teachers were asked to administer questionnaires in their own classes. At the end of data collection, one of the researchers visited each school to collect completed response sheets and to interview teachers and students in order to check that the data collection

had proceeded as intended.

Analysis

In order to validate the classroom environment instrument for use with Nigerian agricultural classes, item and factor analyses were conducted. A series of analyses of variance was carried out in order to find out if the actual version of each scale was able to differentiate significantly between the perceptions of students in different schools.

To investigate the relationships between classroom environment perceptions and student outcomes, two main methods of analysis were used: simple correlational analyses of relationships between individual outcome scores and individual environment scales; and multiple regression analyses of relationships between each outcome scale and the set of environment scales as a whole. All analyses were conducted once using the individual student score as the unit of statistical analysis, and repeated using the

school mean as the unit of analysis.

The investigation of associations between classroom-level and school-level environment involved simple correlations between school means of student perceptions on five classroom environment variables and school means of teacher perceptions on seven school environment dimensions.

Cross-Validation of the Classroom Environment Instrument

Table 1 reports validation information for both the actual and the preferred forms of the classroom environment instrument based on its use in Nigeria. Although a 48-item six-scale version was administered, data in Table 1 are reported for the 32-item in five scales which survived item and factor analysis procedures. The alpha reliability coefficient was used as the index of scale internal consistency, while the mean correlation of a scale with the other four scales was used as a convenient index of scale discriminant validity. Analyses are reported separately for two units of analysis (the individual student and the school mean). Figures reported in Table 1 generally suggest that each scale has satisfactory reliability for scales containing relatively small numbers of items (from 5 to 8). For example, the reliability of different scales in the actual form ranged from 0.55 to 0.82 with the individual as the unit of analysis and from 0.71 to 0.96 with the school mean as the unit of analysis. As expected, higher reliabilities were obtained when the school mean was used as the unit of statistical analysis. Comparable reliability estimates were found for the preferred form.

The mean correlation of a scale with the other four scales (i.e., the index of discriminant validity) ranged from 0.12 to 0.46 for the preferred form, and was comparable to the actual form (0.24 to 0.39). These figures are sufficiently low to indicate acceptable discriminant validity, and to suggest that the instrument assesses somewhat overlapping dimensions of classroom environment.

TABLE 1. Internal Consistency Reliability (Alpha Coefficient), Discriminant Validity (Mean Correlation with Other Scales) and Ability to Differentiate Between Schools (ANOVA Results) for the Classroom Environment Scales for Two Units of Analysis

Scale	No. of Items	Unit of Analysis	Alpha Reliability		Mean Correlation with Other Scales		ANOVA Results
			Actual	Preferred	Actual	Preferred	Eta ² Actual
Negotiation	5	Individual	0.55	0.50	0.24	0.12	0.32*
		School Mean	0.71	0.73	0.49	0.31	
Autonomy	7	Individual	0.73	0.60	0.37	0.31	0.45*
		School Mean	0.96	0.91	0.49	0.46	
Student Centredness	7	Individual	0.82	0.59	0.37	0.37	0.14*
		School Mean	0.91	0.74	0.33	0.42	
Investigat'n	8	Individual	0.64	0.59	0.39	0.27	0.31*
		School Mean	0.94	0.90	0.48	0.43	
Different-iation	5	Individual	0.59	0.50	0.28	0.27	0.16*
		School Mean	0.82	0.75	0.38	0.37	

* $p < 0.001$

The sample consisted of 1175 students in 20 schools.

Eta² is the ratio of 'between' to 'total' sums of squares and represents the proportion of variance in scale scores accounted for by class membership.

Another desirable characteristic of the actual form of any classroom environment instrument is that students within the same school should perceive the environment relatively similarly, while mean environment perceptions should vary from school to school. The analyses of variance (with school membership as the independent variable) reported in the last column of Table 1 confirm that the actual version of each scale differentiated significantly ($p < 0.001$) between the perceptions of students in different schools in this sample. The eta 2 statistic (which is

the ratio of 'between' to 'total' sums of squares and represents the proportion of variance in scale scores accounted for by class membership) ranged from 0.14 to 0.45 for different scales.

Factor analyses suggested that the factor structure obtained previously in other nations was replicated to a large extent, with the exception of only a few items, with the Nigerian samples. Overall, the various analyses provide considerable support for the validity of the classroom environment instrument. Therefore, teachers and researchers in Nigeria can have confidence in using the new questionnaire in the future.

Descriptive Information on Environments of Nigerian Agricultural Science Classes

Figure 2 shows the mean for the Nigerian sample for each of the five scales remaining in the classroom environment instrument after performing item and factor analyses. Because the number of items which survived the item and factor analysis procedures differed from scale to scale (from 5 to 7 items), the descriptive information reported in Figure 2 is based on item statistics (i.e., the scale mean or standard deviation divided by the number of items contained in that scale) rather than statistics based on scale totals.

Figure 2. Actual and Preferred Item Means for Classroom Environment Scales for Nigerian Sample

Several patterns are evident from Figure 2. First, the higher mean scores on the actual form occurred in Nigeria for the Negotiation, Autonomy and Investigation scales, whereas the lowest mean scores occurred on the Student Centredness and Differentiation scales. This suggests that Nigerian agricultural science classes tend to be teacher centred and that there is relatively little differential provision for different students simultaneously to undertake different topics and experiments and to proceed at different speeds.

The second pattern evident in Figure 2 is the consistent differences existing between actual and preferred mean scores for the four scales of Negotiation, Autonomy, Investigation and Differentiation. Preferred means are higher than actual means by at least one standard deviation for class means for these four scales. That is, students would prefer to have more opportunities to negotiate meaning, to be given autonomy, to investigate, and to have differential provisions for different

students than currently is perceived to be present in the classroom. This pattern, in which Nigerian students would prefer

a more positive classroom environment than the one actually present, replicates past research in Australia (Fisher & Fraser, 1983), the USA (Moos, 1979) and Israel (Hofstein & Lazarowitz, 1986). However, it is interesting to note that, for Student Centredness (which is a scale with a low mean on the actual form), the actual environment already is just the way that student would prefer it to be. Not only is the level of Student Centredness low in Nigerian agricultural science classes, but students also prefer it to be at the low level.

Associations Between Student Outcomes and Classroom Environment

Table 2 reports associations between the two student outcome measures (namely, enquiry skills and attitudes) and the five classroom environment scales. Analyses were performed for two units of analysis, and only statistically significant associations ($p < 0.05$) are reported in Table 2. Because the simple correlation analyses are likely to be associated with a relatively high Type I error rate for the study as a whole, stepwise multiple regression analyses were conducted to provide a more conservative test of the associations between an outcome measure and a specific environment scale when all other environment scales preceding it in the stepwise analysis were mutually controlled.

The simple correlation analysis reported in Table 2 shows that the number of statistically significant associations ($p < 0.05$) between attitude scores and an environment scale was 4 with the individual as the unit of analysis (16 times that the expected by chance) and none with the school mean as the unit of analysis. For the inquiry skills outcome, the number of significant associations was 3 with the individual as the unit of analysis (12 times that expected by chance) and 5 with the school mean as the unit of analysis (20 times that expected by chance).

The bottom of Table 2 shows that the multiple correlation was significantly greater than zero for the attitude outcome with the individual as the unit of analysis, and for the enquiry skill outcome with either unit of analysis. Table 2 also reports the standardised regression coefficient for those environment scales which accounted for a significant increment in outcome variance beyond that accounted for by the other environment scales preceding that scale in the stepwise analysis.

For the stepwise multiple regression analyses, a significant relationship was found between attitudes and Autonomy with the individual as the unit of analysis, between enquiry skills and both Negotiation and Autonomy with the individual as the unit of analysis, and between enquiry skills and both Autonomy and Student Centredness with the school mean as the unit of analysis.

As expected, the number of significant findings in the multiple regression analysis was smaller than for the simple correlational analysis.

TABLE 2. Significant Results from Simple Correlational and Stepwise Multiple Regression Analyses for Associations Between Classroom Environment Scales and Student Outcomes for Two Units of Analysis

The present results replicate considerable research in numerous countries which has established consistent relationships between student outcomes and student perceptions of the classroom environment (Fraser & Fisher, 1982; Haertel, Walberg & Haertel, 1981; McRobbie & Fraser, 1993). Moreover, with one exception, higher scores on environment scales were associated with more positive attitudes and higher enquiry skill scores. The one exception, in which a negative relationship was found between enquiry skill proficiency and Student Centredness, is consistent with prior research in other countries involving the Student Centredness scale (Fraser, McRobbie & Giddings, 1993).

Determinants of Classroom Environment

Whereas the previous section reported an investigation of the effects of classroom environment on student outcomes, the aspect of the research which is described in this section involved an investigation of some determinants of classroom environment (namely, the nature of the school-level environment).

School-Level Environment

Various writers have found it useful to distinguish classroom or classroom-level environment from school or school-level environment, which involves psychosocial aspects of the climate of whole schools (Anderson, 1982; Fraser & Rentoul, 1982; Genn, 1984). Nevertheless, despite their simultaneous development and logical linkages, the fields of classroom-level and school-level environment have remained remarkably independent. Consequently, it is common for workers in one field to have little cognizance of the other field and for different theoretical and conceptual foundations to be used to underpin the two areas. It is acknowledged here, however, that it would be desirable to break away from the existing tradition of independence of the two fields of school and classroom environment and for there to be a confluence of the two areas.

A common way of viewing school environment is to consider it as

something distinct from and more global than classroom environment. For example, whereas classroom climate might involve relationships between the teacher and his/her students or among students, school climate might involve relationships between teachers and their teaching colleagues, head of department and school principal. Similarly, while classroom environment is usually measured in terms of either student or teacher perceptions, school environment is assessed usually (but not exclusively) in terms of teacher perceptions.

School climate research owes much in theory, instrumentation and methodology to earlier work on organisational climate in business contexts (Anderson, 1982). This point is illustrated clearly by the fact that two widely-used instruments in school environment research, namely, Halpin and Croft's (1963) Organizational Climate Description Questionnaire (OCDQ) and Stern's (1970) College Characteristic Index (CCI), relied heavily on previous work in business organisations. Consequently, one feature of school-level environment work which distinguishes it from classroom-level environment research is that the former has tended to be associated with the field of educational administration and to rest on the assumption that schools can be viewed as formal organisations (Thomas, 1976). Another distinguishing feature is that, whereas classroom-level research

has been concentrated on secondary and elementary schools rather than in higher education, a sizeable proportion of school-level environment research has involved the climate of higher education institutions.

Assessment of School Environment

In the present study, teachers' perceptions of their school environment were assessed using a modified version of the School-Level Environment Questionnaire (SLEQ; Fisher & Fraser, 1991b; Rentoul & Fraser, 1982). Separate actual and preferred forms of a 44-item version of this instrument were administered to 64 teachers in the same 20 schools. Following item analysis of these data, two of the SLEQ's original scales and several individual items were omitted to form a 35-item version. The names of the scales in this version are listed in Table 3.

The SLEQ has been used in exploring differences between the climates of primary and high schools (Fisher & Fraser, 1991a) among a sample of the 109 teachers in 10 schools in Tasmania. The most striking pattern of findings was that the climate in primary schools emerged as more favourable than the environment of high schools on most of the SLEQ scales. In particular, relative to high school teachers, primary school teachers

perceived their school climates considerably more favourably in terms of greater Affiliation, Professional Interest, Staff Freedom Participatory Decision Making, Innovation and Resource Adequacy. Also, the SLEQ was used successfully by teachers to assess their school environment and to use this information as a basis for improving their school environment (Fisher & Fraser, 1991a).

TABLE 3. Internal Consistency Reliability (Alpha Coefficient), Discriminant Validity (Mean Correlation with Other Scales) and Ability to Differentiate Between Schools (ANOVA Results) for the School-Level Environment Questionnaire for Two Units of Analysis

An examination of the scale means (adjusted for the varying number of items per scale) for the Nigerian sample of teachers revealed two patterns. First, the scale with the lowest mean on the actual form was Resource Adequacy. Clearly, Nigerian teachers feel that the material resources in their schools are inadequate. Second (as in past research reported by Fraser, 1994), there were quite large differences between actual and preferred school environments, with teachers preferring considerably higher levels of Application, Professional Interest, Participatory Decision-Making, Innovativeness and Resource Adequacy.

Cross-Validation of SLEQ in Nigeria

Table 3 reports for the SLEQ validation information analogous to that reported previously in Table 1 for the classroom environment measures. Data are reported for two units of analysis - the individual teacher's score and the school mean score. The statistics reported are the alpha reliability (internal consistency), mean correlation of a scale with the other scales (discriminant validity) and ANOVA results for class membership differences (ability to differentiate between classrooms).

Generally the reliability figures are high for the actual form

(ranging from 0.77 to 0.94 for different scales in the actual version with the individual as the unit of analysis), but lower for the preferred form of the SLEQ, for the two units of analysis. The mean correlations suggest adequate discriminant validity but, clearly, these scales overlap. The ANOVA results confirmed the ability of each scale to differentiate significantly ($p < 0.001$) between the perceptions of students in different classes. Although the statistics reported in Table 3 provide researchers and teachers with a degree of confidence in using the SLEQ in the future, further validation studies are

desirable.

Associations Between School and Classroom Environments

With a couple of exceptions (Fisher, Fraser & Wubbels, 1993; Fraser & Rentoul, 1982), past research has not attempted to establish links between school-level and classroom-level environments. Table 4 reports associations between students' perceptions of classroom-level environment and teachers' perceptions of school-level environment. Simple correlations are reported for the sample of 20 school means. The smallness of the sample of school means precluded more sophisticated multivariate analyses and, therefore, the present investigation should be regarded as exploratory and its findings as tentative.

TABLE 4. Correlations Between Classroom and School Environment Scales Using School Mean as Unit of Analysis

It is interesting to note from Table 4 that all five dimensions of school-level environment (i.e., Affiliation, Professional Interest, Participatory Decision-Making, Innovativeness, and Resource Adequacy) appear to affect significantly the level of classroom Negotiation, Autonomy and Investigation. On the other hand, none of the school environment variables were related significantly to the amount of classroom Student Centredness and Differentiation. That is, a more positive school environment (in terms of greater Affiliation, Professional Interest, Participatory Decision-Making, Innovativeness and Resource Adequacy) seem to promote classroom environments which provide more opportunities in the classroom for student Negotiations, Autonomy and Investigation. On the other hand, the school environment appears to have little influence on the levels of Student Centredness and Differentiation, which also happen to be the two classroom environment dimensions with low mean scores relative to the other scales (see Figure 2).

Although little prior research has attempted to establish links between school-level and classroom-level environment, the pattern of results emerging from this study generally replicate two prior studies conducted in Australia using the SLEQ (Fisher, Fraser, Wubbels & Brekelmans, 1993; Fraser & Rentoul, 1982). Nevertheless, because of the preliminary nature of this aspect of the study, this fascinating pattern of findings should be considered tentative until further replication studies have been carried out in Nigeria.

Summary, Limitations, Implications and Suggestions for Further Research

This paper reported four main aspects of a study of Nigerian agricultural science classroom environments. First, an

examination of the profiles of mean environment scores showed that, relative to scores on Negotiation, Autonomy and Investigation, Nigerian agricultural science classroom environments were perceived to have low levels of Student Centredness and Differentiation. Also, past research (e.g., Fisher & Fraser, 1983) was replicated in that students generally preferred a more positive classroom environment than the one perceived to be actually present.

Second, data supported the cross-cultural validity of the classroom environment scales when used for the first time in Nigeria. In particular, each scale was found to display satisfactory internal consistency reliability and discriminant validity when either the student score or the school mean score was used as the unit of statistical analysis. Also, the actual form of each scale differentiated significantly between the perceptions of students in different classrooms.

Third, when simple and multiple correlation analyses were used to investigate associations between classroom environment and student outcomes, significant relationship emerged for two units of analysis (the student and the school mean) for both an attitude and enquiry skills outcome. The present study specifically in agricultural science classes in Nigeria generally replicates considerable past research (e.g., McRobbie & Fraser, 1993) into the effects of classroom environment on student outcomes in other countries in other subject areas.

Fourth, in order to investigate associations between students' perceptions of classroom environment and teachers' perceptions of school environment, it was necessary to cross-validate a five-scale version of the School-Level Environment Questionnaire. This instrument was found to have adequate reliability and discriminant validity for two units of analysis (the teacher and the school mean) and to differentiate between the perceptions of teachers in different schools. When simple correlations were calculated between classroom and school environment dimensions using the school mean of the unit of analysis, it was found that all school environment dimensions (namely, Affiliation, Professional Interest, Participatory Decision-Making, Innovativeness and Resource Adequacy) were linked with greater levels of Negotiation, Autonomy and Investigation within the classroom environment. This aspect of the research provides one of the few studies of associations between classroom-level and school-level environment.

Given that the present study was the first to focus on Nigerian agricultural science classroom environments, it is not surprising that the research had some limitations. Like most prior classroom environment research, associations between outcomes and actual environment were investigated in naturally occurring classrooms. What is needed in future research, then, are experimental studies in which the environment is changed deliberately in specific ways in order to establish more clearly the causal effects of these changes on students' outcomes. This study's methodology was predominantly quantitative, although useful qualitative components were involved during instrument development (in that the opinions about a preliminary version were sought from various experts, teachers and students) and in the instrument administration phase (teachers and students were interviewed to check that administration had proceeded as intended). Although the demands of quantitative aspects of this

study meant that it was outside the scope of the present research also to include an intensive qualitative component, it is fully acknowledge that a qualitative component would have complemented the quantitative component in the useful ways described by Fraser and Tobin (1991).

This study has several implications for improving agricultural science education in Nigeria. First, because considerable energy was devoted to adapting, developing and validating instruments to assess student perceptions of classroom environment, teacher perceptions of school environment, and student attitude and enquiry skill outcomes, teachers should make use of each of these instruments to enlarge their repertoires of evaluation instruments and to obtain information which can form the basis for the improvement of teaching and student achievement. Second, the aspect of research involving associations between classroom environment and student outcomes suggests that teachers are likely to be able to improve their students' attitudes and enquiry skills by changing their classroom environments to provide greater emphasis on Negotiation and Autonomy. Third, the part of the present study involving determinants of classroom environment suggested that educators wishing to improve classroom environment should exploit the finding that a greater emphasis on each school environment dimension (namely, Affiliation, Professional Interest, Participatory Decision-Making, Innovativeness and Resource Adequacy) is likely to lead to more positive classroom environments in terms of the level of student Negotiation, Autonomy and Investigation.

The present research leads to several directions for future research. There is scope both to replicate the present study and to extend it to the use of other classroom environment measures,

to a broader range of student outcome measures (e.g., achievement, critical thinking, qualitative understanding), and to other Nigerian samples (that extend beyond agricultural science classes at the junior high school level). Furthermore, by including students' scores on both an actual and a preferred form of a classroom environment scale within the same analyses involving student outcomes, past person-environment fit research (Fraser & Fisher, 1983) could be replicated in an attempt to ascertain whether student outcomes are enhanced when students are in their preferred classroom environment. Similarly, in future research, it would be desirable to replicate the present research into determinants of classroom environment using larger samples and multivariate statistical analyses, and also to investigate other determinants of classroom environment. Finally, as mentioned previously, it would be desirable to combine qualitative and quantitative methods in future classroom environment research (Fraser & Tobin, 1991).

In addition, it is desirable to replicate other lines of past research. For example, based on the fruitfulness of incorporating classroom environment measures into evaluations of Harvard Project Physics (Welch & Walberg, 1972) and computer assisted learning (Teh & Fraser, in press), it is suggested that evaluations in Nigeria include classroom environment dimensions as criteria of effectiveness. Furthermore, it could be beneficial to replicate past studies which have employed classroom environment dimensions as independent variable in investigating differences between students' and teachers' perceptions of the same classrooms (Fisher & Fraser, 1983), differences between the environments of primary and secondary schools (Docker, Fraser &

Fisher, 1989), of Catholic and government schools (Dorman, Fraser & McRobbie, 1994), of coeducational and single-sex schools (Trickett, Trickett, Castro & Schaffner, 1982), of classes of different sizes (Anderson & Walberg, 1972) and of classes at different grade levels (Welch, 1979). Other potentially useful lines of past classroom environment research which could be worth replicating in Nigeria include studies of changes in classroom environment during the transition between primary and secondary schools (Midgley, Eccles & Feldlaufer, 1991), incorporating the evaluation of classroom environment in teacher assessment schemes (Heroman, Loup, Chauvin & Evans, 1991), identifying distinct typologies of classroom environments (Moos, 1978), investigating the climates of exemplary teachers' classrooms (Fraser & Tobin, 1989) and developing and using a 'personal' form of classroom environment scales (Fraser, McRobbie & Giddings, in press).

Now that a classroom environment instrument has been developed and validated specifically for use in Nigeria, it is highly

desirable that teachers make use of the new questionnaire as a basis for guiding improvements in their classrooms. Fraser and Fisher (1986) have outlined a simple five-step procedure involving assessment of actual and preferred environment, feedback to the teacher, reflection and discussion, intervention and reassessment for improving classroom environments. Various case studies (e.g., Thorpe, Burden & Fraser, in press) attest to the usefulness of teachers employing classroom environment instruments to provide meaningful information about their classrooms and a tangible basis to guide improvements. It is recommended that teacher-researchers in Nigeria use these methods with the learning environment instrument in attempts to improve classroom environments.

The research reported in this paper generally consolidates a rich tradition of past research into the assessment, effects and determinants of classroom psychosocial environment (Fraser, 1994). However, this study of agricultural science classroom environment in Nigeria was unique in several ways. Although the study of learning environments has spanned many different countries, this line of research has been almost nonexistent in Nigeria. Also it appears that previously no learning environment study has been conducted specifically in agricultural science classrooms in any country. A secondary but important contribution of the present study is that it resulted in the development of some widely-applicable, valid and reliable instruments that can be used in future research to assess classroom environment, school environment and student outcomes (especially attitudes and enquiry skills) in Nigerian schools.

References

Adindehin, F. (1993). An investigation of some features of the psychosocial learning environment in some Nigerian secondary schools. *Research in Science and Technological Education*, 11, 117-126.

Anderson, C. S. (1982). The search for school climate: A review of the research. *Review of Educational Research*, 52, 368-420.

Anderson, G. J., & Walberg, H. J. (1972). Class size and the social environment of learning: A mixed replication and extension. *Alberta Journal of Educational Research*, 18, 277-286.

Burden, R., & Fraser, B.J. (in press). Use of classroom environment assessments in school psychology: A British perspective. *Psychology in the Schools*.

Chavez, R.C. (1984). The use of high inference measures to study classroom climates: A review. *Review of Educational Research* , 54 , 237-261.

Docker, J. G., Fraser, B. J., & Fisher, D. L. (1989). Differences in the psychosocial work environment of different types of schools. *Journal of Research in Childhood Education*, 4 , 5-17.

Dorman, J., Fraser, B.J., & McRobbie, C.J. (1994, April). Rhetoric and reality: A study of classroom environment in Catholic and government secondary schools . Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Dunkin, M.J., & Biddle, B. (1974). *The study of teaching* . New York: Holt, Rinehart and Winston.

Fisher, D.L., & Fraser, B.J. (1983). A comparison of actual and preferred classroom environment as perceived by science teachers and students. *Journal of Research in Science Teaching*, 20, 55-61.

Fisher, D.L., & Fraser, B.J. (1991a, April). Incorporating learning environment ideas into teacher education: An Australian perspective. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Fisher, D. L., & Fraser, B. J. (1991b). School climate and teacher professional development. *South Pacific Journal of Teacher Education*, 19, 17-32.

Fisher, D., Fraser, B., & Wubbels, Th. (1993). Interpersonal teacher behavior and school environment. In Th.Wubbels & J.Levy (Eds.), *Do you know what you look like?: Interpersonal relationships in education* (pp. 103-112). London, England: Falmer Press.

Fisher, D. L., Fraser, B. J., Wubbels, Th., & Brekelmans, M. (1993, April). Associations between school learning environment and teacher interpersonal behavior in the classroom. Paper presented at annual meeting of American Educational Research Association, Atlanta, GA.

Fraser, B.J. (1979a). Evaluation of a science-based curriculum. In H.J. Walberg (Ed.), *Educational environments and effects: Evaluation, policy, and productivity* . Berkeley, CA: McCutchan.

Fraser, B. J. (1979b). *Test of Enquiry Skills*. Melbourne: Australian Council for Educational Research.

Fraser, B. J. (1981). Test of Science-Related Attitudes (TOSRA). Melbourne: Australian Council for Educational Research.

Fraser, B.J. (1986). Classroom environment. London, England: Croom Helm.

Fraser, B.J. (1989). Twenty years of classroom environment

research: Progress and prospect. *Journal of Curriculum Studies* , 21 , 307-327.

Fraser, B. J. (1990). Individualised Classroom Environment Questionnaire. Melbourne: Australian Council for Educational Research.

Fraser, B. J. (1994). Research on classroom and school climate. In D.Gabel (Ed.), *Handbook of Research on Science Teaching and Learning* (pp. 493-541). New York: Macmillan.

Fraser, B. J. & Fisher D. L. (1982). Predicting students' outcomes from their perceptions of classroom psychosocial environment. *American Educational Research Journal*, 19, 498-518.

Fraser, B.J., & Fisher, D.L. (1983). Use of actual and preferred classroom environment scales in person-environment fit research. *Journal of Educational Psychology* , 75, 303-313.

Fraser, B.J., & Fisher, D.L. (1986). Using short forms of classroom climate instruments to assess and improve classroom psychosocial environment. *Journal of Research in Science Teaching* , 5, 387-413.

Fraser, B. J., McRobbie, C., & Giddings, G. (1993). Development and cross-national validation of a laboratory classroom environment instrument for senior high school science. *Science Education*, 77, 1-24.

Fraser, B.J., McRobbie, C. J., & Giddings, G. J. (in press). Evolution and validation of a personal form of an instrument for assessing science laboratory classroom environment. *Journal of Research in Science Teaching*.

Fraser, B.J., & O'Brien, P. (1985). Student and teacher perceptions of the environment of elementary-school classrooms. *Elementary School Journal* , 85 , 567-580.

Fraser, B. J., Okebukola, P., & Jegede, O. (1992). Assessment of the learning environment of Nigerian science laboratory classes. *Journal of the Science Teachers Association of Nigeria*, 27(2), 1-

17.

Fraser, B. J., & Rentoul, A. J. (1982). Relationship between school-level and classroom-level environment. *Alberta Journal of Educational Research*, 28, 212-225.

Fraser, B. J., & Tobin, K. (1989). Student perceptions of psychosocial environments in classrooms of exemplary science teachers. *International Journal of Science Education*, 11, 19-34.

Fraser, B.J., & Tobin, K. (1991). Combining qualitative and quantitative methods in classroom environment research. In B.J. Fraser & H.J. Walberg (Eds.), *Educational environments: Evaluation, antecedents and consequences*. Oxford, England: Pergamon Press.

Fraser, B.J., & Treagust, D.F. (1986). Validity and use of an instrument for assessing classroom psychosocial environment in higher education. *Higher Education*, 15, 37-57.

Fraser, B. J., & Walberg, H. J. (Eds.) (1991). *Educational*

environments: Evaluation, antecedents and consequences. Oxford, England: Pergamon Press.

Fraser, B.J., Walberg, H. J., Welch, W.W., & Hattie, J. A. (1987). Syntheses of educational productivity research. *International Journal of Educational Research*, 11 (2), 145-252. (whole issue)

Genn, J. M. (1984). Research into the climates of Australian schools, colleges, and universities: Contributions and potential need-press theory. *Australian Journal of Education*, 28, 227-248.

Haertel, G. D., Walberg, H. J., & Haertel, E. H. (1981). Socio-psychological environments and learning: A quantitative synthesis. *British Educational Research Journal*, 7, 27-36.

Halpin, A. W., & Croft, D. B. (1963). *Organizational climate of schools*. Chicago, IL: Midwest Administration Center, University of Chicago.

Heroman, D., Loup, K., Chauvin, S., & Evans, L. (1991, April). Student perceptions of the learning environment, on-the-job assessments of teaching and learning. Paper presented at annual meeting of American Educational Research Association, Chicago, IL.

Hofstein, A., & Lazarowitz, R. (1986). A comparison of the actual and preferred classroom learning environment in biology and chemistry as perceived by high school students. *Journal of Research in Science Teaching* , 23 , 189-199.

Idiris, S. A. (1988). A study of the status of agricultural science in post-primary schools of Kaduna State. Master of Education thesis, Ahmadu Bello University, Zaria, Nigeria.

Idiris, S. A. (1990, April). Teacher factors in the teaching of agricultural science in Nigerian schools and colleges. Paper presented at the Science Teachers' Association of Nigeria national workshop, University of Calabar.

Jegede, O., Fraser, B., Agada, D., & Okebukola, P. (in press). Junior secondary students' perception of science classroom climate relative to selected school demographic variables. *Abraka Journal of Education*.

MacAuley, D.J. (1990). Classroom environment: A literature review. *Educational Psychology* , 10, 239-253.

McRobbie, C. J., & Fraser, B. J. (1993). Associations between student outcomes and psychosocial science environment. *Journal of Educational Research*, 87, 75-85.

Midgley, C., Eccles, J.S., & Feldlaufer, H. (1991). Classroom environment and the transition to junior high school. In B.J. Fraser & H.J. Walberg (Eds.), *Educational environments: Evaluation, antecedents and consequences* . Oxford, England: Pergamon Press.

Mohapelon, J. M. (1973). Education for frustration. *West African Journal of Education*, 17, 141-150.

Moos, R.H. (1968). The assessment of the social climates of correctional institutions. *Journal of Research in Crime and Delinquency* , 5 , 174-188.

Moos, R. H. (1978). A typology of junior high and high school classrooms. *American Educational Research Journal* , 15 , 53-66.

Moos, R.H. (1979). *Evaluating educational environments: Procedures, measures, findings and policy implications* . San Francisco, CA: Jossey-Bass.

Moos, R.H. (1991). *Connections between school, work, and family*

settings. In B.J. Fraser and H.J. Walberg (Eds.), *Educational environments: Evaluation, antecedents and consequences*. Oxford, England: Pergamon Press.

Moos, R.H., & Houts, P.S. (1968). The assessment of the social atmospheres of psychiatric wards. *Journal of Abnormal Psychology*, 73, 595-604.

Moos, R.H., & Trickett, E.J. (1987). *Classroom Environment Scale manual* (2nd. ed.). Palo Alto, CA: Consulting Psychologists Press.

Olaitan, S. O. (1984). Low status of agriculture. In O. C. Onazi (Ed.), *Agricultural education in the tropics*. London, England: Macmillan

Owens, L. C., & Straton, R. G. (1980). The development of a cooperative, competitive and individualized learning preference scale for students. *British Journal of Educational Psychology*, 50, 147-161.

Rentoul, A. J., & Fraser, B. J. (1982). Development of a school-level environment questionnaire. *Journal of Educational Administration*, 21, 21-39.

Stern, G. G. (1970). *People in context: Measuring person-environment congruence in education and industry*. New York: Wiley.

Taylor, P. C., & Fraser, B. J. (1991, April). CLES: An instrument for assessing constructivist learning environments. Paper presented at annual meeting of National Association for Research in Science Teaching, Fontane, WI.

Taylor, P., Fraser, B., & White, L. (1994, April). CLES: An instrument for monitoring the development of constructivist learning environments. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Teh, G., & Fraser, B. (in press). An evaluation of computer-assisted learning in terms of achievement, attitudes and classroom environment. *Evaluation and Research in Education*.

Thomas, A. R. (1976). The organizational climate of schools. *International Review of Education*, 22, 441-463.

Thorpe, H., Burden, R., & Fraser, B. (in press). Assessing and improving classroom environment. *School Science Review*.

Tobin, K., Kahle, J., & Fraser, B. (Eds.). (1990). *Windows into*

science classrooms: Problems associated with higher-level
cognitive learning. London, England: Falmer Press.

Trickett, E.J. (1978). Toward a social-ecological conception of
adolescent socialization: Normative data on contrasting types
of public school classrooms. *Child Development* , 49 , 408-414.

Trickett, E.J., Trickett, P.K., Castro, J.J., & Schaffner, P.
(1982). The independent school experience: Aspects of
normative environments of single sex and coed secondary schools.
Journal of Educational Psychology, 74 , 374-381.

Walberg, H.J. (Ed.). (1979). Educational environments and
effects: Evaluation, policy, and productivity. Berkeley, CA:
McCutchan.

Walberg, H.J., & Anderson, G.J. (1968). Classroom climate and
individual learning. *Journal of Educational Psychology* , 59 ,
414-419.

Welch, W. W. (1979). Curricular and longitudinal effects on
learning environments. In H. J. Walberg (Ed.), *Educational
environments and effects: Evaluation, policy, and productivity*.
Berkeley, CA:McCutchan.

Welch, W. W., & Walberg, H. J. (1972). A national experiment in
curriculum evaluation. *American Educational Research Journal*, 9,
373-383.

Wubbels, Th., Brekelmans, M., & Hoymayers, H. (1991).
Interpersonal teacher behavior in the classroom. In B.J. Fraser &
H.J. Walberg (Eds.), *Educational environments: Evaluation,
antecedents and consequences* . Oxford, England: Pergamon Press.

BJF/Idiris-875-DY-23/11/94