

Determinants and Effects of Learning Environments in Agricultural Science Classrooms in Nigeria

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Although the study of learning environments has spanned many different countries, this line of research has been almost nonexistent in Nigeria, with the only two examples of prior studies being a cross-national study of science laboratory classroom environment settings (Fraser, Okebukola & Jegede, 1992) and a study of the socio-cultural environment (Jegede, Fraser, Agada & Okebukola, in press). Recent comprehensive literature reviews (e.g., Fraser, in press; Fraser & Walberg, 1991) suggests that previously no learning environment study has been conducted specifically in agricultural science classrooms in any country.

Background

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 secondary school students. 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). Consequently, the present study of the learning environments of Nigerian agricultural science classes, and the effects of these

environments on student attitudes and achievement, is timely and important.

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) an investigation of the effect of classroom environment on students' attitudes and inquiry skills.

A third aim of the study, which is outside the scope of the present paper, was to investigate some of the determinants of classroom environment including student gender, region (north, south), type of school (urban, rural), and the nature of the school-level environment.

Method

Sample

The sample consisted on 1 175 students in 50 junior secondary and senior secondary agricultural science classes in 20 different schools in 8 states of Nigeria. The sample was representative of schools from the northern and southern regions, and of urban and rural areas.

Instruments

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 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 dropped following item analysis procedures. Each classroom environment scale was amended to maximise its suitability for use in agricultural science classes in Nigeria.

Student achievement of enquiry skills was assessed with a 15-item instrument based on the Test of Enquiry Skills (Fraser, 1979), while the assessment of students' attitudes towards the learning of agricultural science involved 23 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.

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.

Validation of the Classroom Environment Instrument

Table 1 reports validation information for both the actual and the preferred forms of the classroom environment instrument. 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.

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 Learning Environment Survey for Two Units of Analysis

| Scale | Actual | Preferred |
|------------------------------------|--------|-----------|
| No. of Items | | |
| Unit of Analysis | | |
| Alpha Reliability | | |
| | Actual | Preferred |
| Mean Correlation with Other Scales | | |
| | Actual | Preferred |
| ANOVA | | |

Results Eta2

Actual

Negotiation 5 Individual
School Mean 0.55
0.71 0.50
0.73 0.24
0.49 0.12
0.31 0.32*

Autonomy 7 Individual
School Mean 0.73
0.96 0.60
0.91 0.37
0.49 0.31
0.46 0.45*

Student Centredness 7 Individual
School Mean 0.82
0.91 0.59
0.74 0.37
0.33 0.37
0.42 0.14*

Investigation 8 Individual
School Mean 0.64
0.94 0.59
0.90 0.39
0.48 0.27
0.43 0.31*

Differentiation 5 Individual
School Mean 0.59
0.82 0.50
0.75 0.28
0.38 0.27
0.37 0.16*

* $p < 0.001$

The sample consisted of 1 175 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.

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.

The analyses of variance reported in the last column of Table 1 confirmed that the actual version of each scale differentiated significantly ($p < 0.001$) between the perceptions of students in different schools in this sample. The eta² 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.

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).

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.

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

| | | Scale | |
|---------------------------|------------|---------|--------|
| Unit of Analysis | | r | b |
| Attitude | | | |
| Enquiry Skills | | | |
| Negotiation | | | |
| School Mean | Individual | 0.22* | 0.45** |
| 0.79** | | | |
| | | 0.33** | |
| Autonomy | | | |
| School Mean | Individual | 0.26** | 0.26* |
| 0.72** | | | 0.59** |
| | | 0.51** | |
| | | 0.80** | |
| Student Centredness | | | |
| School Mean | Individual | 0.24* | 0.16 |
| -0.49* | | | |
| | | -0.61** | |
| Investigation | | | |
| School Mean | Individual | 0.21* | 0.50** |
| 0.56** | | | |
| Differentiation | | | |
| School Mean | Individual | | -0.01 |
| 0.67** | | | |
| Multiple Correlation R | | | |
| School Mean | Individual | 0.26* | 0.67** |
| 0.94** | | | |
| * p<0.05 | | | |
| ** p<0.01 | | | |

The sample size was 1 175 students in 20 schools.

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 and Haertel, 1981; McRobbie & Fraser, in press). 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).

Conclusion

The present study resulted in the development of some widely-applicable, valid and reliable instruments that can be used in future research on classroom environment in Nigerian schools. Also, the present finding of relationships between classroom environment specifically in agricultural science classes in Nigeria generally replicate numerous prior studies in other subject areas in several other countries. This study is distinctive not only because there has been little past research in the area of classroom environments in Nigeria, but also because research which specifically examines the environments of agricultural science classes has been nonexistent worldwide.

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