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Perception of Psychosocial Environment of Chemistry by Senior Secondary School Chemistry Teachers and their Students: A Nigerian Perspective

Thomas Igwebuike* Helen Ajuar
School of Education, College of Education, PMB 1251, Warri, Delta State
*beluolisa2005@yahoo.com

Abstract

The study was designed to determine secondary school chemistry students' and their teachers' perceptions of their classroom environment. The study sample consisted of 280 (grade 12) chemistry students and 50 chemistry teachers in Warri Municipality of Nigeria. Actual and preferred versions of Individualized classroom Environment Questionnaire were administered to the sample. Z-test statistic observed at 0.05 alpha level was used for analyzing the data. The analyses indicated that there was significant difference between the perceptions of actual classroom environment by the students and their teachers. The findings further revealed that there was difference between the students' perception of their actual and preferred environments but there was no difference between perception of the actual environment by the teachers and that for preferred environment by the students. Implications of the findings were discussed and suggestions for further studies were given.

Keywords: Chemistry; classroom environment; perception; secondary school students.

1.Introduction

Following Walberg's (1970) proposition that learning or achievement in school

programmes depends on three distinct factors and elaboration much later by Badmus (1987) that there was quasi-functional relationships among these three factors and learning/achievement, many studies were conceptualized to probe these relationships. The relationships, according to Badmus (1987) can be expressed as:

$$L_h = F(C_i, E_j, S_k),$$

where L_h, C_i, E_j, S_k respectively stand for learning outcomes/achievement, curriculum, environment of learning and students' characteristics. The subscripts h, i, j, k suggest that each of the symbols L_h, C_i, E_j and S_k represent numerous operational representations of variables and other interactions within the same construct domain. These studies cut across all disciplines both science and non-science and have been carried out over the previous quarter of a century (Fraser, 1986, 1998, 2002, 2007; Fraser & Walberg, 1999; Khine & Fisher 2003; Fisher & Khine, 2006; Fraser, Aldridge & Adolphe, 2010). Majority of such studies have been carried out in developed educational systems. In the Nigerian situation, such studies are alarmingly few (Fraser, Okebukola, and Jegede, 1992; Igwebuike, 1996) and they include: Fraser, Okebukola and Jegede, 1992; Igwebuike, 1996; Igwebuike and Ilegar, 1994; Akale and Nwankwonta, 1996; Okonkwo, 2010; Peters, 2010; and Okoh, 2011). Mucherah (2008) also says that very little is reported about how senior secondary school students perceive their biology classroom environment in Africa. This observation is also applicable to chemistry. Findings of some of these studies will be highlighted later.

Chemistry as a secondary school is pivotal to the development of science and technology. It is the bedrock of technology, and the science that treats matter and energy and of the laws governing their reciprocal interplay under conditions susceptible to precise observation, experimentation, control and exact measurement. (Akojuru, 1999). Despite the importance of chemistry to national development, secondary school students do not perform well in the subject in their Senior Secondary Certificate Examinations (SSCE). For instance, according to West African Examination Council (WAEC), 1988 only 20.7% of the students had credit and above in chemistry. In 1989, 1990, 1991 and 1992, the percentages were 10.8, 4.1, 10.4 and 19.0 respectively. In 2010 the percentage was 24. Poor performances in science subjects have also been highlighted by Eniayeju (1986), Okpala (1988), Jegede, Okebukola & Ajewole (1992). The poor performances can be attributable in part, to the nature of psychosocial learning

environment in chemistry/science classrooms. It may be instructive to study how the stakeholders (chemistry teachers and their students perceive psychosocial relations in their chemistry classrooms.

Studies carried out in Nigeria on learning environment have indicated different results. For instance, Igwebuike (1996) carried out a study using a decomposed customized instrument on psychosocial classroom environment on Nigeria Certificate in Education (NCE) science students. He found that there was no significant difference in perception between biological and physical NCE science students. Akale and Nwakwonta (1996) using Science Laboratory Environment Inventory (SLEI) indicated that the correlation values (r-values) for physics, chemistry and biology show positive correlation between academic achievement and each of the actual dimensions of SLEI. The study also showed that there was a significant difference between students' perception of the actual environment and the teachers' perception of the actual environment. A significant difference was also reported in that study between students and teachers perceptions of the preferred environment. It should be noted that the instrument used for this study assesses science laboratory environment that is scarcely provided for in most secondary schools. Findings of study by Okonkwo (2010) indicated that the proportion of secondary school chemistry students with positive perception of their classroom environment is significantly higher than 0.5, and that chemistry students with positive perception of their classroom environment performed significantly better than their counterparts with negative perception. Another study (Okoh, 2011) indicated that secondary school biology students' perception of their environment is not influenced by nature of school (public or private) and gender.

The result from Okonkwo's (2010) study which indicated that chemistry students with positive perception of their environment performed better than their counterparts with negative perception suggests that further studies of students' perceptions of their classroom environments can help chemistry educators and teachers in part, to solve this problem of underachievement in chemistry. Such studies should investigate if there is any difference between the students' perception of their actual and preferred environments.

1.1 Research Questions

Answers were sought to the following research questions:

- Is there any significant difference between chemistry teachers and students' perceptions of the actual psychosocial classroom environment?
- Is there any significant difference between chemistry students perceptions of their actual and preferred psychosocial classroom environment?
- Is there any significant difference between chemistry teachers' perceptions of psychosocial classroom environments and students' perceptions of preferred psychosocial classroom environments?

2. Method

2.1 *Population and Sample:* The population of this study consisted of senior secondary school chemistry students (grade 12) and their chemistry teachers in Warri township and its environs, Delta State of Nigeria. A total of 280 (140 males and 140 females) students and 50 chemistry teachers were involved in the study. They were selected from the chemistry classrooms taught by the teachers using random sampling technique. SSI students were not selected because they have been marginally exposed to chemistry and so could not respond meaningfully to the questionnaire. The average age of the students used in this study was 16.87 years with a standard deviation of 1.31.

2.2 Research Instrument

Various research instruments can be used to investigate psychosocial classroom environment. The instruments include:

- Learning Environment Inventory (LEI).
- Classroom Environment Scale (CES).
- Individualized Classroom Environment Questionnaire (ICEQ).
- My Class Inventory (MCI).
- College and University Classroom Environment Inventory (CUCEI).
- Science Laboratory Environment Inventory (SLEI).
- What Is Happening In This Class (WIHIC).

These instruments have different forms which can be used to investigate difference between student's and teachers' perceptions of the same classroom environment, and discrepancies between actual and preferred environment by teachers and students.

But ICEQ was selected because:

(i) it assesses those dimensions which distinguish individualized classrooms from conventional ones;

(ii) it has scales considered appropriate for this study; and

(iii) it has a short-form which shows parsimony.

ICEQ has both long and short forms. The short form has 25 items. The scales are: Personalization, Participation, Independence, Differentiation, Investigation. Each of these scales has 5 items. The short form of ICEQ was preferred to the long form because of its parsimony and this characteristic does not tamper with its psychometric integrity. Response options were structured using Likert model with five-point alternatives of Almost Never, Seldom, Sometimes, Often, Very Often. They were scored 1,2,3,4,5 respectively for positively stated items. The direction was reversed for 9 of the items that were negatively stated. The description of each of the scales and sample items are given below:

Table 1: Description of Scales in ICEQ

Scale Name	Description	Sample Item
Personalization	Extent to which practices are personalized with respect to students.	The teacher talks with each student.
Participation	Extent to which students participate in the class.	Students' ideas and suggestions are used during classroom discussion.
Independence	Extent to which students are free in the class.	Students choose their partners for group work.
Investigation	Extent to which individual students carry out investigation.	Students choose their partners for group work.
Differentiation	Extent to which individualization of instruction takes place.	Different students do different work.

ICEQ was validated by Fraser and Fisher (1982) using different samples from different countries. The units of analysis they used were individual and class. The present study used the individual student and teacher as the unit of analysis and the results are presented below:

Table 2: Reliability Coefficients of the Scales

Scale	Coefficient of Stability	Internal Consistency	Discriminant Validity
Personalization	0.78	0.79	0.28
Participation	0.67	0.70	0.28
Independence	0.83	0.68	0.07
Investigation	0.75	0.71	0.21
Differentiation	0.78	0.76	0.10

The low values of discriminant validity measures suggest that each of the scales has adequate discriminant validity to warrant its use. As mentioned earlier, a cross validation of this short form of this instrument in Nigeria yielded test-retest reliability coefficients of 0.71, 0.69, 0.76, 0.78 and 0.67 for Personalization, Participation, Independence, Investigation and Differentiation respectively (Igwebuike and Ilegar, 1992). But for the purpose of this study, the test-retest reliability coefficient of the instrument was determined again using another similar sample (n =56). The exercise yielded reliability coefficients of 0.67, 0.70, 0.72, 0.74 and 0.68 for Personalization; Participation, Independence, Investigation and Differentiation respectively. Each of these exceeded the minimum value of 0.60 given by Nunnally (1981) as an acceptable reliability coefficient for research purposes.

2.3 Procedure

The instrument was administered on the subjects (chemistry teachers and their students) who were told that their responses would be treated confidentially. The students were asked to respond to both the actual and the preferred

versions of the ICEQ. The students were also told to see their chemistry teachers as the "teacher" referred to in the instrument. The class teachers assisted in the distribution and collection of the questionnaires from the students. This guaranteed complete retrieval of the questionnaires.

3. Results and Discussion

Analysis of data was carried out using Z-test which is a more appropriate parametric test than t-test considering the size of the sample. The unit of analysis was the individual teacher or student. Observations were made at the 0.05 level of significance. The results are shown below:

3.1 Hypothesis I

This hypothesis states that there is no significance difference between chemistry teachers and students' perceptions of their psychosocial classroom learning environment.

Table 3: Z-test of difference between group means

Variable	N	ΣX	$\overline{X}$	SD	Z_{cal}	Z_{tabled}	Remarks
Teachers' Actual	50	4020	80.21	8.97	4.38	1.96	Significant
Students' Actual	280	20778	74.01	8.61			

From the table, the calculated Z value is higher than the tabled valued and the hypothesis of no difference was rejected. There is therefore dissonance between the perceptions of actual psychosocial classroom environment by the chemistry teachers and their chemistry students.

3.2 Hypothesis 2

The hypothesis states that there is no significant difference between chemistry students' perceptions of their actual and preferred psychosocial classroom environment.

Table 4: Z-test of difference between actual and preferred

Variable	N	ΣX	$\overline{X}$	SD	Z_{cal}	Z_{tabled}	Remarks
Students' Actual	280	20778	74.01	8.61	4.89	1.96	Significant
Students' Preferred	280	22550	81.24	8.97			

Table 4 indicates that the calculated Z value of 4.89 is higher than the tabled value. The null hypothesis was therefore rejected. Chemistry students therefore would prefer a different psychosocial classroom environment from their actual environment.

3.4 Hypothesis 3

The third hypothesis of this study states that there is no significant difference between chemistry teachers' perceptions of psychosocial classroom environments and chemistry students perceptions of their preferred psychosocial classroom environments.

Table 5: Z-test of difference teachers' actual and students' preferred

Variable	N	ΣX	$\overline{X}$	SD	Z_{cal}	Z_{tabled}	Remarks
Teachers' Actual	50	4020	80.21	8.97	0.72	1.96	Not Significant
Students' Preferred	280	22550	81.24	8.97			

Table 5 indicates that the calculated Z value of 0.72 is less than the tabled value of Z. The null hypothesis was therefore not rejected. This means that the actual psychosocial chemistry classroom environment, as perceived by chemistry teachers is the same with students preferred.

3.5 Discussion

The major purpose of this study was to determine if there was dissonance between secondary school chemistry students and their teachers' perceptions of the same classroom environments. The study also investigated if there was difference between the chemistry students actual and preferred psychosocial classroom environment, and if there was difference between chemistry teachers perception of actual and chemistry students perception of their preferred environment.

With reference to the first purpose which is posited in hypothesis I, it was found that chemistry students and chemistry teachers' perceptions of the actual psychosocial classroom environments differed significantly. This result confirmed the findings of studies by Fisher and Fraser (1983), Fraser (1989), Giddings and Fraser (1990) and Akale and Nwankwonta (1996) that teachers' perceptions of their classroom environments were more favourable than their students' perceptions on most classroom dimensions or scales. Fisher and Fraser (1983) used ICEQ and found that teachers perceived a more positive classroom environment than did their students in the same classrooms. They also found that students preferred a more positive classroom environment than was actually present for all five ICEQ dimensions. The result obtained in this study can be explained by the fact that ICEQ which was used for this study and which the chemistry teachers responded to is like a self-reporting device. In the era of poor performances in science by secondary school students, teachers would respond to such self-reporting device by passing the buck as this would, among other things, guarantee exonerate them and their job security. The result of this study, with reference to the first hypothesis has therefore added some confirmatory note to the speculation that teachers tended to perceive the classroom learning environment more favourably than did their students in the same classrooms.

An interesting revelation from this study is that chemistry students perceive their actual and preferred classroom environment differently. This means that the students' preferred environment is different from the actual classroom environment. This dissonance can be implicated in the phenomenon of abysmal performance in chemistry. This assertion can be justified by the findings of a study by Fraser and Fisher (1983) on person-environment fit. The study concluded that students' learning outcomes were enhanced in classrooms in which the actual classroom environment was similar to that preferred by the students. A positive and strong relationship was also established by Koul and Fisher (2002) denBrok, Brekelmans & Wubbel, 2004; Okonkwo, 2010) between classroom psychosocial environment and science-related attitudes which are affective outcomes. A practical implication of the findings of the present study and others highlighted here, and has also suggested by Fraser (1998), is that students achievement might be enhanced by attempting to change actual classroom environment in ways that make it more congruent with that preferred by the students.

This study also revealed, though surprisingly, that there was no difference between chemistry teachers' perception of the actual psychosocial environment and their students' perceptions of their preferred environment. This means that the actual learning environment provided by the teachers is similar to students' preferred environment. The result is a stark contrast to the result discussed earlier. It can be explained by the fact that teachers tended to perceive the same classroom environment more positively than students as endorsed by Hofstein and Lazarowitz (1986) and Zanduliet and Fraser (2004).

Inspite of limitations of this study, one of which is small sample size, the findings overall do seem to have important implications for chemistry education. The strong relationship established in other related studies (Fraser & Fisher, 1983; Fraser & McRobbie, 1995; Koul & Fisher, 2002; denBrok, brekelman's Wubbel, 2004; Zanduliet & Fraser, 2004; Chidi, 2010) between students' perceptions of their psychosocial learning environment and learning outcomes suggests that chemistry teacher should be encouraged to seek ways of reducing skills' gap militating against their organizing conducive psychosocial climate in their classrooms. Improving chemistry teachers' skills for organizing effective classroom environment should be one of the imperatives of preparing chemistry students for their future roles in science and technology for national development. This can be achieved in part, by organizing workshops, seminars and conferences which will focus on how teachers can create more conducive classroom environments for studying chemistry. It can also be achieved by revamping chemistry teacher education programmes in that direction. Assessment of classroom environment acknowledgeably, should include both quantitative and qualitative techniques. But this study did not incorporate the qualitative technique. It is therefore suggested that future studies on this phenomenon include qualitative research methods. Future studies should also improve on the sample size to further enhance the generalizability of the findings.

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Thomas B. Igwebuike became a Chief Lecturer (Associate Professor) in Curriculum Studies (Science Education) in 1994. He studied in the University of Benin, Benin-City, Edo State, Nigeria and was awarded B.Ed (Hons.) Biology in 1978. He was awarded an M.Ed degree in Curriculum Studies (Science) in 1985. He was a British Council Scholar in 1986/1987 in King's College, University of London, London, UK and was awarded Associateship of the Faculty of Education, University of London. He studied in the University of Benin and was awarded Ph.D (Science Education) in 2000. He was Dean, School of Education, College of Education, Warri, Delta State Nigeria (1987-1991) and Director, Nigeria Certificate in Education Programme in the same college (1991 – 1993). He is a member of the Science Teacher's Association of Nigeria (STAN) and International Research and Development Institute (IRDI).

Helen N. Ajuar became a Chief Lecturer (Association Professor) in Educational Measurement and Evaluation in 2009. She studied in the University of Benin, Benin-City, Edo state, Nigeria from where she was awarded B.Ed. (Hons) Biology in 1985 and the University of Nigeria, Nsukka, Enugu State, Nigeria where she was awarded M.Ed. and Ph.D in Educational Measurement and Evaluation in 1992 and 2006 respectively. She is presently the Director of Delta State University, Abraka Degree Programme in affiliation with College of Education, Warri Delta State, Nigeria.

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