

TEACHERS PATTERN OF INSTRUCTION AND LOCATION ON PUPILS CRITICAL THINKING IN SCIENCE ACHIEVEMENT IN IMO STATE

G. C. DOMIKE AND E. O. ODEY

(Received 20, April 2011; Revision Accepted 31, May 2011)

ABSTRACT

This paper seeks to ascertain the influence of teachers' pattern of instruction and location on pupils' critical thinking in science achievement in Imo State. To achieve this objective, two hypotheses were formulated. Ex-post facto research design was adopted for the study. A total of ninety (90) teachers and one thousand (1000) pupils' were randomly selected using a multi-stage (2-stage) sampling procedure involving stratified and simple random sampling techniques. Questionnaire was the main source of data collection. Data collected were analyzed using the Independent t-test. The results revealed that there are significant differences in the level of dominative and integrative teaching pattern of teachers as well as capacity to stimulate critical thinking among pupils' by teachers' in terms of locality. Based on this, it was therefore recommended that classroom teachers be sufficiently equipped with appropriate skills that would enable them provide the relevant stimulation needed by pupils' (irrespective of location) to engage in critical thinking activities.

INTRODUCTION

There is no gainsaying that science is one of the subjects that trains the pupils' in the art of investigating nature in order to make accurate explanation and prediction about diverse objects, events, situations and relationships occurring in nature. It makes a child careful and an objective observer of events occurring in nature. The child who learns science well in a conducive environment will be skeptical about given information. He will not accept any statement as adequate or valid until he has verified such a statement through experiments. He measures carefully, records and reports his findings as accurately as possible. This play of such scientific attitudes such as persistence, objectivity, skepticism, open-mindedness, curiosity, avoidance of prejudice and dogmatism, to mention a few, distinguish a scientist from a layman. The broad objectives of primary education in Nigeria did emphasize among others;

- a) to inculcate permanent literacy and numeracy, and ability to communicate effectively;

- b) the laying of a sound basis for scientific and reflective thinking;
- c) to give citizenship education as a basis for effective participation in and contribution to the life of the society;
- d) mould the character and develop sound attitude and morals in the child;
- e) develop in the child the ability to adapt to the child's changing environment. (FRN, 2004).

The broad objectives suggest that science education will be enriched if deliberate effort is put in place to bring about critical thinking abilities out of the learners right from the primary school. Studies on the status of science education in the U.S. have consistently revealed that inquiry oriented strategies are little used and that there is generally crisis in science, technology and mathematics (STM) education (Ajeyalemi 1990, Kosemani, 2000).

The global concern for our learners to possess critical thinking (C.T) abilities resulted to a growing accord in the eighties, that the heart of education was exactly where traditional advocates of liberal education always said it was,

in the processes of inquiry learning and thinking rather than in accumulation of disjointed skills and information (Facione, 1990). This therefore calls for a research for effective approaches to the teaching of science.

American experts' consensus statement regarding critical thinking as follows:

We understand critical thinking to be purposeful, self regulatory judgment which results in interpretation, analysis, evaluation and inferences as well as explanation of evidential, conceptual, methodological, criteriological or contextual considerations upon which that judgment is based (Facione, 1990:2).

Critical thinking is a discriminatory, purposeful, intellectual exertion, directed at the production of objective interpretation, analysis, evaluation, inference aimed at the solution of o an existing problem (Ennis, 1989; Scharge, 1992).

However, it is worthy of note that the Federal Government of Nigeria deeply underlines the significance of science education. This is clearly shown in the National Policy on Education (FRN,2004) where the Federal Government's policy stipulates 60:40 ratios for students' admission into higher learning institutions in the country, in favour of science and technology related courses.

Despite the huge investments in science and technology, there have been very little positive outcomes by way of thorough acquisition of scientific skills and inquiry as well as problem solving by pupils'. Pupils' have experienced problems acquiring the requisite basic scientific knowledge and points of view that are vital for effectively conceptualizing generalized methods of gaining understanding of themselves and the world in which they live. In the same manner, pupils' has immense problems appreciating the order and complexity of the universe. Akpan (1992) and Abdullahi (1993) have pointed out that in spite of governmental efforts to promote science education; there has been a considerable drift away from science and related courses.

Focusing on our teachers, less than 10% of the 444,000 public primary school teachers in Nigeria today are specialist in primary science teaching (Okebukola,1986).Over 45% of the teachers who had the Grade II Teachers' Certificate were mostly "reluctant" science students in the Teachers College. 25%-30% NCE holders are mostly arts and social science teachers who, obtained certification through the

distance learning mode (Above 1999). In other words, we can only have a handful of professionally qualified primary science teachers in our 41,000 primary schools.

The emphasis on the use of the environment as the "laboratory" rather than the "standard Laboratory as we know it, has been misconstrued by many teachers who believed that they are handicapped by the absence of a standard laboratory (Okebukola, 1986). As a result, teachers teach science through telling and note copying. It confirms the cognitive achievement of pupils in primary science as hardly encouraging. The poor performance of Nigerian primary school pupils has gone down in the records of the second international science study held in 1992 as being the last among pupils world over (Above, 1999).

The above situation necessitates a number of significant questions:

- (1) Can science teaching be improved by identifying appropriate behavior patterns by teachers?
- (2) Are these certain patterns of science teaching that are associated with more positive pupils achievement?
- (3) Could the science achievement of pupils in science be predicted from the classroom interaction pattern in the classroom and related teacher characteristic?

LITERATURE REVIEW TEACHERS' CLASSROOM DOMINATIVE AND INTEGRATIVE PATTERN AND LOCALITY.

The dominative pattern of classroom instruction is typically defined as one in which the teacher does most of the talking, directing, explaining, goal-setting, assignment making, and evaluation in the classroom. In integrative pattern, the interactive activities occur among the teacher and the learners.

Reflecting on and improving one's C.T. skills involve judging when one is not performing well and considering ways of improving one's performance skills, particularly C.T. Cognitive skills can be taught in a variety of ways, such as making the procedures explicit, describing how they are to be applied and executed, explaining and modeling their correct use and justifying their application. Teaching cognitive skills also involve exposing learners to situation where there are good reasons to exercise the desired procedure. Judging their performance and improving the

learner with constructive feedback regarding both their proficiency and ways to improve its instruction might start with situations that are simple but should culminate in situations that are realistically complex (Schrage, 1992).

According to Kalu(1997),though pupils performance is not a single direct consequence of the teachers teaching act, teachers nevertheless do have a lot to do with classroom learning. Teachers set up the pattern of general behavior during the teaching and learning process. On the other hand pupils set up certain types of conduct to match these patterns. As a result, the pupils participate at various levels in different classes and react differently to different teachers. This combined instructional pattern and pupil participation lead to a specific classroom environment characterized by specific interaction pattern. Therefore, Kalu (1997) in a study to observe and code the interaction patterns during Physics lessons and to relate the identified patterns to students' post-instructional attitude towards physics and achievement in low and high academic task, used a sample of 516 SS1 students and 15 Physics teachers drawn from 15 selected secondary schools in Calabar Education Zone of Cross River State, Nigeria. Each teacher/classroom was observed for 4 lesson periods spaced over a period of 8 weeks and the interaction pattern coded using the Science Interaction Categories. The result shows that a significant positive relationship exist between interaction pattern and students' post instructional attitude and low academic task achievement.

Similarly, Okebukola (1986) reported that classroom participation had the greatest independent contribution (22%) to the variance in achievement scores while Udeani (1992) reported that classroom interaction accounted for about 74% and 71% of the variation in students' cognitive achievement and process skill acquisition respectively. Also Okafor (1993) found a positive relationship between classroom interaction behavior and students' level of achievement.

Mckeachie (1956), showed by the descriptions of specific teachers and their methods of relating to children and the kinds of teacher behaviour that he judged necessary of learning and growth. To him the resulting interpersonal relationship was one where there

was freedom of expression within the limits of the classroom, where each person could express himself without fear of criticism or condemnation, where feelings were expressed and explored, where ideas and creative thinking were treasured, and where growth of self were the most important value.

In furtherance to these, Mckeachie arranged a number of sessions in which both structured and unstructured procedures were used. During the structured periods, the teacher gave directions and all the children did the same thing. During the unstructured sessions, the children were told "to do as they pleased" as long as they were fairly quiet and did not border one another or children in other rooms. On these occasions, they tended to talk with the teacher or talk about pictures they were encouraged to draw. The teacher showed interest in complete acceptance of what the children were doing and saying. Out of the 26 children involved in the study, 14 followed a definite pattern such as drawing and talking about fighting and war and adhered to it throughout. 7 of them said a little at first but were quite vocal at the end of the experiment and revealed their feeling and attitudes quite clearly 5 children after drawing their pictures described them without expressing much feeling. The teacher further reported that the angry and unsettled youngster tended to reflect these qualities in their pictures and stories. Besides, Denis(1991) and Ekong (1996) in their study postulated that given the differential availability of learning resources including both human and materials, not only were interaction patterns at variance in urban and rural areas, but also these differences were reflected in the academic achievement of students.

Moreover, Rich (2006), carried out an experiment on classroom interaction patterns among teachers and emotionally disturbed children. Observational procedures were used to investigate classroom interaction patterns among direct and indirect teachers and emotionally disturbed children who were classified as conduct problems or personality problems. It was discovered that initiated and respondent interaction dyads, classified as dominant, non-direct, and nurturing modes were the same(reciprocal),thus creating an interaction "circle".

These researches points to the fact that teachers dominative and integrative pattern of instruction have significant influence on pupils' critical thinking in science achievement.

Research Hypotheses.

1. There is no significant difference in the level of dominative and integrative behaviours as well as capacity to stimulate critical thinking among pupils by teachers.
2. Locality does not significantly influence pupils' critical thinking in science.

Method

The study was essentially an ex-post facto research. The target population involved in the study consisted of all primary school teachers and pupils in Imo State. The accessible population which the researcher believed typified and reasonably represented the target population consisted of all the primary school teachers' and pupils' in Imo State. These teachers numbered 13, 000 and primary school pupils' numbered 1.15 million as recorded by Imo State Primary Education Board (SPEB, 2007). A multi-stage (2-stage) sampling plan involving stratified and simple random sampling technique was used to select 90 teachers and 900 pupils. Nine (9) primary schools were randomly selected for the study, in each nine schools; ten (10) teachers and one hundred (100) pupils were selected. Out of the number of teachers, 32 were males, while 58 were female teachers.

The hypotheses were tested using the independent t-test. The derived values from the data and analysis are given below:

Table 1

Independent t-test analysis of the influence of teachers' instructional pattern on pupils' critical thinking in science

Instructional Patterns.	N	X	—	SD	t-value
Dominative	90	34.09		2.05	4.94*
Integrative	90	32.36		2.63	

Significant 0.05 level, df = 178, critical t = 1.97

As presented in table 1 above, the results of the data analysis show that the calculated t-value of 4.94 is greater than the

Two research instruments were used for data collection. The first was a modified from a Flander scale for the identification of verbal interaction in the classroom. The scale had ten categories with the first four consisting of indirect teacher influence (democratic); the subsequent three are of direct influence (autocratic) while the next two consisted of students talk. The second instrument was the Primary Science Learning Outcome Test (PSLOT). The instrument was a sixty (60) multiple choice items to measure students science learning outcome.

In terms of validity, three (3) experts in educational measurement and evaluation and educational research and statistics affirmed with 90% agreement that the instrument were valid. Using the Kuder Richardson21 (KR21) reliability method, the PSLOT was tested for reliability. The reliability index was found to be 0.84. The independent t-test was used to analyze the data.

Analysis of data and research results

The presentation here is done on the basis of hypotheses directing the study.

Hypotheses

- i There is no significant difference in the level of dominative and integrative behaviours as well as capacity to stimulate critical thinking among pupils by teachers .
- ii Locality does not significantly influence pupils critical thinking in science.

critical table value of 1.97 at 0.05 level of significance and 178 degree of freedom. The implication of this result is those teachers'

instructional pattern influence pupils' critical thinking in science. In terms of patterns, pupils of the integrative pattern teachers have greater

critical thinking in science achievement than those of dominative instructional pattern.

Table 2

Independent t-test analysis of the influence of location on pupils critical thinking in science achievement

Location	N	\bar{X}	—	SD	t-value
Urban	90	51.02		5.02	11.09*
Rural	90	43.37		4.38	

Significant 0.05 level, $df = 178$, critical $t = 1.97$

As observed in table 2, the results revealed that the calculated t-value of 11.09 is greater than the tabulated t-value of 1.97 at 0.05 level of significance with 178 degree of freedom. The table also revealed that pupils' critical thinking in science in the urban location is greater than those in the rural location. The interpretation of this is that teachers' location influence pupils' critical thinking in science in the research area.

Discussion of findings and conclusion

The study did establish that interaction patterns in terms of dominative and integrative behaviours as well as the capacity to stimulate critical thinking processes among students' differ significantly among urban and rural classrooms. It was observed that given the differential availability of learning resources including both human and material in favour of urban areas, and differences in educational attainment of teachers, these difference will manifest themselves in the type and quality of interaction that occur in classrooms. (Ekong, 1996).

All in all, a major finding of this study is the significant difference in science achievement of pupils who were taught by teachers who were more inclined to using one pattern of interaction rather than the other. Indeed, the study showed that the pattern of interaction revolving around the stimulation of critical thinking produce the highest level of science achievement while the dominative achieved the least among the three groups. These findings are in line with Okebukola(1986),Udeani(1992), Okafor (1993) and Kalu(1997) who from their various researches opined that there exists a positive

relationship between teachers' classroom interaction pattern and students' academic achievement. It is also worthy of note that given the differential availability of learning resources including both human and materials, not only were interaction patterns at variance in urban and rural areas, but also these differences were reflected in the academic achievement of students in terms of locality.(Denis1991 and Ekong 1996).

CONCLUSION

From the foregoing analysis, there is no gainsaying the fact that no meaningful teaching/learning can exist without a good teacher-student relationship irrespective of locality. The benefits accruable from the use of discussion, project, independent study and discovery methods cannot be overstressed. Teachers should always strive to create a classroom situation where there exists a considerable involvement of the learners creating a two way communication between teachers and the learners and among pupils. These will establish rapport; motivate individuals and group of students even as it will serve as an opportunity for both teachers' self evaluation and evaluation of students' progress in the course of instruction. This of course is in line with the learning theories of Piaget, Brunner, and Asubel who underlined the centrality of concrete experiences through a continuous exploration and manipulation of the physical world as a basis for the child to obtain information or knowledge about the world of objects and thereby develop appropriate structures and Schemata.

REFERENCES

- Abdullahi, M. D., 1993. "Technology and Science Education in Nigeria-an Overview". *Education Today* 6,3,15-24.
- Above, M. A. N., 1999. Evaluating the level of stress among primary science pupils in Lagos State. *Journal of Science Teachers Association of Nigeria* 40 250-253
- Ajeyalemi, D., 1990. *Science and Technology Education in Africa: Focus on Seven Sub-Saharan Countries*. Lagos: University of Lagos Press.
- Akpan, O. E., 1992. *Towards Creative Science Teaching and Learning in West African Schools*. Cape Coast: Catholic Mission Press.
- Denis, W. S., 1991. Rural school science teaching: what affects achievement. *Journal of the school science and mathematics Association* 91 8-19
- Ekong, R. B., 1996. "Availability of Science Instructional Materials in Urban and Rural Areas". Bachelors of Education Research Project, Faculty of Education University of Calabar.
- Ennis, R., 1986. Critical Thinking and Subject Specificity Classification and Needed Research, *Educational Researcher* 18(3), 4-10.
- Facione, P. A., 1990. *Critical Thinking: A Statement of Experts, Consensus for the Purpose of Educational Instruction and Assessment* California: The California Academic Press.
- Federal Republic of Nigeria (FRN, 2004). *National Policy on Education*, Abuja: Federal Government Press.
- Kosemani, J. M., 2000. *Scientific Literacy: How Many Lost Generations can afford*. Federal College of Education Lecture Series 4; p4.
- Okafor, L. C., 1993. *Analysis of Classroom Interaction Patterns in Biology in Secondary Schools in Anambra State.*, Unpublished Research Ph.D. Thesis. University of Nigeria Nsuka
- Okebukola, 1986. Some presage, context and process variables relative to students' achievement in biology. *Journal of the Science Teachers Association of Nigeria*
- Kalu I. M., 1997. *Classroom interaction patterns, teachers and students characteristics and students learning outcomes in physics*. An unpublished Ph.D Thesis University of Nigeria, Nsuka.
- Mckeachie, W. J., 1956. Individual conformity to attitudes of classroom groups. *Journal of Abnormal social psychology* 49 282-289.
- Rich, H. L., 2006. "Classroom interaction Pattern Among teachers and Disturbed children" *International Journal of Disability, Development and Education*. London: Routledge publications.
- Rosenshine, B. V., 1986. *Explicit Teaching, Educational Leadership*. 46, 60-89.
- Schrage, F., 1992. "Critical Thinking" in Aitim, M.C. (Ed.) *Encyclopedia of Educational Research* 1; 254-256.
- State Primary School Board (SPEB, 2007); Owerri: Nigeria
- Udeami, U. N., 1992. *Learning outcomes in integrated science as related to teacher and students characteristics and classroom interaction pattern*. Unpublished Ph.D Thesis, university of Nigeria Nsuka.

