THE STATE OF THE SCIENCE CLASSROOMS OF BEGINNER AND EXPERIENCED TEACHERS IN NIGERIAN HIGH SCHOOLS

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ABSTRACT

The classroom learning environment is a critical aspect of learning as it affects both the learner as well as the teacher. The modern learning paradigm emphasizes the importance of active learning and learner engagement in the achievement of effective learning. This has been found to be achievable in ICT-based or ICT-enhanced instructional modes and is especially important in the sciences where the need for hands-on experience and actual learning-related activity has become extremely necessary to combat the problem of learners’ inability to relate to learning materials due to abstractness. The level of teaching experience possessed by a teacher also plays important roles in the attitude, adaptability and skills in classroom management and control which together provide an indication of how constructivist the learning environment will be in the classroom of such a teacher. This study assesses the level of constructivism in the classrooms of beginner (0-5 years) and experienced (>10 years) teachers in Nigerian secondary schools as a predictor of the possibility of the integration of the use of ICT tools into classroom instruction. 71 science teachers drawn from 12 secondary schools in 2 local government areas responded to items in the Actual version of the Classroom Learning Environment Survey (CLES-Actual). Findings indicate that the classrooms of older, more experienced teachers are less constructivist in approach than those of their younger, less experienced counterparts. It also reveals a tendency towards the old traditional approach to teaching, which calls for re-orientation and retraining of the teachers if the integration of ICT tools in classroom learning will be an achievable feat soon.

Field of Research: Classroom Learning Environment, constructivism, active learning, beginner and experienced teachers

1. Introduction

Traditional schooling is based on an educational paradigm that has been around for a long while. During the industrial revolution, the purpose of education was to prepare people for jobs on assembly lines (Wikipedia). So, the organized classroom evolved, where students sat and received their training from a teacher. Active learning is the new paradigm for active education. It puts the learner in control of the learning process. Students can pursue topics that interest them. The goal is to give students the ability to explore subjects/topics on their own and not to spoon-feed them specific facts about the topics. Students are in charge of their learning and can customize their educational experience. The teacher does not need to be a subject expert—an impossible task in this age of so much information. Instead, he now oversees the learning process (Funderstanding, 2008). The nature of the learning environment has been found to influence learning significantly. According to Bereiter & Scardamalia (1989), learners in supportive environment have high levels of self-efficacy.
and self-motivation and sees learning as a primary transformative force. To be effective, instructional multimedia should address the unique sources for learning differences that influence success. (Martinez, 1999). Research on learning environment reveals that the best learning environment is one of high challenge and low stress, that constant and varied exposure to new material encourages quicker and deeper learning, differentiated structures are necessary for effective individualized learning, the environment should support pupils to become independent and active learners and good visual display can improve recall and attention by up to 80% (Highland learning and teaching toolkit, 2006).

The learning environment is the sum of the internal and external circumstances and influences surrounding and affecting a person’s learning (Wiki, 2006). It includes the physical (classroom arrangement, instructional materials, teaching aids, etc) as well as the abstract content (social, emotional and psychological state of teacher and students, teachers’ knowledge of subject matter, conducive and comfortable environment) of the environment of learning.

Descarga (2008) identified 10 components of an ideal learning environment. The components he identified compare well with the six principles of learning and teaching (Victoria, 2008): a supportive and productive learning environment, a learning environment that promotes independence, interdependence and self-motivation; one in which students’ needs, background, perspective and interest are reflected in the learning programme; where students are challenged and supported to develop deep levels of thinking and application; in which assessment practices are an integral part of teaching and learning, and one in which learning connects strongly with communities and practices beyond the classroom. An investigation of factors related to student achievement in science by the International Association for the Evaluation of Educational Achievement (IEA) shows one commonality between all the twelve countries examined in spite of the incomparable educational systems between them. This is, an increased practical work component in science achievement by students. Furthermore, the variability found in science achievement outcomes from school to school supports the assertion that the students’ learning environment has an effect on achievement outcomes (CNC, 2007).

From its early beginnings, science has developed into one of the greatest and most influential fields of human endeavour. Today, different branches of science investigate almost everything that can be observed or detected, and science as a whole shapes the way we understand the universe, our planet, ourselves, and other living things (Encarta, 2005). Science education therefore is very important in the entire educational process. Its basic aim is to enable students among other things to become healthy and creative members of the society with some necessary scientific literacy (Kim, Fisher & Fraser, 2008; Adewuyi, 2009)

Science is certainly a very fascinating subject to learn as it arouses learner’s curiosity about the nature and whatever happens in everyday life. Learning science is also very beneficial as it has been linked with other subjects such as Geography, Mathematics and English. This will certainly help the learners in so many ways as they get to learn many things at a time (Shbie, 2008). The importance of science is also observable in the contributions of science and technology to human life. However, in spite of the obvious importance of science education, however, and especially in the current globalized world, students’ performance in Nigeria shows no improvement in either the traditional or the vocational science subjects. According to the report of the West African School Certificate Examination (WASCE) results for Nigeria for the years 2006-2008, performance in science subjects including the traditional, social and vocational sciences shows credit passes below 50% for most subjects (Osun State Ministry of Education, Osogbo). Some of the reasons for the state of science education include poor infrastructure (laboratories, libraries, classrooms, etc) due to poor funding of the education sector. However, more important is the abstract nature of many of the subjects,
which makes it difficult for students to relate with the content. Major culprits are the physical sciences: chemistry, physics and mathematics.

Developments in communications theory and systems concept led to studies of the educational process, its elements and their interrelationships. Among these elements are the teacher, the teaching methods, learning environments, the information conveyed, the materials used and the student (Obameta, 1995; Etta, 2001; Sawage, 1999). As a result of these studies, emphasis shifted from devices and materials to the teaching-learning process. Many research works in learning environments have shown that an effective learning environment must be activity-oriented (Adeyemo, Adegbola & Oke, 2009). They also identified interaction as one of the keys to effective learning. All these prove one fact: the value of an additional means of teaching apart from audio only. This will not only facilitate perception, but can be carefully organized, and can require the student to use more than one modality. Teaching approaches should change from teacher-based instruction to learner-based learning where teachers facilitate learning, and this can be largely achieved with ICT tools (Aladejana, 2006) but despite various research findings which lend their support to the effectiveness of ICT tools in science education, most Nigerian schools, especially government-owned schools have not shown any serious positive response to the use of ICT tools in science education and an average science teacher in Nigeria is still without basic knowledge of the operations and use of most ICT tools (Aladejana, 2006). The reason for this lack of knowledge may be viewed from different angles. The use of ICT tools focuses on the modern perspective of education, which views the teacher as a facilitator of knowledge rather than the custodian of it (Azer, 2005.). This might be a threat to the traditional position of the teacher who may therefore show a tendency not to favour the integration of the use of ICT tools in education and this may in turn provide no motivation for acquiring any form of literacy; this may be much more applicable to experienced teachers who have spent a considerable amount of time in teaching and therefore sees nothing wrong in the old methods.

This study is significant because current globalization puts a demand on teaching and learning in Nigeria to adapt to changes in classroom practices across the world in order to bridge the digital divide in the educational process between the developed and the developing nations. This will only be possible through positive response on the part of teachers. This study is a diagnostic one whose result will assist in finding a solution to the problem of poor performance in science subjects. This will be possible through the use of the findings to plan for the proper training and possibly re-orientation of teachers to achieve more effective teaching in Nigerian schools through the use of ICT tools.

2. Theoretical Background

The study assumes that the use of ICT tools has a positive influence on learning of science and that appropriate use of the computers, multimedia packages etc can bring tremendous improvement to the learning of science. The study is based on the theory of constructivism, a philosophy that perceives learning as a process of adjusting mental models to accommodate new experiences (Aladejana, 2006). It suggests that learners construct knowledge out of their experiences. According to Jean Piaget in Encarta (2005), this is done through processes of accommodation and assimilation. Social constructivism suggests that the background and culture of the learner must be taken into consideration throughout the learning process (Aladejana & Odejobi, 2006). According to Von Glaserfeld (1989), learners look for meaning and will try to find regularity and order in the events of the world even in the absence of full or complete information. He further opines that by experiencing the successful completion of challenging tasks, learners gain confidence and motivation to embark on learning, thus lending support to the importance of extrinsic far above intrinsic motivation factors. Furthermore, in social constructivism, the instructor takes the role of a facilitator rather than that of a teacher in which case ‘he asks rather than tell, gives support from the back
rather than lecturing from the front, provide guidelines to assist the learners arrive at his or her own conclusions rather than giving answers according to a set curriculum, and maintains continuous dialogue with the learners rather than give a monologue, the critical goal being to support the learner in becoming an effective thinker’ (Aladejana & Odejobi, 2006).

3. Objectives

This study is intended to find answers to the following questions:

- Is the science learning environments in Nigerian schools sufficiently constructivist in approach to engender the use of ICT tools?
- Is there a difference in the level of constructivism of the science classrooms of beginner and experienced teachers?
- Is the full integration of ICT tools in Nigerian science education a realizable dream in the nearest future?

4. ICT in Education

Computer technology has barely found a foothold in Nigerian schools at a time when in many parts of the world, teaching and learning has moved on to the ICT-based delivery mode. Many teachers are yet to know how to make use of the computer. According to Okebukola (1998) these are the same teachers who must be prepared to write computer programmes, send e-mails, and use technology to stimulate biology, physics and chemistry experiments. Jimoh (2005) reported use of less than 60% of communication media by lecturers in the colleges of education and polytechnics, indicating there is still a long way to go.

5. Classroom Learning Environments

Classroom environment refers to the totality of all the influences that surrounds a child and affects his/her learning. These include physical, psychological as well as the emotional atmosphere in the classroom. Rutter, Maughan, Mortimore, Ouston and Smith (1979), believe that students would have spent up to fifteen thousand (15, 000) hours at school by the time they finish senior high school and so have a large stake in what happens to them there. Etta (2001) on the other hand posits that the teacher’s personality will affect a number of aspects of classroom interaction and this bears a direct effect on students’ learning. Studies have shown that the student is a product of the environment and the classroom learning environment and teaching materials exert some dominant influence on learners’ academic performance (Obameta, 1995; Adeboyeje, 2000; Obayan, 2003).

Classroom environment on one hand can be affected by factors including teachers’ competence in class management, cleanliness, and emotional atmosphere, the social climate of the classroom (Adeyemo, Adegbola & Oke, 2009) and the availability of instructional aids. Classroom environment on the other hand affects both the teacher and students and consequently the learning activity. The effects of classroom atmosphere on pupils’ motivation are also reported by Philip Jackson (1989) and Adeyemo & Adegbola, (2009). Tyler & Wheeler are of the opinion that learning is a result of learner’s reaction to the environment. Young (2008) believes that the classroom should be home-away-from-home for both teachers and students in order to make for effective learning. According to Otote & Alufohai (2009), some of the basic variables that must be in place, include proper seating arrangement, good furniture/seats, proper position of the white or black board, visual displays, proper lighting and temperature, proper spacing, good ventilation and fresh decorations. The teaching process, including teaching methods also bear a direct impact on learning. Ibraheem & Oludipe (2008) reported the use of archaic teaching methods and the teacher-centered mode of
teaching as a major problem confronting science teaching in Nigerian schools. Various research reports indicated that students learn meaningfully when they are actively involved in the learning process (Adeyemi, 2002; Ojo, 2003; Omosehin, 2004; Akinbode, 2006 and Ibraheem, 2008). In essence, active learning strategies are central to meaningful learning as it provides the learners with the opportunity to work in small groups, negotiate meaning and construct conceptual understanding in a community of learners (Johnson et al, 1991; Cohen, 1991). The use of constructivist approach is central to this process.

6. Methodology

6.1 Sample and data collection method

The population for this study consists of science teachers in Nigerian secondary schools. A sample of seventy-one (71) science teachers was drawn from among science teachers from twelve (12) secondary schools in Osogbo Local Government Area. The science teachers are those who teach traditional science subjects (physics, chemistry, biology, and agricultural science), mathematics, additional mathematics, integrated science, computer education and introductory technology. A total of one hundred (100) CLES were administered out of which ninety-six (96) were returned. The questionnaires were administered to all the science teachers in all the sampled schools. Stratified random sampling was employed for sample selection. All teachers with teaching experience between 0-5 years and those with teaching experience of 10 years and above were drawn from among all the science teachers sampled. A total of seventy-four (71) teachers were in this category.

6.2 Instrumentation

The instrument for data collection is the “Classroom Learning Environment Survey” (CLES-Teachers Actual). The CLES was used to assess how constructivist the science classrooms in the schools were. The original CLES was a standard instrument developed by Taylor & Fraser (1991) to provide teachers with an efficient means of learning more about their students' perceptions of the extent to which the classroom learning environment enabled them to reflect on their prior knowledge, develop as autonomous learners, and negotiate their understandings with other students. The need for an instrument that addresses the socio-cultural restraints of the original CLES gave rise to the revised version which incorporated a critical theory perspective on the socio-cultural framework of the classroom learning environment (Taylor, Fraser & White; 1994). The CLES consists of two forms, Actual and Preferred, which can be administered to students and teachers. The Actual form assesses participants' perceptions of their "actual" classroom learning environment while the preferred form allows participants to record elements of their "preferred" classroom learning environment. This research made use of an instrument adapted from the first part of the Teachers' Actual form and the original CLES. The items reflect a constructivist-oriented approach to teaching and learning which encourages the construction of knowledge through negotiation, both internal and social, collaboration with both students and teachers, and teachers' reflections on their students learning and understanding and on other students' ideas and explanations. The second part of the CMLES measures students' reactions to the interactive multimedia program; it is not used in this study.

The CLES adapted for use in this study is a two-section instrument. The first section is the personal information section which provides demographic information including type of school (public/private) and length of teaching experience of the teacher. Section two consists of six (6) scales including a total of 30 questions. Each scale consists of five (5) items. The section examines the different learning opportunities available to the students based on the nature of the classroom environment created (Table 2).
### TABLE 2: Descriptive Information for each scale of the CLES used in this study (Taylor, Fraser and White, 1994, Maor, 1999)

<table>
<thead>
<tr>
<th>CLES Scale Type</th>
<th>Scale name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Negotiation</td>
<td>Learning to Communicate</td>
<td>Extent to which students have opportunities to discuss their questions and their solutions to questions.</td>
</tr>
<tr>
<td>Personal Relevance</td>
<td>Learning About the World</td>
<td>Extent to which students perceive the relevance of school science to their out-of-school experiences</td>
</tr>
<tr>
<td>Reflective Thinking</td>
<td>Learning to Think</td>
<td>Extent to which students have opportunities to reflect on their own learning and thinking.</td>
</tr>
<tr>
<td>Inquiry Learning</td>
<td>Learning to Investigate</td>
<td>Extent to which students are encouraged to engage in inquiry learning.</td>
</tr>
<tr>
<td>Shared Control</td>
<td>Learning to Learn</td>
<td>Extent to which students are invited to share control with the teacher of the total learning environment, including the design and management of learning activities, determining and applying assessment criteria, and participating in the negotiation of the social norms of the classroom</td>
</tr>
<tr>
<td>Critical Voice</td>
<td>Learning to Speak Out</td>
<td>Extent to which a social climate has been established in which students feel that it is legitimate and beneficial to question the teacher’s pedagogical plans and methods, and to express concerns about any impediments to their learning</td>
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</table>

### 6.3 Validity and Reliability of Instrument

The original CLES was reported to have a discriminant validity of 0.44 and reliability of 0.88. This is exactly the same value as calculated for the adapted instrument used in this study which gives Cronbach’s alpha 0.878 indicating highly correlated and therefore reliable items.

### 7. Finding & Discussion

#### 7.1 Data analysis

The data analysis procedure involved the selection of the two groups of teachers concerned in this study: beginner teachers and experienced teachers. Beginner teachers are teachers with 0-5 years teaching experience while experienced teachers are teachers with teaching experiences of 10 years and above. The intermediate group of teachers—those with 6-9 years teaching experience—are excluded from the study. Data analysis was done using percentages and frequency tables.
7.2 Results and Discussion

Research Question 1: Is the science learning environments in Nigerian schools sufficiently constructivist in approach to engender the use of ICT tools?

Each of the response options Almost Never, Seldom, Sometimes, Often and Almost Always are assigned values 1, 2, 3, 4, and 5 respectively. The highest mark possible for any question is therefore 5 (Almost Always), making the highest possible mark for all questions per respondent a total of 150 and the highest possible mark for all the beginner teachers 5,850 (i.e. 150x39) and 4800 (150x32) for experienced teachers. Scores below the average value of 50% indicates a non-constructivist science classroom, scores above 50% indicates a constructivist classroom and score above 75% indicates a highly constructivist classroom.

Table 2: Summary of Teachers’ Responses to the CLES

<table>
<thead>
<tr>
<th>QUESTION CATEGORY IN THE CLES</th>
<th>BEGINNER TEACHERS % Score</th>
<th>EXPERIENCED TEACHERS % Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning to communicate</td>
<td>Q1-5</td>
<td>70.1</td>
</tr>
<tr>
<td>Learning about the World</td>
<td>Q6-10</td>
<td>69.6</td>
</tr>
<tr>
<td>Learning to Think</td>
<td>Q11-15</td>
<td>67.2</td>
</tr>
<tr>
<td>Learning to Investigate</td>
<td>Q16-20</td>
<td>53.9</td>
</tr>
<tr>
<td>Learning to Learn</td>
<td>Q21-25</td>
<td>43.6</td>
</tr>
<tr>
<td>Learning to speak Out</td>
<td>Q26-30</td>
<td>60.3</td>
</tr>
<tr>
<td>General</td>
<td>Q1-30</td>
<td>63.1</td>
</tr>
</tbody>
</table>

The observations made from the responses of both groups of teachers are summarized below; these are to provide a picture of the environment in terms of the various factors being assessed in each category.

- Neither the classroom of the beginners nor experienced teachers is highly constructivist though both are averagely constructivist in approach.
- The Nigerian science classroom is therefore, in general, sufficiently constructivist in approach to engender the use of ICT. However, students’ participation in the determination of the classroom atmosphere, and hence their own learning is still very poor as shown in the responses of both groups of teachers to questions 21-25 where percentage scores are below 50% for both groups of teachers.

In addition to the above general observations, the following can also be noted:

There is a reasonable level of communication in the science classrooms and level of student-student interaction is appropriate. With reference to the Personal Relevance scale, the study shows that while the level is high for beginner teachers, it is only moderate for experienced teachers. This is one of the critical issues in science learning resulting into abstractness which on the part of the students translates to lack of relevance of classroom learning to out-of-school life. The result also shows that it is not often that the learner is presented with the opportunity to reflect on personal learning.
Opportunities for inquiry learning were also found to be low. Result shows average values for both groups of teachers. This is not surprising considering the state of the science learning environment especially the science laboratories, in most Nigerian schools. With laboratory materials and equipment not available, very little can be done in terms of investigation by science students.

The result based on the Shared Control scale is the poorest. It is concerned with students being invited to share control with the teacher of the total learning environment, including the design and management of learning activities, determining and applying assessment criteria, and participating in the negotiation of the social norms of the classroom. The result shows this to be very poor for both groups of teachers which is indicative of the fact that teachers still exercise absolute control over their classroom while the other major stakeholders, the learners are denied the opportunity to participate in determining how and what they learn. This situation does not produce a good learning environment required for effective learning.

The Critical Voice scale assesses the extent to which a social climate has been established in which students feel that it is legitimate and beneficial to question the teacher's pedagogical plans and methods, and to express concerns about any impediments to their learning. The scale is named Learning to Speak Out. The result shows average value for both groups of teachers. A good learning environment should be one in which students are actively involved in the learning process (Adeyemi, 2002; Omosehin, 2004)

Based on the result of this study, the Nigerian science classroom is still far from what it should be. The traditional view of the teacher as all-in-all still holds a strong place in education. There is the need to intensify efforts at all levels to train and retrain teachers to adjust teaching pedagogies in a way to ensure that learners are brought to a central place in the entire learning process.

**Research Question 2:** Is there a difference in the level of constructivism of the science classrooms of beginner and experienced teachers?

From Table 2 (above), the following can be observed:

- The science classrooms of beginner teachers are moderately constructivist while those of experienced teachers are less constructivist in approach;
- The classrooms of the beginner teachers are slightly more constructivist in approach than those of the experienced teachers.

**Research Question 3:** Is the full integration of ICT tools in Nigerian science education a realizable dream in the nearest future?

The result shows that science teachers still employ the traditional teacher-centered teaching methods in most cases and the perception of the teacher as the ‘all-in-all’ in the classroom still pervades the thinking of many teachers. Students still have no say in their learning and the science classrooms are only averagely constructivist in approach and the use of ICT tools for teaching and learning may still be a challenge for some time. However, with the observation made with beginner teachers, there may be hope that with more effort put into policy implementations, a positive trend might be observed in not too distant future with particular reference to beginner teachers.

There is need for more effort to be put into the re-orientation of teachers to adopt the modern view of the teacher as a facilitator of learning. In this age of information, it is an impossible task for anyone to adopt the position of the custodian of any type of knowledge. Teachers-in-training curriculum should incorporate ICT from the very beginning as this is the only way to ensure that teachers will be in the position to take their proper place in the classroom with regards to ICT. The research has shown that the Nigerian science classroom is only slightly constructivist in approach;
this is a challenge to the full integration of ICT in teaching and learning. It is also observed that beginner teachers’ classrooms are more constructivist in approach than those of their older counterparts, hence there is hope that with more focus on teachers-in-training and more training opportunities for beginner teachers, a lot can be achieved within a short time. Finally, going by the present state of things in the Nigerian science classroom, it will take some time before the full integration of ICT in science education can be achieved.

8. Conclusion and Future Recommendation

There is need for more effort to be put into the re-orientation of teachers to adopt the modern view of the teacher as a facilitator of learning. In this age of information, it is an impossible task for anyone to adopt the position of the custodian of any type of knowledge. Teachers-in-training curriculum should incorporate ICT from the very beginning as this is the only way to ensure that teachers will be in the position to take their proper place in the classroom with regards to ICT. The research has shown that the Nigerian science classroom is only slightly constructivist in approach; this is a challenge to the full integration of ICT in teaching and learning. It is also observed that beginner teachers’ classrooms are more constructivist in approach than those of their older counterparts, hence there is hope that with more focus on teachers-in-training and more training opportunities for beginner teachers, a lot can be achieved within a short time. Finally, going by the present state of things in the Nigerian science classroom, it will take some time before the full integration of ICT in science education can be achieved.

Based on the conclusions drawn from the study, it becomes imperative that:

1. If ICT were going to play any meaningful part in Nigerian science classrooms, there is a need for further and continuing re-orientation of teachers on the need to adopt the modern view of education and thus work at making their classrooms more student-centered. Teacher education as well as primary and secondary school curricula should reflect the perceived importance of these tools and classroom practices should follow in the same direction. Influx of younger, easily adaptable teachers should be encouraged into the schools while lesser number of older, un-adaptable ones should be retained. There should be mandatory recommendation of practical in-service courses in the use of ICT tools in the classroom and continuous reorientation of all teachers towards the adoption of the learner-centered instructional mode.

2. Educational policies must also reveal this need and its importance. Then only, can ICT tools find a place in the Nigerian science classroom.

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