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Focus Conversational Method and Students' Mathematics Achievement in Secondary Schools

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Abstract: Mathematics permeates the whole of the society and its ever-increasing importance makes our society become more technological and complex. Ironically, the subject who has assumed such prominence in the society is plagued with high failure rate in our educational system and the society at large due to the method used in teaching the students. The study focused on exploring the possible challenges to be faced by Mathematics teachers in Nigeria in the implementation of a conversational style of teaching. It is being advocated that the style of lesson delivery by teachers of Mathematics should change from the present examination focused style to a conversational method that emphasizes understanding, which the students can communicate. The conversational style was used in teaching junior secondary school students mathematics in 3 schools in Ado-Ekiti, Nigeria and the level of understanding of the students was tested after a school term of 3 months and compared with the level of understanding among students in other three schools, where the Conversational method was not used. It was found that when teachers and students verbalize their mathematical activities, they show better understanding of the problems. Part of the challenges faced by teachers and students include the fact that ability to communicate was hampered by the extent of Mathematical knowledge, limited abilities to link Mathematical concepts with tasks in real life and the language of teaching. It is advocated that teachers should alter their perception of their roles as purveyors of knowledge and information and see themselves as facilitators to create the sense of inquiry in the students. Also, authors and curriculum planners are to formulate specific laws for teachers in schools to use this method in teaching Mathematics and Sciences because it helps the thinking horizon and language construction of students.

Key words: Challenges, mathematics, conversational method, understanding

INTRODUCTION

The present practice of teaching can be visualized as a delivery system, where all efforts and resources had been devised to ease the transmission of the essential material from a source or reservoir (teacher) to several receiving ports (students). By this conceptualization, teachers see themselves as the experts transmitting the required knowledge to the students. In the traditional classroom, teachers stand at the chalkboard, writing out equations and describing each step of the operations used to solve them. Students on their part copy and mimic the teacher until they had memorised the operational steps that yielded the solution to the mathematical problem (Bishop, 2007). This teaching and learning situation relies heavily on memorizing formulas and giving very scanty attention to mathematical reasoning and understanding of concepts. It is likely that this is one of the major reasons, why a majority of students in Nigeria find Mathematics difficult. Many studies have shown that students have even developed phobia for the subject (Buxton, 1981; Ahia, 2004). This situation does not augur well for the achievement of the goals of Nigeria's National Policy on Mathematics education. According to the national policy, Mathematics education goals include:

- The inculcation of computational skills.
- The understanding of Mathematics concepts and their application to everyday living in this modern age of science and technology.
- Ability to be precise, logical and abstract thinking.
- Ability to recognize problems and to solve them with related Mathematics knowledge among others.

Under the present situation where, students essentially train for examinations, which require the demonstration of little skill but rewards ability to recall concepts and memorized procedure, the acquisition of the Mathematical competency required for future life is doubtful. There is the need to break this learning cycle and replace it with a system, where students can articulate and show/express how they think in order to produce the

solution to a Mathematics problem. The purpose of this study therefore, is to test the conversational method of teaching mathematics and observe the possible challenges that may be associated with the approach.

The study of students' mental construction has been seen as fundamental to learning especially in children (Piaget, 1983). Recently, however, a number of diversification has entered into the field. Theoretical discussion of learning that used to focus only on mental constructions of pupils are now acknowledging the need for the replacement of 'knowing' with 'understanding' and communicating the understanding. It is now being acknowledged that discourse, talk and conversation play vital roles in those constructions. Laurillard (2002) for instance, advocated dialogue at a practical and theoretical level between teacher and student. Such dialogue according to Daly (2006), can be made explicit in that it can be discursive, adaptive, interactive and reflective therefore making teaching and learning a dialogic and interactive negotiation of meaning between the teacher and students (Daly, 2006). It is through such interactions that students encounter feedback as to whether or not their mental construction are useful (Dorfler, 2000), since the act of communication of one's thinking according by Hiebert *et al.* (1997), can also transform one's understanding. The major challenge however is in how to get the teachers and students to adjust to this new way of handling mathematics teaching and learning. The shift in teaching methodology required for this discursive/conversational approach is not likely to be easy for Mathematics teachers who are used to the expository method not only because of the usual human inertia to change but also because of the limitations in Mathematical knowledge among the teachers themselves. Students who also have become conditioned to be passive recipients of knowledge may find a novelty in this new situation, where they are required to discourse with the teacher. It follows from this point therefore that the teacher should be familiar with what the learner is bringing to the learning event so as to achieve a constructive alignment, which according to Biggs (2003), involves the alignment of the various components such as the curriculum, methods of teaching, assessment procedures, student interaction and institutional climate.

For the above reasons the complexity theory of Davis and Simmt (2003) becomes important and relevant. According to the complexity theory, which arose from studies of mathematical processes and biological systems (Sinclair, 2004), the Mathematics classroom is a complex environment where innovations are possible once certain conditions are met. The conditions to be met include those of: internal diversity, redundancy, decentralized control, organized randomness and neighbour interactions. Internal diversity in the classroom is associated with the possible range of experiences, skills and abilities of the students. Redundancy in the classroom has its nature in the sharing of vocabularies and experiences. To satisfy the condition of decentralized control, the teacher should not see himself as the 'king' who knows all and sends instructions to others. Learning, therefore, emerges from shared mathematical insights of the students under the guidance of the teacher. Neighbour interaction in the classroom refers to the interaction among peers and groups within the class during the Mathematics lesson.

Table 1: The four levels of the focused conversational model

Objective level	Data presentation of facts about the topic. External reality. Ensures that all students get the gist of the problem, body of data and all other aspects.
The reflective level	Internal reflections and interpretation of the data. Reveals the initial responses from individual pupil/group.
The interpretive level	Draws out the meaning of the questions/data and allows. A comparison of responses within the group.
The decisional level	General discussion within the group, agreement on solutions to the problem and extension to other life situation

Adapted from Asher (2007), focused conversation intro. institute for cultural affairs

In order to foster, the learning community envisioned by the complexity theory in the Mathematics classroom, it is being suggested to adopt the focused conversation method especially when gender is involved. For instance Popoola (2007) and Mansaray (1992), reported gender imbalance in the use of and learning of Mathematics. Ojo (1986) and Umoren and Ogbene (2006), said many students particularly girls can not 'think' Mathematics, hence, their roles in the subject is minimal, after all Mathematics, they have been told to be a masculine subject, which belong to selected few. Teachers, who use teaching approaches that make Mathematics frightening to students worsen this situation. The focused conversation method is a process in four levels led by the teacher, who facilitates the discursive activities in the class that take the students from the surface of the Mathematics problem to its depth and implications for their life and future (Table 1).

These study used the conversational method as an alternative to the expository method and see the challenges posed by the new method to both teachers and students. The situation that provides data for the observation of the challenges is a project involving teachers and students in three schools where the Conversational method was employed.

Table 2: Topics of presentation by teachers during project

Topic on projection	Topic on simultaneous equation	Topics on factorization	Topics on Simple equation of one unknown
A farmer stays in an area in his farm to keep away from sun or rain and a times sleeps there. What is it? Sketch this with your free hand. Ans = Pyramid	Mama Ade went to the market and made the following purchases. She bought 3 cups of ground nut oil and 4 tubers of Yam for 120 Naira from Mama Ojo. She latter found that the same items were sold more cheaply by Mrs. Akamo and decided to buy additional 4 cups of groundnut oil and 3 tubers of Yam. She paid N45 to Mrs. Akamo for these items. If we add up all she spent how much is the cost of each of the items?	Bunmi's daddy took a yam from daddy Bose and daddy Tope, he later took another 5 yams from daddy. Tolu and a Production 6 and add up to what he got before. How can you express this in simpler form?	Titi has a friend who gave her 2 bags and 8 products, which costs 12 naira only Express this in simple equation.
2. A Fulani (cattle rearer) makes her/his own house in the bush (i) Name and sketch it (ii) Sketch similar objects.			

Hypotheses:

- There is no significant difference between the performance of students using conversational method and expository method in mathematics.
- There is no significant difference between the performance of male and female students using conversational method in mathematics.

MATERIALS AND METHODS

Design: The study employed a pretest, posttest control group approach. For the purpose of establishing, the effectiveness of the independent variables the groups that experienced conversation method (treatment) is compared with the non-treatment groups (expository Instruction).

Subjects: Six intact classes comprising males and females were randomly assigned to the two (treatment and control) groups. Those who participated fully in the project (use of conversation method) were randomly selected to form the subjects of the study, using hand picking. Two hundred and sixty three male and female students were randomly selected from 3 local government areas junior secondary schools were used for the study making 131 males and 132. Both the experimental and control groups were given pretest and a posttest.

Procedure: The topics for the study include projection, simultaneous equation, simple equation in one unknown and factorization. The permission of the school authorities were secured to involve the teachers and students of primary 9 (JSS1) before the commencement of the study. Some sessions were held with the teachers to brief them on the conversational approach. The briefing emphasized the need to focus on addressing students thinking skills with the intension of improving students performance and the way students can apply or link Mathematics to their daily needs, using local examples.

Three volunteer Mathematics teachers were involved in the project. The teachers were also briefed on the 4 levels of the conversational method and asked to adopt the method in teaching their Mathematics lessons for the next 3 months (one term). Parts of the strategy are to allow the students to work in groups of 2 or 3 and students are to pick partners of their own choice.

At the objective level, teachers are to present the topic/problem in narrative form and mindful of not involving or using any mathematical terms or symbols. The teachers were to use local events and situations to present the situation to be tackled. Students are then allowed to discourse within their groups the salient points or issues in the teachers presentation. The reflective and interpretive levels go together as students draw out the mathematical problem from the presentations of the teacher. Meanwhile, the teachers moved round through the class to assist with the problem. After the mathematical problems have been drawn out of the narrative, the solution to the problem was then discussed. Throughout the lesson, teachers and students within their own groups freely asked questions. Each student must explain, how the mathematical problem was drawn out of the teachers presentation.

The range of presentations by the teachers is shown in Table 2. At the end of the 3 months, the students were given teacher made tests on the various topics covered during the course of using conversational method alongside their counterparts who did not participate in the study.

RESULTS

Table 3 presents the summary of the mean and standard deviation of test scores of students when conversational and expository methods are used to teach students in mathematics class. The result of the test was shown according to male and female students in both conversational method classes and expository method classes. It was shown that there was no difference

between the mean (29.62 and 28.15) and (15.90 and 15.75) performance of male and female students with conversational method and expository method. But a difference shows in the mean (19.62 and 15.90) performance of male and male students in conversational and expository methods so, also in the mean (28.15 and 15.75) female and female students in conversational and expository method. Due to the difference in the performance of students in conversational and expository method, analysis of covariance was used, using pre-test as covariates.

Hypothesis 1: There is no significant difference between the performance of students using conversational method and expository method in mathematics.

Table 4 shows that the use of conversational method of teaching on students performance in mathematics was significant (F (1.262) = 149.662; $p<0.005$). Thus, hypothesis 1 was rejected. There was a significant difference in performance of students using conversational method. Figure 1 a and b showed the histogram and line graph representing performance of the two groups in pre-test and post-test in Mathematics. It therefore, followed from the result that the conversational method group performed better than the expository method group. This indicated that the conversational method produced better performance than the expository method.

Hypothesis 2: There is no significant difference between the performance of male and female students using conversational method in mathematics (Table 5).

Table 5 showed that the use of conversational method of teaching on male and female students performance in mathematics was significant (F (1.132) = 0.810; $p>0.05$). This made hypothesis 2 to be retained. There was no significant difference in the performance of male and female students by using conversational method in mathematics. Figure 2 a and b showed the histogram and line graph representing the performance of male and female students in the post-test in mathematics. This

Table 3: Descriptive statistics of students performance and gender using conversational and expository methods

Gender	Method	Mean	S.D.	N
Male	Conversational	29.62	9.640	68
	Expository	15.90	4.986	63
Female	Conversational	28.15	9.351	65
	Expository	15.75	3.258	67
Total	Conversational	28.90	9.992	133
	Expository	15.82	4.170	130
	Total	22.44	9.843	263

Table 4: Summary of Analysis of Covariance (ANCOVA) of students performance according to methods

Source	SS	df	MS	F	p-value
Main effect	11410.1880	2	5707.094	106.160	0.000
Covariates (Pretest)	164.1330	1	164.133	3.054	0.082
Group	8042.9070	1	8042.907	149.662	0.000
Explained	13972.5270	260	53.740		
Residual	25382.7150	262			
Total	1577.8500	263			

$p<0.05$

Table 5: Summary of analysis of covariance (ANCOVA) of male and female students performance using conversational method

Source	SS	df	MS	F	p-value
Main effect	106.785	2	53.393	0.589	0.556
Covariates (Pretest)	35.576	1	35.576	0.392	0.532
Gender	73.424	1	73.424	0.810	0.370
Explained	11786.944	130	90.669		
Residual	11893.729	132			
Total	122994.000	133			

$p>0.05$

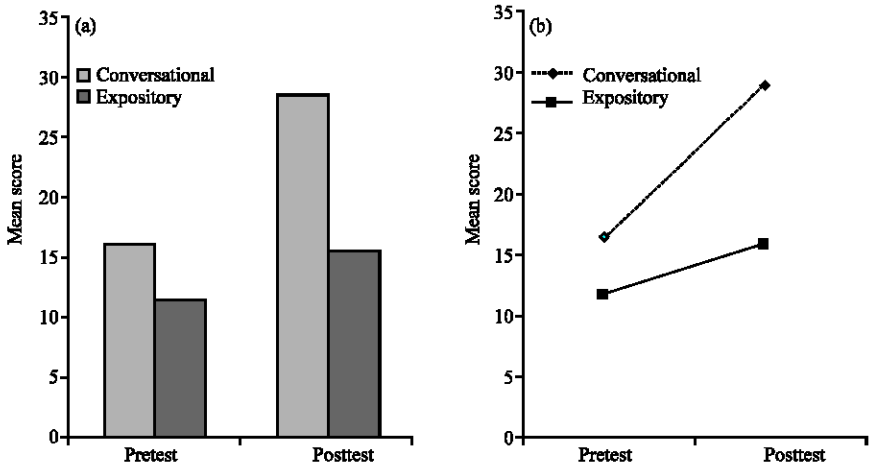

Fig. 1: Pretest and posttest of students using conversational and expository methods

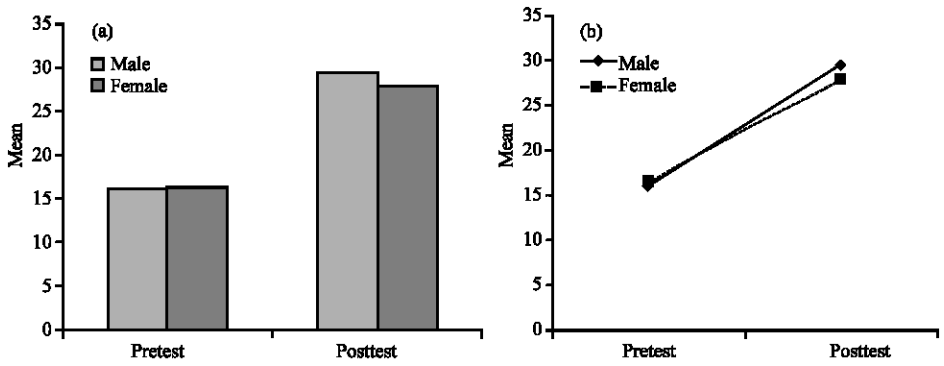

Fig. 2: Pretest and posttest of students using conversational and expository methods

implies that with the use of conversational method, the performance of male and female students does not change significantly. This indicated that the conversational method produced better performance in mathematics even with female students who thought mathematics is a masculine subject.

This study has shown a number of issues that relate with the quality of method used by teachers in teaching Mathematics. Those emphasized include the method and language use in expressing Mathematics to students. In the area of teaching methods, researchers (Awodeyi, 2004; Popoola, 2007) have discovered that they are major problems and challenges in Mathematics teaching and learning. We can also say here that many teachers do not base their teaching on these basic needs especially at the junior secondary scholl (primary 9). We also found that many students enjoyed interaction with peers and friends especially females, who are always shy and show nonchalant in mathematics lessons. Hence, teachers and students have greater roles to play in mathematics learning.

Observations on challenges posed by the use of conversational method: Having mapped out and described the conversational method based project in the classroom, the challenges facing teachers will now be addressed. Teachers in Nigerian secondary schools are used to the expository method of teaching Mathematics whereby students are prepared for one terminal examination or the other and teachers are seen solely as the experts and purveyors of knowledge. Students are introduced right on the onset to mathematical terms in a way that hardly had any meaning to their experience or the way they live. The system rarely allows students to express or demonstrate the way they think or show understanding. It is usually assumed that they understood once they got the sums correct. It however becomes difficult, afterwards for the students to explain how the problems were solved or apply the concepts in life situations. It is therefore, a major challenge to break this learning cycle in order to develop the mathematical competences required in future life. With this new method of teaching Mathematics comes a different pedagogical style with narrative, discursive, problem based learning and student centeredness being some of the basis of classroom practice. However, even if the conversational method promises to place the learner at the centre of the learning event, the language of instruction, the need to cover the curriculum at the end of term, teachers knowledge of mathematical concepts, students breaking of the barrier to discourse with teachers are obvious challenges that need to be overcome. The following observations, clustered around the four levels of the conversational method indicate the challenges that need be addressed in order to foster understanding of Mathematics by students.

The objective level: The main focus of the objective level is for the teacher to present the facts of the problem in a narrative form that encompasses the experiences and environment of the student. Throughout the period of the project, two observations threw themselves up. The first issue is that of language of instruction. Initially, teachers made use of English language, which is the usual language of instruction in Nigerian schools at the secondary school level. Because the teachers solely used English language to conduct the lesson, students also stuck to the use of the same language, but working in groups, it was observed that a number of the students interrupted their colleagues by asking questions in their native Yoruba (and even Ekiti dialect) language. This was allowed to continue and soon the interaction became more lively, free and surprisingly, the students began to seek clarifications from the teachers. One implication of the observation is that teachers may have to be allowed by the authorities to adopt whatever language that she/he finds most suitable for the students to understand what

he is teaching them. For the set of students involved in this project, more learning occurred when English language was interspersed with their native tongue.

The second observation has to do with the extent of the mastery of the mathematical concept by the teachers themselves. While, it was possible for a teacher to pass mathematics examinations themselves, some do not possess sufficient mastery of some concept to make students understand the concepts. When this is the case, the narratives provided by the teacher do not sufficiently include all necessary facts succinctly told for students to give correct interpretation of the story.

The reflective and interpretive levels: There were overlaps in these two levels as students jointly discourse and give meaning to the mathematical problem as presented in the narrative. It was obvious that the students were happy to work together. Watching, the students interact among themselves, one could develop a new awareness of the roles of peers in helping one, another in Mathematics and in letting the teacher know what they know and more importantly-their misconceptions on some of the concepts in mathematics e.g., the difference between the cube and the cuboids. Moving around the class to listen to student groups at work, created more opportunities for students and teacher to raise questions thereby increasing communication among teachers and students.

One problem that arose in the course of the project however, was the issue of class size because the students were allowed groups of three only; the number of groups was large-up to 15 in one place. This made it difficult to cover all the groups in one lesson and the same lesson had to continue the following day. In the situation, where teachers are required to cover specific grounds within a given period of time, they find it difficult to pursue lessons to their satisfaction.

The decisional level: At this stage, the teachers collate the various ideas emanating from the group discussion and guide the students to jointly see the correct solution to the mathematical problem. One major step at this level is to carry the concepts from the concrete operational stage to the stage of abstraction. Thus, 3 cups of orange juice and 4 plates of rice can now be seen as 3x and 4y. Many students in this project, expressed that for the first time, they saw Mathematics as a creative endeavor.

CONCLUSION AND IMPLICATIONS

This study examined the effectiveness of the Conversational method in the teaching of Mathematics at the junior secondary school level. The analysis suggests that the method is adaptive, resilient boundless and novel and enjoyable by the students. A number of implications/conclusions however, emanate from the project.

In order to put understanding on the Mathematics agenda in Nigeria's schools, it is important that the teacher training agencies should adopt innovative methods such an the Conversational methods and others in the training of Mathematics teachers. Since most teachers teach the way they were taught, while in college, their teachers should abandon the lecture method for such innovative ones. This is likely to encourage practicing teachers to re-evaluate their roles as teachers.

There is a need to ensure a greater understanding of student learning by studying generational characteristics, learning styles and preferences. Junior secondary school students in Nigeria ought to have reached the formal operation stage if regulations on entry are applied, but most students at this level are younger than the prescribed age. Teachers should therefore, see and handle their teaching at the level appropriate for their age and mental development. Present generation of students appears also to be fast in grasping facts and applying them due to their exposure to technology such as video games, computers. They also have a fascination for performance, interest in social interaction and group activity.

REFERENCES

Ahia, F., 2004. Confronting Nations Mathematics Phobia. School Administrator and Mathematics Educator, Canada.

Asher, K., 2007. Focused Conversation: Intro. Institute for Cultural Affairs. 2nd Edn. 655 Queen Street East-Toronto, Ontario. PDF Version, pp: 691-1422.

Awodeyi, A.F., 2004. Mathematics for sustainable development: Implications and illustrations for secondary education. J. Math. Assoc. Nig. (MAN), 29 (1): 49-57.

Biggs, J., 2003. Teaching for quality learning at University. 2nd Edn. Buckingham, U.K. Society for Research into Higher Education. Academic Press, New York, pp: 281-288.

Bishop, P., 2007. New knowledge for better teaching and learning of Science, Mathematics and Engineering. Centre for Research on Education in Science, Mathematics, Engineering and Technology. Cresmet News, pp: 3.

Buxton, L., 1981. Do you panic about Mathematics? Coping with mathematics Anxiety. London: Heinemann Educational Books.

Daly, P., 2006.The pedagogical challenges facing French business schools in the implementation of e-learning initiatives. Int. J. Teach. Learn. Higher Edu. (IJTE), 16 (2): 89-96. www.professoral.Edhec.com/servlet/com.u...

Davis, B. and E. Simmt, 2003. Understanding Learning Systems: Mathematics Education and Complexity Science. J. Res. Math. Edu., 34 (2): 137-167.

Dorfler, W., 2000. Means for Meaning. In: Cobb, P., Yackel and K. Mclain (Eds.). Symbolizing and Communicating in Mathematics Classrooms: Perspective on Discourse, Tools and Instructional Design. Mahwah, NJ; Lawrence Erlbaum Associates, pp: 99-131. DOI: 0-8058-2976-8(pb). www.fagsider.nla.no/rar/metaforer/cerme...

Hiebert, J., T.P. Carpenter, E. Fennema, K.C. Fuson, D. Wearne and H. Murray, 1997. Making sense: Teaching and learning mathematics with understanding. Portsmouth, NH: Heinemann, 18: 305-340. DOI: 0-902238-52-3. arcib.dowling.edu/bernstelh/. VCH Publishers, Inc., www.ericdigests.org/2004-3/math.html.

Laurillard, D., 2002. Rethinking University Teaching: A Conversational Framework for the Effective use of Learning Technologies. 2nd Edn. London: Routledge Farmer, pp: 9-18. DOI: 0415256778. www.ecesalford.ac.uk/proceedings/p...

Mansaray, A., 1992. The marginalized in education: What Group and Why? UNESCO Africa No. 1, pp: 17-22.

Ojo, J.O., 1986. Improving Mathematics Teaching in our Schools. J. Mathemat. Assoc. Nig. (MAN)., 17: 164-177. ISBN: 97-35224-6-9.

Piaget, J., 1983. Piaget's theory. In: Hussen, P.H. and W. Kessen (Ed.). Handbook of child psychology. 4th Edn. NewYork John Wiley and Sons. www.Norton.207. www.epjournal.net/filestore/epo127.

Popoola, A.A., 2007. Gender issues in Mathematics and Science Subjects among Secondary School Students in Ekiti State. Mathematical Association of Nigeria (MAN). Proceedings, Unilorin Press, Ilorin. ISBN: 97-35224-6-9.

Sinclair, M.P., 2004. Complexity Theory and the Mathematics Lab-Classroom youku. Complicity: Int. J. Complex. Edu. (IJCE), 1 (1): 55-71. www..ca/sinclair/.

Umoren, G.U. and A. Ogbene, 2006. Girl-Child Educating; A perspective on the challenge in Nigeria. In: Proceedings of the African Conference on primary/Basic Education. Collegium Educational Publishers. Macmillian Botswana and Master printers, S. Books Botswana, pp: 1-934.