

Classroom Conversation: Texture of Teacher's Utterances in Secondary School Mathematics

¹Rasheed Sanni (PhD) & ²Ibraheem Abiola Alabi

¹Department of Science and Technology Education, Faculty of Education
Lagos State University, Ojo, Lagos

&

²PhD Student, Department of Science and Technology Education, Faculty of Education
Lagos State University, Ojo, Lagos

Abstract:- This study is part of a larger study which explores the classroom conversation: texture of teacher's utterances in secondary school Mathematics. For this part, it uses qualitative research design of two teaching strategies on Sequence and Series (Arithmetic & Geometric Progression) in Mathematics. The qualitative method examines and interprets the observations on the texture of classroom conversation via the use of videotape and transcription. The target population for the study consist of all Senior Secondary Two (SS2) students in the public secondary schools in Lagos State. The study samples involve two SS2 students of public schools in the Badagry Local Government Area. In analysing qualitative data, descriptive statistics, mean, standard deviation, frequency counts, percentage bar chart are used. The findings of the research question show differences in the texture of the teachers' utterances in the treatment classroom and those in the conventional classroom. It is concluded that the students' actively participation in classroom are greatly dependent on the texture of the teacher's utterances. It is however recommended that the Mathematics educators should spring up wide publicity of the urgency or needs for the classroom conversation to be taken into cognisance while in the Mathematics classroom.

Keywords:- *Texture, Conversation, Teacher's Utterances, Mathematics Education.*

I. INTRODUCTION

Conversation is an important skill for effective Mathematics classroom learning. The students need to articulate their own ideas, learn how to listen to and contribute to the ideas of their peers in order to participate in meaningful mathematical conversations (Yeulet, 2010). In another context, Brodie (2007) observes that "Conversations allow the learners and the teacher to consider, question and add to each other's thinking and to co-produce generative mathematical ideas and connections" (p. 17). Classroom conversation is the trading engagement of language within the classroom environment and its interactions in either positive or negative statement. "Interacting with a range of learners' contributions makes the teachers' decisions about how to proceed and when and how to evaluate the learners thinking far more complex" (Brodie, 2008; p. 9). In

classroom discourse, the students engage in conversation in order to share, shape and improve their understanding towards a particular text or a topic or a problem and also in order to move their own thinking forward (Ontario, 2011). It is, therefore, to adopt conversation as a fundamental model of knowledge towards learning Mathematics in the classroom environment as this would further strengthen the explanation of the mathematical knowledge objective in a classroom conversation through the students' inquiry. The students pursue inquiries so as to develop ideas and acquire information for the purpose of sharing and debating the problems they encounter and later call for the joint consideration of alternative possible solutions, setting the stage to expand their current ways of thinking (Pantaleo, 2007; Wells, 2007).

Many research studies over the years have been conducted across the globe on classroom conversation as implicated towards the students learning achievements. The review of various literatures has shown differences and similarities in the classroom conversations on the part of the teacher's utterances. In the research study of McAninch (2015) he examines the secondary Mathematics teachers' questioning, responses and perceives influences upon their instructional decisions regarding questioning and response to students' ideas. The research study focuses on all the teachers' moves in the Mathematics classroom and provides insights into the teacher education programme for the Mathematics teachers. This study employs a multiple case study research design to compare the questioning practices and responses of three beginning teachers and three experienced teachers. The study data is analysed mainly using the constant comparative method to identify the regularities and patterns emerging from the data. The findings from the study reveal differences among the beginning and experienced teacher participants in the frequency and diversity of the questions asked. The study further reveals that the biggest interference to meaningful teacher questioning is a belief that rules and procedures are needed in order to make the students succeed in Mathematics.

In another teacher's moves research study conducted by Jensen (2017), he aims at the teachers' use of reasoning-based questions in the procedural and conceptual lessons. The research study involves mixed methods that focus on

the descriptive data of the teachers' questioning patterns with a cross-case analysis of five elementary Mathematics teachers to investigate how the nature of elementary teachers' questioning changes between procedural and conceptual Mathematics classes. The study further intends to know how the teachers' level of Mathematical Knowledge for Teaching (MKT) and their philosophies about the teaching and learning either support or obstruct their ability to ask questions that involve the students in mathematical reasoning and sense making. The findings reveal that the higher levels of the MKT typically lead to more effective teaching abilities in terms of helping the students to make meaning of mathematical concepts but philosophies seem to be a mediating factor in this relationship.

In another field of the research study conducted by Sofyan and Mahmud (2018), they aim at analysing teacher's talk in the classroom interaction based on Foreign Language Interaction Analysis (FLINT) system used as the research instrument in speaking classroom which involves a descriptive method. The study samples are both the institution lecturer and students of a speaking class from English Department. The findings reveal that the teacher's talk of giving praises and encouragement is approximately less, the asking questions category dominate the teacher's talk category which means it is in the beneficial function. The study further reports that the lecturer poses the questions to the students and the students respond to them well by speaking eagerly, thereby making the utterances of giving direction occur in relatively short times.

Lobato, Clarke and Ellis (2005) research on initiating and eliciting in teaching: A reformulation of telling. The researchers address the telling/not-telling dilemma in the Mathematics education with an advance of theoretical reformulation of telling as the set of teaching actions that serve the function of stimulating students' mathematical thoughts through the introduction of new ideas into a classroom conversation. The researchers further reformulate telling in three forms namely: function rather than the form of teachers' communicative acts; the conceptual rather than procedural content of the new information and its relationship to other actions rather than as an isolated action. They argue that for a teacher to tell something, telling must be reconceived with conceptual rather than procedural content and elaborate a variety of patterns of interaction between eliciting and initiating. Initiation-Reply-Evaluation (I-R-E) where the teacher initiates by asking a question about a known fact or idea, students reply with answers, and the teacher evaluates the responses for correctness which suggests that teachers often guide students to correct responses by evaluating their answers. Elicitation-Response-Elaboration (E-R-E) where teachers elicit a response, the students respond and teachers elaborate on the response which suggests an attempt to encourage deeper conversations. Proposition-Discussion (P-D) patterns where a student or a teacher makes a proposition and then other class members discuss it. This reformulation resolves some of the concerns with teaching as telling and helps create the

acceptability of providing new information within a constructivist perspective on learning.

The teacher's utterances, as examined by Brodie (2004) focuses on working with the students' contributions: coding the teacher's responses. This study develops a coding scheme for analysing the teacher's moves when following up on students' contributions in classroom conversations. The classroom observations of the study are videotaped on four South African teachers and are transcribed to form the study data. This data is analysed using her developed coding scheme and shows that the codes do distinguish between the teachers in ways that go beyond apparent distinctions. The study concludes that there are some constraints to all the teacher's moves which are to the extent of being constrained by particular students' contributions.

However, the researcher adopts the Brodie's (2004) analytical framework for this study. This analytical framework has been used in the classroom conversation over the years and is both similar to and different from other existing contexts of analytical framework. The framework is particularly suggesting the evaluation move and the subsequent initiation move on how the teachers work with the students' ideas in the Mathematics classroom. Brodie focuses on the fused evaluation or initiation move as one move and such a move is accorded with a turn of the teacher's talk with the intention of accounting for all the moves that the teacher makes in the Mathematics classroom. Brodie (2004) develops two levels of coding system and distinguishes between when a teacher follows up on a learner's response or does not and how the students follow up. The level one is basically on the teacher's talk while the level two details one item of level one called follow-up into another subcategory. The coding system categorically details the texture of the teacher's talk in the Mathematics classroom. The teacher's talk coding for the level one is as follows:

- Affirm (AF): It is the teacher's utterance made in the classroom to the response in reacting to the students' contributions as being good or correct.
- Direct (DR): It is the teacher's utterance made in the classroom to the act of managing the classroom and asking or calling someone to do something.
- Initiate (IT): It is the teacher's utterance made in the classroom when trying to get a mathematical idea from the students' contributions but not directly followed up.
- Inform (IF): It is the teacher's utterance made in the classroom to give information or explain an idea to the students.
- Follow-up (FL): It is the teacher's utterance made in the classroom to pick up on a contribution made by a student either immediately or later on.
- Other (OH): It refers to the utterance not in the category aforementioned.

The subcategories of the FOLLOW-UP move are as follows:

- Confirm (C): It is the teacher's utterance made in the classroom to the act of following up to check whether the students' contributions are clearly heard.
- Maintain (M): It is the teacher's utterance made in the classroom to the act of following up to repeat the idea, ask other for comment or indicate that the students should continue.
- Press (P): It is the teacher's utterance made in the classroom to the act of following up to push or probe the students for more on their idea to clarify, justify or explain more clearly.
- Elicit (E): It is the teacher's utterance made in the classroom to the act of following up to proceed on a contribution and make the teacher later try to get something from the students.
- Insert (I): It is the teacher's utterance made in the classroom to the act of following up to add something in response to the students' contributions, elaborate on it, suggest something or make a link.

II. STATEMENT OF THE PROBLEM

Although various researchers over the years have explored different teaching strategies, the students' learning outcome still face various challenges in the Mathematics discourse. The implication here is that the use of the various strategy has only been used to replace the conventional approach of teaching but not taking into cognisance the conversation in delivering instruction to the students. Fundamentally, many researchers have worked on classroom conversation over the years and reported that it is effective on learning as it propels the students thinking towards identifying and understanding concepts in the Mathematics classroom (Chauraya & Brodie, 2018; Berger & Bowie, 2012; Chitera, Kufaine, Jumbe & Nhlema, 2012; Sfard, 2008; Brodie, 2008; Brodie, 2004).

Taylor (2017) opines that a good reflection of classroom conversation can only work if the teachers take and consider the time to respond to the students' entries while offering words of encouragement to the learners. However, classroom conversation is of great importance to classroom interaction and the aftermath has prompted many researchers to explore and see what value it adds to the teaching environment. For instance, Brodie (2004) studies teacher's utterances which reveal the involvement of teacher and students' interaction to a large extent in the Mathematics classroom. It is against this background that the researcher explores the classroom conversation: the texture of teacher's utterances in secondary school Mathematics.

III. PURPOSE OF THE STUDY

The researcher explores the classroom conversation: the texture of teacher's utterances in secondary school Mathematics. It is the belief of the researcher that the teacher's utterance has the potentials of providing a panacea for the students' learning difficulties in Mathematics.

IV. RESEARCH QUESTION

What is the difference in the texture of the teacher's utterances in the treatment classroom and those in the conventional classroom?

V. RESEARCH METHOD

The researcher employs a qualitative approach in the conduct of the study. "There has been a growing trend in the Mathematics education for researchers to use qualitative approaches" (Sharma, 2013; p.50). This phenomenal enquiry about all the factors involved in the research study gives a detailed account of what transpires in the real realm situation. The researcher uses a case study tradition of qualitative research design as folklore for describing the texture of the teacher's utterances in the Mathematics classroom influence students learning. The target population for the study consists of all the Senior Secondary Two (SS2) students in the public secondary schools in Lagos State. The choice of SS2 as population for the study is because the selected concept for students was on SS2 scheme of work. The topic is basically on the Sequence and Series concepts in Mathematics as the main concepts of the study. The accessible population is understudied based on the quantitative data obtained from the sample of the SS2 students of Lagos State.

The study sample involves two non-equivalent (intact) classes of the Senior Secondary Two (SS2) students designated as the treatment and control groups of public schools in the Badagry Local Government Area, Agboju District V in Lagos State. Both classes are mixed with male and female students and comparable numbers of students (60 in the treatment group and 54 in the control group) randomly picked from the population.

VI. RESULTS

The research question asked is: what is the difference in the texture of the teacher's utterances in the treatment classroom and those in the conventional classroom? In the consideration of this question, the classroom data, that is, the video tapes of the lessons from the treatment and control groups are analysed using the Brodie's (2004) categories as presented in the introduction part of this study. To begin with, the researcher identifies and codes the teacher's utterances and moves that are AFFIRM, DIRECT, FOLLOW-UP, INFORM, INITIATE and OTHER. The analysis of the teacher's utterances and moves shows that 304 teacher's moves and 484 teacher's moves are recorded in both the treatment and the control groups respectively. These moves are recorded over eight lessons that lasted for 157 minutes 36 seconds and 164 minutes 34 seconds in both the treatment and the control groups respectively. The reasons for differences in the time spent in the treatment and control groups are attributable to different days of lesson delivery. The Mathematics period used in the treatment group is on a day when the school timetable is adjusted to have lessons shortened to 35 minutes so as to accommodate sporting activities while the period used in the control group

was on a day with normal lesson duration of 40 minutes. The proportion of the teacher’s moves that is AFFIRM, DIRECT, FOLLOW-UP, INFORM, INITIATE and OTHER is then computed and converted into percentages and presented below for the treatment and control groups.

It is, therefore, necessary to make two notes of attention at this stage. First, the researcher looks into the difference of teacher’s utterances and moves in the treatment and control groups in order to discover which among the teacher’s moves is predominant and having the texture of effective learning in the Mathematics classroom. Second, the researcher finds what Brodie reports as subcategories of the FOLLOW-UP moves useful and thus looks into the difference of these sub-categories in order to discover which among the sub-categories is predominant and having the texture of effective learning in the treatment and control groups (see table 2 and figure 2). The subcategories of FOLLOW-UP moves include ELICIT, INSERT, PRESS, MAINTAIN AND CONFIRM. The analysis of these FOLLOW-UP moves shows that there are 110 FOLLOW-UP moves in treatment group and 153 FOLLOW-UP moves in control group across all the four lessons in each group. In the next few paragraphs, a comparison of the distribution of these moves in the treatment and control groups is presented to explicate on the difference in the texture of the teacher’s utterances in the think-pair-share Mathematics classroom (treatment) and that in the conventional classroom (control). Table 1 below

shows the distribution of the teacher’s moves across all the four lessons each in both the treatment and control groups.

Table 1: Teachers’ talk in the treatment and control groups across all the lessons

Move	Treatment	Control
INITIATE	18 (6%)	17 (4%)
DIRECT	71 (23%)	125 (26%)
INFORM	82 (27%)	172 (36%)
AFFIRM	14 (5%)	6 (1%)
FOLLOW-UP	111 (37%)	153 (32%)
OTHER	8 (3%)	10 (2%)
TOTAL	304	483

Importantly, the revelation in the table above is the characteristics of the teacher’s moves in the treatment and control groups. The frequency count of the control group shows more teacher’s moves than the treatment moves which implies that the teacher in the control group talks more in the classroom and less in the treatment group. The reasons for these findings may not be unconnected with the classroom environment in the treatment group where the classroom lesson is based on strategy and the control group is without strategy. These frequencies count of the teacher’s moves is converted to percentage value as indicated in the table above. The percentage bar chart is computed to show more of the difference in the texture of the teacher’s moves in the treatment and control groups as shown in the figure 1 below.

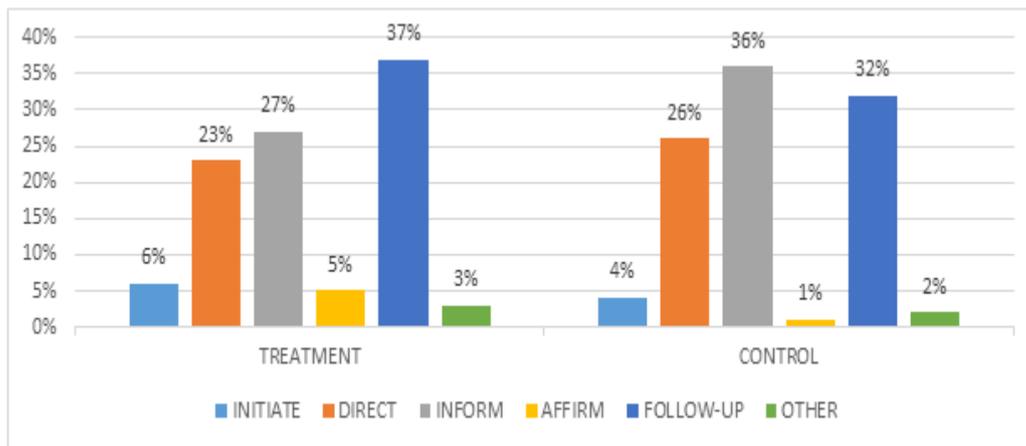


Figure 1: Categories of the teachers' talk in the treatment and control groups

Considering the figure 1 above, showing the categories of the teacher’s talk that characterised the classroom teacher’s talk in both the treatment and control groups, the percentage value of each teacher’s move is presented in the bar chart. This reveals the proportion of the teachers’ moves for all the lessons delivery in the treatment and control groups. These distributions are evenly predominant with the DIRECT, INFORM and FOLLOW-UP moves in both groups. The use of the INFORM and DIRECT moves has long been the traditional ways of teaching and these are seen in the control group. Although the teacher’s talk in the treatment group has some proportions of the teacher’s moves with the INFORM and DIRECT moves, the FOLLOW-UP move is predominant throughout the lessons.

These teacher’s moves in the treatment and control groups have the highest proportion of 37% and 36% for the FOLLOW-UP and INFORM moves respectively. The important point captured in the treatment group is the texture of the teacher’s utterances which involve active interaction that affords the students to work in pairs and boldly share their pair result. This strategy embraces the use of the FOLLOW-UP move so as to engage students’ participation in the classroom.

It is noteworthy that the INITIATE, DIRECT, INFORM, AFFIRM, FOLLOW-UP and OTHER moves are all relatively recorded throughout the lessons. This is an indication that the lessons are focused on the learner-teacher

conversation. In describing the predominance of the teacher's utterances and moves, an extract from one of the transcripts of the lessons in the treatment and control groups is examined as shown below. This extract is focused on the DIRECT, INFORM and FOLLOW UP moves that are predominant as indicated in the table 1. In doing this on the one hand, the researcher reflects on the treatment group extract and first looks at the DIRECT move predominance in one of the transcripts for the treatment group. These extracts are as follows:

TG-L2-U1 Teacher: *Writing date, subject and topic on the board*

TG-L2-U2 Teacher: Good Morning students!

TG-L2-C1 Chorus: Good Morning Ma!

TG-L2-U3 Teacher: We are going to start up with Geometry Progression and before we proceed, I will quickly write to ..., ehm ... remind (*not clear*)..., remind us of our last topic. Our last topic was the AP, Arithmetic Progression. I want someone to quickly remind us of what Sequence is all about.

TG-L2-C2 Students: *Silence*

TG-L2-U4 Teacher: What do we understand by Arithmetic Progression?

TG-L2-C3 Students: *Silence*

TG-L2-U5 Teacher: Yes, who can remind us?

TG-L2-C4 Students: *Silence*

TG-L2-U6 Teacher: What is Arithmetic Progression?

TG-L2-C5 Students: *Silence*

TG-L2-U7 Teacher: Yes, who can tell us?

TG-L2-C6 Students: *Ehmm ...*

TG-L2-U8 Teacher: Who can quickly remind us?

TG-L2-C7 Students: *Silence*

TG-L2-U9 Teacher: What do we mean by ...?

TG-L2-C8 Students: *Ehmm ...*

It is indicated from the extract above that the texture of the teacher's utterances is mostly characterised with the DIRECT move. The teacher's utterances are used to manage the classroom, ask question or call on someone to respond to a task in the classroom as evident in the lines TG-L2-U2, TG-L2-U7, TG-L2-U8 and TG-L2-U9 in the extract above. This shows that for some period of time of the teacher's moves, the texture of the teacher's utterances is focused on the acts of controlling the classroom and asking someone to do something. It is also evident in the extract above that there is a desire on the part of the teacher to allow the students to contribute in the classroom conversation which often prompt the teacher to continue using the DIRECT

move even when the students are not responding. By so doing, the students' interest becomes aroused and they have the boldness to meaningfully contribute to the classroom conversation. Second, the researcher looks at the INFORM move predominance in one of the transcripts for the treatment group. These extracts are as follows:

TG-L2-U15 Teacher: Arithmetic Progression, you can tell us by the formula.

TG-L2-C14 Bola: The general formula for arithmetic progression is a plus *into bracket* "n" minus one, *close bracket* d, that is the formula for nth term.

TG-L2-U16 Teacher: Okay! Arithmetic Progression is a sequence in which the increase or decrease, there is what ...? There is a constant manner

TG-L2-C15 Students: *Silence*

TG-L2-U17 Teacher: The increase or decrease in it is in a constant manner and is always called a common difference. Is that clear?

TG-L2-C16 Chorus: Yes!

TG-L2-U18 Teacher: This is a kind of sequence in which the increase or decrease, is in a what ...?

TG-L2-C17 Students: *Silence*

TG-L2-U19 Teacher: It is in a constant manner and normally follows a rule. This ... or this difference is called a common difference, is it clear now?

TG-L2-C18 Chorus: Yes, Ma!

It is indicated from the extract above that the texture of the teacher's utterances is mostly characterised with the INFORM move. The teacher's utterances are used to disseminate information or detail explanation in the classroom as evident in lines TG-L2-U15, TG-L2-U17 and TG-L2-U19 in the extract above. This shows that for some period of time of the teacher's moves, the texture of the teacher's utterances was focused on acts of giving information or explanation on idea. By so doing, the students become well enlightened on the task and have the courage to meaningfully contribute to classroom conversation. Third, the researcher looks at the FOLLOW-UP move predominance in one of the transcripts for the treatment group. These extracts are as follows:

TG-L2-U30 Teacher: Now before we talk about this technique to work on this example, there is a general formula. The general formula for the GP of the series is written as, that is, nth term is equal to a times r raise to power of n minus one that is the nth term of Geometry Progression where the a is standing for the first term and the r is standing for the common ratio and the n is standing for the number of terms, number of terms in the series. So the nth term of Geometry progression is a times r raise to power of n minus one where a is first term, r is common ratio and n is the number of term. Now let look at this example, given the Geometric Progression five, ten, twenty, forty, eighty ... what is the common ratio?

TG-L2-C29 Chorus: Two

TG-L2-U31 Teacher: It is the ratio, divides (*pause*)... the common ratio is ten divided by five which gives us ...

TG-L2-C30 Chorus: Two.

TG-L2-U32 Teacher: If you try others, you have twenty divides ten to give us ...*Showing various ways of getting common ratio*

TG-L2-C31 Chorus: Two

TG-L2-U33 Teacher: Common ratio there is what? *Showing various ways of getting common ratio.*

TG-L2-C32 Chorus: Two

TG-L2-U34 Teacher: And our first term is what?

TG-L2-C33 Chorus: Five

TG-L2-U35 Teacher: First term is five; then, the number of term, what is the number of term?

TG-L2-C34 Students: *Silence*

It is indicated from the extract above that the texture of the teacher's utterances is mostly characterised with the FOLLOW-UP move. The teacher's utterances are used to pick up on the students' contributions made in the classroom as evident in the lines TG-L2-U31, TG-L2-U32, TG-L2-U33, TG-L2-U34 and TG-L2-U35 in the extract above. This shows that for some period of time of the teacher's moves, the texture of the teacher's utterances is focused on the acts of keeping the students' response and building on it for further discussion towards the give task while the students contribute in return to the teacher's talk. On the other hand, the researcher reflects on the control group extract and first looks at the DIRECT move predominance in one of the transcripts for the control group. These extracts are as follows:

CG-L3-U1 Teacher: *Writing date, subject and topic on the board*

CG-L3-U2 Teacher: Good Morning Class!

CG-L3-C1 Chorus: Good Morning Ma!

CG-L3-U3 Teacher: How are you today?

CG-L3-C2 Chorus: Fine, thank you Ma!

CG-L3-U4 Teacher: Last lesson, we talked about Geometric Progression. Who can tell me, what we mean by Geometric Progression and formula for Arithmetic, ehm.. Geometric Progression?

CG-L3-C3 Students: *Silence*

CG-L3-U5 Teacher: Yetunde, what do you mean by Geometric Progression. nth term for Geometric Progression or formula for calculating Geometric Progression.

CG-L3-C4 Yetunde: Ehm ...

It is indicated from the extract above that the texture of the teacher's utterances is mostly characterised with the DIRECT move. The teacher's utterances are used to manage the classroom, ask question or call on someone to respond to a task in the classroom as evident in the lines CG-L3-U2,

CG-L3-U3 and CG-L3-U5 in the extract above. This shows that for some period of time of the teacher's moves, the texture of the teacher's utterances is focused on the acts of controlling the classroom and asking someone to do something. By so doing, the students' interest becomes aroused and they have the boldness to meaningfully contribute to the classroom conversation. Second, the researcher looks at the INFORM move predominance in one of the transcripts for the control group. These extracts are as follows:

CG-L3-U93 Teacher: Formula for calculating the sum of Arithmetic Progression. The first one is n over two into bracket a plus 1, *close bracket*, where a is first term and 1 is what?

CG-L3-C92 Chorus: Last term

CG-L3-U94 Teacher: Second term (*pause*)..., Second formula if you substitute the nth term of the AP into the first formula, that will be given n over two into bracket two-a plus into *another bracket* n minus one, *close the second bracket*, d, *close the first bracket*. So, if there is no question, let go into class work, classwork.

CG-L3-C93 Students: *Silence mood in solving class work*

CG-L3-U95 Teacher: One second (*pause*)..., time, one second more. Exchange your books, pens up, pens up. Exchange your books (*pause*)..., exchange your books (*pause*)..., exchange your books.

CG-L3-C94 Students: *Silence*

It is indicated from the extract above that the texture of the teacher's utterances is mostly characterised with the INFORM move. The teacher's utterances are used to disseminate information or detail explanation in the classroom as evident in the lines CG-L3-U93, CG-L3-U94 and CG-L3-U95 in the extract above. This shows that for some period of time of the teacher's moves, the texture of the teacher's utterances is focused on the acts of giving information or explanation on ideas. By so doing, the students become well enlightened on the task and have the courage to meaningfully contribute to the classroom conversation. Third, the researcher looks at the FOLLOW-UP move predominance in one of the transcripts for the control group. These extracts are as follows:

CG-L3-U55 Teacher: What is our common difference?

CG-L3-C54 Students: *Silence*

CG-L3-U56 Teacher: That is what?

CG-L3-C55 Students: *Silence*

CG-L3-U57 Teacher: Nine minus what?

CG-L3-C56 Chorus: Sixteen.

CG-L3-U58 Teacher: What would that give us ...

CG-L3-C57 Chorus: Minus seven.

CG-L3-U59 Teacher: Minus seven. We have our a to be what?

CG-L3-C58 Chorus: Sixteen.

CG-L3-U60 Teacher: So, let's see what? S_n is equal to twenty over two (*pause*)..., two times sixteen over twenty minus one (*pause*)..., times what?

CG-L3-C59 Chorus: Minus seven.

CG-L3-U61 Teacher: This is ten (*pointing to 20/2 on the board*). S_{20} is equal to ten into two times sixteen.

CG-L3-C60 Chorus: Thirty-two.

CG-L3-U62 Teacher: Bracket nineteen times minus seven. So, we have ten into thirty-two plus ..., nineteen times minus seven.

CG-L3-C61 Chorus: Minus one hundred and thirty-three.

CG-L3-U63 Teacher: Okay, minus, thirty-two minus one hundred and thirty-three, we have ...

CG-L3-C62 Chorus: Minus one hundred and one

CG-L3-U64 Teacher: One hundred and one.

CG-L3-C63 Chorus: Minus one hundred and one.

It is indicated from the extract above that the texture of the teacher's utterances is mostly characterised with the FOLLOW-UP move. The teacher's utterances are used to pick up on the students' contributions made in the classroom as evident in the lines CG-L3-U58, CG-L3-U59, CG-L3-U62, CG-L3-U63 and CG-L3-U64 in the extract above. This shows that for some period of time of the teacher's moves, the texture of the teacher's utterances is focused on the acts of keeping the students' response and building on it for further discussion towards the given task while the students contribute in return to the teacher's talk. For instance, most of the teacher's moves from the extract are connecting to the students' contributions which are noted for FOLLOW-UP. It also implies that the FOLLOW-UP move makes the students' contributions consistently in the classroom conversation when used by the teacher.

In general terms, the comparison of the difference in the texture of the teacher's utterances is observed based on their record in the think-pair-share classroom and the conventional classroom. First, the INITIATE move is seldom recorded to introduce the new idea about the concepts at hand in the beginning of the lesson after the introduction of the concepts in both groups. The difference in the INITIATE move represents 2% in favour of the treatment group over the control group. Second, the DIRECT move is often recorded to start the lesson in both groups. In the treatment group, it is observed that the teacher prefers to use the FOLLOW-UP move at a stage where the DIRECT move is used in the control group of the same concepts. The difference in the DIRECT move represents 3% in favour of the control group over the treatment group. Third, the INFORM move usually follows the DIRECT move in the beginning of every lesson in order to introduce

the concepts to the students in both groups. In the control group, it is observed that the teacher continues using this move because of no classroom interaction effectively in place. The difference in the INFORM move represents 9% in favour of the control group over the treatment group.

Fourth, the AFFIRM move is often recorded after the teachers in both groups ask the students to contribute and the feedback is excellent. In the treatment group, it is observed that the teacher often uses this AFFIRM move after a successive sharing of any pair result in the classroom. This allows the use of the AFFIRM move more in the treatment group than in the control group. The difference in the AFFIRM move represents 4% in favour of the treatment group over the control group. Fifth, the FOLLOW-UP move is considerably recorded in both groups but slightly differs in the pattern of recording the FOLLOW-UP. The difference in the FOLLOW-UP move represents 5% in favour of the treatment group over the control group. Sixth, the OTHER move is evenly recorded in both groups and the difference represents 1% in favour of the treatment group over the control group. Recall that the subcategories of the FOLLOW-UP moves in both the treatment and control groups include ELICIT, INSERT, MAINTAIN, PRESS and CONFIRM. These subcategories afford the researcher to explicate on the FOLLOW-UP move that is considered to slightly differ in their pattern of recording. The table 2 below shows the distribution of these subcategories of the FOLLOW-UP moves across all the four lessons each in both the treatment and control groups.

Table 2: Subcategories of the FOLLOW-UP move in the treatment and control groups across all lessons

Move	Treatment	Control
ELICIT	20 (18%)	8 (5%)
INSERT	41 (37%)	100 (65%)
MAINTAIN	18 (16%)	24 (16%)
PRESS	28 (25%)	14 (9%)
CONFIRM	4 (4%)	7 (5%)
TOTAL	110	153

Importantly, the revelation in the table 2 is the characteristics of the subcategories of the FOLLOW-UP moves in the treatment and control groups. The frequency count of the control group which represents 32% of all the moves shows more teacher's moves than the treatment moves which represents 37% of all moves. The reasons for these findings may not be unconnected with more moves recorded for the control group over the treatment group in all the lessons as the teacher in the control group talks more than the one in the treatment group. This frequency count of the subcategories of the FOLLOW-UP moves is converted to percentage value as indicated in the table 2. The percentage bar chart is computed to show more of the difference in the texture of the subcategories of the FOLLOW-UP in the treatment and control groups as shown in the figure 2 below.

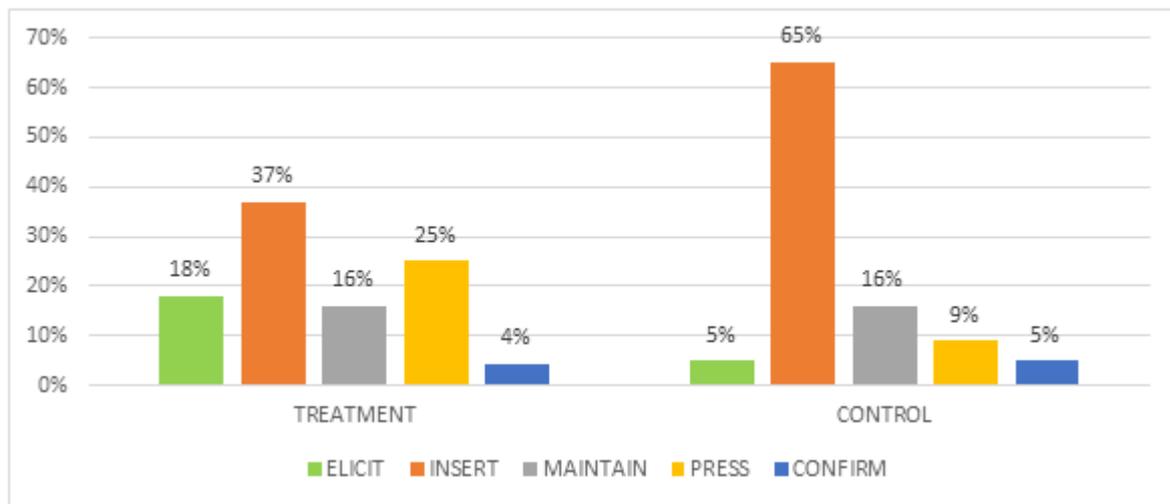


Figure 2: Subcategories of the FOLLOW-UP in the teacher's talk of the treatment and control groups

Considering the figure 2 above, showing the subcategories of the FOLLOW-UP moves in both the treatment and control groups, the percentage value of each subcategory move is presented in the bar chart. This reveals the proportion of the subcategories of the FOLLOW-UP moves for all the lessons delivery in the treatment and control groups. The lessons in the treatment and control groups show that the subcategories of the FOLLOW-UP moves are predominantly INSERT in both the treatment and control groups with 37% and 65% respectively. The FOLLOW-UP INSERT move is indicative of the acts of the teacher's moves involving adding something or elaborating or correcting in response to the students' contributions in the treatment and control groups. Whatever the teacher's moves in the treatment and control groups are connecting to the previous contributions made by the students which improve the classroom interaction. The important point captured in the treatment group is the texture of the teacher's utterances which is not only limited to the FOLLOW-UP INSERT but also to other subcategories of the FOLLOW-UP move while the scenario is different in the case of the control group. It is noteworthy that the FOLLOW-UP INSERT move is predominant throughout the lessons. In describing further, this predominance of FOLLOW-UP INSERT, an extract from one of the study transcripts of the treatment and control groups is examined as shown below. This extract is focused on the FOLLOW-UP INSERT move that is predominant as indicated in the table 2. In doing this on the one hand, the researcher reflects on the treatment group extract and looks at the FOLLOW-UP INSERT move predominance in one of the transcripts. These extracts are as follows:

TG-L3-U31 Teacher: First term is what?

TG-L3-C30 Chorus: Sixteen

TG-L3-U32 Teacher: Plus, twenty

TG-L3-C31 Chorus: Twenty minus one . . .

TG-L3-U33 Teacher: Our common difference is what?

TG-L3-C32 Chorus: Minus seven (*pause*) ..., minus seven . . .

TG-L3-U34 Teacher: Minus seven, so we go on with divide, two can go here . . .

TG-L3-C33 Chorus: Ten

TG-L3-U35 Teacher: So we have ten, then this (*pointing to 2 x 16 on the board*) gives us . . .

TG-L3-C34 Chorus: Thirty-two

TG-L3-U36 Teacher: This (*pointing to 20 - 1 on the board*) gives us . . .

TG-L3-C35 Chorus: Nineteen

It is indicated from the extract above that the texture of the teacher's utterances is mostly characterised with the FOLLOW-UP INSERT move. The teacher's utterances are used to pick up on the students' contributions made in the classroom through adding something or elaborating in response to the students' contribution as evident in the lines TG-L3-U32, TG-L3-U34 and TG-L3-U36 in the extract above. This shows that for some period of time of the teacher's moves, the texture of the teacher's utterances is focused on the acts of adding something or elaborating in response to the students' contributions while the students contribute in return to the teacher's talk. By so doing, the students become active participants and have the courage to meaningfully contribute to the classroom conversation. On the other hand, the researcher reflects on the control group extract in order to describe the predominance of the FOLLOW-UP INSERT move. An extract from one of the study transcripts of the control group is examined as shown below. This extract is focused on the FOLLOW UP – INSERT move that is predominant as indicated in the table 2. In doing this, the researcher looks at the FOLLOW-UP INSERT move predominance in one of the transcripts for the control group. These extracts are as follows:

CG-L3-U67 Teacher: Example two. The first and last terms of an AP are zero and one hundred and eight respectively. If, if the sum of the series is seven hundred and two, find (a) the number of terms in the AP. (b) the common

difference between them, the common difference between them. So which formula are we using? Formula one or formula two?

CG-L3-C66 Chorus: Formula one

CG-L3-U68 Teacher: Formula one, why?

CG-L3-C67 Students: *Silence*

CG-L3-U69 Teacher: Because we are giving ...

CG-L3-C68 Chorus: The last term

CG-L3-U70 Teacher: And the first ...

CG-L3-C69 Chorus: Term.

CG-L3-U71 Teacher: S_n is equal to n over two..., a plus 1. ... n , we don't know, a equal to zero and 1 is what?

CG-L3-C70 Chorus: One hundred and eight.

CG-L3-U72 Teacher: One hundred and eight, S_n is equal to

..

CG-L3-C71 Chorus: Seven hundred and two.

It is indicated from the extract above that the texture of the teacher's utterances is mostly characterised with the FOLLOW-UP INSERT move. The teacher's utterances are used to pick up on any students' contributions made in the classroom by adding something or elaborating in response to the students' contributions as evident in the lines CG-L3-U69, CG-L3-U70 and CG-L3-U72 in the extract above. This shows that for some period of time of the teacher's moves, the texture of the teacher's utterances was focused on acts of adding something or elaborates in response to the students' contribution while the students contribute in returns to teacher talk. By so doing, the students become active participants and having the courage to meaningfully contribute to the classroom conversation. However, the comparison of the difference in the subcategories of the FOLLOW-UP moves was observed based on their record in the think-pair-share classroom and the conventional classroom. First, the FOLLOW-UP ELICIT move is used more in the treatment group than in the control group. The difference in the FOLLOW-UP ELICIT move represents 13% in favour of the treatment group over the control group. Second, the FOLLOW-UP INSERT move is used more in the control group than in the treatment group. The difference in the FOLLOW-UP INSERT move represents 28% in favour of the control group over the treatment group. Third, the FOLLOW-UP MAINTAIN move is used at the same rate in the treatment and control groups and there is no difference in the two groups proportion. Fourth, the FOLLOW-UP PRESS move is used more in the treatment group than in the control group. The difference in the FOLLOW-UP PRESS move represents 16% in favour of the treatment group over the control group. Fifth, the FOLLOW-UP CONFIRM move is used more in the control group than in the treatment group. The difference in the FOLLOW-UP CONFIRM move represents 1% in favour of the control group over the treatment group.

Above all, this section of the study reveals some differences in the texture of the teacher's utterances and moves in the treatment and control groups. It is observed that the teacher's utterances in the treatment and control groups are characterised with the DIRECT, INFORM and FOLLOW-UP moves. The use of the think-pair-share strategy in the treatment group afford the teacher to talk less

because the students are allowed to interact with their pair and the whole class when sharing their results. Thus, the texture of the teacher's utterances in the think-pair-share classroom is largely with the FOLLOW-UP move. While in the control group, the teacher talks more in the classroom conversation which is attributed to lack of classroom interaction. Thus, the texture of the teacher's utterances in the conventional classroom is largely with the INFORM move. Meanwhile, the differences in the texture of the teacher's utterances in the subcategories of the FOLLOW-UP move in the treatment and control groups are characterised with the FOLLOW-UP INSERT move. It is also observed that the proportion of the FOLLOW-UP INSERT move is greatly predominant in the conventional classroom when compared to the think-pair-share classroom. The findings on these students' contributions are analysed in the next section of this study.

VII. DISCUSSION OF FINDINGS

The findings of this study reveal differences in the proportion of the teacher's moves in the treatment classroom and those in the conventional classroom. The findings reveal the FOLLOW-UP move as the most prevalent move in the treatment classroom and the INFORM move as the most prevalent in the conventional classroom as illustrated in the earlier the table 1 and the figure 1. Students in the treatment group actively participate in the classroom as a result of the strategy involved which prompts the predominance of the FOLLOW-UP move in the teacher's utterances. The predominance of the FOLLOW-UP move is an attribute of the teacher's questioning as reported by McAninch (2015) and Brodie (2008). They both report that the teacher's questioning is a useful tool in engaging the students in deep thinking about mathematical ideas and bringing about improvement in the students' participation in the classroom conversation. Meanwhile, it is seen in the control group that the students participate less in the classroom as a result of the strategy involved which prompts the predominance of the INFORM move in the teacher's utterances. The INFORM move with the attribute of giving information or explanation lacks the act of questioning as many teachers find it difficult to ask meaningful questions (Sofyan & Mahmud, 2018). This is an indication of the conventional method of teaching used in the control group where there is the teacher's utterances predominance in the classroom conversation as against the classroom conversation in the treatment group.

Furthermore, the subcategories of the FOLLOW-UP move reveal the level of the moves prompted by the teacher's talk in connection with the students' contributions. Among the subcategories of the FOLLOW-UP move, the INSERT move is predominant in both the treatment and control groups as indicated in the table 2 and the figure 2. The level of the follow-up increases steadily and a positive aftermath is expected at the end of the class. This finding is in conjunction with the literature that the teacher's selection is repeatedly on the use of inserting or explaining moves towards the students' contributions as a key to his students' contributions in the classroom conversation (Lobato, Clarke

& Ellis, 2005 and Brodie, 2008). The teacher's utterances are very important as one cannot easily differentiate between the treatment and control groups since both are predominantly with the INSERT move. In the case of the treatment classroom, the teacher's utterances are basically to propel the students' thinking and allow for classroom interaction to take place while in the control group, the teacher's utterances are basically to inform the students with the desire to accept their utterances and not to allow the students' contributions to take place. These students' contributions are discussed in the next section of this study.

VIII. CONCLUSION

The study explores the classroom conversation: the texture of teacher's utterances in the secondary school Mathematics. From the findings of this study, it is concluded that the students' active participation in classroom are greatly dependent on the texture of the teacher's utterances.

IX. RECOMMENDATIONS

In consideration of the findings of this study, the following recommendations towards improvement are made:

- i. Education districts, schools, teachers and future researchers could benefit from this study and continue building on this research.
- ii. Mathematics educators should spring up wide publicity of the urgency or needs for the classroom conversation to be taken into cognisance in the classroom.
- iii. There is need to often organise seminars or workshops in training the teachers on the contemporary concepts in teaching and learning Mathematics.
- iv. Professional associations like the Mathematical Association of Nigeria (MAN) should popularise the classroom conversation.

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