The Influence of Dialogic Instruction on Students’ Classroom Achievement in Vihiga County, Kenya

Jackson Khayati Mwelese

Doctoral Student of Mathematics Education,
Masinde Muliro University of Science and Technology, Kiambu, Kenya
Author’s Email: mwelesejackson@gmail.com

Abstract
Recent reforms in mathematics education call for efforts that create collaborative and student-centred environments, where students have opportunities to reason and construct their understanding as part of a community of learners. While there have been successes to this end, traditional models of instruction still dominate mathematics classrooms in Kenya especially at the secondary school level. Accordingly, this study sought to look into the role played by secondary mathematics teachers in implementing such activities that promote rich verbal and written peer-to-peer and teacher-to-student mathematics classroom communication. Specifically, it sought to find out the influence of dialogic instruction on mathematics classroom discourse and investigate its influence on students’ academic achievement. This study offers relevance to the academic study of teaching and learning practice. It also ensures teachers offer learners better learning opportunities and outcomes. Besides, the study informs both curriculum review and teacher professional development in mathematics.

Keywords: Dialogic Instruction, Classroom Discourse, Achievement, Communication, Discussion.
Although the writers of mathematics education reforms and innovative K-12 mathematics curricula have been recommending and providing support for mathematical discourse in the classroom for over 20 years (e.g., Lappan, Gillies, & Ladoff 2002; Shroyer & Fitzgerald, 1986), research on what teachers themselves need to know in order to orchestrate classroom discourse effectively in the mathematics classroom is more recent. One line of research has provided strong evidence that teachers need to not only have deep and connected subject matter knowledge of mathematics to lead mathematical discussions with their students, but also need to know mathematics content that is specific to teaching and specifically addresses the needs of learners (Hill, Rowan, & Ball, 2005). According to Stein (2007), reform-based mathematics is focused on the idea that mathematics should be taught in a way that encourages students to use “mathematical discourse to make conjectures, talk, question, and agree or disagree about problems in order to discover important mathematical concepts” (p. 285). According to Truxaw & DeFranco (2007), participating in a mathematical community through discourse is an important step for learning mathematics and for conceptual understanding. They note that mathematical communication is necessary for ideas to become objects of reflection, refinement, discussion, and amendment. Kabasakalian (2007) supports this point by noting that the vehicle that promotes understanding mathematical concepts is the ability to process language, an ability that a lot of middle school and high school students still need to learn and develop.

This position has also been endorsed by NCTM (1989, 2000) which calls for instructional programs to enable students, to use the language of mathematics to express mathematical ideas precisely, communicate their mathematical thinking coherently and clearly to peers, teachers, and others and to organize and consolidate their mathematical thinking through communication. NCTM (2002) and Davis (2008) note that communication is an essential part of mathematics and mathematics education and formal mathematical terminology is an indispensable component of this communication. Noting the importance of communication in mathematical process, Thompson & Rubenstein (2000) call for the need for students to know the meaning of mathematics vocabulary words, whether written or spoken, in order to better understand and communicate mathematical ideas. Student participation in discourse serves as a practice in mathematical thinking. Rawding and Williams (2012) describe the features of rich discourse in mathematical classrooms as:

*Just as students need plenty of time to practice skills such as solving fraction problems, they also need time to practice the skills of discourse to become not only better communicators but also stronger mathematicians.* (p. 48).

Therefore, if the discourse is rich, we expect to see active student participation. When participation is rich and interactive, we get students making meaning of mathematics and improving their performance.

It is important to note that participation alone is not enough to define rich mathematical discourse. Participation means that students share in the “mathematical authority of the classroom, using the teacher’s and one another’s statements as thinking devices to generate new, and sometimes unexpected, mathematical meaning” (Azevedo, 2012). Therefore, it’s worth noting that rich discourse also requires that the mathematical meaning generated is consistent with the essence of practices in the discipline itself. Rich mathematical discourse should in addition generate mathematical meaning that is consistent with and equivalent to the practices implied by the set learning goals.
Despite the calls to promote classroom discourse, teachers generally find it convenient to use classroom activity structures. The benefits of these structures include precise control over content coverage and pace. Research indicates that teachers use activity structures that limit student participation in order to achieve the range and consistency of student behaviour used for assessment. The activity structure used in the classroom helps to determine the level and type of student interaction that is likely to occur. Gillies & Ashman (1998) argue that depending on the activity structure imposed upon participants, student participation ranges from passive reception of information to construction of mathematical arguments that are key for critical thinking. Conventionally, the prominent activity structure in most mathematical classrooms is the lecture method structure. This method allows for little or no student participation, thus remaining passive in class. Alternatively, pure dialogue does not, by definition, place any restrictions on participants. This is not evident in most classroom settings in our secondary schools. Because most teachers prefer the lecture method, to their advantage, student participation is limited. Where students are engaged in a learning activity, meaning making is enhanced. The activity structure provides a description of how teachers, through it, impact student learning through lesson design.

The present literature on dialogic teaching lays more emphasis on the use of language in mathematics instruction and its importance in understanding terminologies and content. The teacher’s role in the literature is to lay the foundation for the discourse and guide the instruction. The teacher here acts as a guide with the map to show the way. In his absence, the child, according to this study gets lost or incapacitated. Besides, the literature presents scaffolding as a suitable practice to enhance understanding of difficult or challenging concepts. Scaffolding is a temporary support provided to the student by the teacher. It is construed in order for the student to obtain a certain particular skill or piece of knowledge that he/she isn’t in a position to get on his/her own. When a child is working on a task or problem, an adult intervention is directed towards limiting the degree of freedom of work on the task, which lets the child focus on the particular skill which should be adopted at that moment. Scaffolding is also characterized by its safety, as it reduces the risk of student failure. This limits the learners’ freedom of expression and increases their reliance on the teacher.

However, this study supplements this effort by empowering the students through peer-to-peer interaction during classroom discourse. This peer interaction allows for free sharing, critiquing and collaboration. In as much as scaffolding helps students to move from the difficult encounters to more familiar ways of obtaining solutions, this study presents dialogic instruction as a motivator of classroom discourse that excites learners into constructive classroom engagements. It’s through these engagements that students make meaning of their learning. They are able to decide the pace of their learning as the teacher provides the necessary facilitation. In this study, dialogic instruction is premised on a view of instruction not as what teachers provide or do to students but rather as what teachers and students collaboratively negotiate. High quality classroom discourse was characterized by substantive reciprocity between teachers and their students. In this study, students and not just teachers had a lot of input into the business of the classroom and hence what was learned.

**Theoretical Underpinnings**

The study draws from the socio-constructivist theory of learning by Bruner (Cobb, 1994; Cobb, Wood & Yackel, 1992). From a socio-constructivist perspective, a learning environment can be created where students construct their mathematical knowledge through interactive inquiry-based activities. Several key components are important for inquiry-based learning. These are exploring, conjecturing, generalizing and communication. The exploring
process can promote students’ inquiry and investigation of the task while the conjecturing and generalizing processes provide a means for students to construct their own mathematical knowledge. The communication process helps build meaning and permanence for ideas (NCTM, 2000). The socio-constructivist perspective emphasizes the role of others in constructing understanding. Socio-constructivist theories call for students to co-construct their knowledge through collaboration with their peers on meaningful activities. Dialogue and collaboration are seen as key to learning success. The social context constructed in the course of their interaction helps to enhance the students’ thinking and learning in the classroom. Students’ active participation and decision-making in the daily life of the classroom and school build responsibility and ownership for learning. These, in turn, become intrinsic motivators for further learning and resiliency. The teacher’s role from a socio-constructivist perspective is that of a facilitator to students’ learning. He guides and supports their construction of viable mathematical ideas. According to Bruner (1986), the constructivist teacher by offering appropriate tasks and opportunities for dialogue, guides the focus of students’ attention, thus unobtrusively directing their learning. The teacher influences learning through his attitude towards his practice and the level of engagement of his students in the learning process.

Figure 1: A three-tier effect on mathematics classroom discourse. Source: Mwelese, J. (2018)

Figure 1 show how the teacher related factors of attitude and level of engagement affect the dialogic instruction that eventually affects the nature of mathematics classroom discourse. Positive attitudes and high learner engagement through group work, whole class discussion and individualized attention enhance meaningful learning. This study preferred the socio-constructivist perspective because teacher’s attitude about the relevance and usefulness of dialogic instruction not only dictates their use but also their role in meaningful learning and achievement in mathematics. Based on the theory and literature reviewed, the study formulates the key research question and hypothesis

RQ 1: What is the influence of dialogic instruction on mathematics classroom discourse?

H01: There is no significant difference students’ academic achievement between those taught using dialogic instruction and those taught using conventional methods of instruction.

Methodology

This research study involved the collection of both qualitative and quantitative data for purposes of addressing the preceding research objectives. As a result, a mixed method research design was preferred. According to Creswell & Plano (2011), mixed methods help a researcher to address objectives that cannot be addressed explicitly using only qualitative or
quantitative methods. Mixed methods therefore provide a more complete picture by noting trends and generalizations, as well as an in-depth knowledge of participants’ perspectives. This study is therefore anchored on the two research paradigms; positivist and interpretivist paradigms.

The positivists or quantitative researchers find it a necessity to apply methods that are successful in natural, social or human sciences in order to scientifically validate theories of human behavior. Positivists claim that social observations should be treated as entities in the same way that physical scientists treat physical phenomena (Johnson & Onwuegbuzie, 2004:14). According to Sale, Lohfeld & Brazil (2002:44), the positivists or quantitative researchers contend that there is only one truth, an objective reality that exists independently of human perceptions. As Sale, Lohfeld, & Brazil (2002) stipulate, the main concern of the positivists is for the investigator to study a phenomenon without influencing it or being influenced by it. To do so, the observer needs to be separate from the entities that are subject to observation. The positivists suggest also that the goal of an investigator should be that of measuring and analyzing relationships between variables but within a value-free framework (Johnson & Onwuegbuzie, 2004).

In contrast to the positivists, interpretivists or qualitative researchers contend that there are multiple truths and multiple realities based on human perceptions. Interpretive researchers use systematic procedures but maintain that there are multiple socially constructed realities. Rather than trying to be objective, researchers’ professional judgments and perspective are considered in the interpretation of the findings. In this paradigm, researchers believe that each individual constructs his or her own view of the world based on his or her own experience and perceptions. Creswell (2003) noted that in interpretive research, the researcher tends to rely on the participant’s views of the situation being studied and recognizes the impact of participant’s back ground and experience on the study. The interpretivists also assume that the best way to understand a phenomenon is to view it in its context and become immersed in it to uncover rich and detailed information. For this reason, investigators should not be detached with the object of the study; rather, they should be interactively linked so that findings become mutually created with the context of the situation which shapes the inquiry (Krauss, 2005:760).

Based on the above, both quantitative and qualitative data were obtained for the analysis. Since this design demands an integration of the data in one or more stages of a research process, the data were collected concurrently (Guest, 2013). However, quantitative data were collected at the beginning and at the end of the study. Qualitative data provided the study’s primary findings, which were then corroborated by the quantitative ones. The qualitative nature of the study was accomplished through administering questionnaires and Focus Group Interviews. Classroom participant observation, video and audio recordings were done throughout the instruction period.

The quantitative aspect of the study was implemented through quasi-experimental research design. Here, students were assigned to non-randomized pretest-posttest groups; experimental and control groups. This design was used since it was not deemed appropriate to randomly assign participants to either treatment or control group. This was because of the complexity of the study schools that had varied challenging infrastructure. Quasi-experimental design can be used retrogressively i.e. after intervention has taken place (Howard & Shagun, 2014). According to Howard and Shagun (2014), baseline data should be collected before the intended recipients are exposed to the programme. That’s why I chose on this design so that a pre-test is administered to both groups before instruction so as to get their entry behaviour.
The aim of this experimental research was to investigate the possible cause and effect relationship by manipulating one independent variable (method of instruction) to influence the dependent variable (student achievement) in the experimental group and measuring the effect of the manipulation by running an ANCOVA. By manipulating the independent variable, it can be established if the treatment to the experimental group makes a difference to the subjects. If the average scores to the two groups prove to be significantly different, then it can be concluded that the effect of the treatment caused the difference (Mason, Gunst & Hess, 2003). A pre-test was given to both groups at the beginning of instruction after which the experimental group received intervention as the control group maintained the conventional instruction. A posttest was given to both groups again at the end of instruction.

Table 1 shows the structure of the experimental design.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-test</th>
<th>Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>O₁</td>
<td>X</td>
<td>O₃</td>
</tr>
<tr>
<td>Experimental</td>
<td>O₂</td>
<td>X</td>
<td>O₄</td>
</tr>
</tbody>
</table>

Table 1: Quasi-Experimental structure

Where O₁ and O₂ are pre-test, O₃ and O₄ are post-test, X is intervention or treatment and X is no intervention or treatment.

Results

In analyzing the influence of dialogic instruction on classroom discourse, Wilson (pseudo name) exploited five major ways of organizing classroom instruction that maximizes the prospects of dialogue and allows meaningful discourse. He engaged students in whole class teaching where all students had equal chances of participation in the lesson as he harmonized their decisions and provided feedback. Throughout the lessons, he assured all students of their right of contribution and the right to information. He later put students in groups according to their abilities. This helped the students to be more harmonious in discussing given tasks and find solutions based on what they know. The ability groups became ideal for value addition processes and remedial classes.

Besides the ability groups, the teacher used one-to-one (teacher and student) and one-to-one (student pairs) to enrich classroom interaction and eventual mathematical discourse. He ensured a collective classroom environment and set the mood to encourage students’ free participation. He crafted an environment that was reciprocal (participants listened to one another, shared ideas and considered alternative viewpoints). He also made the classroom environment supportive (students expressed their views freely, without fear of embarrassment over wrong answers, and helped each other to reach common understandings). Wilson made the environment cumulative by allowing students to build on their answers and other contributions and chained them into coherent lines of thinking and understanding. Lastly, he ensured that the classroom environment was purposeful through talk and open dialogue.

Wilson scaffolded his teaching into an active student engagement through discussion. I addressed this intensity and quality of student participation within the classroom in three separate aspects: behavioural engagement, emotional engagement, and cognitive engagement. To identify behavioural aspects of students, I used lesson participation and classroom involvement. I wanted to establish how classroom engagement affects discussion. Behavioural engagement was defined by how students maintained learning effort (structured
concentration), question the teacher and fellow students, participation in content-focused discussion and presentations. For emotional engagement, we collected data about students’ interests, value of the content as outlined in the syllabus, classroom anxiety (learner freedom and freeness), classroom achievement and sense of belonging. Lastly, cognitive engagement was measured in terms of task operations (their engagement in tasks). Here, students were expected to portray a deeper understanding, creative cognitive connections and self-regulating of their own learning. This was observed through; (1) students’ mastery of the topic, and (2) their strategic abilities to problem solving. The topic Surface Area of a frustum was used to gauge the levels of cognitive development and engagement as classroom discourse was adopted.

### Table 2

*Aspects of Student Engagement*

<table>
<thead>
<tr>
<th>Expectations from Students</th>
<th>Behavioral Engagement</th>
<th>Emotional Engagement</th>
<th>Cognitive Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectations</td>
<td>High emotional tone</td>
<td>Willingness to share. Developed interest. No anxiety. High achievement. Sense of belonging.</td>
<td>Easily handle HOTs Creativity in solutions Mastery of content. problem solving skills</td>
</tr>
<tr>
<td>Teacher</td>
<td>Harness engagement by modeling, appraising &amp; facilitating accordingly.</td>
<td>Lead from the front. Encourage &amp; reward participation. Assure all equally</td>
<td>Develop reasoning skills. Allow creativity. Challenge their thought &amp; actions</td>
</tr>
<tr>
<td>Collective Expectations</td>
<td>The teacher to orchestrate classroom activity and leave the action to the students. The students to actively take part in the lessons freely dialogue and take charge of the learning as the teacher does the facilitation.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From Table 2, it was found out that those students in Wilson’s class showed behavioural involvement in learning activities by positive emotional tone. They easily selected task at the border of their competencies. They freely initiated classroom discourse whenever an opportunity arose and showed enthusiasm, curiosity and interest during learning.

One of the key components of dialogic instruction in this study was scaffolding. Under this strategy, the teacher role of the teacher is to support students’ development and provide a supportive structure to let them get beyond the level at what they can do (Raymond, 2000). The teachers in the experimental classes employed this strategy quite often in problem solving and giving individualised attention to needy students. The process of scaffolding enables students to complete tasks that they are unable to do by themselves because scaffolding stimulates learner activity in the ZPD (Vygotsky, 1978). Pedagogically, scaffolding allows new knowledge to be cooperatively constructed; unfinished or incorrect concepts to be challenged or corrected, or forgotten knowledge to be recalled (Holton & Clark, 2006). Furthermore, teacher’s language in a dialogic instruction is more personal, friendly and informal than the teacher-centred instruction (Gillies, 2004; 2011; Hertz-Lazarowitz & Shachar, 1990). Jane, a student in Wilson’s class confessed that she found dialogic teaching to be the best method ever because the teacher was more friendly and
allowed students to share and move together. According to Hartman (2002), scaffolding allows the teacher to encourage and control students’ self-regulation. Gillies and Boyle (2005) found that the teachers’ appropriate scaffolding provide students with the ability to obtain benefits in term of improved thinking and problem-solving during dialogic instruction that puts a lot of emphasis on cooperative learning. They also found that the quality of talk produced by the children scaffolded by the teachers’ modelling of communication skills greatly influence the extent of their learning.

In addressing the influence of dialogic instruction on students’ academic achievement, a descriptive analysis of the raw data from MAT 1 and MAT 2 for the pre-test and post-test was done respectively. This was meant to establish trends and patterns that would inform some of the observations made in the analysis of quantitative data. Table 2 gives the results of the means and standard deviations.

Table 3
Means and Standard Deviations for Pre- and Post-Test

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test M</th>
<th>Pre-test SD</th>
<th>Post-test M</th>
<th>Post-test SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>47.43</td>
<td>4.869</td>
<td>70.51</td>
<td>8.653</td>
</tr>
<tr>
<td>Control</td>
<td>47.52</td>
<td>5.625</td>
<td>53.22</td>
<td>6.071</td>
</tr>
<tr>
<td>Both</td>
<td>47.47</td>
<td>5.259</td>
<td>61.87</td>
<td>11.43</td>
</tr>
</tbody>
</table>

From the above Table, it can be observed that both experimental and control groups had almost equal mean scores, experimental mean score M = 47.43, control mean score M = 47.52. Similarly, the standard deviations for both groups do not differ much [experimental Standard deviation SD = 4.869, control standard deviation SD = 5.625]. Consequently, it can be seen from Table 2 that students’ overall pretest scores in all the groups were relatively similar [mean score M = 47.47, standard deviation SD = 5.259]. The scores on the pre-test reveal that all the students had similar entry behaviour and that they were homogeneous.

Besides, it can be observed from the table that there were great differences in the groups’ means and standard deviation on the post-test. The experimental scores greatly differed from the control scores [experimental: M = 70.51, SD = 8.653; control: M = 53.22, SD = 6.071]. At the end of the instruction, there was an improvement on the overall result [both groups: M = 61.87, SD = 11.43] i.e. positive improvements of 14.40 on the mean and 6.171 on the standard deviation. It can also be observed from the results of the pre-test and post-test in Table 2 that the experimental group that was exposed to the treatment (dialogic instruction) had improved scores that eventually had a positive impact on the overall result. The treatment caused the improvement on both the mean and standard deviation of the experimental group.

To find out if there were any significant differences in the means, inferential statistics were employed with an Analysis of Covariance (ANCOVA) being conducted at an alpha level of 0.05, with gender and type of school as covariates. The following null hypothesis was tested:

\[ H_{01}: \text{There is no significant difference in achievement between students taught Surface Area using dialogic instruction and those taught using the conventional methods.} \]
Table 4
Results of ANCOVA on Students’ Achievement in Mathematics

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>56700.800</td>
<td>1</td>
<td>56700.800</td>
<td>1021.988</td>
<td>.000</td>
</tr>
<tr>
<td>Main Effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methods</td>
<td>520.428</td>
<td>1</td>
<td>520.428</td>
<td>9.380</td>
<td>.000*</td>
</tr>
<tr>
<td>Gender</td>
<td>54.510</td>
<td>1</td>
<td>54.510</td>
<td>.983</td>
<td>.322</td>
</tr>
<tr>
<td>School Type</td>
<td>14.080</td>
<td>1</td>
<td>14.080</td>
<td>.254</td>
<td>.615</td>
</tr>
<tr>
<td>2 Way Interaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methods * Gender</td>
<td>57.931</td>
<td>1</td>
<td>57.931</td>
<td>1.044</td>
<td>.307</td>
</tr>
<tr>
<td>Gender * School Type</td>
<td>74.319</td>
<td>1</td>
<td>74.319</td>
<td>1.340</td>
<td>.247</td>
</tr>
<tr>
<td>Methods * School Type</td>
<td>286.884</td>
<td>1</td>
<td>286.884</td>
<td>5.171</td>
<td>.023*</td>
</tr>
<tr>
<td>3 Way Interaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methods* Gender * School Type</td>
<td>196.143</td>
<td>1</td>
<td>196.143</td>
<td>3.535</td>
<td>.060</td>
</tr>
<tr>
<td>Error</td>
<td>66133.213</td>
<td>1192</td>
<td>55.481</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4749312.000</td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>156578.130</td>
<td>1199</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* R Squared = .578 (Adjusted R Squared = .575); * Denote significant F at p < 0.05

The summary of ANCOVA results in Table 4 reveals that there is statistically significant main effect of Dialogic and conventional methods of teaching on students’ academic achievement (F = 9.380, p < 0.001). This implies that post-test mathematics achievement test scores of students exposed to dialogic teaching are significantly different from those of the conventional method. The null hypothesis which states that Dialogic method of teaching does not have an effect on academic achievement is therefore rejected.

In order to examine the magnitude of the difference in attitude, a Pairwise comparison was done and the results presented in Table 5.

Table 5
Pairwise Comparison of Post Test MAT Scores on Dialogic and Conventional Methods

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>Pairwise Comparison</th>
<th>Sig</th>
<th>95% Confidence Interval for Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I)Treatment Groups (J) Treatment Groups</td>
<td>Mean Difference Std Error</td>
<td></td>
<td>Lower Bound  Upper Bound</td>
</tr>
<tr>
<td>Control Group Experimental Group</td>
<td>-17.061  0.444</td>
<td>0.000</td>
<td>-17.931 -16.190</td>
</tr>
<tr>
<td>Experimental Group Control Group</td>
<td>17.061  0.444</td>
<td>0.000</td>
<td>16.190 17.931</td>
</tr>
</tbody>
</table>

Based on estimated marginal means
* The mean difference is significant at the 0.05 level
b. Adjustment for multiple comparisons: Bonferroni

Table 4 shows that Dialogic teaching is significantly better than the conventional method in raising students’ academic achievement in mathematics. The mean difference of -17.061

The summary of ANCOVA results also reveals a statistically significant 2-Way interaction effect between methods of teaching and type of school on the post test scores of mathematics test (F = 5.171, p = 0.023), hence the null hypothesis was rejected. This implies the treatment
interacted with type of school to have significant effect on post test scores of mathematics test. It means one of the treatment groups was superior over the other for any of the type of schools.

Discussion and Conclusion

Dialogic instruction has been shown to be effective in increasing student achievement when teachers employ the method effectively (Veenman, Kenter & Post, 2000). In doing so, the role of the teacher as a facilitator of the discourse has important, positive and long-lasting implications for students’ academic and social development. Jollifee (2007) claimed that the positive development of the necessary classroom culture includes receptiveness to students’ ideas, equality, not just control or domination and honesty, warmth and friendliness such as smiling, eye contact, reassuring gestures, not on a ‘stage’, but walking around the classroom. This is in agreement with the principles of dialogic instruction in this study. According to Willies (2014), these can be achievable when firstly teachers have more interactions with students and secondly the interactions are appropriately designed to be more horizontal than vertical. Gillies and Boyle (2005) also argued that less of student-teacher interaction and more of student-student interaction provides teachers with occasions for reflective examination of individuals and groups, evaluation of their learning dynamics, and adjustment of instructional plans to achieve the best learning experience for all students. The interaction also provides students a greater sense of partnership with teachers in the learning progression, as well as increased cognitive, social, and emotional benefits (Gillies & Ashman, 1998; Gillies, 2004; Rojas-Drummond & Mercer, 2003).

The research finding which shows that dialogic instruction as a method of teaching and learning mathematics promotes higher performance than the conventional methods augers well with Azevedo (2012) who observed that students exposed to dialogic instruction tended to perform much better than those not exposed to it. The research finding which shows that dialogic instruction is a better method for teaching and learning mathematics agrees with the findings of researchers like Herrington (1999) who described computer application and other discourse related enablers as intellectual partners that support learning that allows students to construct their own knowledge. Still in agreement with the findings in this study, the International Society for Technology in Education (2005) suggested that teachers who change from a traditional learning environment to a new learning environment promote active learning, higher order thinking and collaborative and multisensory stimulation of learners.

When teachers encourage students to develop ideas and opinions, and when they engage these students in ways that motivate discussion, students begin to view classroom discourse as an integral part of the learning process and a legitimate mathematical activity. Here, the importance of motivating a need for discussion, as part of the process of facilitating discussion, cannot be overstated. This is because motivation to learn influences the extent to which students share, listen, question and debate ideas. This motivation is dialogic instruction. An instruction where the teacher orchestrates dialogue allows for varied views from students and promotes problem solving. Students learning in dialogic environments tend to be active in discussions and view mathematics as a subject just as easy as the rest. Such students perform better than those in non-dialogic environments. Dialogic instruction motivates the students into classroom discourse. When discussion is well motivated, students seldom engage not only because the teacher requires it, but also because they see discussion as beneficial to their own learning. Besides, not all students would accept this pedagogy as viable and useful for them. Some may extremely resist this change because of their usual tendencies and the fact that they are familiar with the traditional approaches that place the
teacher as the dispenser of knowledge. However, with proper collective planning and intense sensitization of both the teacher and students, mathematics classroom discourse undoubtedly comes up as the best option for all cadres of students. Dialogic instruction becomes the best tool to ensure that the classroom is live and active. Consequently, as noted by Sfard (2003), there is substantial evidence to show that instruction focused on meaning making that emphasizes investigation, conjectures, communication and collaborative conclusions, is more effective than those that try to circumvent it.

**Recommendations, Limitations and Implications for Future Research**

To promote classroom discourse, mathematics teachers should practice collective reflection and abstraction. They should encourage a sense of safety in exploration among students to encourage dialogue. Thus, they should employ activity structures proven effective such as teacher-mediated dialogue. Teachers should therefore possess classroom control mechanisms that are in conformity with the learners’ interests. This should form part of the classroom motivation where students are free to share, critique, and ask questions without any fear of intimidation from either their peers or the teacher. As such, teachers should embrace dialogic instruction as a novel instructional approach.

Regarding structure, teachers should scaffold learning by progressing from individual contributions or small groups to teacher-mediated dialogue. In this study, the teacher exploited the small group activity structure to foster confidence among students by allowing them to test responses against peers, or as a group. Students are more likely to admit confusion or to ask for direction during small group collaboration than any other activity structure. Thus, one important feature missing from secondary and post secondary classrooms is the inclusion of this activity structure.

Regarding learning goals, teachers should not present a general solution to students in combination with the problem it solves. Students should be required to reason what information is necessary and how to apply it in a given context. They should therefore be allowed and guided to present problems and develop their solutions through discourse. Dialogic instruction and mathematics classroom discourse should form part of the subject methods taught in teacher training institutions.

As stated by Denscombe (2002,) there is need for the researcher to confront the reality of limited resources and less than perfect research tools, and eventually strike some kind of balance which involves a trade-off between competing demands and priorities. Striking such a kind of balance was a continuous concern for this study. Student population within the study location was not uniform. Some had more than the required 45 students per stream while others, especially new schools, did not have the same capacity. This required a balance to be struck during group identification. Since syllabus coverage is not uniform in all schools, some schools that were ahead in coverage had done the topic by the time of study. Others were way behind in form one work. In such cases, the researcher embraced uniformity in syllabus coverage as much as possible.

The findings in this study have far-reaching implications in the field of mathematics education and their consideration for future research will enable the realization of the most desired reforms in mathematics instruction. As such, further research is needed to completely describe the discursive moves that foster student reasoning in secondary school classrooms. Secondly, there are many other aspects of learning that affect students’ academic achievement, yet their interaction was not investigated in this study. A similar study should
therefore be replicated to determine whether there are other combinations of learning indicators, whose interaction might significantly impact on students’ academic achievement in mathematics. This study however, provides a clear and well-illustrated case for the significance of spoken language in classroom settings in shaping the teaching practice and contributing to pupils’ learning. By using evidence of how pupils engage in, share control over the discourse and influence its direction, this study provides empirical findings that are missing from the field. The findings can further be elaborated by educational researchers to explain how classroom talk contributes to the pupils’ understanding and educational attainment.

References


Cite paper as:


© 2018 the Author(s). Creative Commons CC-BY: This open access article is distributed under the terms of Creative Commons Attribution 4.0 License. This permits anyone to share, use, reproduce and redistribute the work without further permission provided the person gives due credit to the work.