Teacher and Student Perceptions of Teacher Oral Communication Behaviour in the Algebra Classroom

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Abstract

This paper examines student and teacher perceptions of teacher oral communication behaviour in the algebra classroom. These perceptions are the views expressed by 4 students and 3 teachers from a university in western state of U.S.A. This study employed qualitative research methodology for its research design and analysis. The sources of data consisted of open-ended questions, and then followed by a semistructured interview of all participants. The data were analyzed by using content analysis of the transcripts. The results of this study indicate that teachers resorted to variable oral communication format, such as, repeating words and procedures, to accommodate the different ability levels of their students. This study concludes that effective oral communication builds a sense of confidence among children, which in turn motivates them to systematically develop their own thought processes, thereby building students' conceptual understanding.

Keywords perceptions, oral communication behaviour, students' conceptual understanding

Introduction

The achievement of the objectives of school reforms as envisioned by the National Council of Teachers of Mathematics (NCTM) can only become a reality if teachers encourage students to share their ideas and communicate mathematical concepts with their peers. The NCTM (2000) makes a strong case that effective communication enables teachers to create supporting and challenging environments that actively engage students in a rich classroom conversational dialogue, which deepens their mathematical understanding.

Both teachers and students have an active role to play in this endeavour. Teachers have to use a variety of methods to engage students to communicate about mathematics, because students usually need to use words at least 30 times over, to enable them adopt as them part of their vocabulary (Thompson & Chappell, 2007). To address the issue of communication, Thompson and Chappell (2007) recommend that mathematics literacy should be an integral part of the school instruction, because students are absorbed in a world of language that challenges them to speak, write, read, and listen to mathematics. By doing so, students will be able to understand and flexibly work with numbers (NCTM, 2000).

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Literature Review

The role of communication in mathematics learning has been identified as a key process in building students' mathematical understanding (Macgregor & Price, 1999; Manouchehri & Enderson, 1999; Warfiel, 2003). Using the vocabulary of mathematics to enhance mathematics teaching and learning is very important (Huang, Normandia, & Greer, 2005). Nevertheless, a few studies have approached communication in mathematics from a linguistic point of view (Wakefield, 2000). What certainly should concern educators and teachers alike, is challenging students to use mathematical language to accomplish social goals that will enable them to select from the set of choices that are available to them in the language system (Christie & Unsworth, 2000).

This calls for a shift in the current curricula that are implemented in schools. Therefore, for successful implementation of school reform, students could learn by participating in communicative activities within classroom discourse communities (Wood & McNeal, 2003). Such communities provide shared responsibilities between teachers and students, both parties, identifying and accomplishing respective roles in the mathematics discipline (Boaler, 2003). To achieve this objective, teachers could act as facilitators by building confidence among students to enable them become successful problem solvers (Goos, 2004). Reform-oriented communities have different models of practice, each with a distinctive environment different from the other, and providing interactive and communicative exchanges within them (Wood & McNeal, 2003). To realize its full impact, teacher educators and researchers must view discourse communities as potential communicative agents, which could disseminate relevant information (Wood & McNeal, 2003). The emphasis should be placed on communicative patterns of mathematical argumentation, in order to challenge and stimulate deep student engagement in mathematical practices (Boaler, 2003; Rojas-Drummond & Mercer, 2003; Wood & McNeal, 2003).

Enhancing Mathematical Discourse

The usefulness of mathematics activities and oral communication to improve teaching and learning has been highlighted by some mathematics educators (Burton & Morgan, 2000). To improve mathematical discourse in schools, instructional design in mathematics education should systematically integrate thinking and oral communication at all levels of the knowledge structure (Huang, Normandia, & Greer, 2005). Teachers, through this process, could play the roles of both mathematicians and mentors by communicating about mathematics for students to cultivate the interest (Huang, Normandia, & Greer, 2005). This goal can be achieved by constructing different knowledge structures or semantic relations associated with the mathematics content (Halliday, 2003). Fostering the existence of these knowledge structures to be operational in schools require thorough understanding of mathematics content knowledge of both mathematics educators and communication experts, to motivate students' to speak mathematically (Huang, Normandia, & Greer 2005).

In this regard, teachers could also capitalize on students' mathematical potential in the classroom to determine and develop an appropriate terrain through the reliance of students' oral communication skills, in order to build their mathematical understanding (Cobb, 2001). These teachers may benefit from activities that focus on the roles of teachers and students in mathematics classrooms (Lloyd, 2005). Such activities might involve teachers' critical examination of their own roles and that of students in diverse representational classroom instruction, such as, in multimedia lessons (Lloyd, 2005). Further, teacher educators could encourage teachers to monitor and reflect on students' experiences and learning, on a regular basis, to enable teachers to explore and identify the right climate conducive for learning to thrive (Lloyd, 2005). These teacher educators, according to Mewborn (1999), could encourage and motivate teachers to think reflectively about teaching and learning, and to support inclinations that view themselves and students as partners in the construction of mathematical knowledge in the classroom. An advantage of such mathematics instruction will allow students to explore mathematics in contexts that support critical thinking and reinforces reasoning and communication. In the classrooms, this instruction, will allow students to engage in tasks embedded in experiences that require them to justify their reasoning and to communicate such thinking to their peers and teachers (Lajoie, 1999; Pugalee, 2001).

Through the facilitation of mathematical discussions by teachers, students actively participate in making conjectures, and provide clear explanations (Pierson, Maldonado & Pierson, 2008). This has the potential of yielding effective instructional approaches. Effective teaching is evidenced by a lively mathematics community that motivates students to brainstorm and to articulate their thoughts. Teachers who teach in such mathematical communities listen to students and authentically engage and guide them in mathematical conversation. They also encourage students to learn mathematics with understanding, discover teaching methods that foster understanding, and engage in mathematical conversations that deepen conceptual understanding (Pierson, Maldonado, & Pierson, 2008).

Theoretical Framework

The theoretical foundation for the design and analysis of the study was based on the Vygotsky's (1978) sociocultural theory, which suggests that, children's thought processes and behaviours change when they interact with people of different cultures. Through this interaction, children use the "tools" available to them within these cultures to form their own worldview. Vygotsky believes that any effective pedagogy creates learning processes that lead to development, which ultimately results in Zones of Proximal Development (ZPD). The Zones of Proximal Development is "the distance between the actual developmental levels of a child as determined by solving a problem independently and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p.86). Vygotsky posits that, a teacher's knowledge and understanding of what a child can do with guidance and what the child can do without

guidance is useful for the teacher, because these two levels of the ZPD indicate the developmental stages of the child at any given moment. For schools to realize its potential benefits, the curriculum should be developmentally appropriate to enable teachers plan activities that encompass not only what children can learn independently, but also what they can learn with the help of others (Karpov & Haywood, 1998). For children to benefit from the classroom discourse, children should be taught with instructions and activities that fall within the zones, because these instructions promote development (Vygotsky, 1978).

In order to reap better pedagogical practices, effective applications of this learning theory require interactions that include effective interpersonal communication within classroom-learning environments among teachers and students. As a challenge, teachers therefore, should assist students to transform their habits of being passive communicators of mathematics to active communicators of mathematics (Cobb, Wood, & Yackel, 1994).

Researcher background

The researcher has conducted an extensive research on oral communication, while a doctoral student in the U.S.A. In Ghana, the researcher's home country, he has witnessed firsthand the need to give teachers' oral communication a special attention in all mathematics instruction. The researcher, by interaction with students and teachers, has come to the conclusion that, oral communication is meaningless if students do not comprehend what their teachers say in the classroom.

This study was guided by the following research questions (1) What teacher oral communication behaviors do teachers and students report as being effective in yielding better teacher-to-student or student-to-teacher interactions in the mathematics classroom? (2) How do teachers and students describe these behaviors and why are they important? (3) How do gender and English Language Learner status influence oral communication behaviors in the classroom?

Method

Design

A qualitative research design was used for the study. Open ended questions followed by a semi-structured interview format were used to collect data from both students and teachers. The data were analyzed by using content analysis of the responses. According to Carney (1972, p. 25), "content analysis is any technique for making inferences by objectively and systematically identifying specified characteristics of messages".

Participants

Three algebra teachers and four algebra students participated in the study. In order to conceal their true identities, gender appropriate pseudonyms were given to these participants. The teachers were: Nancy, Tracy, and Jeffrey. Each of them was born in the U.S, has English as a first language, has between 4 and 15 years of teaching

experience in their respective subject areas, and holds a four-year college degree in mathematics. The students were Alan, Albert, Akira, and Alicia, with ages ranging between 14 and 17 years.

First, the sample size was not diverse because participants were selected from the same locality. For the results to be transferable to other locations, a diverse sample from several U.S. schools would have been more representative. Even though an attempt was made to choose a gender balanced sample for the study, the number of female teachers who volunteered to participate far outnumbered the males. Hence, the smaller number of male participants in the study.

Data Collection

The initial source of data was a questionnaire consisting of open-ended questions, followed by an interview. The questionnaire focused on participants' perceptions of teacher oral communication behaviours in the algebra classes. It also investigated if gender and ELL status of students affect teachers' oral communication behaviours. The second stage of data collection was shaped by an initial analysis of data from the responses to the open-ended questions and, as a result, the second stage included interview questions consisting of participants' perceptions of teacher oral communication behaviours in the classroom. The interview was purposely done to clarify the inconsistencies from the responses to the open-ended questions. Each participant was interviewed for 20 minutes.

Data analysis

The data were analyzed by using inductive method in which students' and teachers' responses were coded and classified according to relevant themes. Coding of the data began with codes generated from the data. The inductive approach to coding was utilized in a case-by-case basis to identify themes in the data. By this approach, each participant's responses were compared and analyzed for similar themes with the other participants. Frequencies of similar participant responses were categorized into relevant themes. Because the data were in two-fold, participants' responses to the open-ended questions were compared with the interview questions for inconsistencies. On completion of the coding, the data were analyzed by identifying, organizing, and understanding the relationships among the primary themes.

Results

These results are organized by the following themes: description of oral communication techniques; reasons for using such oral communication style; and, gender and English language learner status. Although data were collected from individual participants, themes related to participants' oral communication behaviors, uses of such communication behaviors, reactions to such communication behaviors, views on whether or not gender, English Language Learner status, and teachers' teaching styles affects students' mathematical understanding were reported. The presentation includes representative excerpts from the responses, preceded by names, which are pseudonyms.

Description of Oral Communication Techniques

The teachers commented that they use different teaching techniques that rely on oral communication as a medium for helping students understand concepts and procedures. Such techniques include collaboration to encourage greater student participation and ownership of learning, and, constructivist orientation for students to build knowledge through dialogue with their teachers and peers. Through these techniques, teachers assume a lead role in the classroom discourse by setting the teaching and learning norms for students to follow. Students, on their part, have the freedom to discover their own learning methods and strategies. Ultimately, these teaching techniques enable students to build on existing knowledge of higher order mathematics. The teachers further commented that without effective oral communication in the classroom, many mathematical concepts and procedures would become so abstract and meaningless that students would not be able to fathom and connect them to everyday life experiences. The teachers noted that achieving students' mathematical understanding has always been the cornerstone of their teaching styles. As a result, they continually review their oral communication strategies, and adapt to new techniques in order to ensure that students understand and communicate coherently to their peers and teachers. The following are representative comments from teachers.

Researcher:	Describe the major oral communication techniques that you often use in the classroom?
Tracy:	I use a stern voice in the class when the class is very noisy, and also use questioning and waiting time strategy to ensure that all students are given equal opportunities.
Jeffrey:	I only speak when students are listening. I try to speak quietly and clearly. I ask students a lot of questions and always try to be respectful and patient.
Stephanie:	I try to bring humor to the class so that students can understand the methods.

The students noted that their teachers often speak to them in clear and concise tones. As a result, their teachers extended extra effort to ensure that students understand the content, and are able to build up on existing knowledge. The students commented that teachers show respect by speaking loudly and clearly. The students commented that teachers' varied the methods to ensure that all students, including ELLs, understand their instructions. The following are representative comments from students.

Alan:	My teacher communicates clearly with students, and explains procedures of lessons in a manner for all of us to understand.
Albert:	My teacher is very understanding, and makes sure we understand what she says. She is my favorite teacher because she communicates with me in ways other teachers wouldn't. She is unbelievably very smart and tries to show examples that enable us to comprehend our lessons.

Akira: My teacher often shares jokes with us, thus making the atmosphere less tense. My teacher doesn't yell or raise her voice. She repeats instructions many times until we understand.

Alicia: My teacher speaks her mind in order for us to know her position on issues. It's very helpful because it guides us to know if we're doing too much or too little in our academic work.

Reasons for Using such oral Communication Styles

The teachers consented that they adopt teaching approaches after they had considered the nature of the children, their interests, their maturity level, as well as the available resources. The teachers agreed that they use various oral communication techniques to aid their instruction, because a few of their students are English Language Learners who should be provided with the necessary assistance to learn and understand mathematics. The following are representative comments from teachers.

Tracy: I use such communication behaviour to teach, introduce, and assess students' mathematical content knowledge.

Stephanie: I resort to such communication behaviour in order to stem my authority in the classroom. I've realized over the years that when I intermittently refuse to talk while students are talking, they collectively realize something is wrong and they keep quiet afterwards.

Jeffrey: I use such communication behaviors to ensure that good students in the class assist the weaker ones. It also builds a sense of confidence among all students to articulate and share their ideas with their peers.

Tracy: I use this method to enable students to retain the procedures learned.

The students commented that their teachers do everything they possibly can to help them in their mathematical understanding. They do not hesitate to repeat procedures and instructions when they discover students are somehow confused about a particular method.

Albert: My teacher does so to encourage group or cooperative learning.

Alan: She often does so to create a good and comfortable learning environment.

Akira: She uses such oral communication techniques because she believes if students clearly hear her when she speaks, we would be able to comprehend her instructions.

Gender and English Language Learner status

The teachers commented that the oral communication behaviors they use in class help students to understand basic concepts. They motivate students to move out from their "shells" and actively contribute to class discussions. Students gradually develop confidence and are able to coherently articulate their thoughts without fear. The teachers further noted that the strategies they employ today may not be applicable two or three years from now since teaching methods are dynamic and are subject to

changes or modifications. Hence, they try to adapt to new strategies to benefit all of their students. The following are representative comments from participants.

Tracy:	Many students follow along so that they will be able to answer questions and justify their answers. Being able to explain their processes helps their mathematical understanding. I don't feel gender plays a role in my teaching style. I do try to be understanding and encouraging, but I know male math teachers do the same. English Language Learner status of my students encourages me to stress on vocabulary when we learn new one. I try to use words that my students understand.
Jeffrey:	The students feel comfortable with taking notes, but I do not encourage them to refer to the notes and examples to solve problems if they do not understand. For ELLs, I try to give more examples on all different types of problems they may encounter.
Stephanie:	For ELLs, I attempt to use simpler vocabulary and give them extra help and lots of demonstration. Usually, students respond well to my communication style.
Tracy:	My students respond well to how I communicate with them. I think that they want to know what to do, even if it is something they aren't thrilled about. Students like consistency in routine; this is what I provide for them.

The students commented that even though their schools continually attract a lot of foreign students with limited English language proficiency, their teachers endeavour to accommodate the different learning needs of their students. The students individually commented about teachers' persistent use of appropriate and convenient oral communication channels to aid class instruction. As a result, their teachers often spoke clearly and loudly to ensure that all learners, including ELLs, benefit from their teaching. The following are representative comments from students.

Alan:	I react pretty well and understand most of the lessons. Thus, my gender and ELL status don't affect my learning style.
Albert:	Yes, I agree my gender and my ELL status sometimes contribute to my mathematical understanding, but the teacher often endeavors to communicate slowly and clearly.
Alicia:	I react very well because I fully understand the methods the teacher uses. Gender and ELL status has nothing to do with it.
Akira:	I listen and respect her. I try my best to do what she says. My gender doesn't matter; her communication style is very encouraging.

Discussion

As discussed in the theoretical framework, since children's mathematical understanding is determined by the quality of interaction they experience with people of different cultures, students' and teachers' interactions, tend to assist all students to get involved in the learning process. Ultimately, this interaction builds a sense of

confidence among children, which motivates them to systematically develop their own thought processes. Eventually, a conducive learning environment is established for all students to create their own mathematical understanding.

Oral communication behaviors teachers and students report as being effective in yielding better teacher-to-student or student-to-teacher interactions in the mathematics classroom

It has been argued by some educators, including Wiest (2008), that using different teaching techniques that rely on oral communication as a medium for helping students understand concepts and procedures, yield greater student participation and ownership of learning, and also creates a constructivist orientation for students to build knowledge through dialogue with their teachers and peers. The results of this study have demonstrated that if teachers utilize appropriate and effective instructional methods, such as encouraging every student to participate in classroom discussion, to aid instructional delivery, it allows students assume a lead role in the classroom discourse. Students, on their part, will have the freedom to discover their own learning methods and strategies. Ultimately, these teaching techniques will enable students to build on existing knowledge of higher order mathematics. These findings support studies that have identified associations among knowledge construction, student learning, and oral communication discourse in mathematics education, and have recognized oral communication as a key process in building students' mathematical understanding (Langer, 2001; Macgregor & Price, 1999; Manouchehri & Enderson, 1999; Rubin, 2002; Warfiel, 2003).

How teachers and students describe oral communication behaviors and why they are important

Effective teachers often utilize well-balanced mathematics instructions for students to explore mathematics in contexts that supports critical thinking. These teachers vary their instructional styles to accommodate the different learners in the classroom. Such instructions in the classroom allow students to discuss mathematical problems on the basis of the experiences they have acquired (Lajoie, 1999; Pugalee, 2001). One of the hallmarks of good teachers is to ensure that they employ appropriate teaching techniques in order to make mathematics enjoyable and interesting for students. This study clearly agrees with similar studies that have confirmed that teachers utilize appropriate and effective instructional methods, including effective oral communication channels, to explain their methods. By speaking loudly and clearly, sometimes repeating procedures and methods, the teachers employ all available teaching methods for students to understand the topics.

Influence of gender and English Language Learner status on oral communication behaviors in the classroom

The fact that students collectively agreed that their ELL status did not affect their learning styles reflects a constructive educational paradigm of good practices among teachers. By this singular action, the teachers could be adhering to the "equity

principle" of mathematics instruction for effective pedagogy. These findings are consistent with studies on educational reform that have challenged and continue to challenge teachers, mathematics educators, and policy makers to continually research and identify appropriate pedagogical approaches to assist instructional delivery in the classroom. The students' comments show that teachers often ask questions to challenge and stimulate deep student engagement in mathematical practices, as noted in previous studies (e.g., Boaler, 2003; Rojas-Drummond & Mercer, 2003; Wood & McNeal, 2003). The teachers' reports show their observance of socio-cultural norms that require them to give ELLs in their classes concise and straightforward explanations and instructions, thus, making their classrooms all-inclusive for the benefit of all students. Teachers are then able to act as facilitators by building confidence among the students to become successful problem solvers, through the provision of interactive and communicative exchanges (Goos, 2004; Wood & McNeal, 2003).

Implications of the Study

Undoubtedly, mathematics educators and teachers alike are often confronted with a myriad of challenges that act as drawback towards effective instructional delivery in schools. Traditionally, many have referred to the high demand and expectation of the curriculum to explain for their inability to reduce those problems. This study has shown that, apart from the many ambitious curricula that are recommended in schools, oral communication behavior of teachers could enable researchers and policy makers focus on effective mathematics discourse in the classroom, which has seriously been relegated to the background for years by many researchers.

The results of this study indicate that teachers clearly have the best interests of all of their students, regardless of gender and/or English Language Learner status at heart. To this end, many teachers have implemented appropriate strategies that will prove beneficial to all of their students. These include their attempts to make the mathematics classroom a challenging and dynamic environment and to provide help to their students as needed. The numerous references to repeating directions and speaking loudly and clearly, however, well-intentioned, raises concerns that these teachers may not possess sufficient understanding of the dramatically different needs the ELLs in their class might have. Providing a professional development program such as Sheltered Instruction Observation Protocol (S.I.O.P), or other similar training to these teachers, could prove highly beneficial in making them more aware of strategies that can be employed that will have a significantly positive impact on all students, and in particular, the ELLs in their class. Equally interesting is the repeated comments by students that their English Language Learner status and/or gender do not have any impact on their learning style. While this may be true, it is also possible that these students are not aware of unintentional biases they may be facing in the classroom. Further study, including extended observations over a period of time, could provide important insights into the actual nature of communication in the

classroom. Based on the results of such studies, additional forms of professional development may be deemed appropriate.

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