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The Influence of Number Talks on the Use of Accountable Talk®

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The Influence of Number Talks on the Use of Accountable Talk[®]

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Northwestern College

An Action Research Project Presented
in Partial Fulfillment of the Requirements
For the Degree of Master of Education

Table of Contents

Abstract.....	3
Introduction.....	4
Literature Review.....	6
Introduction to Accountable Talk®.....	6
Introduction to Number Talks.....	7
Controversy.....	10
Safe Learning Environment.....	11
Dimensions of <i>Accountable Talk</i>	12
Components of <i>Accountable Talk</i>	15
Methods.....	17
Participants.....	17
Measures.....	21
Procedures.....	23
Results.....	25
Data Analysis.....	25
Discussion.....	26
Summary of Major Findings.....	26
Limitations of the Study.....	27
Further Study.....	28
Conclusion.....	30
References.....	32

Abstract

The purpose of this action research study was to determine the influence of number talks on the use of *Accountable Talk* by students. The participants included 14 first grade students, who attend Prairie Elementary, a diverse public school in Worthington, Minnesota. Students participated in ten to fifteen-minute daily number talks over a five-month period. The pre- and post-intervention data for this study was collected using a Microsoft Excel observational checklist. The study found that implementing daily number talks gave students additional opportunities to practice speaking and listening skills and in turn had a positive impact on their use of *Accountable Talk*. The researcher recommends further studies be conducted including increased sample size, length of study, and number of classrooms involved in order to further validate the results of the study.

The Influence of Number Talks on the Use of Accountable Talk®

Engaging in conversation with others is essential for learning (Michaels, O'Connor, Hall, & Resnick, 2010). The amount of time children spend communicating using technology is increasing in today's society (Zwiers & Hamerla, 2018). According to Zwiers and Hamerla (2018), interactions between people and the quality of conversation has dramatically changed due to the lack of face-to-face encounters. When children speak to one another, they must use active listening skills, as well as share their ideas and build upon other's thoughts (Zwiers & Hamerla, 2018).

In today's information age, students must possess a profound understanding of mathematics (Parrish, 2014). The ability to converse and discuss ways to solve intentionally designed computation problems is at the heart of number talks (Parrish, 2014). Parrish (2014) states that students have the opportunity to communicate their mathematical thinking by sharing and discussing specific strategies. This gives students the opportunity to explain their thinking, take note of their peer's strategies, explore mathematical relationships, gain additional strategies, and the knowledge to choose effective ways to solve problems (Parrish, 2018).

There are several terms associated with *Accountable Talk*. These include labels such as academic talk (McGlynn & Kelly, 2018), authentic discussion (Billings & Roberts, 2014), academic conversation (Zwiers & Hamerla, 2018), academically productive classroom talk (Michaels, O'Connor, & Resnick, 2007), and real talk (Nichols, 2014). All of these labels encompass the meaning of talk that is accountable (Michaels et al., 2010). Therefore, in this study, the term *Accountable Talk* is used.

This research analyzes data from a group of first grade students. The intention of this study is to find whether number talks influence the *Accountable Talk* used by students. The

researcher initially observed the students in the second month of school prior to the introduction of number talks. The research looks at the following components of *Accountable Talk*: eye contact between students, staying on topic, taking turns listening and speaking, sharing ideas clearly, and building on ideas by taking multiple turns. Data collection is in the form of a checklist using Microsoft Excel. Throughout the course of this research, students participated in number talks daily for five months. After the number talk intervention, the researcher will observe the student's use of the *Accountable Talk* components.

Literature Review

Introduction to Accountable Talk®

Accountable Talk helps students contribute accurate knowledge and add to what their peers have said (Michaels, O'Connor, Hall, & Resnick, 2010). Students that use this academically productive talk use evidence to back up their thinking and reasoning (Michaels et al., 2010). The process of students participating in all classroom conversations is a difficult task (McGlynn & Kelly, 2018). With purposeful planning, however, students can use *Accountable Talk*, which helps the teacher understand student knowledge and increase the amount of learning (McGlynn & Kelly, 2018).

Accountable Talk is based on a Vygotskian theoretical framework (Wertsch, 1991). This framework stresses the importance of social interaction in the development of minds (Michaels et al., 2007). In a discussion-based classroom, students have the right to speak, but also the duty to explain their thinking (Michaels, O'Connor, & Resnick, 2007). This type of dialogue improves their thinking and strengthens their capability to use and produce knowledge (Michaels et al., 2010). The article goes on to state that having students simply talk with one another does not necessarily lead to learning. Authentic discussion allows students to encounter the excitement of determining and creating meaning (Billings & Roberts, 2014).

Michaels et al. (2010) state that the content and process of student conversations is key. According to McGlynn & Kelly (2018), many conversations happening in classrooms have an initiation, response, and evaluation (IRE) pattern. They also state that an IRE type of discussion encourages only one or two students to take over the conversation and deters other students from participating. Although teachers strive to remove themselves from this discussion design, it can be hard to break away from this (Nichols, 2014). Nichols (2014) suggests that instead of

focusing on student ideas, the answers obtain the emphasis. When there is no purpose for the discussion, the talk turns into a distraction instead of a vehicle for learning (Michaels et al., 2010).

According to Michaels et al. (2007), there is a great amount of research on the use of discussion techniques, how they support student learning, and the impact on participation in the classroom. Regardless the form of classroom discussion taking place, talk should remain accountable to the learning community, to accurate knowledge, and to rigorous thinking (Michaels et al., 2010). Discussion of the three dimensions is later in the research. Students in *Accountable Talk* classrooms are part of a community that revolves around the use of respectful and purposeful discussion (Michaels et al., 2007). According to Socrates, Dewey, and Habermas, educational discussion has helped learners develop the ability to understand through listening, reflecting, proposing, and incorporating alternate views (Michaels et al., 2007).

Introduction to Number Talks

Ruth Parker and Kathy Richardson created number talks in the early 1990s to encourage math inquiry and student engagement in meaningful math discussions (Sun, Baldinger, & Humphreys, 2018). Number talks are an instructional practice that encourage meaningful mastery of combinations of numbers (Postlewait, Adam, & Shih, 2003). Today's society is in need of citizens who possess number sense and the ability to apply it (Parrish, 2014). Parrish (2014) states they must also possess the ability to communicate solutions to problems. Therefore, development of number sense needs to be an essential part of teaching math (Postlewait et al., 2003). Instead of centering attention on memorization of facts and mathematical procedures, children must have opportunities to develop an abstract understanding of numbers and operations.

A number talk is a brief, ten to fifteen-minute activity that supports the mathematical sense making and flexible thinking of children (Sun et al., 2018). They can be carried out in a whole group or small group setting (Postlewait et al., 2003) and consist of five key components (Parrish, 2011). These include classroom environment and community, classroom discussions, the teacher's role, the role of mental math, and purposeful computation problems (Parrish, 2014). Creating a classroom environment and community is important in order to provide a safe setting where children can take risks (Parish, 2011). According to this study, this environment is essential for an effective number talk to take place. The author also stated that students should feel comfortable participating in discussion and trying out new strategies.

Sun et al. (2018) found number talks help children understand the possibility of having multiple ways to solve a math problem. Children develop a trust in their ability to reason, which can help build their self-efficacy (Humphreys and Parker, 2015). According to Postlewait et al. (2003), time should be devoted to number talks at least three times per week.

To begin a number talk, pose the math problem to the class, followed by an ample amount of wait time to solve it mentally (Parrish, 2014). Postlewait et al. (2003) says to include a variety of problems, with varying levels of difficulty in order to meet the needs of a diverse group of learners. Children must have the understanding to not shout out the answer, but rather put their fist to their chest and silently put their thumb up (Sun et al., 2018). This helps avoid feelings of competition and anxiety from their peers (Sun et al, 2018). While others are thinking, children continue to produce additional strategies, acknowledging this by putting up more fingers (Parrish, 2014). When most thumbs are up, the teacher asks for volunteers who are willing to share their answer (Sun et al., 2018). Through sharing and discussion of computational

strategies, children have the opportunity to clarify their thinking, explore mathematical relationships, and learn additional strategies (Parrish, 2011).

Number talks help encourage all students to participate and build upon their mathematical knowledge (Hutchinson, 2010). Parrish (2014) emphasizes the importance of accepting and recording all answers, both correct and incorrect. All answers help children understand the mathematical concept better (Sun et al., 2018). Students consider the reasoning behind their answer and the strategy they used (Hutchinson, 2010). A benefit that comes from number talks is the shift of focus from what the answer is to how and why it was solved (Sun et al., 2018). Children will eventually grow to be comfortable with making mistakes and view it as an opportunity to expand their knowledge (Humphreys, 2016).

Sun et al. (2018) state that children have the opportunity to explain and defend their answer. Teachers have the opportunity to learn a great deal about their student's knowledge of math concepts and can see them expand their understanding as well (Hutchinson, 2010). During this process, the teacher needs to assume the role of facilitator since a goal of number talks is to build on mathematical relationships (Parrish, 2014). Teachers provide students with opportunities to make connections that in turn help them realize relationships between numbers (Postlewait et al., 2003). The teacher playing the role of facilitator helps students stay focused on the topic as well (Billings & Roberts, 2014). When the teacher assumes the role of authority over the discussion, students are discouraged to respond to one another (Nichols, 2014). This causes interference with student ideas (Nichols, 2014). Hutchinson (2010) says taking a step back from being the authoritative figure can be difficult as a teacher.

Controversy

When using *Accountable Talk* to talk about math, science, or other subject areas, students are not always going to provide correct answers (Michaels et al., 2007). According to Parrish (2011), an important part of creating a respectful learning environment is the understanding of the acceptance of all answers and ideas, even if they contain errors. It is important to not label student responses as “right” or “wrong” according to McGlynn and Kelly (2018). Students become encouraged to explore strategies and solutions when the teacher accepts all answers and does not give praise or recognize mistakes (Hutchinson, 2010). The verbal and nonverbal reactions from teachers in response to student ideas have the capability of expanding the discussion or completely shutting it down (Nichols, 2014). Discussion based on incorrect answers will happen, much to the dislike of some stakeholders who focus on mathematical correctness (Michaels et al., 2007; Michaels et al., 2010). They do not agree with students considering the wrong answer (Michaels et al., 2007).

Those who research or teach math and science possess differing views about how long an incorrect idea should be entertained, how often students construct their own ideas, and when and how to inform students of the correct answer (Michaels et al., 2007). With practice, students will emphasize the strategies used and their thinking instead of being concerned whether their answer is right or wrong (Hutchinson, 2010). Richardson (2010) explains that *Accountable Talk* is beneficial and can happen successfully in any content area. For example, Richardson (2010) says math teachers can allow their students the opportunity to explain their strategies during number talks. Science and social studies teachers can successfully implement *Accountable Talk*, as well, to have students converse more in depth on a topic (Richardson, 2010).

Safe Learning Environment

In order to promote the use of *Accountable Talk*, students must first feel as though they are part of a safe and comfortable classroom environment (McGlynn & Kelly, 2018). Without establishing a place where the thinking of all students is respected and accepted, students will not take risks to communicate their thinking (Boyd, 2015; McGlynn & Kelly, 2018). Valuable conversations do not happen when students feel attacked (Nichols, 2014). Instead, teachers need to emphasize the ability to learn from mistakes and the power it holds (McGlynn & Kelly, 2018). Students will benefit in the end from having all answers accepted because they will know how to identify where they went wrong or why their strategy was unsuccessful (Hutchinson, 2010). These types of classrooms acknowledge all student voices without ridicule (Boyd, 2015). When evaluation is given from the teacher, it cuts off the thinking of students when the answer given is not what the teacher intended (Boyd, 2015). Boyd says that teachers should instead direct student discussion in the right direction. When teachers listen, they earn student trust and gain student involvement (Boyd, 2015).

Students who are English Language Learners are often reluctant to speak in front of their peers (Goldsmith, 2013). Teaching these learners the language they need in order to communicate their ideas is essential (Goldsmith, 2013). This same study insists that English Learners participate in conversations even though they may be hesitant to. One of the strategies to help English Language Learners, as well as other reluctant speakers, is think, pair, share (Goldsmith, 2013). This researcher explains that first the teacher poses a question. Then, the students take time to pause and think of how they will respond. After that, students pair up with one of their peers. Goldsmith explains that as a last step, the students share their response with their partner. After time for discussion, the students turn their attention back to the teacher

(Goldsmith, 2013). Teachers may need to adjust the amount of wait time given to students if they remain silent (Nichols, 2014). Just because a child is silent, does not necessarily mean they do not have anything to say (Nichols, 2014). Sufficient wait time gives students an opportunity to clarify, process, and even translate words (Walter, 2018). Additionally, students can find a different partner to share with before the think, pair, share time is over (McGlynn & Kelly, 2018). This method allows even those students who are typically silent to find their own voice in a small and safe setting (Goldsmith, 2013). Another way to initiate conversation is to pair up a student who may be reluctant to speak with a more outgoing, vocal student (Goldsmith, 2013). Students who are verbally outgoing tend to dominate discussions (Nichols, 2014). These students can model conversation skills while, at the same time, work on allowing the other participants to speak as well (Nichols, 2014).

Dimensions of Accountable Talk

There are three dimensions important to *Accountable Talk* in the classroom (Michaels et al., 2010). They are accountability to the learning community, accountability to accurate knowledge, and accountability to rigorous thinking (Michaels et al., 2010). The dimensions can both work together and standalone but must all happen in order for academic discussions and learning to take place (Michaels et al., 2007). When classroom talk is accountable to the community, students consistently participate in talk together (Michaels et al., 2010). Michaels et al. (2010) says that in this setting, students have the ability to actively listen to one another without making many interruptions. They also say students recognize the contributions of others while showing respect and trust. Students also feel comfortable taking risks and are able to communicate reasons why or why not they agree with their peers (Michaels et al., 2007). When accountable to the community, students ask for clarification if needed and also extend or

elaborate on another child's idea (Michaels et al., 2007). Talk that is accountable to the community provides students with sufficient time and social safety to develop ideas (Michaels et al., 2007). Children may suddenly think of something they want to contribute and will need to refrain from interjecting in the middle of another student's turn (Michaels et al., 2010). Teachers are accountable for making judgement calls for whether an off-topic idea should be entertained to take advantage of a teachable moment or to stay focused on the task at hand (Michaels et al., 2010). Topics for discussion or problems posed should be open-ended with multiple possibilities for solutions (Michaels et al., 2007). Michaels et al. (2007) say when talk is accountable to the community; teachers begin to discover the capabilities of their students. According to City (2014), we often underestimate the challenges our students can handle. Richardson (2010) explains that students make contributions that the teacher may not have even considered.

Accountability to accurate knowledge means student contributions to classroom discussion must be as factual and specific as possible (Michaels et al., 2010). Classrooms that uphold this expectation have students who expect to ask and answer questions that will be challenging (Michaels et al., 2010). Michaels et al. (2010) points out that these students use background knowledge and previously learned concepts to back up their thinking. Authentic discussion allows students the experience of discovering and putting together meaning while taking ownership of this knowledge (Billings & Roberts, 2014). This is information that all students have access to (Michaels et al., 2007). Participants in the discussion help to expose any misconceptions (Michaels et al., 2007). Michaels et al. (2007) points out that the teacher serves as a guide for conversation to include academically correct concepts. Unsupported contributions to classroom discussion are questioned (Michaels et al., 2010). This is where teachers and

students who are accountable to the use of accurate knowledge seek out the knowledge needed for support (Michaels et al., 2010).

Accountability to rigorous thinking gives students the opportunity to explain their ideas and make connections (Michaels et al., 2007). Michaels et al. (2007) say students explain their thinking and self-correct through this type of talk. Classrooms need to foster critical thinking through meaningful conversations (Goldsmith, 2013). This rigorous thinking creates productive argument (Michaels et al., 2010). Creating arguments requires putting facts together in a way that makes sense (Michaels et al., 2010). Students challenge statements from their peers in a non-confrontational way (Michaels et al., 2007). Being accountable to rigorous thinking means knowing that the facts cannot just be good, but rather adequate to support a claim (Michaels et al., 2010). When classrooms hold a standard of expecting rigorous thinking, students and teachers insist on explanations for contributions made to the classroom community (Michaels et al., 2010). Michaels et al. (2010) states that the facts must also be credible and relevant. While one can distinguish the difference between accountability to knowledge and accountability to rigorous thinking, they work together and are both essential (Michaels et al., 2010). According to Michaels et al. (2007), even young children are capable of questioning others or building an argument to challenge the thinking of their peers. This is an improvement from what was believed to be true in the past (Michaels et al., 2007). In a classroom of this caliber, students are consistently giving thought to the quality of their contributions or arguments (Michaels et al., 2010). Michaels et al. (2010) say these types of classrooms commonly have students digging deeper and asking higher order thinking questions.

Components of *Accountable Talk*

There are many important components included in *Accountable Talk*. Eye contact with a partner shows listening during academic discussions (Zwiers & Hamerla, 2018). In addition to eye contact, smiling and nodding are also visual cues that illustrate listening (Zwiers & Hamerla, 2018). Farroni, Csibra, Simion, and Johnson (2002) stress that making eye contact builds trust and has a positive effect on development of the brain. These gestures offer a feeling of safety and trust (Zwiers & Hamerla, 2018). An adult must first model this action (Zwiers & Hamerla, 2018). In addition to eye contact, the speaker may also show interest in other's contributions by leaning their direction, using facial expressions, and making occasional sounds to signify understanding (Wilson, 2014).

The skill of taking turns is essential to practice, especially for young children as they are learning how to be patient and may struggle yet to focus (Zwiers & Hamerla, 2018). Zwiers and Hamerla (2018) say students must be taught that conversations include both partners taking multiple turns. The researchers suggest using turn-taking counters to help control which partner talks and who listens. These conversations must be continuous with students following one another with responses to extend or question what was said (Walqui & Heritage, 2018). To improve the quality of conversation, students are encouraged to sit with their knees facing one another (Wilson, 2014). The student speaking should be sure their partner knows when it is their turn to speak by cueing them (Wilson, 2014). When speaking in a small group, Wilson (2014) says it is even more difficult to have a back and forth conversation because all participants want a turn to speak. Skills to follow while speaking in a small group setting are to make a quick point, listen while others are talking, and wait until others have had a turn to contribute before taking another turn (Wilson, 2014).

Young children have many ideas in their minds that can be challenging to communicate clearly (Zwiers & Hamerla, 2018). Conversations with peers are a beneficial way for them to practice putting their ideas into words (Zwiers & Hamerla, 2018). Students must listen while their partner speaks and speak clearly to their partner in return (Zwiers & Hamerla, 2018). While speaking, confidence is important (Wilson, 2014). As Wilson (2014) points out, it reassures the speaker and in turn helps the listener to be more apt to pay close attention to the conversation. In order to speak clearly and confidently, the speaker must have good posture, eye contact, and use an appropriate volume and pace (Wilson, 2014). For instance, the speaker may slow down or increase their volume to emphasize a specific part of the conversation (Wilson, 2014). Wilson goes on to suggest that students must also speak with clarity. It is important for them to think before speaking in order to get their thoughts in order, speak in complete sentences, and choose specific words (Wilson, 2014).

One of the challenging components of *Accountable Talk* is the idea of staying on topic (Wilson, 2014). This skill also includes the ability to self-correct and know when to stop speaking if nothing else needs to be added to the conversation (Wilson, 2014). According to Wilson (2014), students must have a purpose or clear topic for discussion, the ability to think of ideas that pertain to the topic and abandon unrelated ideas. Students are better prepared to participate in a discussion with clear intentions (Richardson, 2010). Richardson (2010) says this gives students boundaries and helps them discuss ideas on topic.

Creating an *Accountable Talk* environment does not happen instantaneously, but rather takes ample amounts of modeling and guidance from the teacher (Michaels et al., 2010). The use of *Accountable Talk* includes a gradual increase in knowledge, trust, and confidence (Boyd, 2015). Teachers who expect students to speak must first show them how (Palmer, 2014).

Methods

Participants

The participants in this study were first graders at Prairie Elementary, located in the Southwest Minnesota city of Worthington. The community's population is very diverse due to work opportunities that attract immigrant families. These include a large beef and pork processing plant, as well as manufacturing companies. The population of Worthington is on the rise and currently sits at 13,271 residents. Prairie Elementary is part of Independent School District 518, which is one of the largest districts in the area, currently serving 3,292 kindergarten through twelfth grade students. Many of the students in the district come from low-income and minority families.

The action research took place at Prairie Elementary. This building houses 1,228 kindergarten through fourth grade students. The elementary also provides Early Childhood Special Education services. As shown in Figure 1, the demographics of the building included 60.9% Hispanic or Latino, 19% white, 9.3% Asian, 6.8% Black or African American, 3.7% two or more races, and 0.2% American Indian or Alaska Native (Minnesota Report Card, 2018). At the time of the study, 75.2% of students received free/reduced-price meals, 54.2% were English Learners, 13.8% received special education services, and 0.3% identified as homeless, as indicated in Figure 2 (Minnesota Report Card, 2018).

Convenience sampling was used in order to select participants for the study. These students were part of the researcher’s homeroom class. Ethnicity information for the class was accessed through the school district’s database, VIEWPOINT®. The 2019-2020 class of first graders included 21 students. However, 14 of the students were selected for the study, as they were the students who were in the classroom at the time of the intervention. The remaining seven students were consistently pulled from the room for various services giving reason for their exclusion from the study. The 14 participants included nine boys and five girls (see Figure 3). As seen in Figure 4, all students involved in the study were six or seven years of age. Five students were considered Asian/Pacific Islander, four were Hispanic, five were White, and one student identified as Black (VIEWPOINT, 2019). The preceding ethnicities of the students are displayed in Figure 5. In addition to these statistics, two of the students received Special Education services at the time of the study and six identified as English Learners. Four home-languages were represented among the selected students including English, Spanish, Lao, and Karen.

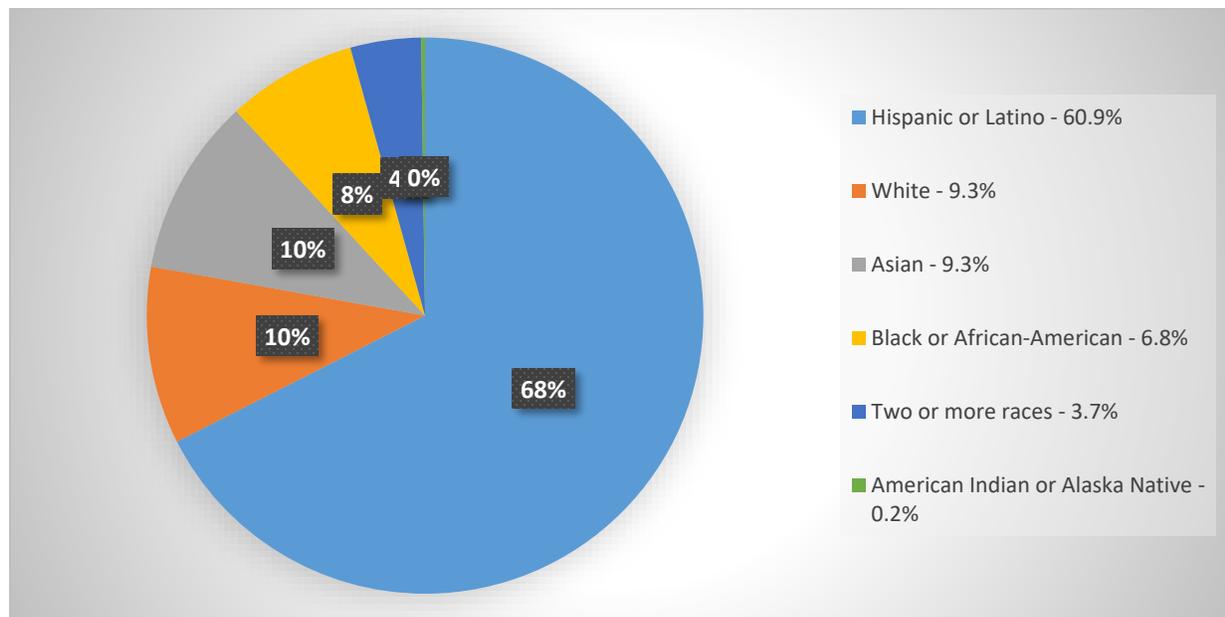


Figure 1. Prairie Elementary ethnicity (N = 1,228).

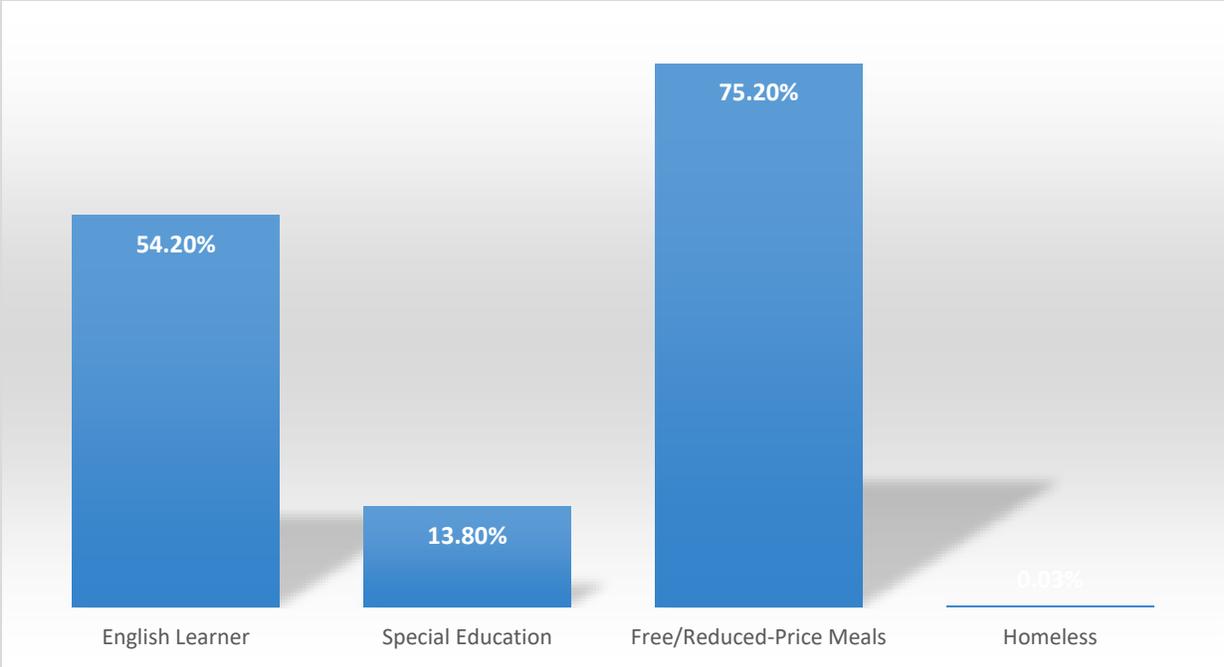


Figure 2. Prairie Elementary enrollment data (N = 1,228).

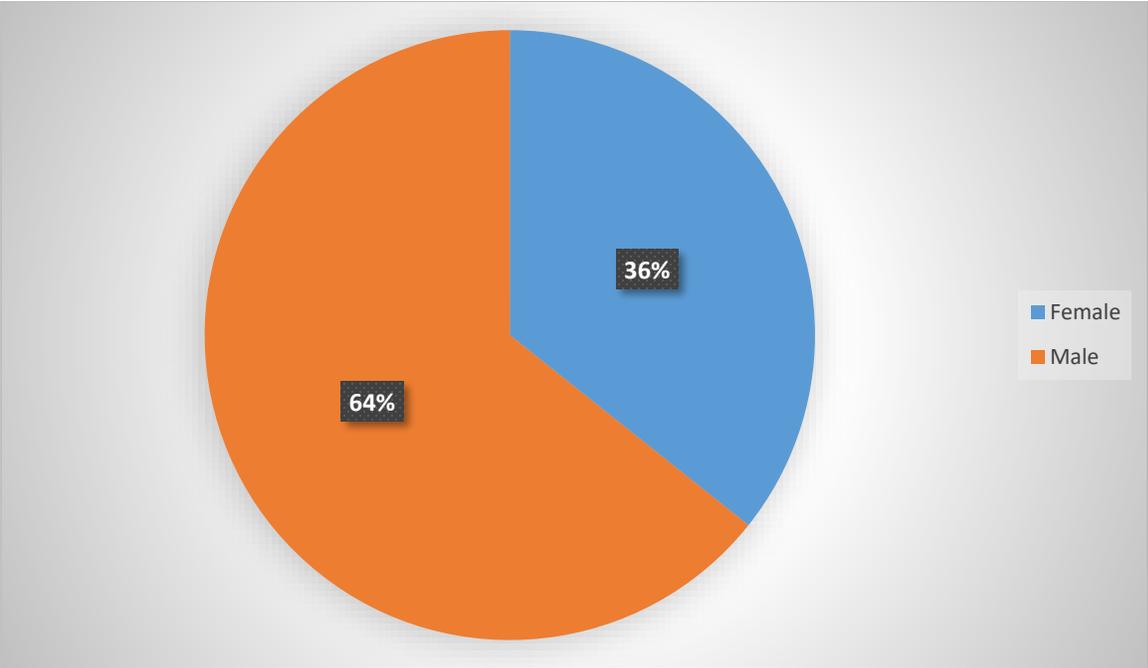


Figure 3. Classroom gender (N = 14).

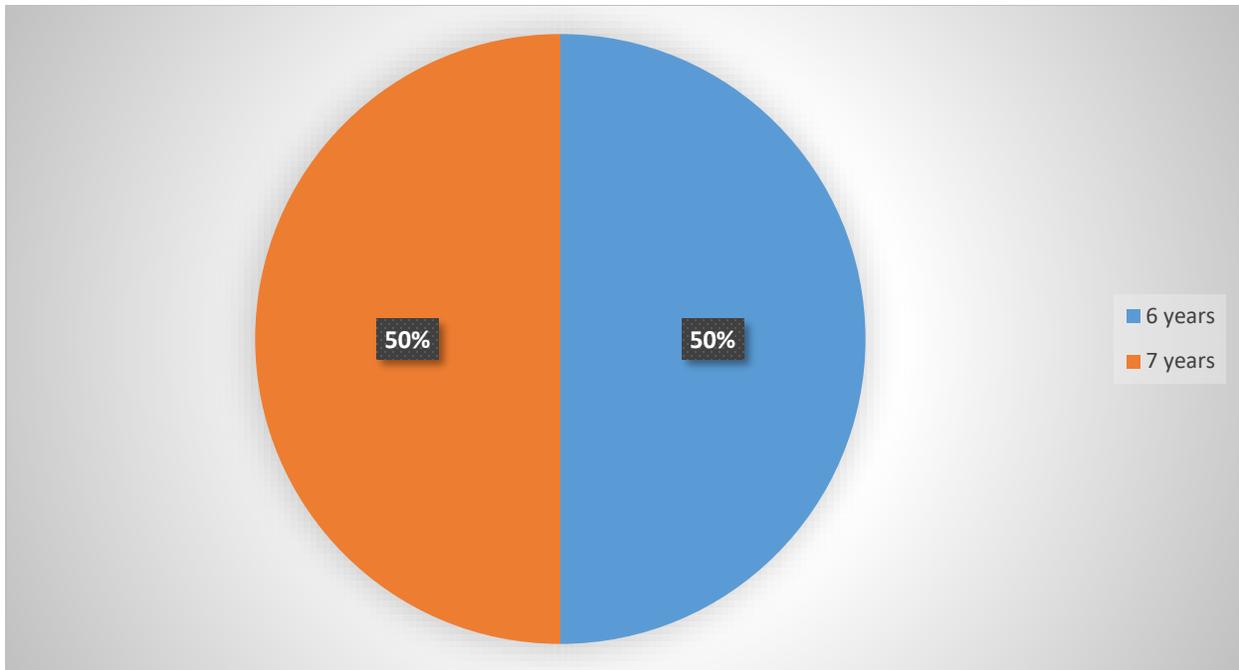


Figure 4. Age of participants ($N = 14$).

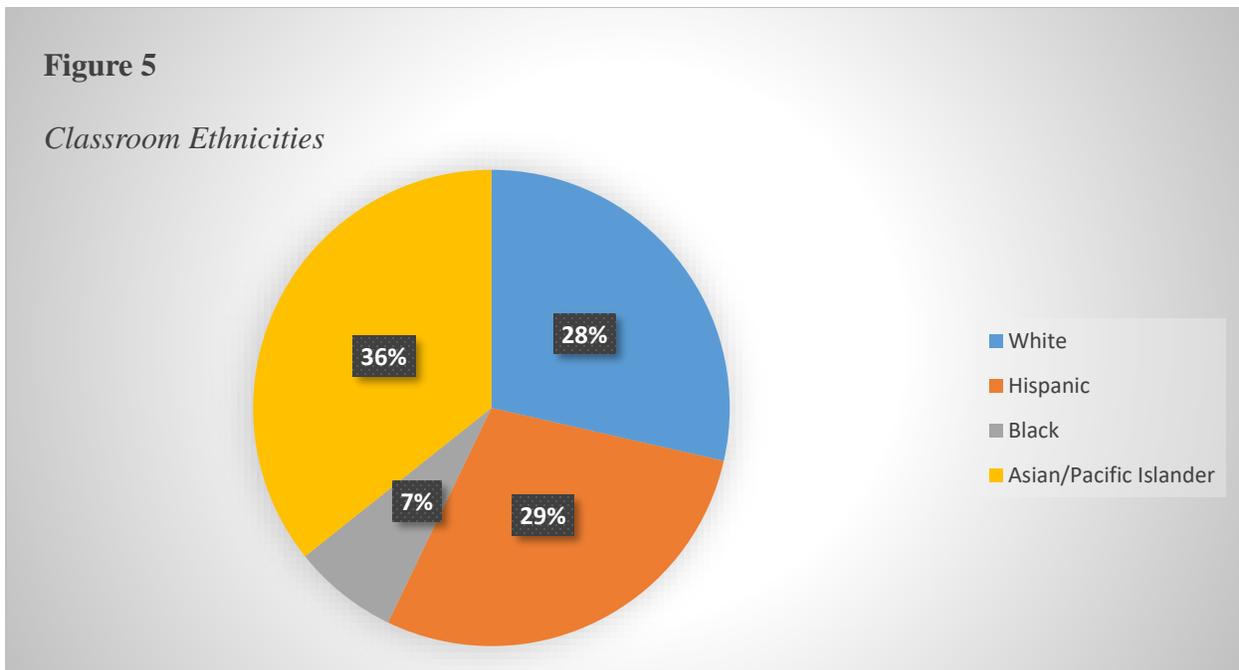


Figure 5. Classroom ethnicity ($N = 14$).

Measures

The pre- and post-intervention data for this study was collected using a Microsoft Excel checklist, as seen below in Table 1. This form of data collection was used to identify the relationship between the independent and dependent variables. The independent variable in the study was the implementation of number talks into the daily practice of the selected first grade students. The dependent variable was the student use of *Accountable Talk* components. These variables are quantitative. The checklist was created by the researcher to record data on student behaviors. These behaviors refer to the *Accountable Talk* components used during number talks. The components include eye contact between students, staying on topic, taking turns listening and speaking, sharing ideas clearly, and building on ideas by taking multiple turns. The *Accountable Talk* behaviors used by students were marked on the checklist prior to the number talk intervention and also at its conclusion. The number of students utilizing each behavior were added together to create a score for the use of each *Accountable Talk* component. Higher scores represent greater use of *Accountable Talk*.

Research supports the importance of the included *Accountable Talk* components. Zwiers and Hamerla (2018) explain that utilizing eye contact with a partner helps demonstrate active listening during a discussion. This component of *Accountable Talk* aids in the development of trust between the students (Farroni et al., 2002). These young children are learning the art of being patient; therefore, they need to be instructed how to take turns speaking and listening (Zwiers & Hamerla, 2018). Students included in the study were expected to sit “knee-to-knee, eye-to-eye” as they spoke, which is the same body language that Wilson (2014) encourages while speaking to a partner. The ability to remain on topic is challenging for children which

is why they need to have a clear purpose for discussion and the ability to drop ideas that are not related (Wilson, 2014). Richardson (2010) says students are better prepared to participate in discussions when there are clear boundaries.

Table 1

Accountable Talk Checklist (N = 20)

Accountable Talk Checklist					
Student #	Eye contact, nodding, facing partner	Stays on topic	Takes turns listening and speaking	Shares Ideas Clearly	Builds on ideas by taking multiple turns
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Procedures

The purpose of the action research was to find whether number talks influence the *Accountable Talk* used by students. The researcher selected 14 first graders using convenience sampling. At the time of the intervention, the remaining students in the first-grade class received ELL or RTI services outside of the classroom, giving reason for their exclusion from the study. As previously mentioned, the selected participants represent a diverse group of first graders.

In order to gather initial, pre-intervention data, the researcher observed the use of the selected *Accountable Talk* behaviors in the participants during the second month of school. The data was collected throughout the student's first participation in a number talk. The five selected components of *Accountable Talk* were observed and documented. The number talk intervention then took place over a five-month period, with approval from the Institutional Review Board at Northwestern College in Orange City, Iowa.

While in their first-grade classroom, students in the study participated daily in a purposefully selected number talk for approximately ten to fifteen minutes. The number talks were created by Primary Bliss Teaching (2015) and purchased by the researcher from the Teachers Pay Teachers website. The following mathematical topics were included in the number talk intervention: number sense development, subitizing, counting on, story problems, part-part-whole relationships, problem solving, doubles facts, equalities and inequalities, multiples of ten, recognizing patterns, combinations to ten, adding 3, single-digit numbers, and finding the difference.

To begin the number talk, the researcher would pose a question, along with a visual of the math problem. The researcher provided an ample amount of think time for students to think of multiple strategies to solve the problem. When the students were ready to share their idea, they quietly put their thumb up. If they were finished early and waiting for their peers, they were encouraged to think of additional strategies to solve the problem. They put up a finger for each additional way they could think of.

The researcher communicated to the participants the importance of respecting all answers and the opportunity to learn from one another. Before calling on students to share their mathematical thinking and justification for answers, the researcher had students turn and talk to a partner. This is where the participants had the opportunity to practice using eye contact, staying on topic, taking turns listening and speaking, sharing ideas clearly, and building on ideas by taking multiple turns. This took place with a considerable amount of modeling and encouragement from the researcher.

After discussing the posed math problem with a partner, students had a chance to share their thinking with the large group. In addition to providing an answer, the researcher also encouraged participants to share their reasoning. This is where the most valuable conversations happen. The students began to explain and clarify their thinking to help each other improve their math skills.

Results

Data Analysis

In order to determine the effect number talks had on the use of *Accountable Talk* by students, data was collected before and after the number talk intervention, which took place over a five-month period. The researcher documented student use of *Accountable Talk* components during the initial number talk. Following the conclusion of the number talk intervention, the researcher repeated this process.

A dependent group *t* test revealed that there was a statistically significant difference in pre-intervention scores on the use of *Accountable Talk* components ($M = 2.86$, $SD = 1.56$, $n = 14$), as compared to post-intervention scores on the use of *Accountable Talk* components ($M = 3.86$, $SD = 1.10$, $n = 14$) following a number talk intervention with moderate effect size, $t(13) = 3.18$, $p < .05$, $d = 0.74$. The number talks intervention had a positive effect on student use of the *Accountable Talk* components. Figure 6 illustrates that on average, there was a 1 point difference in means.

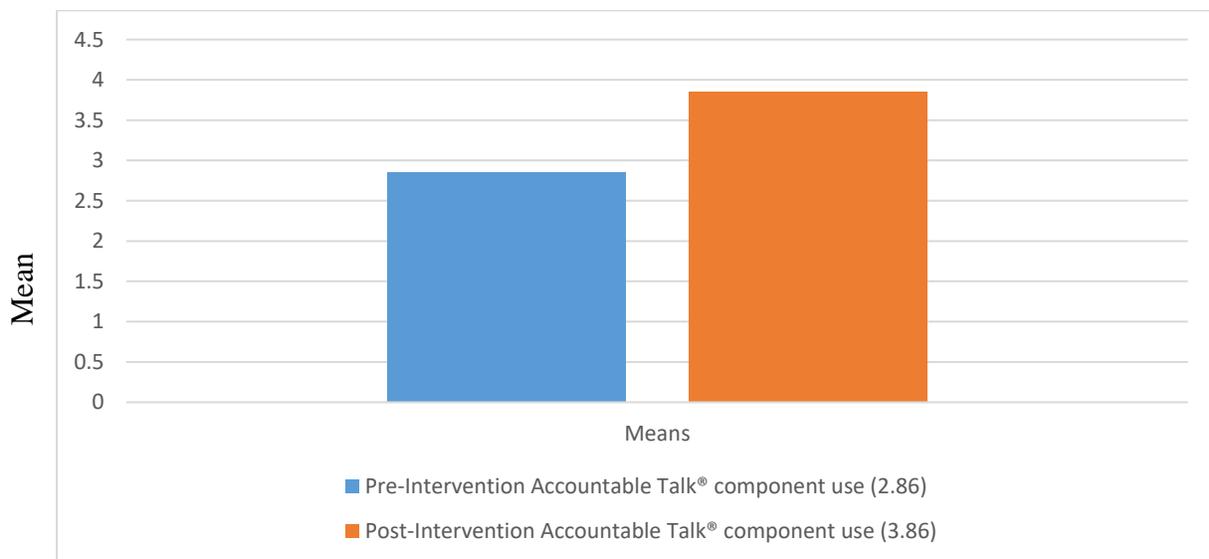


Figure 6. Mean difference ($N = 14$).

Discussion

Summary of Major Findings

The purpose of this study was to determine the effect number talks had on the use of *Accountable Talk* by students. The results of the dependent group *t*-test indicate that the implementation of number talks helped increase student use of the *Accountable Talk* components. Prior to the number talk intervention, data was collected to show which *Accountable Talk* components students utilized. Following the five-month intervention, the researcher repeated the process of recording data. When comparing pre-intervention data to post-intervention data, the group mean increased by one point.

As noted in the measures section, the *Accountable Talk* components that were observed include eye contact between students, staying on topic, taking turns listening and speaking, sharing ideas clearly, and building on ideas by taking multiple turns. Each component exhibited an increase in the number of students who displayed each specific behavior. The number of students who demonstrated the ability to use eye contact with their partner increased from 86% to 93%. This component showed the least difference following the number talk intervention. Students who stayed on topic while speaking improved from 50% to 71%. Taking turns listening and speaking went from 71% to 93%. The ability to share ideas clearly showed the same increase going from 57% to 79%. The *Accountable Talk* component that showed the most significant increase was building on ideas by taking multiple turns, which showed an increase from 21% to 50%.

The researcher was pleased to see the positive impact of the number talk intervention. The participants showed an increased understanding in mathematical concepts. This was evident throughout the daily number talk implementation. Students were able to explain their

mathematical thinking with more confidence. They were also able to offer multiple strategies to solve mathematical problems that were posed during the intervention. All students involved in the study were able to contribute to each math talk. This helped enrich the content of each discussion. The students had a positive experience during the implementation of the number talk intervention. The researcher has continued the use of number talks in order to allow students to continue their enjoyment of collaborating with one another to develop multiple problem solving strategies.

Limitations of the Study

Throughout the implementation of the study, there were various limitations that became evident. One limitation was the sample size of the study. There were only 14 students involved in the number talk intervention, which could make it difficult to relate the results of the study to other subjects attempting to implement this same study. In addition to the sample size, the students involved in the study varied in their mathematical ability level.

Another limitation is that seven of the students involved were English Learners. These students also had varying language levels. However, most of them possessed strong English speaking skills. A positive characteristic of the number talk intervention was that all students had the ability to manipulate numbers with equity, no matter their level of language acquisition skills. In fact, participating in number talks helped instill confidence in many of the English Learner participants and in turn improved their ability to use the components of *Accountable Talk*. The students who were unable to improve on building on their partner's ideas by taking multiple turns were mostly English Learners. This could have had an impact on the results of the study.

In addition to English Learners, there were also two special education students involved in the number talk intervention. While this was helpful for them to participate in daily number talks, their lack of improvement in the use of *Accountable Talk* could have been due to their difficulty with learning new concepts and communicating mathematical skills with their peers.

The number talk intervention took place over a five-month period. Although students participated in daily number talks, the results may have been altered if they were given more time and opportunity to practice *Accountable Talk* skills. Perhaps if this study had occurred over the period of an entire school year, the participants would have had more exposure to number talks, with the opportunity to work on additional mathematical skills.

Further Study

The researcher has continued the implementation of daily number talks. This has inspired curiosity of whether a longer period of number talk exposure would affect student use of *Accountable Talk* components. Next school year, it is the researcher's intention to repeat the study, beginning pre-intervention data at the start of the school year. In addition to checking in at certain points in the year, the researcher will collect post-intervention data in the last month of school. This will allow students an additional four months to learn and improve upon their *Accountable Talk* skills.

It is the hope of the researcher to alter this study to include a read aloud intervention with opportunity to use *Accountable Talk* components. There are known benefits to including these strategies before and after reading a text aloud to students. However, it would be of interest to the researcher to see the results of a pre- and post-intervention data comparison.

The researcher also suggests that a similar study be conducted with future groups of first graders. The original study was completed with a classroom of first graders who had not had the

opportunity to focus on utilizing the *Accountable Talk* components in kindergarten. The results could possibly vary with students who have prior knowledge of the components. The researcher would also like to compare the results from the current study to that of future studies. It would be of interest to the researcher to conduct a similar study with a group of students who participated in number talks throughout kindergarten as well. Once again, the prior knowledge would play an important role in how students communicate with one another.

Conclusion

The findings of this study suggest that number talks had a positive impact on the use of *Accountable Talk* by first grade students. Analysis of the results indicate that daily implementation of ten to fifteen-minute number talks can help increase student use of *Accountable Talk* components. There were several mathematical topics covered in the five-month number talk intervention. These topics included the following: number sense development, subitizing, counting on, story problems, part-part-whole relationships, problem solving, doubles facts, equalities and inequalities, multiples of ten, recognizing patterns, combinations to ten, adding 3, single-digit numbers, and finding the difference. The participants had the opportunity to practice using eye contact, staying on topic, taking turns listening and speaking, sharing ideas clearly, and building on ideas by taking multiple turns. The researcher modeled and encouraged the participants throughout this process.

Prairie Elementary, where the study took place, consists of a diverse population of students. There are several languages spoken and a large variety of ethnicities represented. Because of this, the school has several initiatives in place to support the diverse group of learners. Two of these initiatives are *Accountable Talk* and number talks, which were focused on in this study. Both initiatives increase the opportunity for students to practice their listening and speaking skills with both teachers and their peers. This in turn helps prepare them for life outside of school.

This action research has provided useful feedback and information in regard to the impact number talks have on student use of *Accountable Talk*. The results of this study validate the importance of the initiatives put in place at Prairie Elementary and provide encouragement for the teachers implementing them into their daily classroom routine. The findings of this study

provide reason to carry out further research. Increasing the sample size, length of study, and number of classrooms involved would help increase the validity of the study. It is essential for academic conversations to be at the forefront of engaged student learning.

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