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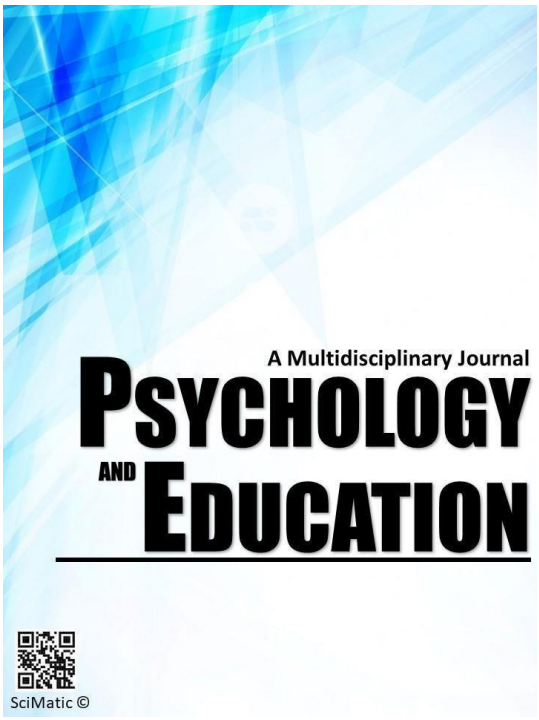


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Research Article

# The Correlation Between Self-Talk and Mathematics Achievement Among Grade School Learners Amidst the Online Learning

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## Abstract

Self-talk is the outcome of a developmental process. It has been studied almost exclusively in children but as they grow older, self-talk is being internalized to them. Addressing the need for self-talk to the students in the classroom and by their age when self-talk is largely internalized, this study investigated how self-talk would be related to mathematics achievement especially to the 4th-grade students. The findings reported in this paper are based on the data from self-talk inventory questionnaires completed by nine-to-ten-year-old, and mathematics achievement test results. Based on previous research, the results were unexpected. Gathered data of the students were analyzed, including that self-talk is still being used by the 4th-grade students, yet no relationship was found with their performance.

**Keywords:** Mathematics, Vygotsky, Online Learning, Achievement, Self-talk

## Introduction

People talk not only to others but also to themselves. It is clear to hold that self-talk may be a way of forming a belief, that self-talk command may be a way of forming an intention (Geurts, 2017). Previous studies have identified different strategies in improving individual performance in various fields (Sawyer, 2017; Wolters, 2003; Winsler & Naglieri, 2003) and one of the most commonly-used strategies is self-talk.

Numerous researches have emphasized the positive effects of self-talk in improving performance, particularly in academics (Ostad & Sorensen, 2007; Ostad & Askeland, 2008; Winsler & Naglieri, 2003; Duncan & Cheyne, 2001) and sports (Hatzigeorgiadis, Zourbanos, Goltsios, & Theodorakis, 2008; Hardy, Gammage & Hall, 2001). According to Høigaard and Johansen (2004), self-talk is an internal conversation that estimates and regulates the judgment and assessment that gives an individual a guideline and instruction in explaining his emotions, approaches, and feelings. Furthermore, Hardy et. al., (2001) stated that self-talk primarily makes use of language which is deemed to play a major role in the development of an individual's thinking and action.

Van Raalte, Cornelius, Brewer, and Hatten (2000), identified two basic types of self-talk, namely, positive self-talk and negative self-talk. Positive self-talk is usually said as a form of praise (e.g., –I know I can do it!‖) and on the other hand, negative self-talk is said as a form of criticism (e.g., –I'm a fool!‖).

The researchers based their study on Vygotsky's (1987) theory of cognitive development; self-talk is the outcome of a developmental process. According to him self-talk has been studied almost exclusively in children. Children use self-talk from about 3 to 8 years old, after which self-talk is internalized and transformed to produce more adult-like inner speech. Duncan and Cheyne (2001) suggested that when it comes to solving difficult problems and tasks, self-talk is mostly used in mathematics.

Previous study found out that students exhibit more positive than negative self- talk in their academic performance, although they report more negative self-talk when faced with a difficult subject compared to an easier academic subject, positive academic self-talk was reported higher in the easy than in the more difficult academic subjects (Sánchez, Carvajal, & Saggiomo, 2015).

Moreover, positive self-talk helped students in mathematical problem-solving, while negative self-talk, such as expressions of confusion and frustration, and task-irrelevant self-talk, made them unproductive in facilitating problem-solving. (Rosenzweig, Krawec, & Montague, 2011)

Children's use of self-talk diminishes as they grow older and follows a curvilinear trend. This is due to changes in ontogenetic development whereby children are able to internalize language (Vygotsky, 1987; Manfra & Winsler, 2006). Furthermore, in a study conducted by Matuga (2003) she investigated the use of self-talk on task performance among first, third, and fifth graders. Results showed that fifth-grade students

used more self-talk than third-grade and first-grade students. Thus, the researchers focused on the relationship of positive and negative self-talk on achievement in mathematics, particularly among grade 4 students (9 to 10-year-old).

Research Questions

The purpose of the current study is to examine the relationship between self-talk (positive and negative) and mathematics achievement among grade four students. The research question has been formulated by the researchers:

1. Is positive self-talk related to mathematics achievement among 4th graders?
2. Is negative self-talk related to mathematics achievement among 4th graders?

## Literature Review

Self-Talk

The term self-talk refers to overtly vocalized speech that is not addressed to anyone other than the speaker. Multiple studies have constantly supported the role of the use of positive self-talk compared to no self-talk (DeCaro, Rotar, Kendra, & Beilock, 2010; Emerson & Miyake, 2003). In fact, making students use self-talk in a task at the same time can affect their self-control (Tullett & Inzlicht, 2010) and may increase their performance in a task (Emerson & Miyake, 2003; Miyake, Emerson, Padilla, & Ahn, 2004).

In a study conducted by Chiu and Alexander (2000), they discovered that children who engaged in self-talk have a higher chance to strive to complete challenging tasks without the direct assistance of an adult. Lee (2011) explored the use of self-talk among seven to eight-year-old children. The result of his findings shows that seven to eight-year-old children continued to engage in self-talk when they faced cognitive and socio-emotional challenges. The findings also showed that the children used self-talk in managing their emotions, exercising self-control in relating to others, comforting themselves, and self-rewarding. Lee continued to investigate the effects of self-talk on young learners together with his colleague. Lee, McDonough, and Bird (2014) investigate eight to nine-years-old used self-talk in the classroom. The findings revealed that persevering self-talk played a role in the children's attempt to persevere when they encounter difficulties in their tasks. It demonstrates that positive self-talk was employed by the children to motivate them to keep going or to manage stress caused by task difficulty.

On the contrary, Lee and McDonough (2014) continued to investigate the role of self-talk among eight to nine-year-old students. Based on the previous research, results were somewhat unexpected, they found out that there is a lack of significant correlation between self-talk and performance. They were surprised to see the result because their previous studies have proven that self-talk and performance have a positive effect and other studies too (Chui & Alexander, 2000; Emerson & Miyake, 2003; DeCaro et al., 2010). Similarly, Bono and Bizri (2013) explored the relations among language skills, self-talk, and self-regulation in three- to five-year-old children. Results indicated that language skills were positively related to self-regulation. However, self-talk was negatively related to language skills and self-regulation.

Nevertheless, more research continues to examine the effects of self-talk on performance. Like in a study conducted by Sawyer (2017), he investigated the effects of self-talk on preschoolers. The results indicated that children in playful conditions used more self-talk than the control group. Children who use self-talk are more motivated to finish the task. In line with that, Winsler, Manfra, and Diaz (2007) explored relations between self-talk and task among young children with and without externalizing behavior problems. Findings in their study revealed that both groups of children performed better on the task when they were given instructions to use self-talk compared to no instructions were given. They suggest that either in allowing, encouraging, or giving children instructions for them to use self-talk as a strategy during tasks can lead to increased performance.

Matuga (2003) also investigated the use of self-talk on task performance among 108 school-aged children, mixed of first, third and fifth graders. Results in their study showed that fifth-grade students used more self-talk than third-grade and first-grade students. Children's self-talk provides an empirical window for exploring many interesting questions about mind, behavior, and language, especially those having to do with language serving a role in the development of children's executive function or self-regulation (Winsler, 2009).

Matuga (2004) further examines the relation of self-talk in children's performance. Matuga hypothesized that there would be differences in the amount of self-talk used by children while they were engaged in

drawing pictures of make-believe objects (i.e., creative activities) compared with real objects (i.e., every day, regular activities). It showed that participants in this study talked to themselves more while they were engaged in drawing the make-believe pictures than the real pictures. Children who use self-talk are more driven to draw what they want.

Callicott and Park (2003) examine the functional role of self-talk in relationship to academic responding and academic engagement of students with emotional or behavioral disorders (E/BD). According to them, training is combined to develop self-talk intervention to improve the academic performances of four students with emotional or behavioral disorders (E/BD). Results indicate effects for self-talk when paired with reinforcement that maintain across withdrawal and delayed conditions. In addition, Evidence of moderate to strong effect sizes is evident for self-talk as a verbal stimulus antecedent for subsequent corresponding academic behavior; the evidence is less clear for the demonstration of a change in academic engaged time across students.

Children who use self-talk typically perform well academically and take more responsibility for their own learning (Connor, Ponitz, Phillips, Travis, Glasney, & Morris, 2010). Winsler, Carlton, and Barry (2000) explored the contexts in which children useself-talk in their classrooms. Results showed that children are more likely to use self-talk during the self- selected activity classroom context and children are more likely to talk to themselves when alone, next likely in the presence of peers, and least likely when in the presence of a teacher.

In addition to Winsler's (2009) study, he reported that 48 mothers of preschoolers, of who reported that their children had been observed using self-talk during problem-solving or in fantasy play (presumably alone). They also reported that their children had engaged in self-talk before going to sleep at night or naptime.

A newly published study by Thibodeaux, Bock, Hutchison, and Winsler (2019) explored the relationship between self-talk and private singing. Children who used private singing and humming during their tests tended to be those who were also using a fair amount of self-talk on the task as well.

Winsler, León, Wallace, Carlton, and Willson-Quayle (2003) examined the relation between children's self-talk in the laboratory and their behavior at home and school with their performance in education. Indeed, self-talk was proven again that there's a positive link between children's goal-directed activity and task performance in the classroom. Also, teachers reported improved social skills and fewer externalizing behavior problems.

Also, Wang, Shim, and Wolters (2017) have investigated in their study the role of self-talk strategies in the relationships between achievement goals and academic engagement. As a result, self-talk was related to positive patterns of engagement in the study. They added self-talk helps to get self-improvement which has been in general consistently leading to higher academic engagement such as adaptive help-seeking, persistence, and preference for challenging tasks.

Day, Smith, Neal, and Dunsmore (2017) observe whether self-talk has a relation to temperamental effortful control to anger and sadness among students. This is the third set of findings (Day & Smith, 2013, 2014) to show that self-talk moderates the association between anger and sadness. Also, the more they use self-talk they become calmer and more responsive. Their findings suggest that self-talk can be used as an indicator of how well children performed in a task, those who are not using self-talk are more distracted or not paying attention to their task.

Preschoolers' playtime interaction presents a unique context where self-talk and shared conversations are co-present as well as within and out-of-pretend play frame talk (Kim, 2018). Two children are playing together and soon one child or both of them wander off to his/her self-talk and then shared engagement is achieved again. Kim's (2018) study suggests that the playtime interaction of preschoolers manages more use of self-talk. Children behave in a way that they say to themselves.

Likewise, the relation between children's imaginary companion status and their engagement in self-talk during free play was investigated among 5-year-olds children (Davis, Meins & Fernyhough, 2013). Results suggest that children with imaginary companions are more engaged in using self-talk rather than of their peers who do not have imaginary companions. Children develop more creativity when using self-talk.

Aram, Elad-Orbach, and Abiri (2016) conducted a study among fifty kindergarteners in their homes in three situations in a fixed order: (1) writing five words with parental mediation; (2) writing the same words independently; (3) instructing the writing of the same words to a hand puppet. Results demonstrate that there are positive correlations between parents' writing mediation, children's use of self-talk while writing, children's understanding of the writing process as

expressed while teaching the puppet, and children's independent writing level. Beyond that, they found that each of these variables has an independent contribution to children's writing, they suggest that self-talk is a good predictor for achievement.

Lee, Wang, and Ren (2019) investigated whether and how self-talk predicted students' learning strategy and academic performance. Data were collected from both secondary school students and university students. The results indicated that both the cognitive regulative function (self-management) and the affective regulatory function (self-criticism or self-reinforcement) of self-talk contributed to students' learning strategy, while only the cognitive regulative function of self-talk significantly predicted students' academic performance. Furthermore, the prediction of self-talk to academic performance was partly mediated by the learning strategy.

There is an increasing call for educators to support children's use of task-relevant self-talk strategies to regulate their learning and task performance (Stanulis & Manning, 2002; Winsler, Manfra, Diaz, 2007). A study by Winsler, Diaz, and Montero (1997) examines the functions of preschool children's self-talk. Age-related changes in children's use of self-talk were also examined. Forty preschoolers, ranging in age from three to five, completed a selective attention task with scaffolded assistance given by an experimenter when needed. Results were that self-talk was used more often during successful than during failed items while the opposite was true for item-irrelevant speech, children were more likely to use self-talk on successful items after scaffolding than they were on similar items, not the following scaffolding; after scaffolding, children were more likely to succeed on the next item if they talked to themselves than if they were silent; and age-related patterns in children's item-relevant self-talk and silence were found, however, only when analyzing speech during successful items.

Shi, Brinthaupt, and Mccree (2017) revealed that different types of self-talk exert influence on performance outcomes. For example, positive self-talk had a direct positive impact on the performance of a person, whereas negative self-talk had an indirect effect. The study found that positive self-talk provides benefits in overcoming anxiety. It appears that the frequent engagement of negative self-talk contributes substantially to the experience of speech-related anxiety. Children's reluctance to report on self-talk, coupled with their apparent lack of awareness of it, should not necessarily be taken as indicating that they do not experience it in any form. The suggestion of links between self-talk and various imaginative and creative activities, such as engaging with an imaginary companion (Brinthaupt & Dove, 2012), also raises the interesting question of whether self-talk plays a similar role in the inner experience of young children. Effects of self-talk on task performance have also been reported in the control groups of typically developing children in studies autism (e.g., Wallace, Silvers, Martin, & Kenworthy, 2009), but these effects have not always been separable from other dual-task demands (Holland & Low, 2010).

According to Van Raalte et. al., (2000) positive self-talk refers to the positive statements that enhance and improve self-esteem and motivation and help concentrate more effectively on the current task and not on the mistakes made in the past. The examples of positive self-talk phrases are the following ones: ―I can surely do it‖, ―I am quite ready, and I will do my best‖. On the other hand, negative self-talk includes statements in the form of criticism that produces increased anxiety, lower self-efficacy, and lower performances. Such examples include: ―There is no possible way I can do this‖, ―I am so bad, and I will certainly fail‖.

Positive self-talk is typically associated with increased self-efficacy (Pintrich, 2004), task interest (Duncan & Cheyne, 2001), emotion regulation ability (Brackett, Palomera, Mojsa-Kaja, Reyes, & Salovey, 2010; Kross, Bruehlman-Senecal, Park, Burson, Dougherty, Shablack, & Ayduk, 2014), and the experience of positive emotion states regardless of situational experience (Oliver, Markland & Hardy, 2010). In contrast, negative self-talk is most commonly associated with threat appraisals (Carver, 2004), less perceived social support (Zourbanos, Hatzigeorgiadis, Goudas, Papaioannou, Chroni, & Theodorakis, 2011), increased anxiety (Shi, Brinthaupt, & McCree, 2015).

Self-talk and Task Difficulty

When children perform complex tasks (i. e., multitasking, academic performance), they activate the regulatory role of language or self-talk. Furthermore, results from studies comparing different types of self-talk in different tasks point out the need to explore the functions of self-talk. Theodorakis et. al., (2000) argued that the effectiveness of self-talk depends on the nature of the performed task. In their study, they examined the effectiveness of different strategies on increasing performance in different tasks. The results of the study have shown that only the participants of their instructional group who used self-talk strategies improved their performance significantly more than

the control group.

Moreover, in a study conducted by Duncan and Cheyne (2001), students who use self-talk during task difficulty perform better and finish the task faster. On top of that, the students are not aware that they are spoken aloud during the study. Another point made by DeCaro et al. (2010), they revealed that using self-talk requires to resolve a difficult task when under pressure. It helps students control the anxiety and stress that may affect their performance. The more that the students are worrying about the worst they performed during the test.

Fernyhough and Fradley (2005) investigated the relations of self-talk, task difficulty, and task performance. The first two experiments were associated with self-talk and task difficulty, the more they increased the difficulty on the task, the more children use self-talk. They consistently found that children used self-talk in moderately challenging tasks and situations, and not so much when tasks are particularly easy.

Next is they test the relation between self-talk and task performance. In this part, self-talk is helpful to children in terms of enhancing task performance. Children performed better when they used self-talk. They concluded that self-talk was positively correlated with task performance and task difficulty.

Self-talk is important for the planning and problem-solving of children. Aziz, Fletcher, and Bayliss (2015) study examined the effectiveness of a training program designed to improve self-talk, and consequently, the planning and problem-solving performance of 87 children aged 4-7 years. Children were tested at three-time points: Time 1- before intervention; Time 2 - after the first group had received training and the second group provided a wait-list control; and time 3 - when the second group had received training. At time 1, the child with self-talk produced less self-regulatory speech and was impaired on the task performance relative to the typically developing children. At time 2, the task performance of children with self-talk in the first training group improved significantly, whereas there was no improvement for the second training group (the wait-list group). At time 3, the second training group improved their task performance and the first group maintained their performance. No significant differences in task performance were evident between typically developing children and those with self-talk at time 3. Overall results show that self-talk was effective in increasing self-regulatory speech and in improving planning and problem-solving performance in children.

Likewise, the study of Winsler, Diaz, Atencio, Mccarthy, and Chabay (2000) attempted to explore how self-talk coordinate with preschool children at risk. They checked on the children on four different occasions as they completed the problem-solving task, self-talk, and task performance. Results have shown that behaviorally at-risk children consistently used more self-talk than control group children across all observations. Both groups of children demonstrated a pattern of increasing silence with task success over time.

Olive, Markland, and Hardy (2010) have investigated the relationship between students' self-talk and their school task effective state. As for the aim of their study, with their collaborating hypothesis of whereby self-talk would be more strongly associated with well-being when students experience stressful or task difficulty in their school. As a result, self-talk was positively associated with positive affect regardless of students' experience or understanding of a school task. Significant interactions were found between controlling self-talk and experience and understanding, in that a negative experience or poor understanding predicted higher state anxiety and negative affect when students used high levels of controlling self-talk.

Dolcos and Albarracin (2014) examine the potential behavioral advantage of using self-talk and the role of attitudes. The first result revealed that giving self-advice about a hypothetical social situation using self-talk yielded better task performance. The second result showed that using self-talk in preparation for task performance, enhanced the performance and that these effects were mediated by participants' attitudes toward the task. Altogether, their study showed that self-talk strengthens both actual behavior performance and task performance.

Furthermore, the study of Salas, Radovic, Castro and Gross (2018) was the first one exploring the relationship between self-talk and emotion regulation. They suggested that emotion regulation relies on the use of self-talk. Self-talk should be considered both as a target of psychological interventions as well as a tool to facilitate therapeutic change. A positive relationship was found between self-talk and the difficulties regulating emotions. However, self-talk was not equally related to all types of difficulties regulating emotions, offering valuable insights into the exact roles that self-talk might play in emotion regulation. The study of Reichl, Schneider, and Spinath (2013) examined whether individuals with a high need to

belong and feelings of loneliness tend to compensate for a lack of social contact by self-talk and whether self-talk prevents negative consequences on their physical and mental health. Results of their study indicate that self-talk might be a risk factor for an increased negative correlation between loneliness and mental health. Self-talk, which is supposed to be related to self-awareness, might reinforce the subjective feeling of loneliness and hence have a negative impact on psychological well-being.

Lodge, Tripp, and Harte (2000) conducted two studies examining the extent to which different cognitive assessment procedures yield similar data in pre-adolescent children. In their first study, anxious children reported their self-talk through think-aloud and verbal thought-listing procedures. Half of the children reported their self-talk using both think-aloud and thought-listing while the rest engaged in thought-listing only. Prior participation in think-aloud did not influence the self-talk subsequently reported by children during verbal thought-listing. Compared with thought-listing, more problem-solving (analytical) self-talk and less balanced self-talk were reported during think-aloud. In their second study, children reported their self-talk through both verbal thought- listing and video-mediated recall (own and others' perspective) procedures. Video-mediated recall generated self-talk of a similar valence to that obtained by thought-listing. More self-talk was generated when the children viewed their own perspective videotape compared with observer perspective videotape and thought-listing. While pre-adolescent children were able to respond to all three cognitive assessment methods, the self-talk produced was not identical.

Children often produce self-talk during their preschool years to regulate their thought and behavior. Gangopadhyay, McDonald, Ellis Weismer and Kaushanskaya (2018) explored the effects of bilingualism on planning abilities in task difficulty. They found that bilingual children were faster planners than monolingual children, but only for the early trials of the planning task. It was suggested that bilingual children were more efficient at planning than monolingual children. An important finding in their study was that all children demonstrated self-talk when facing task difficulty and were more likely to finish the task when they use the language they most preferred.

Sawyer (2016) also adopted an experimental approach to compare monolingual and bilingual children in the use of self-talk to improve performance in complex tasks such as planning. Indeed, they have the same results. Children use self-talk to help them control impulsive and aggressive behavior and gain mastery over their actions.

Aro, Poikkeus, Laakso, Tolvanen, and Ahonen (2014) examined the associations between 5-year-old children's behavioral self-regulation, cognitive abilities, and their use of self-talk during task performance. More specifically, they analyzed the extent to which the children uses self-talk and whether they performed better in the task when using self-talk than when not using it (i.e., self-talk effectiveness), and whether the amount of positive self-talk was associated with the children's behavioral-regulation (i.e., impulsivity, inattention, and lack of effort) and cognitive abilities (language, inhibition, planning and fluency, and memory). The results indicated that children used self-talk naturally (at least sometimes without being encouraged), and most of the children performed better (got more of the items correctly) when they used self-talk than when they did not use it. Children used positive self-talk less in the easiest task items than in the longer and more difficult ones.

When individuals correct their speech, it is often assumed they are doing so for the benefit of others' comprehension. As such, most of the research exploring speech repairs, especially among young children, has been conducted with social speech (between two or more people) and self-talk (Manfra, Tyler, & Winsler, 2016). In their study, they explore social and self-talk and self-repairs from 27 three and four-year-old preschoolers who completed a selective attention task and a Lego construction task with and without an involved experimenter. Findings indicate that they got more errors while using social speech during the task and while using self-talk, it can improve their task performance, with or without the assistance of the experimenter. They also found out 3 years-old preschoolers used more self-talk in task-relevant speech than 4 years- old.

Self-talk also appears to be an important part of silent reading. For instance, Alexander and Nygaard (2008) played a conversation involving two voices with different speaking rates (one fast, one slow), and then asked participants to read passages written by the people whose voices they had heard. For easy texts read out loud, passages ‒written‖ by the slow voice tended to be read more slowly than those associated with the fast voice; reading silently showed no effect of voice. But for more difficult texts, both out-loud and silent reading showed evidence of being read according to the speed of speech that was previously heard. This effect also showed evidence of individual differences: those who self-reported low imagery skills

only showed a voice effect on their silent reading for difficult texts, but those with high imagery skills showed the effect for easy and difficult passages of text. Thus, more complex or challenging conditions appear to prompt self-talk-like experiences as a complementary tool during reading, but for some people, this experience will persist even during easy reading. Indeed, Dolcos and Albarracín (2014) explicitly note that the use of second-person inner speech could reflect the putative social origins of regulatory inner speech, suggesting that ―initial external encouragements expressed using You may become internalized and later may develop into self-encouragement‖.

Brinthaupt and Dove (2012) examined differences in the frequency with which people use self-talk. Children without siblings reported more use of self-talk than children with siblings. Respondents who reported having an imaginary companion in childhood also reported significantly more self-talk than those who did not have an imaginary childhood companion.

Previous studies do find that using self-talk is helpful for performance on a variety of tasks. Like the study of Lidstone, Meins, and Fernyhough (2010), they explored the role of self-talk in executive task performance in seven to ten-year-old children. As noted before, the researchers pointed out that there is a positive correlation between the use of self-talk by children and their task performance and achievement. Suggesting that self-talk also mediates the executive function of planning. It also introduces the role of self-talk in cognitive development and its contribution to language development, social development, and communication. And it also supports the opinion that self-talk provides a self-regulatory function and guides behavior and problem-solving. (Martínez, Calbet & Feigenbaum, 2011).

Meanwhile, Corkum, Humphries, Mullane, and Theriault (2008) compared the use of self-talk of children with ADHD and normal controls during problem-solving and inhibition tasks. Thirty-two children (16 children with ADHD and 16 matched controls) aged 6–11 years participated. Children with ADHD produced more task-irrelevant and task-relevant self-talk than control children during problem-solving tasks but did not differ in their use of self-talk. However, even when the children with ADHD use more self-talk their performance was lower than the control group. In line with this, Calvete and Cardeñoso (2002) examine the relationship between self-talk dimensions and behavioral problems in adolescence. Findings in their study showed that the data provide empirical support for the existence of two self-talk dimensions, which are positive and negative self-talk. Second, the positive and negative factors are not independent but correlated. All types of self-talk correlated significantly with internalizing behavioral problems. Although the highest correlations observed were found on the negative self-talk scale.

Alarcón-Rubio, Sánchez-Medina, and Prieto-García (2014) explored the relationship between executive function and self-talk in a cross-sectional study of 81 children between four and seven years of age. The children performed an executive function task, the Dimensional Change Card Sort (DCCS), and children's use of self-talk was observed during a labeling task. The results indicated that children's use of self-talk during the labeling task was significantly related to the number of phases successfully passed on the DCCS task, which required them to switch between card sorting rules.

Children who used more self-talk were more likely to pass the most challenging phase of the DCCS task. Furthermore, Wolters (2003) focused on the nature and function of self-talk.

When it gets difficult to persist a task at hand, instead of simply abandoning the work, students engage in purposeful self-talk to encourage themselves to continue. Lupyan and Spivey, (2010) further confirmed this study that using self-talk during a search task improves performance. Indeed, not using self-talk can interfere with self-control as manipulated in the task paradigm (Tullett & Inzlicht, 2010), and problem-solving performance is facilitated by self-talk use in children (Fernyhough & Fradley, 2005).

Self-Talk and Mathematics

Self-talk has been recognized as an important tool used by children to regulate their thinking and behavior (Manfra & Winsler, 2006). Investigating the association between self-talk and mathematical problem-solving strategies among 5–12-year-olds with and without mathematical difficulties, Ostad and Sorensen (2007) explore children's use of self-talk. They suggested that self-talk is linked to their mathematical fact proficiency even though their study did not provide concrete evidence for the link. Although Ostad and Askeland (2008) experimented with eight-to-nine-year-old who were taught self-talk strategies, the result of their findings shows that they performed better at mathematical fact retrieval than the control group. Because the study results indicated that developmental levels of self-talk reflect the quality of

children's mathematical achievement, this research leads to the rather optimistic possibility that the impact of the difficulties can be compensated for by the use of training programs developed to stimulate self-talk (Ostad & Sorensen, 2007).

Mathematics achievement is the competency shown by the student in the subject mathematics (Pandey, 2017) that deals primarily with the performance of students in their either teacher-made test or standardized achievement test administered by examining bodies. (Nizoloman, 2013). Furthermore, mathematics achievement has been a great concern for researchers, educators, teachers, parents, and students themselves. But, the desired level of mathematics achievement seems to require a dynamic interplay between student, class/teacher, and school factors. (Kiwanuka et al., 2015).

In addition, Rosenzweig et al., (2011) investigated eight graders' self-talk, they found that positive self-talk helped them in mathematical problem-solving, while negative self-talk, such as expressions of confusion and frustration, and task-irrelevant self-talk, made them unproductive in facilitating problem-solving.

Daugherty and White (2008) also determine the relationships between self-talk and creativity measures in at-risk preschool children. As creativity increased, the content of self-talk became more useful in a task, especially during mathematical problem-solving. The result indicates that the use of self-talk during mathematical problem-solving may be related to higher creative thinking in young children. They also found out that less creative children did not use self-talk at all.

Salami (2016) conducted a study of the effects of self-talk on math problem-solving performance on fifth-grade male students. They separate the students from using self-talk and not using it. The result indicates average scores of two groups of fifth-grade male students in math problem solving with and withoutself-talk use show a significant difference. In other words, self-talk has no impact on the performance of fifth-grade male students in solving verbal math problems. It should be noted that findings of Salami's (2016) work cannot be directly compared to findings in the above works, both with consistent and inconsistent results because self-talk is an age-related phenomenon and subjects in the above research works were mostly preschool children or children up to 9 years old (Fernyhough & Fradley, 2005). According to Vygotsky's theory self-talk appears before 3 years old to 8 years old, and self-talk improves around 8 years old.

Although, a study conducted by Sánchez et al., (2015), investigated and prove that self-talk can also be used by young adolescents. They examine the effects of self-talk among undergraduate students. The result of their study was participants exhibited more positive than negative self-talk in their academic performance, although they report more negative self-talk when faced with a difficult subject compared to an easier academic subject, positive academic self-talk was reported higher in the easy than in the more difficult academic subjects. Morin, Duhnych, and Racy (2018) also supported the use of self-talk among college students. In line with this study, Ren, Wang, and Jarrold (2016) investigate self-talk among adults. Their study was conducted to investigate how individual differences in the frequency of inner speech use are related to cognitive and non-cognitive factors. The cognitive factors that were considered included executive functioning and complex reasoning and the non-cognitive factors consisted of trait anxiety and impulsivity. Results revealed that anxiety and impulsivity were mainly related to the frequency of the effective function of negative self-talk (self-criticism) and executive functions and complex reasoning were mainly related to the frequency of the cognitive, self-regulatory function of positive self-talk (self-management).

Another study by Daugherty and White (2008) observe children's self-talk. Self-talk was collected in an open play context and children completed structured logical-mathematical activities. Results revealed that both originality and fluency creativity were linked to self-talk. Children are more skilled in math when they use their inner speech; they produce creativity while finishing the task.

Ostad's (2015) recent study explores again the relation of self-talk to mathematical difficulties. The main concern of their study was whether or not the two phonological memory factors evaluated in the study (i.e. the results of children's digit span assessments, both forward and backward) relates to self-talk internalization and whether this relationship changes with children's age, or mathematical achievement levels, or both. They made a comparison between children with acknowledged mathematical difficulties and children without mathematical difficulties regards to their self-talk. The results not only confirm the impact of self-talk but also emphasize a possible parallel role of phonological memory for subsequent mathematical achievement. In contrast to the

mathematical difficulties of the children, children without mathematical difficulties showed an age-determined shift from a lesser to the greater relationship between a high level of self-talk and high-level phonological memory skill. As a whole, given that the results are valid, the results, which are consistent with a developmental of self-talk, suggest that relationships between self-talk and may reflect among individual differences in children' s mathematical achievement.

According to Vygotsky's theory of cognitive development (1987), the phenomenon of private speech (self-talk used by children in various situations that is not addressed to others) reflects children's potential for self-direction to plan, guide, and monitor their goal-directed activity. Vygotsky placed great importance on the role of self-talk as a tool for the development of higher psychological functions, such as planning, executive functioning, and behavioral self-regulating. The research above has shown that children's self-talk usually peaks at 3–4 years of age, decreases at 6–7 years of age, and gradually fades out to be mostly internalized by age 10.

## Methodology

The current study aimed to investigate the relationship between positive and negative self-talk and mathematics achievement among grade four students. Thus, its research design is a cross-sectional, descriptive study. The paradigm that the researcher used is post-positivism.

According to Johnson (2001), if the researchers are primarily describing and documenting the characteristics of the phenomenon and there is no manipulation, then it is descriptive non-experimental research. For the time dimension, cross-sectional research was applied with the data collected from participants at a single point in time.

The researchers used post-positivism that they are trying to challenge the belief of the previous study. According to Creswell (2009), post-positivism holds a deterministic philosophy in which causes determine effects or outcomes. Thus, the problems studied by post-positivists reflect the need to identify and assess the causes that influence outcomes, such as those found in experiments. The accepted approach to research by post-positivist—a researcher begins with a theory, collects data that either supports or refutes the theory, and then makes necessary revisions and conducts additional tests.

Participants

The sample consisted of 72 grade four students from 3 different schools, 20 of those participants came from pilot testing, because of the pandemic the researchers decided to merge the gathered data from pilot testing to final data gathering. From these schools, the researchers used purposive sampling; it's a non-probability sample that is selected based on characteristics of a population and the objective of the study such as the students must be taking math subject, they should be 9 or 10 years old and their academic school year should end before April. There were 23 males (M = 14.35, SD = 3.86) and 49 females (M = 15.90, SD = 5.09).

Measures

For measuring positive and negative self-talk, the researchers used Burnett Self-Talk Inventory (BSTI; Burnett, 1996). The BSTI includes two scales: The Positive Self-Talk Scale (PSTS) and the Negative Self-Talk Scale (NSTS). Burnett (1996) reported Alpha coefficients of .89 and .86, respectively for the two scales. Calvete, Estévez, Landín, Martínez, Cardeñoso, Villardón, and Villa (2005) also used this scale among adolescents and reported that the alpha coefficient in their study is .70 and .82 which are respectively for the positive self-talk scale and negative self-talk scale.

Participants were asked what they will say to themselves in each of 36 statements in response to 5 imaginary situations, using a 3-point response formatted scale (often, sometimes, never). For scoring instruction items 1 to 36 are scored using the format: (3 = often, 2 = sometimes, 1 = never). Items 1, 3, 5, 7, 8, 10, 12, 15, 17, 19, 22, 24, 26, 28, 31, 33, 35, and 36 are added together to form the Positive Self-talk Scale (e.g. I can do this, I read really well last time, I'll do it again) Items 2, 4, 6, 9, 11, 13, 14, 16, 18, 20, 21, 23, 25, 27, 29, 30, 32 and 34 are added together to form the Negative Self-talk Scale (e.g. I wish my teacher wouldn't do that, I know I am going to fail). The higher score the participant got from either the two sub-scale indicates the type of self-talk the participants mostly used.

Mathematics achievement was measured according to a math test that was also given by the researchers.

Procedure

Permission for conducting research and data collection is typically granted by the school principal. Approval was sought and obtained for the researchers to conduct the research investigation at the school before data

collection. Before asking the students to fill out the questionnaires, they were given an informed consent address to their parents or guardian. The participants were also asked if they want to participate, if they do, they will also sign an informed consent address to them. After briefing the participants on the nature of the study, they answered the questionnaires about self-talk followed by a math test administered by the researchers. Thus, students were informed that their participation will be kept anonymous and that they can refuse or discontinue participating at any time without penalty. The students signed an informed consent form that allowed the researchers to use their responses to the survey as well as to extract their test scores from the database. Only the researchers will be allowed to access this sensitive information. Since the math test is multiple-choice, the researchers expected that the children will guess the answer and will not take seriously each question. To prevent that kind of event, the researchers asked the participants to show their solutions.

Data Analysis

The researchers used Statistical Packages for Social Sciences (SPSS) to analyze the collated quantitative data from the pilot test and the final data gathering. The internal consistency of the instrument was the first to explore by calculating Cronbach's alpha. Descriptive Statistics was used to present quantitative descriptions in a manageable form. It involves summarizing and organizing the data so it can be easily understood. Multiple Regression Analysis was run to predict the value of mathematics achievement on positive and negative self-talk.

## Results

In this section, the researchers outline and explain the data analysis used to conduct the research. Table 1 shows the descriptive statistics for the study variable. The internal consistency coefficients were both highly reliable (see Table 1, α). Math scores of students (n = 72) averaged 15.40 (SD = 4.76) which is below average. The scores of positive self-talk averaged 46.89 (SD = 4.95), and negative self-talk as 30.78 (SD = 6.87) which indicates that positive self-talk seemed to have a greater potential influence on students' math scores than negative self-talk.

**Table 1**. Descriptive Statistics for Study Variable

| | Minimum | Maximum | Mean | SD | α |
|---|---|---|---|---|---|
| Math Scores | 8 | 27 | 15.40 | 4.76 | |
| Positive Self-talk | 33 | 54 | 46.89 | 4.95 | .81 |
| Negative Self-talk | 18 | 50 | 30.78 | 6.87 | .86 |

In addition, the mathematical achievement scores appeared to be higher for girls (M= 15.90, SD = 5.09) than boys (M= 14.35, SD = 3.85). Same with positive self-talk, girls also tended to use more positive self-talk (M = 46.98, SD = 4.81) than boys (M = 46.70, SD = 5.35). On the other hand, negative self-talk seems to be higher for boys (M= 31.22, SD = 7.08) than girls (M = 30.57, SD = 6.84).

In the model summary shown in Table 2, the correlation coefficient is R= .14, which suggests that our model has a weak relationship and may not be a good predictor for the outcome variable. Also, the $R^2$ is .02, which it can be concluded the mathematics achievement has low predictive powers, as these variables account for about 2% of the variation in self-talk.

**Table 2**. Model Summary

| Model | R | R square | Adjusted R | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .14 | .02 | -.01 | 4.78 |

Multiple regression analyses were performed to investigate whether Positive self-talk and Negative self-talk could significantly predict participants' mathematics achievement. The first research question was whether positive self-talk is related to mathematics achievement among fourth graders. The results indicated that self-talk was non-significant predictor of mathematics achievement $F(2,69) = .72$, $p = .49$.

Furthermore, Table 3 shows us that no significant relationship was found between positive self-talk and mathematics achievement ($p = .41$). Also, as positive self-talk increased by one unit, mathematics achievement increased by .10 units. The second research question was whether negative self-talk is related to mathematics achievement among fourth graders. As shown in Table 3, negative self-talk has a non-significant relationship towards mathematics achievement ($p = .56$). Also, as negative self-talk increased by one unit, mathematics achievement decreased by .05.

**Table 3**. Multiple Regression Analysis

| | B | SE B | β | t | Sig |
|---|---|---|---|---|---|
| Positive Self-talk | .10 | .12 | .10 | .83 | .41 |
| Negative Self-talk | -.05 | .09 | -.07 | -.58 | .56 |

## Discussion

The purpose of this study was to quantitatively investigate the relationship of self-talk among fourth-graders when they are engaged in task difficulty, which is mathematics. 72 grade-four students

participated in this study voluntarily. Results from the present study found that there was no relationship between self-talk and mathematics achievement, neither positive self-talk nor negative self-talk. It failed to support our null hypotheses. Although, it was found that positive self-talk seemed to have a greater potential influence on students' math scores than negative self-talk. The present study has similar results from Lee and McDonough's (2014) study, they also investigated self-talk from performance but they found no correlation between them.

One possibility why it turns out to be non-significant is that there is an insufficient number of participants. Another possibility is that awareness of children's use of self-talk is more related to the quantity or quality of the verbal strategy used by the child. Manfra (2003) reported that among preschool children interviewed about their use of self-talk after completing a selective attention task, the degree to which children's use of self-talk during the task was loud, overt, and frequent (and thus more noticeable by the child) was a better predictor of children's self-reported use of speech than was age.

Awareness of verbal self-regulatory strategies appears to be important. Regardless of actual speech use, children who reported talking to themselves did better on the task than those who did not, and those who were aware of covert speech had higher standardized achievement scores than those who did not.

Moreover, self-talk has been emphasized with the positive effects on people, especially in academics and sports. This study is based on Vygotsky's cognitive development theory that children use self-talk from about 3 to 8 years old as the effect of self-talk is being internalized to them. The researchers focused on how self-talk would be related to mathematics achievement and its role for the student. Through this study, students could find the use of self-talk and its relationship in their times like in task difficulties or solving a problem. And also, it was found that if there is any relationship of self-talk to children who are older than 8 years old where they are in internalized age.

## Conclusion

Mathematics achievement was estimated based on the use of different self-talk with the use of the Burnett Self-Talk Inventory (BSTI), and the mathematics test from the Department of Education (DepEd). The results provided supportive evidence for the construct validity of the mathematics achievement. To further assess the construct validity of it, descriptive statistics and multiple regression models were performed to examine the relationship between the self-talk. The results were in discord with the hypotheses. No significant relationship was observed for the positive self-talk and negative self-talk with mathematics achievement revealing that students do not experience positive self-talk or negative self-talk referring to task difficulties like when they are solving a problem or doing mathematics. In sum, the results of the model showed poor internal consistency with the variables. A similar result was also found in Lee and McDonough's (2014) study. In general, positive self-talk and negative self-talk showed a non-significant relationship with mathematics achievement among 4th graders.

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