ELSEVIER

Early Childhood Research Quarterly 22 (2007) 215–231

Early Childhood Research Quarterly

"Should I let them talk?": Private speech and task performance among preschool children with and without behavior problems

Adam Winsler [a,*], Louis Manfra [b], Rafael M. Diaz [c]

[a] *Department of Psychology 3F5, George Mason University, Fairfax, VA 22030-4444, United States*
[b] *Florida International University, United States*
[c] *San Francisco State University, United States*

Received 18 May 2006; received in revised form 21 December 2006; accepted 5 January 2007

Abstract

Preschool and kindergarten teachers must make decisions everyday about how much to allow their children to talk out loud to themselves during various classroom activities. The present study examines the effects of children's private speech use on task performance for a group of behaviorally at-risk children and a group of control children during a speech–action coordination task. Twenty-nine behaviorally at-risk preschool children and 43 control children completed two versions of a speech–action coordination task (motor sequencing version and numeric tapping) two times, once with and once without speech instructions. Results indicated that the behaviorally at-risk children used more speech spontaneously compared to control children and performed just as well, and that both groups of children performed better when given instructions to use speech. Implications of these findings for early childhood educators' decisions about children's private speech use in the classroom are discussed.

Keywords: Private speech; Behavior problems; Preschool; Kindergarten; Task performance

1. Introduction

Young children often talk to themselves as they go about their daily activities. Preschool and early elementary school teachers must decide every day whether to allow children to talk to themselves as they engage in their classroom activities. Should teachers let them talk? Should they encourage children to use such speech in the classroom? Should they ask children to be quiet if they are talking? Is such speech use good or bad for the children? Do the answers to these questions depend on whether the child is well-behaved or has behavior problems? The present study helps answer these questions by comparing young children's performance on a motor sequencing task under different speech instruction conditions.

1.1. Research on private speech

Children's use of self-talk or "private speech," as a means of guiding behavior has been a topic of considerable study over the years (Diaz & Berk, 1992). A variety of different aspects of children's private speech have now been

* Corresponding author. Tel.: +1 703 993 1881; fax: +1 703 993 1359.
E-mail address: awinsler@gmu.edu (A. Winsler).

0885-2006/$ – see front matter © 2007 Elsevier Inc. All rights reserved.
doi:10.1016/j.ecresq.2007.01.001

explored, including ontogentic and microgenetic developmental trajectories (Berk, 1986; Berk & Spuhl, 1995; Duncan & Pratt, 1997; Winsler, Diaz, Atencio, McCarthy, & Adams Chabay, 2000), links with adult–child interactions (Berk & Spuhl, 1995; Winsler, Diaz, McCarthy, Atencio, & Adams Chabay, 1999), task and situational influences (Frauenglass & Diaz, 1985; Krafft & Berk, 1998; Winsler, Carlton, & Barry, 2000; Winsler & Diaz, 1995), children's awareness of such speech (Manfra & Winsler, in press; Winsler & Naglieri, 2003), and private speech use within special populations of children (Berk & Landau, 1993; Berk & Potts, 1991; Winsler, 1998). However, an early and central theme of inquiry in this area has been determining the extent to which private speech is helpful to children in terms of either guiding motor behavior or enhancing task performance (Fernyhough & Fradley, 2005).

This thread of research began with the early work of Vygotsky (1930–1935/1987) and Luria (1959, 1961) on young children's verbal control of motor behavior. Luria conducted a series of experiments involving a bulb-squeezing task in which children between the ages of 1.5 and 5.5 were asked to squeeze a rubber ball some number of times based on either the experimenter's verbal commands or instructions for the child to say certain things while squeezing. These studies found that young children (3–5.5 years old) were able to successfully complete the task when the number of squeezes matched the number of syllables/words in the verbalization but were unable to succeed when there was inequality between the number of squeezes and syllables (e.g., a child asked to say "Squeeze two times," would squeeze three times – once for every word – instead of twice). With increasing age, verbal instructions from either the experimenter or from the self gained in their regulatory effect on children's motor behavior (Luria, 1959, 1961; Wozniak, 1972).

Other researchers using similar tasks to examine speech–action coordination in young children replicated Luria's findings (Birch, 1966; Lovaas, 1961, 1964; Meichenbaum & Goodman, 1969a, 1969b). Birch (1966), for example, instructed children to "press" (say and do) when they saw a green light and to "don't press" (say and do) when they saw a red light. Results from this study revealed that all of the 5.5–6.5-year-old children were able to successfully complete this task, while 75% of 4.5–5.5-year-old children were successful, and only 37.5% of 3.5–4.5-year-old children were successful. Meichenbaum and Goodman (1969b) extended this work by exploring differences between instructing kindergarten and first grade children to use overt (i.e., aloud to self) or covert (i.e., quiet with lip movements) speech to exercise verbal control over motor responses in a peg-tapping task. First graders' benefited more from the covert speech condition than did kindergarteners. These findings support the notion that as children develop, the motoric component of speech becomes less influential in controlling the child's motor behavior while the semantic content of the child's speech becomes more influential. Additionally, these studies point out that the shift from the motoric to the semantic aspects of the speech being functional occurs at about the same time as Vygotsky's hypothesized internalization of private speech from other to self, from overt to covert (Vygotsky, 1934/1987).

Wozniak (1975) and others (Balamore & Wozniak, 1984; Goodman, 1981; Tinsley & Waters, 1982), using a task that involves children tapping sequences of colored pegs with a toy hammer while listening to and/or producing various verbal instructions during or before tapping, showed that when children's vocalizations accompany the action of tapping, performance is enhanced, however, when verbal self-instructions are given before the hammering starts the speech is not as helpful in guiding behavior. Three- and 4-year-old children also performed better on the task when they used self-vocalizations compared to when they did not. Research by Mischel and Patterson (1976; Patterson & Mischel, 1975, 1976) examining preschool children's instructed use of self-verbalizations while trying to resist the temptation to play with attractive but prohibited toys similarly found that children are able to resist or delay longer when they used the verbal strategies they were instructed to use, compared to control children who were either instructed to use irrelevant verbalizations or given no instructions. Also noted in these studies was that children delayed longer when they were given specific things to say to themselves and when they were given cues as to when to speak, compared to children given less specific instructions.

1.2. Children with externalizing behavior problems

Applications of this early experimental work with normally developing children began to emerge for children with behavior control problems ("hyperactive" or impulsive children, or children with externalizing behavior problems) in the 1970s in the form of cognitive–behavioral self-instructional training programs (Camp, Blom, Hebert, & van Doorninck, 1977; Kendall, 1977; Meichenbaum & Goodman, 1971). Much of this was inspired by Meichenbaum and Goodman (1969a), who examined the differences between overt (i.e., aloud to self) and covert (i.e., quiet with lip movements) speech use by kindergarten children and their ability to exercise verbal control over their

motor behavior while working on Luria's bulb squeezing task. In addition to simply examining overt versus covert speech differences, these researchers also categorized children as being impulsive or reflective based on Kagan's Matching Familiar Figures test (Kagan, 1966), in which latency to respond is measured as children are asked to indicate which similar picture is exactly the same as a target picture. Results indicated that verbalizations were less effective for impulsive children compared to reflective children, and that impulsive children relied more on the motoric aspect of the verbalizations whereas reflective children relied on the semantic content of the verbalizations. The reasoning behind the self-instructional training efforts that ensued was clear and simple—if typical children use speech as a tool for controlling behavior, and impulsive children with behavior problems have trouble regulating behavior, then they must be deficient in their use of self-speech for this purpose, and we should train such children how to talk to themselves. Although initially quite popular, partly because such training procedures were typically combined with several other behavioral and pharmacological interventions, self-instructional training programs were ultimately found to be ineffective by themselves in increasing the self-regulatory skills of hard-to-manage children (Diaz & Berk, 1995). Diaz and Berk (1995), in a review of 13 studies on the efficacy of self-instructional training programs, and others (Winsler, 1998), concluded that the failure of these programs was likely due to several unfounded assumptions. For example, it was assumed that children with externalizing behavior problems do not use much overt private speech, that modeling speech use for such children and telling them to talk is effective in eliciting private speech, and that getting such children to talk to themselves will necessarily lead to improved performance/behavior. These unfounded assumptions stemmed from a general lack of understanding about the functioning of verbal self-regulatory systems in children with behavior problems (Winsler, 1998).

Subsequent research on the private speech of children with self-regulatory difficulties (children either clinically diagnosed with ADHD or hard-to-manage preschoolers at risk for such a diagnosis) has shown that such children (a) do spontaneously use overt private speech for self-regulation (often even more than typical children of the same age working on the same task), (b) produce qualitatively similar types of private speech, that is, they use all forms of self-speech utterances, including those that appear to be quite mature and self-regulatory in nature, but (c) appear to be delayed in the internalization of private speech—children lacking in self-control continue to talk to themselves out loud while same-age comparison children engaging in the same task are quieter and use more partially internalized forms of speech, such as whispers and inaudible muttering (Berk & Potts, 1991; Copeland, 1979; Diaz, Winsler, Atencio, & Harbers, 1992; Winsler, 1998; Winsler et al., 1999; Winsler, Diaz et al., 2000; Winsler, Carlton et al., 2000). Winsler, Diaz et al. (2000) and Winsler, Carlton et al. (2000), for example, found that the normal developmental trajectory for private speech between the ages of 3.5 and 5.5 appears to be one of decreasing private speech overall accompanied by increasing task success with silence, a pattern from which children at-risk for ADHD deviate. These investigators also found that high and increasing amounts over time of task-irrelevant private speech are linked with poor child behavior both at home and at school (Winsler, Diaz et al., 2000; Winsler, Carlton et al., 2000; Winsler, de León, Wallace, Carlton, & Willson-Quayle, 2003).

1.3. Application to the early childhood classroom

Although these findings are important, many fundamental questions of direct educational and clinical relevance remain to be answered, such as whether children with or without externalizing behavior problems do better on tasks when they are talking to themselves or not. If children are not talking, should we ask them to talk? Is it detrimental to tell them to stop talking if they are? Early childhood educators and kindergarten/early elementary school teachers likely struggle with such questions as they must decide every day how much to allow, encourage, or discourage children's overt self-talk in the classroom. These are the questions addressed in the present study. Although research has clearly documented that preschool and early elementary school age children spontaneously engage in substantial amounts of private speech in the classroom setting (Berk, 1986; Kraftt & Berk, 1998; Winsler, Carlton et al., 2000; Winsler & Diaz, 1995), and that such speech appears systematically as a function of their task activities, social setting, and classroom structure, little is known about the extent to which teachers encourage or discourage children's use of private speech. Recent studies (Deniz, 2004; Oliver, Edmiaston, & Fitzgerald, 2003) show that there is much variance among teachers in their tolerance for overt self-talk in their classrooms and that some teachers do tell children to refrain from such speech during classroom activities. If indeed children's spontaneous private speech is helpful to some or all children, then such classroom policies would need to be revisited.

1.4. Speech–performance relations

Considerable study of typically developing children's natural or spontaneous use of private speech during a variety of problem-solving tasks has shown that such speech is related to children's performance, but in complex ways. There are numerous methodological challenges for research in this area that have led investigators to explore such issues in a variety of creative ways. These challenges to investigating speech–performance relations include: (a) the third variable confound of task difficulty—that private speech most often emerges during obstacles and moments of task difficulty and because performance is also likely to be poor when difficulty is high, associations at one point in time between private speech use and performance are often negative (Diaz, 1992), and (b) global associations or correlations between amount of speech used by children and overall task performance do not tell us much about speech–performance relations because many children do not speak much yet also do well on the task, thus it is less clear that overall greater frequencies of speech throughout the task are necessarily a good thing as is assumed to be the case when overall speech use and task performance correlations are calculated (Diaz, 1992).

To get around these problems, researchers have moved in three directions: (a) looking more microanalytically at the specific item or trial level (Winsler, Diaz, & Montero, 1997), (b) examining longitudinal relations between current speech use and future performance (Gaskill & Diaz, 1991), and (c) manipulating children's speech use by either giving speech instructions or by more generally encouraging or discouraging private speech during tasks (Behrend, Rosengren, & Perlmutter, 1989; Lee, 1999; Müller, Zelazo, Hood, Leone, & Rohrer, 2004). It is important to point out, however, that the vast majority of the studies on private speech and performance have been conducted on typically developing children. Much less is known about speech–performance relations among children with externalizing behavior problems.

Studies examining speech manipulation have found that encouraging speech can help children perform better at a task, while discouraging speech can be detrimental to performance (Lee, 1999; Müller et al., 2004), at least with tasks that elicit considerable amounts of spontaneous speech or executive control tasks. Lee (1999) found that 5-year-old children who were encouraged to use private speech talked more during a sequencing task than they did when given no encouragement and that performance was enhanced during the speech encouragement condition. Müller et al. (2004) instructed 3- and 4-year-old children to verbally label stimuli during an executive control task and showed that such speech use enhanced executive functioning, especially among the 3-year-olds. These findings suggest that children respond to adult-given instructions to use speech and that such speech can lead to increased performance. It should be noted that these findings, however, are based on typically developing children. The extent to which the same may be true for children with behavior and attention problems while working on a different task is the topic of the study presented here. Diaz and Berk (1995) argue that if children are already spontaneously using task-related strategies (verbal or non-verbal) that come naturally to them in order to complete a task, asking them to use certain scripted speech utterances at the same time can sometimes be detrimental to performance.

Finally, regardless of speech instructions, as is the case with any problem-solving strategy (Bjorklund & Douglas, 1997), the relationship between children's self-talk and task performance (i.e., whether the use of speech will assist in performance) is likely to vary considerably as a function of task, setting, and child characteristics (Berk, 1992; Bjorklund & Douglas, 1997; Frauenglass & Diaz, 1985; Winsler, Naglieri, & Manfra, 2006). For example, Winsler and Naglieri (2003) found that for a group of 5–7-year-olds, speech use was helpful for a cognitive matching task, while Winsler et al. (2006) found that speech was only positively related to performance on a search task among 5–7-year-olds when the child was also using a systematic search strategy. Manfra, Davis, Ducenne, and Winsler (submitted for publication) found that it was the use of a combination of both motor and verbal strategies that led to successful performance for preschoolers on a resistance-to-temptation task. Thus, additional research testing the conditions and circumstances under which children's self-speech is helpful appears warranted.

1.5. The present study

The present study responds to the methodological challenges described above by examining two different groups of children (typical preschoolers/kindergarteners and children viewed by their teachers as showing significant behavior problems) and manipulating children's speech use during a motor sequencing and counting task via speech instructions. Also, this study explores more specific, within-child and within-trial co-occurrences of speech and performance to determine under which conditions speech is the most helpful to children. The following research questions were

addressed in the present investigation: (1) Do children choose to talk to themselves during the task when there are no speech instructions? Is such spontaneous use of private speech related to child externalizing behavior problems? (2) Do children do better on the task when they are told to talk to themselves or when no speech instructions are given? Is this different for children with externalizing behavior problems? (3) To what extent do children comply with speech instructions? (a) Do they talk more when they are told to than when they are not? (b) Can children who spontaneously talk during the task be quiet when told to do so? (c) Can children who typically do not talk during the task talk out loud to themselves when told to do so? (d) Does any of the above vary by group? (4) Do children do better or worse (or the same) on the task when they are spontaneously talking to themselves compared to when they are not, and is this related to externalizing behavior problems? and (5) Are children who do better with speech than without more likely to spontaneously use private speech and is this related to externalizing behavior problems?

Based on the literature reviewed above, we expected that private speech would occur spontaneously and often during the task, and that children with externalizing behavior problems would be as or even more likely to talk to themselves spontaneously during the task. Given that the children studied here at age five and six were old enough for speech to be helpful, we thought that speech would be helpful and that children would perform better under conditions of speech instructions. Given that speech is naturally linked with behavior, we expected that it would be difficult for children who spontaneously talk to themselves to stop when requested to do so and that children with behavior problems would have even more difficulty inhibiting their speech than typically developing youngsters.

2. Method

2.1. Participants

The sample consisted of 72 5-year-old children (age $M = 65.6$ months, S.D. = 5.57) from a large metropolitan area within Northern California. Children were recruited through a diverse set of 11 participating preschools/childcare centers so all of the children attended preschool of some type. These centers included corporate-sponsored, university-affiliated, and for-profit childcare centers of varying quality and they also varied considerably in terms of the socioeconomic levels of the families served. At the time of this study, 68% of the sample was enrolled in kindergarten.

Participants were recruited 1–2 years earlier in the context of a larger-scale longitudinal study (Winsler, Diaz et al., 2000; Winsler, Carlton et al., 2000) involving two groups of children: (1) those identified by their preschool teachers as being hard-to-manage, behavior-problem preschoolers at-risk for ADHD and (2) comparison children without attention or externalizing behavior problems. The behavior problems group included those children who, during a screening of 566 children attending 11 preschools, scored among the top 10% after averaging across two independent preschool teacher ratings of impulsivity/behavior problems. The teacher rating scale was based on the diagnostic and statistical manual of mental disorders (DSM; American Psychiatric Association (APA), 1987) diagnostic criteria for ADHD. Items from the scale include: “Child has difficulty following verbal directions,” “Child interrupts or disrupts activities of peers,” “Child shifts activities quickly before completion,” “Child fidgets and appears restless,” “Child is disruptive during organized group activities,” and “Child has difficulty playing alone.” This 6-item, 5-point Likert scale in previous work has been reported to have an inter-preschool teacher rating correlation of .64 (Diaz et al., 1992). The control group consisted of a randomly selected subsample (matched on gender and preschool) of the other children who also participated in the screening but who received teacher behavior problem ratings within the normal range.

Of the 72 children, 29 were from the “at-risk” externalizing behavior problems group (83% male) and 43 were from the comparison group (77% male). As seen in Table 1, there were no significant group differences on any demographic variables at the time of initial subject recruitment, but at the time when the data were collected and reported in this report, children in the behavior problems group were more likely to be in a single parent household (21% as opposed to 5% for the comparison group). As reported elsewhere (Winsler, Diaz et al., 2000; Winsler, Carlton et al., 2000) there was stability in children’s behavior problems over time as the children originally placed in the at-risk group two years earlier still had significantly greater parent- and teacher-reported CBCL attention problems and aggression at the time of this data collection.

Table 1
Group comparisons on demographic variables

Variable	Behavior problems group ($N = 29$)	Comparison group ($N = 43$)
Age (months)		
M	66.0	65.4
S.D.	5.5	5.6
Gender (%)		
Male	82	77
Female	18	23
Number of children in home		
M	.93	1.26
S.D.	1.1	.89
Mother's education (years)		
M	15.3	15.9
S.D.	2.2	1.9
Father's education (years)		
M	15.7	16.6
S.D.	2.8	2.2
Age of mother		
M	37.2	37.1
S.D.	5.7	5.6
Age of father		
M	38.2	38.5
S.D.	6.8	5.1
Other language in home (%)	18	16
Ethnicity (%)		
Caucasian	62	64
African-American	3	0
Latino/Hispanic	0	5
Asian-American	7	9
Mix/Other	28	22
Marital status*		
Married (%)	79	95
Father's employment (%)		
Unemployed	7	0
Unskilled	3	0
Skilled	28	29
Professional	62	71
Mother's employment (%)		
Unemployed	14	36
Unskilled	3	5
Skilled	28	14
Professional	55	45
Home owner's status		
Home owner	76	83
PPVT vocabulary		
M	41.37	45.08
S.D.	16.0	13.8

*Group difference significant $p < .05$.

2.2. Procedures

Children were videotaped as they completed a speech–action coordination task (described below) with the experimenter in either a separate corner of their regular preschool classroom or in an extra room that was available at their preschool. A high quality, flat, table microphone was used to increase the quality of the audio input on the videotape.

2.2.1. Speech–action coordination "hammer" task

This motor task, adapted from Balamore and Wozniak (1984) and originally based on Luria's (1961) work, involves a series of requests for the child to tap (with a toy plastic hammer) a sequence of colored pegs (red, green, orange, yellow, blue) placed on an 8.5 in. × 11 in. white, rectangular, plastic pegboard. One peg was placed toward each corner of the pegboard and the remaining peg was situated in the center of the board. Before beginning the task, the experimenter made sure the child could label each of the colors. The task, for purposes of the present study, consisted of two parts, each with a condition involving speech instructions to the child and one without. This task was selected because of its use in previous studies and because it lent itself well to affording multiple task conditions (i.e., with and without speech instructions).

On the first part of the task, *motor sequencing*, the experimenter asked the child to tap a progressively longer sequence of colored pegs (2, 3, 4, then 5 colors), with two trials present within each sequence length. Children went on to the next higher sequence of colors if they correctly hit the colors in order on both trials. Children were told that the experimenter would only say the colors once and that they should listen carefully. Thus, the experimenter would say, for example, "blue, red, green" (when they were on a sequence of 3 trial) and if the child tapped the pegs in the correct order on this and the next different sequence of three, s/he would go on to a sequence of four (i.e., yellow, green, blue, orange") and so on. The first time they completed this task the children were simply instructed to hit the pegs in the order stated by the experimenter with no instructions given for child vocalization. After children completed the first pass (got as high as they could before making too many errors) with no speech instructions, children completed a similar set of trials (with different color sequences) again, but this time children were told to say out loud the sequence of colors stated by the experimenter as the children were tapping the pegs ("Now this time we are going to do the same thing but now I want you to say the colors that you are tapping out loud as you are tapping them"). Children were reminded to say the colors out loud while they tapped if they did not do so on the previous trial. For this motor sequencing part of the task, performance was based on the longest sequence correctly hit by the child.

The second part of the task, *numerical tapping*, involved the child simply tapping the center peg (the other pegs were removed) *X* number of times, rather than hitting sequences of colored pegs. On four trials, the experimenter asked the child to hit the peg with the hammer 5, 3, 8, and then 6 times and the child was given no speech instructions. Whether or not the child spontaneously counted out loud during any of the first four trials was noted by the experimenter. After these four trials were completed, the experimenter asked the child to tap the peg the same *X* number of times on four more trials, but this time the experimenter gave instructions to the child to verbally do the reverse of whatever they spontaneously did on the last four trials. That is, children were asked to either count out loud while hitting (if they were silent before on all trials) or to be quiet and not say anything while they hit (if they counted out loud before at least once). The specific instructions were "OK this time please do the same thing but count out loud as you are tapping the peg" for those who were quiet before, and "OK this time please do the same thing but don't count or say anything outloud while you are tapping" for those who spontaneously talked before. Whether or not the child counted out loud on each trial was noted by the experimenter. For the numerical tapping portion of the task, performance was coded dichotomously as simply whether on not, for each trial, the child tapped the peg the correct number of times.

A number of different variables relating to speech and performance were calculated. First, the proportion of trials on which the child used speech was calculated since the number of trials completed across children varied (those who did well completed more trials). Also noted was the percentage of children who were either silent the whole time or who spoke the whole time. In addition, the probability of the child getting the item correct while s/he was using speech (number of trials containing speech that were correct/total number of trials with speech) was calculated along with the probability of getting the item correct while s/he was silent (number of trials with silence that were correct/total number of trials with silence). The above two variables were only calculated for those children (typically a subset) who completed some items with speech and some without. Finally, these children who completed items with and without

speech were categorized on the basis of whether they performed better (the child's own proportion of items correct with speech was greater than the proportion of items correct with silence), worse, (the child's proportion of items correct with silence was greater than the proportion of items correct with speech), or the same (the child's proportion of items correct with speech was the same as the proportion of items correct with silence) with the use of private speech.

3. Results

3.1. Spontaneous use of private speech

The first research question addressed had to do with the extent to which children spontaneously choose to talk to themselves during the task when there were no particular instructions to do so and whether such a tendency to use speech varied by group. The top portion of Table 2 lists the average proportion of trials on the unconstrained phase 1 of the *sequencing* part of the task that children used speech as well as the percentage of children that never spoke during the task. Overall, most (79%) children engaged in at least some private speech during the first phase of the sequencing task with no instructions (21% were silent the whole time). Interestingly, this proportion varied as a function of group—93% of the children with externalizing behavior problems spoke to themselves spontaneously at least once during the phase 1 trials, compared to 70% of the comparison children, $\chi^2(1) = 5.72$, $p < .05$, Phi R effect size = .28. Overall, 36% of the children talked on every unconstrained trial and such children were slightly but not significantly over-represented in the behaviorally at-risk group, 45% compared to 30%. The overall average proportion of no-instruction trials that were completed with speech was .56 (S.D. = .40) with this number being higher for the behavior problems group (.69) compared to the control children (.47), t (70) = 2.30, $p < .05$, effect size $d = .56$. Thus, children with externalizing behavior problems are more likely to spontaneously approach a novel motor sequencing task with the strategy of self-talk compared to children without such difficulties.

Children's spontaneous speech behavior during the numerical tapping portion of the task is also relevant to answer the first research question, so we will briefly turn our attention to the top of Table 4 as well which lists the proportion of children who spoke on their own accord during the first phase of the numerical tapping portion of the task. As seen in the top section of Table 4, 84% of children overall spontaneously counted out loud while tapping the peg during the first unconstrained phase with no speech instructions, with this figure being slightly and but not quite statistically significantly higher for the children with behavior problems (93%) compared to comparison children (79%), $\chi^2(1) = 2.56$, $p = .10$. Given that this group difference was significant for the sequencing portion of the task and not here, it appears that counting tasks elicit spontaneous speech use more similarly across different types of children than does sequencing tasks.

3.2. Performance as a function of speech instructions

The second research question asks whether children do better on the task when they are told to talk to themselves or when no speech instructions are given and whether children with externalizing behavior problems are different from comparison children in this regard. That is, regardless of whether youngsters actually talk, do they perform better when told to talk to themselves than when no speech instructions are given and does this vary by child age? To answer this, a 2-way mixed ANCOVA was performed with condition (speech instructions versus not) on the sequencing task as the repeated measure, group as the between-subjects factor, age in months as a covariate, and task performance as the dependent measure. A significant condition effect was found: after controlling for child age, children did better on the motor sequencing task when they were told to say the colors out loud while they were hitting [task performance means for each condition are found in the first row of both Table 2 (no instructions) and Table 3 (speech instructions)] compared to when no such instructions were given, F (1,69) = 4.16, $p < .05$, and this was true for both groups of children, as indicated by a non-significant group-by-condition interaction. The group effect was also non-significant. Interestingly, however, there was a significant age-by-condition interaction, F (1,69) = 4.07, $p < .05$. Older children did better on the task but only when there were no speech instructions (see Fig. 1). Performance was associated with age of child during the no instructions condition ($r = .26$, $p < .05$) but not during the condition with speech instructions ($r = .02$, *n.s.*). By giving children instructions to talk out loud during the task, age differences in performance were eliminated.

Table 2
Children's speech use and performance during the unconstrained (no instructions) phase of the motor sequencing task, by group

	Overall Sample (n = 72)		Behavior Problems Group (n = 29)		Comparison Group (n = 43)	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Task Performance	3.76	(.96)	3.72	(1.07)	3.79	(.89)
Proportion of Trials Containing Speech*	.56	(.40)	.69	(.35)	.47	(.42)
Percentage of Children Who Spoke at Least Once*	79.2%		93.1%		69.8%	
Percentage of Children Who Never Spoke (Always Silent) *	20.8%		6.9%		30.2%	
- Proportion of Trials Correct	.67	(.22)	.50	(.13)	.69	(.20)
Percentage of Children Who Were Never Silent (Always Talking)	36.1%		44.5%		30.2%	
- Proportion of Trials Correct	.71	(.16)	.69	(.16)	.72	(.16)
Percentage of Children Who Sometimes Used Speech and Sometimes Didn't	43.1%		48.6%		39.6%	
- Proportion of Trials with Speech That Were Correct	.68	(.30)	.65	(.29)	.71	(.31)
- Proportion of Silent Trials That Were Correct	.73	(.30)	.74	(.36)	.72	(.27)
- Percentage of *Children* Whose Performance Was:						
Better with speech (than without)	29%		14%		41%	
Better without speech (than with)	42%		57%		29.5%	
The same with or without speech	29%		29%		29.5%	

*Group difference significant $p < .05$.

3.3. Compliance with speech instructions

The third research question addressed whether children talked more when they were given instruction compared to when they are not given instruction. The first way this question was explored was by doing a mixed ANCOVA

Table 3
Children's speech use and performance during the speech instructions phase of the motor sequencing task, by group

	Overall Sample (n = 72)		Behavior Problems Group (n = 29)		Comparison Group (n = 43)	
Task Performance	3.81	(.93)	3.76	(.99)	3.84	(.90)
Proportion of Trials Containing Speech	.90	(.21)	.89	(.24)	.91	(.20)
Percentage of Children Who Spoke at Least Once	97.2%		96.6%		97.7%	
Percentage of Children Who Never Spoke (Always Silents)	2.8%		3.4%		2.3%	
- Proportion of Trials Correct	.125	(.03)	.00	-	.25	-
Percentage of Children Who Were Never Silent (Always Talkers)	73.6%		72.4%		74.4%	
- Proportion of Trials Correct	.75	(.14)	.71	(.13)	.77	(.14)
Percentage of Children Who Sometimes Used Speech and Sometimes Didn't	23.6%		24.2%		23.3%	
- Proportion of Trials with Speech That Were Correct	.73	(.18)	.71	(.18)	.73	(.20)
- Proportion of Silent Trials That Were Correct	.55	(.43)	.47	(.47)	.61	(.41)
- Percentage of *Children* Whose Performance Was:						
Better with speech (than without)	41%		57%		30%	
Better without speech (than with)	53%		43%		50%	
The same with or without speech	6%		0%		20%	

*Group difference significant $p < .05$.

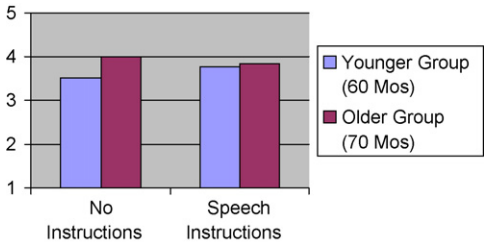

Fig. 1. The interaction of age and speech instruction condition on performance on the sequencing part of the task.

with condition (speech instructions versus not) on the sequencing task as the repeated measure, group as the between-subjects factor, age as a covariate, and proportion of trials that contained speech by the child as the dependent measure. This analysis revealed a significant condition effect, $F(1,69) = 9.34$, $p < .01$, indicating as expected that children talked more when they were told to talk than when no such instruction was given, $d = 1.13$. A significant group by condition interaction, $F(1,69) = 7.19$, $p < .01$, indicated that while children with behavior problems talked on more items than controls when no speech instructions were given, there were no group differences when they were told to talk (see Fig. 2). Both groups increased their amount of talking with instructions but the control children increased more (because the behaviorally at-risk kids were already talking a lot before being told, as discussed above). The age by condition term was significant as well, $F(1,69) = 5.92$, $p < .05$—age was slightly positively ($r = .21$, $p = .07$) associated with speech use on sequencing items when no instructions were given but differently associated with speech use ($r = -.12$, $p < .05$) when speech instructions were present. Table 3 also shows how with speech instructions, 97% of all children regardless of group status spoke out loud during at least one trial during the speech instructions condition.

3.3.1. Can children who spontaneously talk during the task be quiet when told to do so?

Recall that children who spontaneously talked during the first pass at numerical tapping (84% of the sample—Table 4) were asked to be quiet during the second pass through the four trials of tapping. Table 4 lists the percentage of such children who were not able to follow instructions to be silent during the second condition of numerical tapping. A full third of the sample, the same for both groups, were not able to stop themselves from counting out loud during the peg tapping task.

3.3.2. Can children who typically do not talk during the task talk out loud to themselves when told to do so?

As listed in Table 4, a small number (16%, $n = 11$) of children were silent during the first pass at the four numerical tapping trials (and then told to speak during the second pass). Although the number of children involved is admittedly small here, it is interesting to note the patterns for exploratory purposes and future research. Of the two children in the behavior problems group who were in this category, both of them were able to talk out loud during the second pass. Of the nine control children who were originally silent, two of them (22.2%) did not count out loud even when asked to do so. Thus, although a minority of normally quiet control children have difficulty talking out loud to themselves even when instructed to do so, the few children with troubling behavior who do not already talk to themselves spontaneously have no trouble doing so when asked.

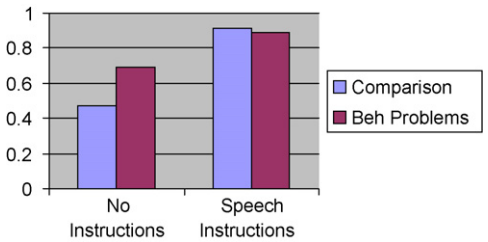

Fig. 2. The interaction of group and speech instruction condition on percentage of items containing speech.

Table 4
Children's speech use and performance during the numerical tapping/counting phase of the task, by behavior problem group

	Overall Sample (n = 72)		Behavior Problems Group (n = 29)		Comparison Group (n = 43)	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Proportion of Trials Containing Speech	.54	(.17)	.54	(.16)	.53	(.18)
Percentage of Children Who Spontaneously Spoke on the First Trials (No Speech Instructions) +	84%		93%		79%	
Proportion of Trials with Speech That Were Correct	.81	(.22)	.79	(.23)	.82	(.22)
Proportion of Silent Trials That Were Correct	.73	(.31)	.73	(.33)	.73	(.31)
Percentage of Children Who Never Spoke (Always Silents)	0%		0%		0%	
Percentage of Children Who Were Never Silent (Always Talkers)	4.2%		0%		7%	
Percentage of Children Who Were Not Able to be Quiet When Asked	33.8%		32%		34.9%	
Percentage of Children Who Were Not Able to Talk Out Loud When Asked	18.2% (2/11)		0% (0/2)		22.2% (2/9)	
Percentage of *Children* Whose Performance Was:						
Better with speech (than without)	43.3%		42.9%		43.6%	
Better without speech (than with)	22.4%		28.6%		17.9%	
The same with or without speech	34.3%		28.6%		38.5%	

+Group difference $p < .10$.

3.4. Speech/performance relations

The next research question asks whether children do better or worse (or the same) on the task when they are spontaneously talking to themselves compared to when they are not, and whether this is related to group membership. The approach used to explore this was to calculate within each child two proportions: (a) the number of items completed by that child with speech that were correct over the total number of items completed with speech. This indicates when children are talking to the themselves, how often they get it right—otherwise stated as the probability of getting the sequencing item correct given that speech was used, and (b) the number of items completed in silence that were correct

over the total number of items completed in silence. This indicates when children are silent, how often they get it right—otherwise stated as the probability of getting the item correct given that the child was silent. The averages of these within-child proportions are listed in Table 2 by group for the no speech instructions condition, and in Table 3 for speech instructions. Note that the first one (the probability of getting the sequencing item correct given that speech was used) cannot be calculated for children who never spoke and the second one (the probability of getting the item correct given that the child was silent) cannot be calculated for children who were never quiet. So for those two groups with no variance in terms of their speech use, their simple average proportion of items correct is also given in Tables 2 and 3.

3.4.1. Under no speech instructions (Table 2)

When children were spontaneously talking during the condition with no speech instructions, they correctly hit the desired sequence of colors, on average, 68% of the time and this figure did not vary much by group. When children were silent on trials in the same condition, the average probability of getting the item correct was similar although slightly higher at .73, and again this figure did not vary by group. The difference between these two figures, according to a mixed ANOVA with group as a between-subjects factor and the two different proportions serving as the repeated dependent measure, was non-significant.

For those who never spoke during the unconstrained condition, the overall probability of getting the sequencing items correct was .67 but this figure varied by group with the probability of getting items correct being .50 for always silent children with behavior problems and about .70 for always silent control children. Clearly being silent all the time during such a task for children with behavior problems is not only a rare occurrence (only 2 children were in this category) but also does not appear to be good for maximizing sequencing performance. For those who always talked, the chance of getting items correct was .71 that did not vary by group.

Listed in the bottom of Table 2 are the percentages of *children* (among only those who both spontaneously talked and were silent on some items) whose within-child probability of getting the items correct was better with speech, better without speech, or the same. For the approximately half of the behavior problems group who used both speech and silence spontaneously on the items, a slight majority (57%) of them did better when they were silent than when they were speaking, and only 14% of them performed better with speech. For the controls using both speech and silence, 41% did better with speech and 30% better without. For both groups, there was a constant 29% of children whose chance of getting the items correct was the same with or without speech.

3.4.2. Under speech instructions (Table 3)

The same set of analyses above was conducted for the phase with instructions to say the colors out loud while they tapped, and the results are listed in Table 3. When children were talking during this condition, they correctly hit the desired sequence of colors, on average, 73–75% of the time and this figure did not vary much by group. This figure is the same for the children who spoke on every trial and for those who spoke on some but not all trials in this condition. Performance was poor for those few children who were silent on all trials in this condition even though they were told to talk. Similarly for those children who sometimes talked and sometimes where silent, the average probability of getting the item correct when silent was around .55 and did not vary by group. Thus, under speech instructions, both groups of children were more likely to get items correct if they talked than if not.

Also listed in Table 3 are the percentages of children (among the subset who both spontaneously talked and were silent on some items) whose probability of getting the items correct was better with speech, better without speech, or the same. Recall that the number of children for which this calculation can be made is quite small at times because most children spoke all of the time as instructed in this condition. Nevertheless, the pattern is clear—57% of the behaviorally at-risk children did better when they were talking than when they were silent and this was not the case for the control group in which only 30% of the children did better with speech.

3.4.3. Speech effectiveness and speech choice relations

Finally, to assess whether a child who performs better with private speech spontaneously chooses to use private speech in the unconstrained condition, a 2-way chi-square test was performed with speech/performance category of child (better, worse, or same with speech) and whether the child spontaneously chose to talk out loud during the unconstrained numerical tapping condition. Results showed that 90% of the children (true for both groups) who did better with speech chose to use speech when there were no instructions, compared to 80% of the children who did worse with speech, and 78% of children for whom speech did not matter for performance, $\chi^2(2) = 1.4$, ns. Although the

test was not statistically significant (because of the overall low base rate probability of NOT speaking for all children) the pattern is still noteworthy for exploration in future research in that children at some level perhaps seem to know that the talking helps them as such children are slightly more likely to choose to engage in private speech spontaneously.

4. Discussion

The current study explored relations between speech and task performance and variations in speech use as a function of speech instructions among young children with and without externalizing behavior problems. Kindergarten and preschool teachers must decide on a daily basis how much overt self-talk to allow and/or encourage from the children in their classrooms (Deniz, 2004; Oliver et al., 2003). Previous work has recommended that teachers allow, if not encourage, private speech use among their students to take advantage of its self-regulatory functions (Berk & Winsler, 1995; Winsler, Diaz et al., 2000; Winsler, Carlton et al., 2000; Winsler & Diaz, 1995) but still little has been known about the effect of speech instructions on children's speech use and task performance and about whether speech instructions function differently for children with and without behavior problems. Findings from the present study showed overall that children from both groups do indeed respond to speech instructions and that performance on motor sequencing and counting tasks is improved when children are asked to speak out loud. During the counting task overall, 78% of the children performed either the same or better when speaking than when they were silent. Thus, the present investigation supports the recommendation that early childhood teachers should allow, if not actually encourage, private speech use among their children during cognitive problem-solving tasks.

It is interesting to note here (but still only suggestive due to the small number of children in some of the cells) that although the majority of the children were able to follow speech instructions of the experimenter, there was a notable minority of children who were not able to modify their spontaneous patterns of speech use (or non-use). A full third of the children (and the same for both groups) was not able to stop talking out loud to themselves during the counting task when asked to be silent. Also, although the behaviorally at-risk children were always able to talk when asked, 22% of the typical youngsters who spontaneously approached the counting task with silence were not able to count out loud when asked to do so. It is thus important for teachers and parents to understand that although encouragement of speech appears to help, it should not be seen as a problem if a fourth or so of the children do not talk to themselves when asked. In this study, children's performance on the task still increased under speech instructions regardless of whether or not the child actually talked. Similarly it is important for adults to understand that it may be considerably difficult for a large proportion of five-year-old children to stop talking to themselves during a task if they are asked to be silent. Private speech appears to be a natural way that some children approach problems and it is difficult to modify this for some children. This means that if a child fails to be silent during a task after being asked to stop talking, it is not necessarily an act of defiance on the part of the child. It may be that the child actually cannot physically be silent while completing the task.

Consistent with previous work (Berk & Potts, 1991; Winsler, 1998; Winsler et al., 1999), the present study found that children with externalizing behavior problems are more likely to spontaneously talk to themselves, without instructions to do so, compared to children without behavior problems. Fully 93% of children in the behaviorally at-risk group talked aloud to themselves at least once during the unconstrained motor sequencing trials (compared to 70% for typical children), with 69% of their trials spontaneously containing speech (compared to 47% for controls). Similarly, during the counting portion of the task, children seen by their teachers as having behavioral difficulties were more likely (93%) to count out loud than their typical peers (79%). But does the use of such speech appear to help behaviorally difficult children? It is interesting to note, in this connection, that there were never group differences observed in task performance. Children with problems of behavior control did just as well on these tasks as comparison children, but they were more likely to use speech while doing so. Perhaps it is the extra speech used by the behaviorally at-risk children that helps normalize their performance on such tasks.

For the control children, during the sequencing task with no speech instructions, speech did not seem to be related to performance in any way. These children completed their trials with 70% accuracy regardless of whether they were always silent, sometimes silent and sometimes talking, or always talking on the items. However, in the same unconstrained phase of the task for children with behavior problems, speech was related to performance in complex ways. Again, but only suggestive due to small cell sizes, children who were always silent performed the worse (50%) and children who always talked on the trials performed better (69%). Behaviorally at-risk children who went back and forth between talking and being silent appeared to talk to themselves on the more difficult trials, because for them on

silent trials they were correct 74% of the time and on trials when they spoke, they were 65% correct. Recall that on the sequencing phase with instructions to talk, for both groups of children, youngsters who talked performed better than those who did not and when talking varied within the individual across items, children were more likely to get the items correct when talking than when they were not.

The fact that children having problems with behavioral control are the ones who are most likely to talk out loud to themselves might be one factor that could inadvertently help lead early childhood teachers to the conclusion that they need to squelch such verbal behavior among their students. Given that children with behavior concerns elicit increased direction and control from adults (Olson, Bates, & Bayles, 1990; Winsler, 1998), teachers may unnecessarily ask children to be quiet in classrooms out of fear that such speech coming from difficult-to-manage children will lead to problem behavior. Teacher training and professional development efforts could thus focus on helping teachers avoid such a conclusion and suggest that teachers increase their tolerance level for children's non-disruptive overt private speech use in the classroom.

In the present study, child age essentially interacted with speech instructions to predict performance. Older children outperformed younger children during the no speech instructions condition, but these age differences in performance were not found for the speech instructions condition. By giving children instructions to use speech, performance differences associated with age disappeared. Such findings are consistent with other work (Müller et al., 2004) that has found that younger children (in this case, 3 year olds) were able to perform as well as older children (4-year-olds) on an executive functioning task – involving selecting a card with the same color as another card that had an incongruent colored piece of candy on it – when they were asked to verbally label the pictures while doing the task. Such findings are also consistent with the notion of a production deficiency discussed in the strategy development literature, whereby young children may not spontaneously use a successful strategy during a task (in this case, speech), but when told to do so they can use it and the use of the strategy is positively related to performance (Miller, 1990). Given that the children in the present study were 4–6 years old, old enough to have already used self-talk for some time and perhaps on the downward slope of internalizing their private speech, the instructions provided here likely encouraged the children to use a tool that they had used before and doing so appears to have helped the younger children perform at similar levels as the older children. Thus it would appear that asking children to talk out loud may be mostly beneficial for younger (age 3–5) children and perhaps not as effective for children around 6 years of age.

The finding that both groups of children performed better on the motor sequencing task when they were given instructions to talk compared to when no instructions were given is consistent with other studies (Lee, 1999) and suggests that either allowing, encouraging, or giving children instructions for them to use speech as a strategy during tasks can lead to increased performance. Although Diaz and Berk (1995), warn that there are likely conditions under which giving children instructions to use speech can hinder their natural (silent) performance, the present study did not find this, so it remains to be elucidated in future research under which conditions adults should not encourage private speech, or whether it is the type or specificity of the speech instructions that matters.

A number of limitations of the present research should be noted and remedied in future research. First, children studied here had all been to preschool for several years. To the extent that instructions to verbalize may be a part of children's regular preschool experience, such schooling could conceivably have affected children's propensity to talk during the task in the first place and children's response to speech instructions. Although certainly a possibility, the limited research that does exist on teacher practices with regard to children's self-talk suggests that teachers do not do much active encouraging of self-talk in the early childhood classroom (Deniz, 2004). Second, children in the behaviorally at-risk group were identified only on the basis of preschool teacher ratings and the instrument used focused on attention and externalizing problems. Future research will have to determine the extent to which the same patterns found here are true for various clinical and non-clinical groups of children presenting with different types of behavioral difficulties. Third, the sample size for the present study was rather small, especially in the case of certain analyses that necessitated the inclusion of smaller subgroups of children.

Finally, in terms of implications of this study for intervention with young children with behavioral difficulties, it is important to recall that preschool children identified by their teachers as having behavioral issues are at significant risk for later behavioral disturbances at elementary school entry and beyond (Campbell, Pierce, March, Ewing, & Szumowski, 1994; Egeland, Kalkoske, Gottesman, & Erickson 1990), and thus early intervention is warranted. This study demonstrates that young children with externalizing behavior problems do spontaneously use private speech for self-regulation, and that when asked to speak, their task performance is improved. Such findings are important for practitioners designing interventions to assist impulsive and disruptive children in using self-speech to guide behavior

as they suggest that gently suggesting that youngsters talk to themselves might be helpful. It is important to point out that this does not mean that strict instructions and specific scripts of things for children to say to themselves are necessarily appropriate. It would appear that it is important for children to have some control themselves over what exactly they say to themselves. Diaz and Berk (1995) and others (Winsler, 1998) argue that self-instructional interventions for children with behavior problems should be based on giving opportunities and social scaffolding for such children to spontaneously talk to themselves during challenging tasks rather than introducing and teaching particular, rigid, verbal scripts for the children to follow.

Acknowledgements

This research was supported by a grant from the William T. Grant Foundation. We would like to thank the participating children, families, and preschools.

References

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed. revised). Washington, DC: American Psychiatric Association.

Balamore, U., & Wozniak, R. H. (1984). Speech–action coordination in young children. *Developmental Psychology*, *20*, 850–858.

Behrend, D. A., Rosengren, K. S., & Perlmutter, M. (1989). A new look at children's private speech: The effects of age, task difficulty, and parent presence. *International Journal of Behavioral Development*, *12*, 305–320.

Berk, L. E. (1986). Relationship of elementary school children's private speech to behavioral accompaniment to task, attention, and task performance. *Developmental Psychology*, *22*, 671–680.

Berk, L. E. (1992). Children's private speech: An overview of theory and the status of research. In R. M. Diaz & L. E. Berk (Eds.), *Private speech: From social interaction to self-regulation* (pp. 17–53). Hillsdale, NJ: Erlbaum.

Berk, L. E., & Landau, S. (1993). Private speech of learning disabled and normally achieving children in classroom academic and laboratory contexts. *Child Development*, *64*, 556–571.

Berk, L. E., & Potts, M. K. (1991). Development and functional significance of private speech among attention-deficit hyperactivity disordered and normal boys. *Journal of Abnormal Child Psychology*, *19*, 357–377.

Berk, L. E., & Spuhl, S. T. (1995). Maternal interaction, private speech, and task performance in preschool children. *Early Childhood Research Quarterly*, *10*, 145–169.

Berk, L. E., & Winsler, A. (1995). *Scaffolding children's learning: Vygotsky and early childhood education*. Washington, DC: National Association for the Education of Young Children.

Birch, D. (1966). Verbal control of nonverbal behavior. *Journal of Experimental Child Psychology*, *4*, 266–275.

Bjorklund, D. F., & Douglas, R. N. (1997). The development of memory strategies. In N. Cowan & C. Hulme (Eds.), *The development of memory in childhood* (pp. 201–246). East Sussex, UK: Psychology Press.

Camp, B. W., Blom, G. E., Herbert, F., & van Doorninck, W. J. (1977). "Think Aloud": A program for developing self-control in young aggressive boys. *Journal of Abnormal Child Psychology*, *5*, 157–169.

Campbell, S. B., Pierce, E. W., March, C. L., Ewing, L. J., & Szumowski, E. K. (1994). Hard-to-manage preschool boys: Symptomatic behavior across contexts and time. *Child Development*, *65*, 836–851.

Copeland, A. P. (1979). Types of private speech produced by hyperactive and nonhyperactive boys. *Journal of Abnormal Child Psychology*, *7*, 169–177.

Deniz, C. B. (2004). Early childhood teachers' beliefs about, and self-reported practices toward, children's private speech. *Dissertation Abstracts International Section A: Humanities & Social Sciences, 64*(9-A).

Diaz, R. M. (1992). Methodological concerns in the study of private speech. In R. M. Diaz & L. E. Berk (Eds.), *Private speech: From social interaction to self regulation* (pp. 55–81). Hillsdale, NJ: Erlbaum.

Diaz, R. M., & Berk, L. E. (Eds.). (1992). *Private speech: From social interaction to self-regulation*. Hillsdale, NJ: Erlbaum.

Diaz, R. M., & Berk, L. E. (1995). A Vygotskian critique of self-instructional training. *Development and Psychopathology*, *7*, 369–392.

Diaz, R. M., Winsler, A., Atencio, D. J., & Harbers, K. (1992). Mediation of self-regulation through the use of private speech. *International Journal of Cognitive Education and Mediated Learning*, *2*, 1–13.

Duncan, R. M., & Pratt, M. W. (1997). Microgenetic change in the quantity and quality of preschoolers' private speech. *International Journal of Behavioral Development*, *20*, 367–383.

Egeland, B., Kalkoske, M., Gottesman, N., & Erickson, M. F. (1990). Preschool behavior problems: Stability and factors accounting for change. *Journal of Child Psychology and Psychiatry*, *31*, 891–909.

Fernyhough, C., & Fradley, E. (2005). Private speech on an executive task: Relations with task difficulty and task performance. *Cognitive Development*, *20*, 103–120.

Frauenglass, M. H., & Diaz, R. M. (1985). Self-regulatory functions of children's private speech: A critical analysis of recent challenges to Vygotsky's theory. *Developmental Psychology*, *21*, 357–364.

Gaskill, M. N., & Diaz, R. M. (1991). The relation between private speech and cognitive performance. *Infancia y Aprendizaje*, *53*, 45–58.

Goodman, S. H. (1981). The integration of verbal and motor behavior in preschool children. *Child Development*, *52*, 280–289.

Kagan, J. (1966). Reflectivity-impulsivity: The generality and dynamics of conceptual tempo. *Journal of Abnormal Psychology*, *71*, 17–24.

Kendall, P. C. (1977). On the efficacious use of verbal self-instructional procedures with children. *Cognitive Therapy & Research*, *1*, 331–341.

Krafft, K. C., & Berk, L. E. (1998). Private speech in two preschools: Significance of open-ended activities and make-believe play for verbal self-regulation. *Early Childhood Research Quarterly*, *13*, 637–658.

Lee, J. (1999). The effects of five-year-old preschoolers' use of private speech on performance and attention for two kinds of problems-solving tasks. *Dissertation Abstracts International Section A: Humanities and Social Sciences, 60*(6-A), 1899.

Lovaas, O. I. (1961). Interaction between verbal and nonverbal behavior. *Child Development*, *32*, 329–336.

Lovaas, O. I. (1964). Cue properties of words: The control of operant responding by rate and content of verbal operants. *Child Development*, *35*, 245–256.

Luria, A. R. (1959). The directive function of speech in development and dissolution. Part 1: Development of the directive function of speech in early childhood. *Word*, *15*, 341–352.

Luria, A. R. (1961). In J. Tizard (Ed.), *The role of speech in the regulation of normal and abnormal behavior*. New York: Liveright.

Manfra, L., Davis, K. D., Ducenne, L., & Winsler, A. (submitted for publication). *Self-control in preschool children: Verbal rule execution, perceptual interference, and inhibition strategies during a resistance-to-temptation task*.

Manfra, L., & Winsler, A. (in press). Preschool children's awareness of private speech. *International Journal of Behavioral Development*.

Meichenbaum, D., & Goodman, J. (1969a). Reflection-impulsivity and verbal control of motor behavior. *Child Development*, *40*, 785–797.

Meichenbaum, D., & Goodman, J. (1969b). The developmental control of operant motor responding by verbal operants. *Journal of Experimental Child Psychology*, *7*, 553–565.

Meichenbaum, D. H., & Goodman, J. (1971). Training impulsive children to talk to themselves: A means of developing self-control. *Journal of Abnormal Psychology*, *77*, 115–126.

Miller, P. H. (1990). The development of strategies of selective attention. In D. F. Bjorklund (Ed.), *Children's strategies: Contemporary views of cognitive development* (pp. 157–184). Hillsdale, NJ: Erlbaum.

Mischel, W., & Patterson, C. J. (1976). Substantive and structural elements of effective plans for self-control. *Journal of Personality & Social Psychology*, *34*, 942–950.

Müller, U., Zelazo, P. D., Hood, S., Leone, T., & Rohrer, L. (2004). Interference control in a new rule use task: Age-related changes, labeling, and attention. *Child Development*, *75*, 1594–1609.

Oliver, J. A., Edmiaston, R., & Fitzgerald, L. M. (2003, April). Regular and special education teachers' beliefs regarding the role of private speech in children's learning. In A. Winsler (Chair), *Awareness, attitudes, and beliefs concerning children's private speech.* Presented at the biennial meeting of the Society for Research in Child Development, Tampa, FL.

Olson, S. L., Bates, J. E., & Bayles, K. (1990). Early antecedents of childhood impulsivity: The role of parent–child interaction, cognitive competence, and temperament. *Journal of Abnormal Child Psychology*, *18*, 317–334.

Patterson, C. J., & Mischel, W. (1975). Plans to resist distraction. *Developmental Psychology*, *11*, 369–378.

Patterson, C. J., & Mischel, W. (1976). Effects of temptation-inhibiting and task-facilitating plans on self-control. *Journal of Personality & Social Psychology*, *33*, 209–217.

Tinsley, V. S., & Waters, H. S. (1982). The development of verbal control over motor behavior: A replication and extension of Luria's findings. *Child Development*, *53*, 746–753.

Vygotsky, L. S. (1978). In M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.), *Mind in society: The development of higher mental processes*. Cambridge, MA: Harvard University Press (Original work published 1930, 1933, 1935).

Vygotsky, L. S. (1987). Thinking and speech. In R. W. Rieber, A. S. Carton (Eds.), *The collected works of L.S. Vygotsky: Vol. 1. Problems of general psychology* (N. Minick, Trans., pp. 37–285). New York: Plenum (Original work published 1934).

Winsler, A. (1998). Parent–child interaction and private speech in boys with ADHD. *Applied Developmental Science*, *2*, 17–39.

Winsler, A., Carlton, M. P., & Barry, M. J. (2000). Age-related changes in preschool children's systematic use of private speech in a natural setting. *Journal of Child Language*, *27*, 665–687.

Winsler, A., De León, J. R., Wallace, B., Carlton, M. P., & Willson-Quayle, A. (2003). Private speech in preschool children: Developmental stability and change, across-task consistency, and relations with classroom behavior. *Journal of Child Language*, *30*, 583–608.

Winsler, A., & Diaz, R. M. (1995). Private speech in the classroom: The effects of activity type, presence of others, classroom context, and mixed-age grouping. *International Journal of Behavioral Development*, *18*, 463–488.

Winsler, A., Diaz, R. M., & Montero, I. (1997). The role of private speech in the transition from collaborative to independent task performance in young children. *Early Childhood Research Quarterly*, *12*, 59–79.

Winsler, A., Diaz, R. M., McCarthy, E. M., Atencio, D. J., & Adams Chabay, L. (1999). Mother–child interaction, private speech, and task performance in preschool children with behavior problems. *Journal of Child Psychology & Psychiatry*, *40*, 891–904.

Winsler, A., Diaz, R. M., Atencio, D. J., McCarthy, E. M., & Adams Chabay, L. (2000). Verbal self-regulation over time in preschool children at risk for attention and behavior problems. *Journal of Child Psychology & Psychiatry*, *41*, 875–886.

Winsler, A., & Naglieri, J. (2003). Overt and covert verbal problem-solving strategies: Developmental trends in use, awareness, and relations with task performance in children aged 5 to 17. *Child Development*, *74*, 659–678.

Winsler, A., Naglieri, J. A., & Manfra, L. (2006). Children's search strategies and accompanying verbal and motor strategic behavior: Developmental trends and relations with task performance among children age 5 to 17. *Cognitive Development*, *21*, 232–248.

Wozniak, R. (1972). Verbal regulation of motor behavior: Soviet research and non-Soviet replications. *Human Development*, *44*, 13–47.

Wozniak, R. H. (1975). A dialectical paradigm for psychological research: Implications drawn from the history of psychology in the Soviet Union. *Human Development*, *18*, 18–34.