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Research-Based Practices as a Protective Factor for Students At-Risk for Academic Failure

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Abstract

Increasing pressure on teachers and administrators due to high-stakes testing has led to increased risk to our most vulnerable population, those students who arrive at school without the prerequisite skills necessary to successfully participate in the academic climate of the classroom. Unfortunately, given the large range of ability levels often present even in early elementary schools, teachers face enormous challenges in meeting the needs of all their students. Further, due to the challenges inherent in teaching low-achieving students, and the ensuing classroom behavior problems often presented by these students, teachers may be conditioned to avoid interacting with these students, particularly during academic instruction. Accumulated over time this differential treatment adds another risk factor that may contribute to students' negative developmental outcomes. The purpose of this paper is to review the literature on academic interventions for low achieving elementary students that might serve to remedy early learning problems in the classroom, thereby setting the stage for improved academic and social competence manifested by desired teacher and peer relationships predictive of school success.

Nature of the Problem

Academic success achieved early in children's school experience is associated with many positive developmental outcomes (Gottfried, Fleming, & Gottfried, 2001). At the same time academic problems, like early antisocial behaviors, if not remediated become extremely resistant to intervention over time (Hinshaw, 1992). To illustrate, a meta-analysis on the effects of one-to-one tutoring with students at-risk for academic failure indicated moderately strong effects for students in grades kindergarten through 3, but no effects for students in grades 4 and higher (Elbaum, Vaughn, Hughes, & Moody, 2000). Further, Juel (1988) found that reading problems that go undetected and unaddressed are likely to persist, and remediation becomes increasingly difficult as soon as 3rd grade (Mastropieri, Leinhart, & Scruggs, 1999). Thus, data that indicate that large percentages of students performing below basic levels of proficiency in reading (37%; Donahue, Finnegan, Lutkas, Allen, & Campbell, 2001) and math (31%; Braswell et al., 2001) in fourth grade are particularly troubling.

Meanwhile, teachers are providing instruction to classrooms of students that are increasingly diverse in a multitude of areas, including academic ability, social competence, disability, cultural, linguistic, and socio-economic status, to name but a few (Maheady, Harper, & Mallette, 2001; Mathes, Torgesen, & Allor, 2001). For example, the academic abilities of students in a first grade classroom already can vary by several grade levels (Mathes, 1999). Teachers must also accommodate these differences in an educational context that emphasizes application, problem-solving, and teaching for understanding, all tied to high-stakes testing (Maheady et al.). As Maheady et al. note, "In essence, classroom teachers are being asked to do more with less, while ultimately doing it better." (p. 6).

Further adding to the instructional challenge faced by classroom teachers in the 21st century is the complex relationship between academic problems and behavior problems. Many students who are low achievers academically also exhibit problematic classroom behavior that makes them even more difficult to teach (Sutherland & Wehby, 2001). To illustrate, Tomblin, Zhang, and Buckwalter (2000) found a significant relationship between reading problems and behavior problems in a sample of 2nd grade students. Rabiner, Coie, and The Conduct Problems Prevention Research Group (2000) examined the relationship between attention problems and reading achievement; findings indicated that attention problems play an important role in the development of reading problems. Two theoretical explanations for how teacher-student interactions may be impacted by learning and behavior problems, and the ensuing effects on student achievement and school outcomes, are the Negative Reinforcement Cycle (e.g., Gunter & Coutinho, 1997; Gunter, Denny et al., 1993; Gunter et al., 1994; Shores, Gunter, & Jack, 1993) and the Transactional Nature of Social Interchanges (Sameroff, 1983; 1995; 2000; Sutherland & Morgan, in press; Sutherland & Oswald, 2003), which are not mutually exclusive.

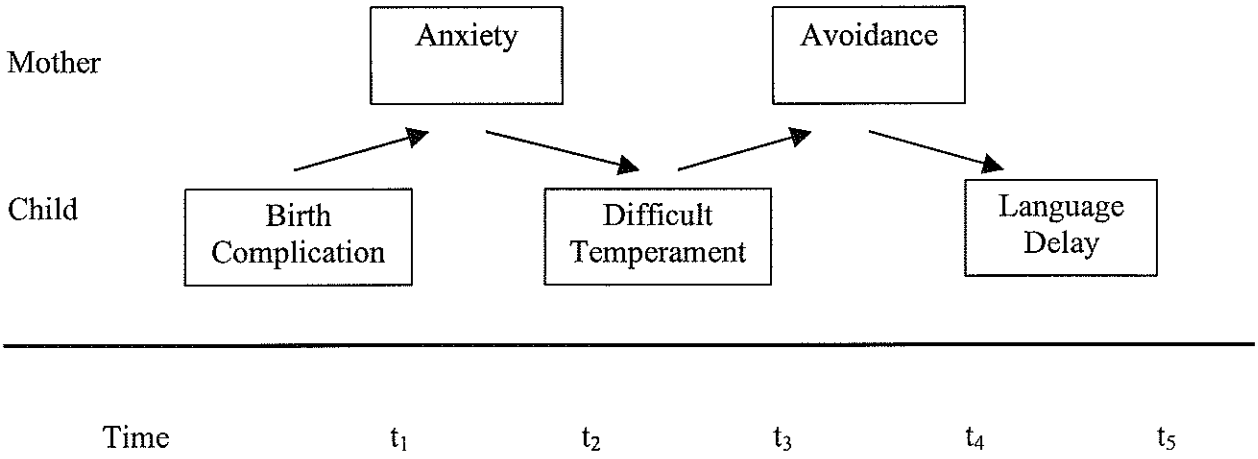
Negative Reinforcement and Transactions Between Teachers and Students

Negative reinforcement occurs when the removal of an aversive stimulus is contingent on the emission of a response that has the effect of increasing the future probability of that response (Skinner, 1953). Sidman (1989) characterized negative reinforcement as coercion, and posited that both our society in general, and classrooms specifically, are by nature coercive. For example, students may study for a test to avoid failing, and this form of coercion is an accepted aspect of education. As Sidman and others (e.g., Gunter & Coutinho, 1997; Gunter, Denny et al., 1993; Gunter et al., 1994; Shores et al., 1993) have pointed out, however, coercion in classrooms can have detrimental effects as well.

Classroom environments are characterized by interactions between teachers and students. When these interactions become coercive in nature, escape and/or avoidance may occur (Sidman, 1989). Responses that remove or reduce aversive stimuli are defined as escape behavior, whereas responses that avoid or postpone the occurrence of aversive stimuli are referred to as avoidance behavior. To illustrate, a student may disrupt class, resulting in an office referral, to avoid having to read in public; another student may escape school altogether by dropping out. The negative reinforcement cycle suggests that students exhibit escape and avoidance behaviors in response to aversive stimuli, namely ineffective academic instruction (Gunter, Denny et al., 1993; Gunter et al., 1994). Furthermore, these escape and avoidance behaviors are often disruptive and aggressive in nature, serving as aversive stimuli for the teacher; teachers then may engage in further escape and/or avoidance behaviors through non-instruction of the student exhibiting the problem behavior (Gunter & Coutinho, 1997).

While helpful in understanding academic interactions between teachers and students, the negative reinforcement cycle fails to take into account the dynamic, ongoing nature of social interchanges. It is in this area that the transactional model of social interchanges complements the negative reinforcement cycle. The transactional model (Sameroff, 1995) describes development as a product of the ongoing interaction between the child and the experiences provided by the environment (i.e., the family and the broader social context). In this model, not only is the child shaped by the environment, but the child also affects the environment, and is in turn impacted by those environmental effects he has wrought. Figure 1, adapted from Sameroff (1995), illustrates the transactional model in the etiology of delayed language development. The child's outcome at any point in time is the product not of the state of the environment or the state of the child, but of the complex relationship between the child and the environment over time.

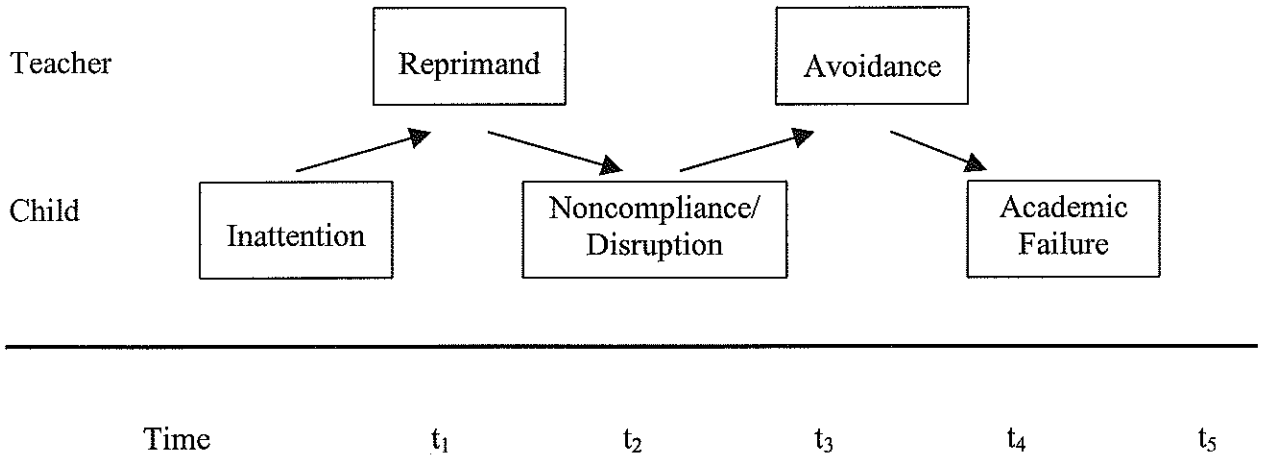
Figure 1. Transactional example of etiology of language delay (adapted from Sameroff, 1995)



The transactional model has strong implications for application to academic interactions in classrooms. To illustrate, research has documented that teachers avoid interacting with students who exhibit the most problematic behavior, while choosing to engage in more instructional interactions with students who exhibited more appropriate behavior (e.g., Carr, Taylor, & Robinson, 1991; Wehby, Symons, Canale, & Go, 1998). Furthermore, lower achieving students, regardless of whether or not they exhibit disruptive classroom behavior, may receive fewer instructional interactions from teachers because teaching them is less rewarding (Greenwood, 1996), which is particularly troubling given research that suggests students at-risk for reading failure require considerably more instructional time to achieve at normal levels (Torgesen, 1997, 1998). In either case, the student's academic response opportunities may be affected by his/her impact on the classroom environment, specifically his/her disruptive behavior or low achievement (Sutherland & Morgan, in press). Given the strong association between active student responding and academic achievement (Greenwood, Delquardi, & Hall, 1984), students who exhibit problematic classroom behavior and/or have low achievement face even more risk for school failure due to differential treatment, represented by fewer response

opportunities, in the classroom. Figure 2 illustrates how student outcomes may be impacted both by the environment, and by the student's effect on the environment. In this example, a teacher reprimands a student for inattention during academic instruction, and the student responds with noncompliance or disruptive behavior. The teacher subsequently avoids interacting with the noncompliant/disruptive student, either by reducing the rate of academic interactions with the student (Gunter & Coutinho, 1997) or by instituting punitive disciplinary procedures that may result in the removal of the student from the classroom (Maag, 2001); each of these avoidance strategies contributes to the student's academic failure.

Figure 2. Transactional example of etiology of academic failure



This example closely resembles the negative reinforcement cycle discussed by Gunter and colleagues (Gunter & Coutinho, 1997; Gunter et al., 1993; Gunter et al., 1994); but an important implication of the transactional model is that not only do teacher behaviors impact students (and vice versa in a reciprocal fashion), but there are often other factors that impact teachers and students at any point in an interaction sequence. Sameroff (1983; 2000) describes this complex determination of behavior as a product of the transactions between the phenotype

(i.e., the child), the environtype (i.e., the environmental context), and the genotype (i.e., the source of biological organization). Thus, extending the example provided in Figure 2, Sameroff's model of transactional development suggests other factors that may influence classroom behavior such as the teacher's health, the physical arrangement of the classroom, curricular demands placed on the student, and peer influences. Furthermore, implications of transactional processes include the teacher and the student influencing each others' downstream behavior. That is, a student who elicits particular responses from a teacher early in his school career, such as coercive responses to inattentive behavior, may be more likely to continue to elicit such reactions from *other* teachers in the future (Sameroff & Mackenzie, 2003); moreover, the teacher might be conditioned to respond similarly to *other* students exhibiting similar behavior in the future as well.

In summary, the negative reinforcement theoretical perspective posits that some children avoid/escape aversive tasks in the classroom through their aberrant behavior, conditioning teachers to avoid future interactions with them due to the likelihood of behavior deemed aversive by the teachers. The transactional theory, as applied to academic interactions, suggests that multiple factors influence student behavior, and student behavior in turn influences teacher behavior. These theories will provide a foundation for this paper, suggesting that the poor academic trajectories of many students is affected adversely by teacher escape and/or avoidance (negative reinforcement) and the differential treatment of low-achieving and disruptive students (transactional theory).

Purposes of the Review

Two specific perspectives provide the rationale for this review. First, cost-effective, sustainable interventions are typically going to be implemented by teachers in their classrooms. These practices have the greatest effect as they reach the largest number of students, and they

impact students year after year. Second, a relationship between low achievement and problem behavior that has been documented early in children's school experiences, and the impact this relationship might have on teacher student-interactions in the classroom, will affect the fidelity with which these interventions reach their targeted population. Therefore, the purposes of this review are to: (1) review the literature on interventions for low achievers, specifically in reading and mathematics; and (2) review the literature on teacher-student interactions in the classroom, focusing on the potential impact on teacher behavior and implications for student academic outcomes. After the literature in each of these two areas is reviewed, findings will be summarized and integrated. Last, implications for practice will be discussed.

Interventions for Low-Achieving Students

Criteria for inclusion in this review included the meta-analysis or study (a) having as participants students identified as low achievers; (b) examining the effect of an independent variable on one or more dependent variables of an academic nature; and (c) having been published in a refereed journal. Search procedures consisted of four steps. First, computer databases (ERIC, 1966 to present; PsycInfo, 1967 to present) were searched using the descriptors meta-analysis, low achievement, low achievers, academics, reading, mathematics, and interventions. Second, a hand search of prominent journals (e.g., *American Educational Research Journal, Elementary School Journal, Journal of Educational Psychology, Journal of Learning Disabilities, Journal of Special Education*) was conducted for the last two years. Next, an ancestral search of identified articles was conducted. Finally, based upon findings of the meta-analyses, selected articles were selected for further review. As such, the following sections will describe intervention research in (1) math achievement, (2) reading achievement, and (3) the effects of peer-assisted learning.

Interventions for Students with Low Achievement in Mathematics. Baker, Gersten, and Lee (2002) synthesized research on the effects of interventions to improve the math achievement of students identified as low achieving using meta-analytic techniques. Mean effect sizes were computed for the 15 studies that met inclusion criteria. Studies were coded into one of five types; effects sizes for four interventions (peer-assisted learning, providing students and/or teachers with data on student performance, explicit instruction, and providing parents with information) had low to moderately positive effect sizes, while one (contextualized instruction) had an effect size of .01. The following discussion will center upon the four interventions associated with positive effects on students' math achievement.

Peer-assisted learning. Six studies examined the effects of peer-assisted learning (PAL) on mathematics achievement of low achieving students. Peer-assisted learning is generally defined as providing strategies and structures that enable students to provide each other with feedback and support. The PAL reviewed in this meta-analysis had students work in dyads, and all were reciprocal in nature. That is, students alternate in the role of tutor and tutee, and students are systematically trained in procedures for the tutoring sessions. The average effect size of .62 was the largest effect size of the interventions reviewed here.

Baker et al. (2002) note that PAL allows students who may be uncertain about problem-solving, but do not have immediate access to their teachers, to seek feedback from their peers. Further, peers can, if instructed, provide the student with suggestions to solve a problem themselves. Finally, researchers who have investigated peer tutoring have emphasized that it is likely to encourage low achievers to persist in their work, which is particularly relevant given that low achieving and students at-risk for academic failure typically are less actively engaged than their peers (e.g., Greenwood, Delquardi, & Hall, 1989; Skinner & Belmont, 1993).

One recent study not included in the meta-analysis examined the effects of a peer tutoring intervention (peer-assisted learning strategies; PALS) on the mathematics development of kindergarten students in 20 classrooms (Fuchs, Fuchs, & Karns, 2001). Classrooms were randomly assigned to either the PALS condition (implemented for 20 minutes twice weekly) or a no treatment condition which consisted of the normal mathematics instruction which followed the district's core curriculum. Student growth, as measured by the Stanford Early School Achievement Test (SESAT) in the PALS classrooms exceeded that of students in the no treatment classroom (ES = .24). Stronger effects on the SESAT were noted for students of medium initial achievement (ES = .53), low achievement (ES = .46), and for students with disabilities (ES = .41), than for students with high achievement (ES = -.20). Interestingly, the authors anticipated this potential effect for high achievers on the SESAT due to a ceiling effect; therefore they also used the mathematics portion of the Stanford Achievement Test as the span of skills tested would provide a more accurate measure of student growth. The effect size of PALS on the Stanford scores for high achieving students was .67, and the authors suggest that high-achieving students may have benefited from constructing explanations for peers in their peer tutoring dyads.

Providing students and/or teachers with data on student performance. Four studies examined the effect of providing teachers and/or students with specific data on student performance. In five of six comparisons across the four studies, students received information on their effort or performance in problem- solving or received recommendations from the teacher or a computer regarding the number of problems they should work in a given period of time. This intervention had the third largest effect size of the meta-analysis (ES = .57).

One study included in this review that was particularly promising was conducted by Fuchs, Fuchs, Hamlett, Phillips, and Bentz (1994). This investigation had two experimental

conditions and a comparison group. Students in the two experimental conditions took weekly tests on the computer, which used items from the state mathematics content standards. The software then created graphs depicting students' individualized performance over time. Teachers in the comparison condition used their typical procedures for monitoring student progress. Additionally, in one of the experimental conditions, teachers were also provided with computer-generated recommendations on content to teach the full class, based upon class profiles derived from the weekly assessment data, as well as information about grouping students for small group instruction, a listing of computer lessons to use with individual students, and suggestions on how to use peer tutoring to provide students with daily practice and reinforcement on learned skills. Baker et al. (2002) performed orthogonal contrasts on the effect of (a) providing weekly performance data (ES = .29), and (b) providing teachers with instructional recommendations based on the performance data (ES = .51). Baker et al. suggest that merely providing teachers with performance data may not be as effective as also providing instructional suggestions based upon student data.

Explicit instruction. Four studies investigated the effects of explicit mathematics instruction on the mathematics achievement of low- achieving students. Several of the studies used principles outlined in Engelmann and Carnine (1982), typically referred to as Direct Instruction. In general, these studies used interventions that taught rules, concepts, principles, and problem-solving strategies in an explicit manner. The mean effect size for studies using explicit instruction was .58, which was the second highest of the research reviewed by Baker et al. (2002). However, for the purposes of this review the only study of interest here is Cardelle-Elawar (1995), as the remaining studies examined the effects of explicit math instruction on low-achieving middle and high school students.

Cardelle-Elawar (1995) used explicit instruction principles in combination with a problem-solving approach on a general measure of mathematics achievement. This approach focused on strategy instruction, with students working individually on problems, under close supervision of the teacher, after the teacher extensively modeled how students should ask themselves questions when faced with math problems. The effect size for this study was .32.

Providing parents with information. Two studies examined the effects of providing information to parents which described examples of students' efforts and successes in math. All examples shared were positive and focused on what the student had learned or on activities on which the student had worked particularly diligently. The role of the parent was not math teacher; rather the interventions focused on helping the parent become a more knowledgeable supporter of their children's math development. The effect size for this intervention was .42. Baker et al. (2002) note that this effect size was not significant, although the "low cost" of the intervention warrants a closer look at future research in this area.

Summary. Results from the meta-analysis provide several instructional recommendations to maximize the effectiveness of math instruction for low achieving students. Reciprocal peer tutoring appears to be a classwide intervention that has benefits for a range of achievement levels in the elementary school classroom. Providing students and/or teaches with systematic performance data and explicit instruction also have moderate effects on students' math achievement, and communicating with parents seems to hold promise as an effective intervention. Finally, contextualized instruction does not appear to be effective with low achieving students; Baker et al. (2002) suggest that low achievers might have more difficulty with authentic problem-solving and discussion of math concepts without solid instruction and preparation in mathematics basic skills.

Interventions for Students with Low Achievement in Reading

A meta-analysis examining the effects of interventions on the reading achievement of low-achieving students has not been conducted. However, in 2000 the National Reading Panel published findings from an extensive best-evidence synthesis, using meta-analytic techniques, on various methods to teach reading (National Reading Panel, 2000). Based upon the findings of this report, and information gathered from recently published research syntheses and meta-analyses of specific instructional methods (e.g., Chard, Vaughn, & Tyler, 2002; Elbaum, Vaughn, Hughes, & Moody, 2000), several recent studies will be discussed that have examined interventions on the reading achievement of students with low achievement that hold promise for practitioners. These interventions are phonological awareness training, peer-assisted learning, and one-to-one tutoring. However, seminal research in this area often combines various aspects of these methodologies, such as one-to-one tutoring and phonological awareness training (Torgesen et al., 1999) or peer-assisted learning and phonological awareness training (Mathes, Torgesen, & Allor, 2001). Therefore, the literature will be organized below according to the primary purpose of the research as indicated by the authors.

Phonological awareness training. Torgesen et al. (1999) note that prevention research with students identified as at-risk for reading failure, to be maximally effective, should contain a combination of instruction to help children construct the meaning of text as well as to improve word identification and fluency. At the same time, given time and resource limitations, identifying the most effective interventions for students with early reading problems is critical, as phonemic awareness deficits and rapid automatic naming ability exercise unique causal influences on the rate at which children learn to read (Wagner et al., 1997). Similar to findings of explicit instruction in mathematics highlighted by the Baker et al. (2002) meta-analysis, reviews

have indicated that explicit instruction in phonemic awareness has had significant effects on measures of reading achievement (e.g., Pikulski, 1994; Wasik & Slavin, 1993).

Torgesen et al. (1999) contrasted two experimental conditions for teaching phonological awareness and phonemic reading skills, a third intervention designed to be more closely aligned with each child's classroom reading instruction (supplemental tutoring), and a no treatment control, with a sample of 180 kindergarten students. The student sample was identified from all kindergarten children in 13 elementary schools (N = 1,436) by their low combined scores on a letter naming task and phonemic elision task, and had an estimated Verbal IQ above 75, and were randomly assigned to one of the four instructional condition within schools.

Children in each of the treatment conditions received four 20-min sessions of one-to-one instruction per week for 2 and a half years, beginning in the second semester of kindergarten. One experimental condition (PASP) provided explicit instruction in phonemic awareness, as well as reading text as soon as children showed reasonable mastery of a group of 10 consonants and 3 vowels. A second experimental condition (EP) used less explicit instruction in phonological awareness and an increased reliance on recognizing words and groups of words, relying upon letter-sound correspondence and reading and writing sentences. As soon as students had a small working vocabulary they began learning words from a basal series containing words they were learning. The children assigned to the third condition (RCS) received individual tutoring based upon the activities and skills taught in their regular classroom. Finally, the no treatment control condition (NTC) received no supplemental instruction.

Results indicated that a significant difference was present across groups for retention (kindergarten and grade 1). Forty-one percent of the NTC group were retained, while 30% (RCS), 25% (EP), and 9% (PASP) of the remaining sample were retained. While not significant overall, there was a significant difference between the EP (42%) and PASP (18%) groups on

percentage of students referred for special services. Simultaneous individual contrasts between groups on measures of word level reading (three measurement points), comprehension (two measurement points), and spelling and math skills (one measurement point) showed that the PASP group was reliably different from the other groups, who did not differ among themselves. To determine the absolute effectiveness of their interventions, the authors compared the performance of the children in each condition with that of the standardization sample of the Woodcock Reading Mastery Test-Revised and the Gray Oral Reading Test-III. Table 1 indicates age-based standards ($M = 100$, $SD = 15$) for each group on these measures. Students in the PASP intervention performed very close to average levels on word level reading skills, while scoring on the low average range in comprehension. Finally, growth curve analysis across the entire sample of students indicated that the factors of rapid identification of letters and words, home literacy environment, and behavior as rated by the kindergarten teacher predicted response to the intervention.

Table 1. Mean age-based standard scores

	PASP	EP	RCS	NTC
Word Attack	99.4	86.7	86.7	81.6
Word Identification	98.2	92.1	92.1	86.3
Comprehension	91.5	88.6	88.3	85.8

Peer-assisted learning. Mathes, Torgesen, and Allor (2001) investigated the effects of peer-assisted learning strategies (PALS), PALS and 8-10 hours of computer assisted phonological awareness instruction, and typical reading instruction on the reading achievement

of 183 first-grade students (118 low-, 33 average-, and 32 high-achieving). Thirty-six first-grade classrooms were randomly assigned to one of the three groups. All students in the 36 classrooms were assessed using 1-min oral reading probes, producing a words per minute score. Students in each classroom were rank-ordered, and students with the lowest four scores were identified as low achieving (LA), while average achievers (AA) read at or near the mean of their class (8-14 words per minute) and high achievers (HA) scored at or near the top of their class (more than 20 words per minute).

The PALS procedures were similar to the procedures used in the Fuchs et al. (2001) investigation discussed earlier which examined mathematics achievement of kindergarten students. Students participated in reciprocal peer tutoring dyads 35 minutes a day, three days per week. These sessions, during which students completed structured activities and read from teacher-selected texts, were supplements to the typical reading instruction. In half of the PALS classrooms, LA students received supplemental computer instruction on phonological awareness prior to beginning the peer tutoring intervention. Teachers in the contrast condition conducted reading instruction in their typical manner. Multiple standardized measures were used at pretreatment and posttreatment to assess reading, as well as bi-monthly curriculum-based measures (CBM) which provided a measure of reading growth across time.

Results suggest that LA students benefited significantly from the PALS intervention (ES = .59), while AA (ES = .34) and HA (ES = .41) students showed a positive trend and generally scored higher than students in the contrast condition. Furthermore, LA students who participated in the PALS intervention scored at or near the AA and HA students on phonological awareness. However, results did not produce consistent significant differences between the PALS group and the PALS group which received supplemental computer instruction.

In another classwide implementation of peer-mediated learning, Greenwood (1991) investigated the effects of classwide peer tutoring (CWPT) on time spent in academic instruction, engaged time, and academic achievement. Classwide peer tutoring is a peer-mediated intervention whereby tutor-tutee pairs work together in highly structured roles to ensure that tutees receive rapid-response trials in a consistent procedure. Teachers organize academic content to be tutored into daily and weekly units, and tutoring occurs simultaneously, allowing teachers to monitor students' responding and to provide feedback where needed. Classwide peer tutoring was implemented by classroom teachers in the experimental group for between 30 min and 90 min per day in spelling, reading, and mathematics in grades 1, 2, and 3. Six low socioeconomic (SES) schools and 3 high SES schools were selected for this investigation; low SES schools were randomly assigned to either an experimental (CWPT) condition or a no treatment control condition, while the 3 high SES schools were in a comparison group no treatment condition.

Results indicated that at the beginning of grade 1, students in the CWPT condition were providing less academic responses during academic instruction (32.2%) than were students in the control (35.9%) or comparison (36.6%) conditions. Subsequent to the implementation of CWPT, the academic responding of the experimental group exceeded that of the control condition, and approximated that of the comparison group, for all but one of the twice yearly phases during the next two years. In addition, students in the control group spent almost twice as much time (14.7%) in competing responses (responses incompatible with academic responding, such as off-task, disruptive behavior) as did students in the experimental group (8.3%) after the implementation of CWPT.

The Metropolitan Achievement Test-Basic Battery was used to measure academic growth between the fall semester of grade 1 and the spring semester of grade 3. Subtests included in

each level sampled the domains of reading, language, and mathematics. Post hoc analyses of reading, language, and mathematics achievement, after controlling for initial IQ and pretest achievement levels, indicated significant effects for both the experimental and comparison groups. Effect sizes for the CWPT group were 0.33 (language), 0.36 (reading), and 0.29 (mathematics).

One-to-one tutoring. Elbaum et al. (2000) conducted a meta-analysis of supplemental, adult-instructed, reading interventions for elementary students at risk for reading failure. A mean weighted effect size of 0.41 was found (N = 29). Several findings from this meta-analysis will be discussed below, with particular emphasis on implications for practice.

First, the authors note that the effect size found in this meta-analysis would not be sufficient to raise the performance of students with severe difficulty in reading to the appropriate grade level; however, the benefit might be sufficient to allow these students to follow classroom instruction and avoid academic failure. Second, findings indicate that interventions that used college students and trained, reliable volunteers provided significant help to readers. Third, findings from small-group comparisons suggest that when a highly qualified teacher implements a well-designed intervention, the effects are the same as when instruction is provided. Finally, the authors noted concerns with the reported outcomes of Reading Recovery. Reading Recovery effects were significant when students were discontinued (i.e. discharged because of positive effects); however, the authors note that comparisons of treatment groups in Reading Recovery that include students who were not discontinued are suspect at best. They write that the practice of reporting data only for discontinued students "represents a particularly pernicious form of participant attrition in which the researches selectively remove participants from a study based precisely on the participants' failure to respond adequately to the treatment" (p. 616). The authors also note concern about the psychometric properties of some of the measures used in the

Reading Recovery outcome studies, noting that the effect sizes reported in this literature are greater for studies which used researcher-developed measures versus those which used standardized measures. In summary, they write that "it is particularly disturbing that sweeping endorsements of Reading Recovery still appear in the literature" (p. 617).

Summary. The three interventions reviewed here have had moderate to strong effects on the reading achievement of young students at risk for reading failure. Phonological awareness training (Torgesen et al., 1999), particularly when implemented in the most explicit fashion, led to fewer students being retained and referred for special services. Further, students in the most explicit intervention group approximated norm reading skills by the end of the study. Peer-assisted learning strategies (Mathes et al., 2001) and classwide peer tutoring (Greenwood, 1991) both had significant effect on various standardized reading measures of students at-risk for academic failure. Finally, one-to-one tutoring, particularly when implemented by trained volunteers and college students, had moderate effects on reading achievement (Elbaum et al., 2000).

The Relationship Between Low Achievement, Problem Behavior, and Teacher Behavior

This section summarizes research conducted in classrooms that has examined the effect of teacher behavior on student behavior. The rationale behind this section is derived from two theoretical perspectives on academic failure, negative reinforcement (e.g., Gunter & Coutinho, 1997) and the transactional nature of social interchanges (Sutherland & Morgan, in press; Sutherland & Oswald, 2003) which posit that the low achievement and problem behavior of students at-risk for academic failure contributes to these students receiving less academic instruction and more negative feedback from teachers, contributing to increased risk for academic failure. Since the most cost-effective means for implementing effective interventions for remediating academic deficits are those implemented by teachers, teachers ability to provide

effective instruction to all students, regardless of achievement level or presenting problem behavior, is critical.

Criteria for inclusion in this review included the study (no meta-analyses on this topic exist) (a) having as participants students identified as low achievers or exhibiting problematic classroom behavior; (b) examining the relationship between teacher instructional behavior and students' classroom behavior and/or academic achievement; and (c) having been published in a refereed journal. Search procedures consisted of three steps. First, computer databases (ERIC, 1966 to present; PsycInfo, 1967 to present) were searched using the descriptors teacher behavior, low achievement, low achievers, problem behavior, academics, reading, mathematics, and interventions. Second, a hand search of prominent journals (e.g., *American Educational Research Journal, Elementary School Journal, Journal of Educational Psychology, Journal of Learning Disabilities, Journal of Special Education*) was conducted for the last two years. Last, an ancestral search of identified articles was conducted. As such, two areas of literature will be discussed: (1) the effect of student behavior on teacher behavior, and (2) reciprocal interactions between teachers and students. While a logical addition to this review would be the effect of teacher behavior on student behavior, it was decided not to include this literature (other than the intervention research already discussed). Intervention research typically examines research questions in a unidirectional manner; that is, the effect of an independent variable, typically implemented by a teacher, researcher, or collaboration between the two, on a dependent variable (i.e. students math achievement, words read per minute, task engagement). Therefore the literature in this area far exceeds the scope of this paper.

The Effect of Student Behavior on Teacher Behavior

Carr et al. (1991) examined the effect of student behavior on teacher behavior. Specifically, they observed 12 teachers instructing four pairs of students; within each pair of

students, one student presented problem behavior while one student presented compliant behavior. Results indicated that teachers provided more instruction to students who exhibited appropriate classroom behavior, while limiting the amount of instruction they provided to students who exhibited disruptive behaviors. Teachers provided significantly more task commands to nonproblem children than to problem children, $F(1,8) = 26.6, p < .001$. Moreover, data indicated that teachers limited the breadth of their instruction with problem children, providing easier and fewer types of tasks than to non-problem children. Thus, students who exhibited problem behavior were provided less, and less effective, instruction than those students who did not exhibit problem behavior. The authors noted that the high rates of problem behavior may have conditioned the teachers to avoid teaching these students; this perspective is in line with the negative reinforcement paradigm suggested by Gunter and colleagues (e.g., Gunter & Coutinho, 1997).

These data are supported by findings from a direct observation study on teacher student interactions conducted by Wehby et al. (1998). These researchers found that a teacher provided less instruction to students who were identified as high aggressors versus students who were identified as low aggressors in an elementary school classroom. The mean percentage of time the teacher spent instructing aggressive students was approximately 9%, while the teacher spent approximately 41% of the time instructing students identified as low aggressors. This research is significant in light of research suggesting that aggressive behavior patterns increase the likelihood that children will develop negative relationships with their teachers (Ladd & Burgess, 1999). In turn, longitudinal research indicates that problematic relationships between teachers and students with behavior problems in kindergarten are associated with academic and behavioral problems through eighth grade (Hamre & Pianta, 2001).

Reciprocal Interactions Between Teachers and Students

There is a developing literature that informs our understanding of the transactional nature of teacher-student interactions. Skinner and Belmont (1993) investigated the relationships among three dimensions of teacher behavior (involvement, structure, and autonomy support) and students' engagement in the classroom (behavior and emotion) as well as the reciprocal relationship between students' engagement and teacher behavior for a sample of 144 elementary school students and their 14 teachers. Teacher and student reports were administered in both the fall and spring of the same school year. A path analysis of the time-lagged data indicated that students who were more engaged were the targets of more positive teacher behaviors, while students who were less engaged experienced more neglect and coercion from teachers and were treated with less consistency. Thus, teachers tended to promote further classroom engagement of students who were already engaged, and interacted with disengaged students in a way that increased the likelihood of further disengagement. Skinner and Belmont describe these effects as magnificatory; that is, positive student engagement elicits positive teacher behavior, further eliciting student engagement, while the relative absence of student engagement elicits negative teacher behavior, further eliciting student disengagement.

The primary limitation of the Skinner and Belmont study is the lack of direct observational data to confirm the data of the questionnaires, a limitation that others have sought to overcome. Van Acker, Grant, and Henry (1996) investigated differences in teacher-student interaction patterns for students facing varying risks for the development of aggressive behavior. The student participants in this study were part of a no-treatment control condition of a larger study, and students were identified as at-risk for aggression through two measures: students must have scored above the grand mean (for the total, large study sample) on both the aggression scale of the Teacher Report Form of the Child Behavior Checklist (TRF) (Achenbach & Edelbrock,

1988) and a peer nomination measure. Students were further divided into a mid-risk group (n = 102) and a high-risk group (n = 104), with students in the mid-risk group falling between the 51st and 75th percentile and students in the high-risk group falling between the 76th and 100th percentile on the TRF. Each student in this study was observed for at least 80 minutes. Data for students in each group were pooled and mean rates of OTR and teacher praise were reported for both the mid- and high-risk groups. Data were then examined using sequential analysis.

Students were given opportunities to respond to academic requests (OTR) in the mid-risk group at a higher mean rate than students in the high-risk group, but these rates were low overall (1.5 and 1.1 per hour). Correct academic responding occurred at a high rate per hour for students in both groups (mid-risk $M = 1.3$; high-risk $M = .8$) given the limited OTR, and the difference in correct academic response rates for the two groups may have been a result of the reported difference in reading comprehension between the two groups favoring the mid-risk group, $F(1, 147) = 6.2$, $p < .05$. Praise, however, was delivered on an infrequent basis, with students in the mid-risk group receiving a mean rate of 1.4 per hour while students in the high-risk group received a mean rate of 1.2 per hour. Furthermore, teachers reprimanded students in the mid-risk group twice as often as they praised them (M = 2.8), while the ratio of reprimands to praise increased to almost four to one for students in the high-risk group (M = 4.4).

A sequential analysis of the data revealed some interesting patterns. First, for the mid-risk group, the following pattern emerged: OTR predicted student volunteering which predicted further OTR; OTR then predicted a correct academic response, which in turn predicted teacher praise. For all intents and purposes, this describes an appropriate instructional interaction. An effective instructional pattern was not evident for the high-risk group, however. The only event that predicted another event in the interactions between teachers and this group of students was OTR predicting a correct academic response. Therefore, in the high-risk group students'

volunteering did not predict their having an OTR and students' correct academic responses did not predict teacher praise above chance levels. Meanwhile, for students in the high-risk group, reprimands were predicted by aggressive and negative behavior, and reprimands predicted further negative behavior. Van Acker et al. note that correct responding is the only behavior for which teachers predictably provided reinforcement, and then only for students in the mid-risk group. Furthermore, teacher reprimands following high-risk students noncompliance predicted further noncompliance, leading the authors to note that "a high-risk student wishing to increase the predictability of the classroom must resort to inappropriate behavior" (p. 331).

Nelson and Roberts (2000) also noted differential treatment in their study of reciprocal interactions between teachers and students using sequential analysis. These investigators examined conditional probabilities during teacher-student interactions following disruptive behavior for both target students (i.e., those identified by teachers with high rates of disruptive behavior; n = 99) and control students (n = 278). Their analyses of 2,367 and 821 ongoing reciprocal sequences, for target and control students respectively, indicated that teacher/student interactions were longer for target students (up to nine events following initial disruptive event, versus one event for control students) and teachers were significantly more likely to provide redirection following control students' disruptions, while they were more likely to provide reprimands following target students' disruptions. Not surprisingly, control students were significantly more likely to comply with teacher requests, while target students were significantly more likely to respond negatively to teacher requests.

Sutherland, Alder, & Gunter (in press) investigated the effects of increased opportunities to respond to academic requests (OTR) on the correct responding and classroom behavior of an elementary school classroom of students with emotional or behavioral disorders (EBD) using an A-B-A-B withdrawal of treatment design. When the teacher increased the rate of OTR from

baseline levels (1.7 to 3.5 per min), students' correct responses (1.2 to 2.7 per min) and task engagement (55% to 79%) increased, and students' disruptive behaviors (2.6 to 2.0 per min) decreased. A decrease in the teacher's rate of OTR (due to the withdrawal of a classroom intervention; 3.5 to 2.3 per min) led to decreases in students' correct responses (2.7 to 1.4 per min), task engagement (79% to 65%) and an increase in disruptive behaviors (2.0 to 3.1 per min). Finally, when the intervention was reintroduced, OTR once again increased (2.3 to 3.5 per min) and this effect was again associated with increased students' correct responses (1.4 to 2.6 per min) and task engagement (65% to 83%), and a decrease in disruptive behaviors (3.1 to 1.9 per min).

Of particular interest in this study is how the teacher's behavior may have shaped, and been shaped by, the students' behavior. The percentage of correct responses (PCR) across phases provides some insight into transactional processes between the teacher and students in this classroom. To illustrate, the PCR remained stable across the initial baseline phase and the two intervention phases (72%, 76%, and 74%, respectively); however, the PCR dropped to 56% when the intervention was withdrawn in the A-B-A-B design. In this instance, some combination of factors may have contributed to teacher behavior (decrease in OTR and increase in difficulty level of OTR) and student behavior (increased disruptions, decreased task engagement, correct responses, and PCR). For example, a decrease in the rate of OTR presented by the teacher may have led to decreased task engagement and increased disruptive behavior by the students, which may have in turn impacted the teacher's presentation of information to the students, resulting in more difficult OTR and a lower PCR by the students. Students' frustration resulting from more difficult OTR and lower PCR may have lead to even more challenging classroom behaviors, further impacting the teacher's instructional behavior.

Summary

Evidence exists that suggests that teacher student interactions are effected by both negative reinforcement contingencies and transactional processes. Carr et al. (1991) reported that students who exhibited problem behavior were involved in less academic interactions with teachers than children who exhibited less problem behavior; moreover, teachers provided instructional activities that were at a considerably lower instructional level than that of the students' with problem behavior. Similarly, Wehby et al. (1998) found that a teacher provided less instruction to students identified as high aggressors than to students identified as low aggressors, which is consistent with the final step in the negative reinforcement cycle described by Gunter and colleagues. Furthermore, Van Acker et al. (1996) found that the correct academic responses of students at high-risk for aggression may have been under the control of negative reinforcement, as a sequential analysis of the data indicated that correct responses did not predict teacher praise above chance levels. Both Carr et al. and Wehby et al. suggested that the teachers avoided interacting with the students that exhibited the most problematic behavior, choosing to focus instructional interactions on students who exhibited more appropriate behavior.

The transactional model would suggest that teacher behavior in both Van Acker et al. (1996) and Nelson and Roberts (2000) magnified the classroom behavior of students as it did in the Skinner and Belmont (1993) study. The transactional process in the classroom may have supported prosocial responses on the part of students in the mid-risk/control groups, while inadvertently promoting inappropriate classroom behavior by students in the high-risk/target groups. Teacher perceptions, students' classroom behaviors, and teacher responses to those behaviors interact dynamically, producing a cycle that confirms and strengthens those perceptions. Findings from Sutherland et al. (in press) provide further support for this assertion within a classroom on a day-to-day basis, as some combination of teacher behavior (fewer OTR)

and student behavior (fewer correct responses and decreased task engagement in conjunction with increased rates of disruptive behavior) contributed to changes in teacher behavior and student behavior in an ongoing, reciprocal manner.

Integration of Research on Academic Interventions and Teacher-Student Interactions

Research on academic interventions for students with low achievement provides guidance to school personnel seeking to identify effective, research-based practices. At the same time, challenges inherent in teaching low achievers, including the relationship between achievement and problem behavior, often make implementing effective practices with fidelity a challenge in and of itself. In this case intervention fidelity might be thought of in two ways. First, the fidelity with which an interventionist (i.e. classroom teacher) implements a method according to the steps outlined by the intervention developer. Second, and potentially the most difficult to measure and monitor, is how the intervention is distributed (i.e. dosage) among the students in the classroom. Unfortunately research would suggest that often the students in most need of an intervention, such as effective academic instruction and academic response opportunities, are least likely to receive it.

To illustrate, Greenwood (1996) hypothesized that academic engagement mediates the relationship between academic instruction (consisting of task quality and exposure) and school outcomes, and this hypothesis was supported by results from an investigation using structural equation modeling (Greenwood, 1996). If students and teachers affect each others' behavior in a reciprocal manner as suggested by research, it is reasonable to hypothesize that students' levels of engagement (and certainly their disruptive behavior) will predict the quality of instruction that they receive in the future. That is, students who are engaged, or who are perceived by teachers to be engaged, during academic instruction may be treated differently than students who are not engaged. This differential treatment may yield increased exposure to academic material,

increased rates of OTR, superior task quality, and increased positive teacher attention. Meanwhile, less engaged students are likely to receive less exposure to academic material, inferior task quality, and more negative and coercive attention. This phenomenon is particularly relevant to the academic instruction of low achieving students, since these students are already more difficult to teach than their normally achieving peers. In light of the challenges inherent in implementing research-based practices that will have a sustainable impact on low-achieving students, what have we learned about classroom-based best practice?

Implications for Practice

Based upon the findings of the meta-analyses, best evidence syntheses, and research reviewed here, the following model is recommended to provide students who are identified as low achievers early in their school careers that best opportunity to build basic academic skills and academic and social competence that will predict a greater likelihood for school success in future years. First, explicit instruction in both reading and mathematics is critical to establishing a firm foundation for future learning. Second, teachers should use systematic data collection to help monitor student progress, provide reinforcement for success, and plan instruction. Third, peer tutoring should be used, in a systematic manner, to reinforce learned skills and provide adequate academic response opportunities. Finally, systematic communication with parents about what their children are learning in school should be undertaken to create more of a bond between school and home. While more difficult to monitor during explicit instruction, the final three recommendations all specifically provide support for teachers in their efforts to overcome differential treatment of students during academic instruction that might result from negative reinforcement or transactional processes. The following sections will discuss each recommendation in more detail.

Explicit instruction. Explicit instruction appears to be the first component in an effective instructional program for at-risk learners. Baker et al. (2002) found a mean effect size of 0.58 in their meta-analysis of math interventions. This effect was even more pronounced when compared to the effect size of contextualized learning (0.01). The difference between these two instructional methods highlights the highly structured learning needs of children who arrive at school without the prerequisite skills to be successful in mathematics. Moreover, Torgesen et al. (1999) found that the more explicit the instruction in phonological awareness, the greater the effects on various measures of reading achievement. Again, low achieving students must be taught basic skills before being prodded ahead at developmental tasks such as math and reading. Social and behavioral products of students who don't acquire basic skills but are expected to perform to the classroom mean in various subject areas may include both externalizing and internalizing behavior problems, placing them at risk for special services and other downstream negative outcomes (Kauffman, 2001).

Given the risk for developing classroom behavior problems associated with frustration over academic tasks, it is imperative that students receive effective, research-based pedagogy throughout their school years, but particularly early in school when intervention is most powerful. Otherwise we risk identifying students for special services who, if taught effectively early in school, may have developed academic competence that could serve as a protective factor throughout their school careers. Again, students who exhibit low achievement and classroom behavioral problems appear to be at-risk for fewer academic interactions from teachers, and it would make sense that these downstream processes continue, leading to accumulated risk year by year (Sutherland & Oswald, 2003).

Data-based decision making. Within the meta-analysis on interventions for math achievement providing students and/or teachers with data on student performance had an effect

size of 0.57 (Baker et al., 2002). This intervention holds promise for classroom teachers for several reasons, and should be used to monitor student progress within the context of the explicit instruction on basic skills they are receiving. First, systematic data collection on student performance can be a useful means for identifying students at-risk for academic failure (including those that might be subject to differential treatment from the teacher). Second, using data collected over time teachers can modify their instruction to better meet the needs of individual learners. Third, data indicating growth can be reinforcing for both the teacher and the student. Finally, systematic data collection using curriculum-based measurement (CBM; Deno, 2003) has had strong correlations (.65-.85) with students' performance on high-stakes testing (e.g., Deno et al., 2002; Good, Simmons, & Kameenui, 2001).

The final point regarding the correlation between scores on CBM and high-stakes assessment was operationalized in the Fuchs et al (1994) study reviewed by Baker et al. (2002). These investigators used items from the state mathematics content standards to assess students weekly on their progress. Frequent (e.g. weekly) assessments using the classroom curriculum (math, reading, writing, etc.), while keeping the difficulty-level of the assessments equivalent are the defining characteristics of CBM, allowing students' growth over time to be measured (Deno, 2003). The most innovative aspect of the Fuchs et al. study was that teachers were given grouping recommendations and instructional strategies from a computer program based upon their students' weekly math assessments. This technology would appear to hold much promise as an instructional resource for teachers attempting to meet the diverse needs in their classrooms.

Peer tutoring. Following explicit instruction in basic skills and student progress monitored by systematic data collection, peer tutoring holds promise as a means for students to practice learned skills. To illustrate further, Rohrbeck, Ginsburg-Block, Fantuzzo, and Miller (2003) conducted a meta-analysis on the effects of learning interventions on learning outcomes

of elementary school students. Results indicate an effect size of .59 across 81 group design intervention studies. The authors noted that the greatest intervention effects occurred with learners with the greatest need (i.e., high poverty, urban, young children, low achievement). Results from this meta-analysis support findings reported in several critical reviews of the literature which highlight the educational benefits of peer-assisted learning interventions (Mathes & Fuchs, 1994; Shanahan, 1998).

Research reviewed in this paper adds support to the findings of the Rohrbeck et al. (2003) meta-analysis. Baker et al. (2002) found an effect size of 0.62 for peer-assisted learning in mathematics, noting that students who may be uncertain about problem-solving can seek feedback from their peers. Fuchs et al. (2001) found significant effects for low, average, and high achievers in mathematics using their version of peer-assisted learning, PALS. Finally, reading effects were strong for low achievers in both the Mathes et al. (2001) and Greenwood (1991) studies that used versions of peer-assisted learning.

Peer-assisted learning, when implemented in a systematic fashion, holds promise as a classroom intervention that focuses on providing increased response opportunities for all students. In light of the research reviewed here on potential negative reinforcement and transactional processes in classrooms that may result in differential distribution of teacher attention, peer-assisted learning also can serve as a protective factor for those students most at-risk for differential treatment. That is, by its very design learning creates a structure whereby students provide task demands and feedback, allowing teachers to facilitate implementation and provide help where needed. Rohrbeck et al. (2003) note the potential benefits of peer-assisted learning with low achievers when they write "Considering the fact that at-risk students generally receive instruction marked by poor use of instructional time, lower expectations, and less opportunity for learning, the use of PAL strategies would be a welcome improvement to

instructional practices with those students." (p. 252). Thus, all students receive practice on the skills they have learned, hopefully through explicit instruction in basic skills. This point is reinforced by Mathes et al. (2001), who suggest that their PALS intervention should be one piece (the practice piece) of a total instructional program for the prevention of reading failure.

Communicating with families. Increasing evidence suggests that the quality of the relationships between families and schools influences children's school success (Eccles & Harold, 1996). For example, research indicates that higher levels of parent involvement in their children's schooling are associated with better student outcomes in both academic and behavioral measures (Zill, 1996). Teachers' practices and attempts to involve parents are as or more important than variables such as the family's race or ethnicity, social class, and marital status for determining how involved parents may become in their children's education (Epstein, 1996), and parents are more involved with their children's education when they feel that schools' are attempting to involve them (Eccles & Harold, 1996). In light of this research, the findings in the Baker et al. (2002) meta-analysis about the effects of communicating with parents on the math achievement of low achievers is particularly promising.

While the effect size (0.42) of providing parents with information about their children's efforts and successes in was not significant, partially due to the small number of studies reviewed ($n = 2$), this low-cost intervention holds promise for engaging families in a productive, positive, and non-threatening manner. It appears that to maximize the effect of this intervention parents should not be encouraged to be teachers of their children related to the information shared, nor should this intervention have as a focus an attempt to have parents coerce their children into completing assignments or comply with authority figures at school. Attempts such as these would remove the non-threatening aspect of the communication, while changing the nature of the communication itself.

Summary

Low achieving students present multiple challenges to their teachers, and these challenges may in fact contribute to an increased risk for academic failure through differential treatment during academic instruction. At the same time, research highlighted in this paper indicates several classroom-based interventions that hold much promise for having lasting effects on academic achievement and, in turn, social functioning. Improvements in these two domains thus lead to improved teacher and peer relationships, contributing to further academic and social competence. Providing teachers with the appropriate training, resources, and support to implement research-based practices early in children's school careers appears to be the best, most cost-effective choice schools have if they want to have a positive, lasting impact on the developmental outcomes of students at-risk for academic failure.

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