BASIC READING THROUGH DANCE PROGRAM

The Impact on First-Grade Students' Basic Reading Skills

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This study evaluates the effectiveness of an arts-based educational program, Basic Reading Through Dance. Basic Reading Through Dance is a 20-session, curriculum-based reading intervention for first-grade students developed by Whirlwind, a not-for-profit organization. There were a total of 721 first-grade students from Chicago public schools who participated in the study, with 328 students from 6 schools receiving the program and 393 students from 9 schools serving as controls. The program was designed to improve reading skills, as assessed by the PhonoGraphix Test, such as code knowledge (alphabet sounds) and phoneme segmentation (separating letter sounds within spoken words). Results suggest that the students who participated in the program improved significantly more than control students on all reading skills that were assessed.

As educators search for effective methods of teaching, there has been a growing debate regarding the impact of arts education on academic achievement. Many suggest that arts education can have positive effects on children through enhancing cognitive development (Rauscher et al. 1997), engagement, creativity, and expression of self (Catterall 1998; Darby and Catterall

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1994; Hanna 1992). In addition, some studies have suggested that arts education leads to higher academic achievement (Hanna 1992; Rose et al. 2000). For example, Hanna (1992) reported that students who complete art courses receive higher SAT scores than students who do not take art courses. Yet, there are few controlled studies that examine the effects of art-education programs, and there is little understanding about why arts-education programs have positive effects on children (Eisner 1998; Wagner 1998).

Catterall (1998) has identified several points that may guide the examination of arts education. First, various forms of art will differ in the extent to which they influence academic skills. Second, the effects of *learning in the arts* (such as acting skills) should be separated from the effects of *learning through the arts* (such as using drama to recreate history). Indeed, although there is little systematic research evaluating the impact of learning through the arts, the effects of arts-based education appear to be greatest when the arts are directed specifically toward raising academic achievement in reading and writing (Eisner 1998). Third, there is evidence for the potential positive impact of the arts, yet it is unclear under what conditions benefits occur and what types of learning are most likely to result from arts education (Catterall 1998).

Although there is published work demonstrating a rationale for the use of arts education, and there is some preliminary empirical support for the effectiveness of arts-education programs, little research examines dance as a specific form of arts education. The dance studies that have been conducted tend to be either case-study approaches with small samples or entirely theoretical in nature. One of the few empirical studies evaluating the impact of dance was performed by Heausler (1987), who examined the effects of a dance program on word analysis concepts and creativity with predominantly middle-class kindergarten and second-grade children. Heausler's study included a controlled experimental design, and the treatment effects were statistically significant; however, the effect size was quite small (9.4%). Given the limited research in this area, there is a significant need for further investigation.

Little (1978) suggested that dance promotes holistic development in children, as it facilitates the reception of sensory input, which may lead to cognitive awareness, enabling children to express themselves through movement. Dance can give form to children's feelings, giving them a beginning, a middle, and an end (Stinson 1982). Feelings and ideas may also become internalized through the movement experience (Dimondstein 1985). Dance differs from other forms of art in that it uses space, time, and force as its materials, and through various combinations, movements form images that use visual-kinesthetic senses (Dimondstein 1985). Dance can be used with students at all levels of development to elaborate and expand meaning (Dimondstein

1985). Internalizing ideas, using imagery (Bell 1986, 1991; Paivio 1979), and elaborating on meaning (Stein and Bransford 1979) are all skills that enhance memory and reading comprehension. Thus, if applied to improving academic skills, programs that incorporate dance strategies have the potential to improve children's reading abilities.

Qualitative data from interviews, teacher journals, and classroom observations suggest that dance may be integrated into other subjects, it may enhance whole-child development, and children are enthusiastic about learning through dance (MacDonald 1991a). Two studies have examined the effects of dance programs with mentally retarded children, suggesting some changes in imagination with 17 preschool retarded children (Jay 1991) and some changes in physical and social skills in 13 retarded adolescents (Crain, Eisenhart, and McLaughlin 1984). Although dance, in general, may facilitate the development of a variety of skills, we cannot expect that these skills will translate into reading skills. However, the positive impact of dance on child development suggests that it could be used as a teaching tool if it was explicitly *designed* to have an impact on a specific academic skill, such as reading ability. We need more solid evidence with rigorous research methods, standardized assessments, large samples, and theory-based interventions to assess whether dance can be used as an effective tool to teach reading.

Previous theorists have demonstrated the importance of imagery for reading acquisition and comprehension (Bell 1986, 1991; Paivio 1979). Examination of research on human memory may provide the necessary links to understanding how imagery may be useful to reading acquisition and comprehension. Reading comprehension is highly dependent on memory, and research suggests that memory for visual information is stronger than memory for written information (Shepard 1967). Furthermore, meaningful information is remembered better than meaningless information (Anderson 1990), so there is a challenge to teach reading skills in a way that is meaningful to children, and visual strategies can be helpful in this regard. Finally, memory research suggests that elaborating on information can improve memory (Stein and Bransford 1979), and visualization can facilitate both meaning and elaboration.

There are several important factors (i.e., cognitive, social, emotional) that influence the process of learning how to read, and it is important to consider all of these factors when developing interventions to teach reading. Phonemic awareness (the skill to perceive a sequence of individual sounds as a spoken word) and knowledge of the alphabet (e.g., Adams 1991; Lepola, Salonen, and Vaurus 2000) are significant predictors of reading acquisition (e.g., Lundberg, Olofsson, and Wall 1980; McGuinness, McGuinnness, and McGuinness 1996; Salonen, Lepola, and Niemi 1998; Vellutino and Scanlon

1987). Furthermore, teaching phonological awareness to first grade children can have a positive impact on beginning reading acquisition, particularly when teachers help children make the connections between the sound segments of the word and the letters representing those segments (Blachman 1991). Motivation (Guthrie et al. 1996; Wigfield et al. 1996) and early literacy experience are also important factors associated with reading skills (Lepola, Salonen, and Vauras 2000; Salonen, Lepola, and Niemi 1998; Wigfield and Guthrie 1997). These findings indicate that children would benefit from early intervention that incorporates a variety of strategies to teach reading that take into account both cognitive and emotional processes (Hennessey 1995; Lepola, Salonen, and Vaurus 2000; Salonen, Lepola, and Niemi 1998).

As we develop interventions for young children, it might also be helpful to consider the ongoing debate regarding the effectiveness of child-centered versus didactic instructional approaches for young children. Some suggest that didactic approaches lead to decreased motivation for learning (Katz 1988; Stipeck et al. 1995), lower perceived competence (Kamii 1985; Katz 1988; Stipeck et al. 1995), and increased dependency on adults (Elkind 1986; Stipeck et al. 1995). Others suggest that didactic approaches build self-confidence and enhance achievement (e.g., Carnine et al. 1988; Gersten, Darch, and Gleason 1988). Stipek and colleagues (1995) suggested that the goal of an instructional intervention should be considered; they found that letter and word recognition skills were more effectively taught with didactic approaches, yet these children fared less well on motivational measures compared to children in child-centered programs (Stipeck et al. 1995). Programs should be developed that incorporate both child-centered and didactic components, promoting positive social climates, yet these programs may not be common in our current educational system (Stipeck et al. 1995).

Building on imagery, memory, and reading research, a curriculum for teaching basic reading was developed, Basic Reading Through Dance (BRD), emphasizing the use of visual and kinesthetic imagery to develop phonetic abilities. If reading instruction can focus more on visual and kinesthetic images and less on text-based information, children may be more likely to retain and recall the information they learn. Teaching children visual strategies, such as physically representing the alphabet symbols for sound combinations, may provide more meaning to the information they are learning and hence be remembered better by children than text-based instructional strategies. The elaboration required in visualizing and actively creating letters and letter combinations through dance may improve phonemic awareness and reading acquisition. Based on these findings and interviews with subject matter experts, the core goal of the BRD program was developed: to use dance as

a tool to improve students' earliest reading skills with a focus on their ability to link visual cues (letters) with the sounds they represent. This program incorporates both didactic methods (teaching basic letter recognition skills) and child-centered methods (children initiating and visually representing letters and letter combinations). By making reading acquisition active and fun, it is also hoped that children will be more motivated to participate in reading-related activities, and higher reading scores will result.

Earlier work with fourth-grade students (see Parks and Rose 1997) suggested that by the time they reached the fourth grade, some Chicago students still lacked the ability to decode basic text. Based on this experience, Whirlwind conducted interviews with reading instruction subject matter experts, including teachers and principals from several school districts, about the specific skills that were critical for early readers that would prepare them to enter fourth grade and facilitate success in the development of reading skills. These interviews provided considerable information about the challenges early readers face and the level at which the program should be targeted. The results from these interviews, combined with the phoneme awareness approach described by McGuinness, McGuinness, and McGuinness (1996), formed the groundwork of the BRD program that was targeted toward early-reading students (typically first grade).

Based on these interviews and a review of language arts theory, Whirlwind developed a model regarding the developmental sequence of language arts acquisition (see Table 1). Beginning, intermediate, and advanced outcomes are highlighted in Table 1, with earlier steps providing prerequisites for later steps. For example, the first step is to understand that letters are symbols for corresponding sounds. An intermediary step is to understand that sounds can be blended together to create words. An advanced step for language arts acquisition is to understand that most sounds can be represented in more than one way. Each stage includes previous outcomes as well as new elements. After articulating this model of development, Whirlwind implemented several first-grade pilot programs in Chicago public schools. Based on these pilot programs, the lesson plans were adjusted moderately to complete the program-planning phase and begin to evaluate the program and its relation to the theoretical model of language arts development.

As schools are pressed to raise test scores and prioritize the "basics," education specialists are encouraged to develop interventions and teaching strategies that improve basic skills in reading, writing, and arithmetic. Given the theoretical support for arts education in general and dance in particular, and the lack of empirical studies conducted in this area, it is important to examine the potential impact of dance on academic achievement. Because imagery, memory, and elaboration are skills involved in both reading and dance, dance

Table 1: Three-Stage Developmental Sequence for Language Arts Acquisition

Beginning Outcomes →	*Intermediate Outcomes* →	*Advanced Outcomes* →
Understand that letters are symbols for corresponding sounds—select consonants and vowels	Understand that letters are symbols for corresponding sounds—select consonants and vowels	Understand that letters are symbols for corresponding sounds—all consonants and vowels
Say the sounds that specific letters represent when they see them—select consonants and vowels	Say the sounds that specific letters represent when they see them—select consonants and vowels	Say the sounds that specific letters represent when they see them—all consonants and vowels
Understand that sounds can be blended together to create words and that words can be segmented apart and made back into individual sounds	Understand that sounds can be blended together to create words and that words can be segmented apart and made back into individual sounds	Understand that sounds can be blended together to create words and that words can be segmented apart and made back into individual sounds
CVC words	CVC words	CVC words
	Adjacent consonants	Adjacent consonants
	VCC	VCC
	CCVC	CCVC
	CVCC	CVCC
		CCCVC
	Understand that two letters can be combined to symbolize one new sound	Understand that two letters can be combined to symbolize one new sound
	ch, wh, th, sh	*ch, wh, th, sh*
	e-controlled vowels	*e*-controlled vowels
		Understand that most sounds can be represented in more than one way
		c, k
		ai, ay
		ee, ea, ey
		i, e

NOTE: C = consonant; V = vowel.

techniques designed to facilitate the steps involved in language arts acquisition have the potential to improve reading skills. This study was designed to evaluate the impact of the BRD program on first-grade students' reading skills, compared to current instructional strategies used in a sample of Chicago public schools. This study of the BRD program was designed to assess the beginning outcomes of reading acquisition for first-grade students. Specifically, the impact of the program was examined regarding the first three steps of Whirlwind's model. These steps include (a) understanding that letters are symbols for corresponding sounds, (b) saying the sounds that specific letters represent, and (c) understanding that sounds can be blended together to create words and that spoken words can be segmented to make individual sounds. The current study reports outcome results for reading acquisition from the 1998-1999 academic year.

METHOD

Whirlwind developed a standard 20-session dance-based reading curriculum, BRD, targeted specifically at improving basic reading skills in the areas of decoding and phoneme-grapheme relationships.[1] Each session in the BRD program requires students to use their bodies to physically represent the alphabet symbols for various sounds in the English language, as well as combinations of sounds. To physically represent each sound, students had to (a) visualize the appropriate symbols (letters) for spoken sounds and then (b) recreate these images physically using their body. Once a physical vocabulary was developed, students worked in teams to represent sounds for letter combinations.

PROGRAM GOALS

The BRD program had one general goal: to improve students' early-reading skills. The program's specific objectives were to teach students to (a) move and freeze their bodies on cue, (b) use their bodies as instruments of communication, (c) create and dance fluidly a locomotive movement sequence, (d) say the sounds of letters or letter combinations they see, (e) dance/write the letter or letter combination that represents a spoken sound they hear, (f) say the individual sounds of short-vowel words they see and blend them into one spoken word, (g) say the individual sounds of short vowel words they hear and write the letters that represent them, and (h) manipulate sound symbols to change words into other words.

SCHOOL AND TEACHER RECRUITMENT

Six Chicago public schools that serve predominantly African American populations from poverty-level families selected the BRD program as part of their reading curriculum, and all 16 first-grade classes from these 6 schools participated in the program. Schools were selected for the control group to match the racial demographics and previous achievement (via 1998 Iowa reading scores) of the experimental-group student population. To provide an adequate control group, we asked the principals (and the first-grade teachers) at 11 other schools for permission to assess their first-grade students' reading skills, and all but two agreed. Thus, 15 Chicago public elementary schools participated in the study, with 6 experimental schools and 9 control schools. The 9 control schools were schools that Whirlwind had worked with in the past or were working with currently in non-first-grade classrooms.

Among these nine control schools, Whirlwind solicited the participation of 25 first-grade teachers but provided no specific information about the study. Teachers were simply told that Whirlwind wanted to assess their students' reading abilities. All but 6 of these teachers accepted. Thus, 19 teachers provided students for the control group. Whirlwind had not previously worked with any of the first-grade teachers in the control group. Pretest and posttest reading assessment is a standard element of the BRD program, so data were readily available for the 16 classrooms of experimental students.

STUDENTS

In total, 721 first-grade students participated in the study, with 328 students in the experimental group and 393 students in the control group. At posttest, 630 students were assessed, with 293 in the experimental group and 337 in the control group. Attrition from pretest to posttest was due to students either having been transferred out of the classroom or simply being absent on the particular day of the posttest. Detailed attrition analyses are described in the Results section.

PROCEDURE

The program was implemented in two phases, the first from October 1998 to December 1998 in three schools, and the second from January 1999 to March 1999 in the other three experimental schools. Control-group data were collected from the nine control schools during these same time periods. Three artists, trained by Whirlwind, implemented the program, and each

artist worked with five to six first-grade classrooms twice a week for 10 weeks. Each session was 40 minutes long; thus, students were exposed to a total of 13.3 hours of dance-based reading instruction. The sessions mainly involved students using their bodies to make the shapes of letters and letter blends representing sounds. For example, standing straight up and extending both arms at 90-degree angles would represent the sound of the letter *t*. During the 3 days each week Whirlwind artists were not present in the classroom, students participated in traditional reading instruction similar to the control classrooms.

The BRD sessions were developed to progress along a continuum of learning according to difficulty, such that later lessons built on earlier concepts. Early lessons focused on learning consonants and vowels. More advanced lessons focused on adjacent consonant letter combinations such as *bl* and more difficult vowel combinations such as *oo*. However, during the study period, the focus was primarily on individual consonants and vowels, with some more advanced classrooms moving on to blends and then words.

Reading instruction. In general, a first-grade student's day is composed of either reading or math instruction, as these are the basic building blocks for other subjects in later grades. Reading instruction for first-grade students is typically divided informally into "structured reading" and "unstructured reading." Each of the Chicago public schools included in the study mandated structured reading time, but the exact activities varied somewhat between each school. Unstructured reading time focuses on reading, but the approach used is largely at the discretion of individual teachers. BRD was used as part of the unstructured reading portion of the curriculum in the 16 experimental group classrooms.

PHONOGRAPHIX TEST

One standardized measure of basic reading ability was used: Read America's PhonoGraphix Test. This performance assessment was used with students in the experimental group and the control group to diagnose individual and class-level reading skills (pretest) and document learning (pretest vs. posttest differences). The PhonoGraphix Test, originally developed by McGuinness, McGuinness, and McGuiness (1996), measures four core areas of preliminary reading: code knowledge, phoneme segmentation, blending, and phoneme manipulation.

The PhonoGraphix Test involves a standardized, individual administration, which takes approximately 15 minutes per student to complete the Code

Knowledge and Phoneme Segmentation scales, the primary measures of interest for this study.[2] The PhonoGraphix Test is scored objectively by the administrator at the time of administration. Items on all scales were scored dichotomously.

The PhonoGraphix Test has a high degree of content and face validity as a measure of basic phonographic awareness. Evidence for the content validity of the test is the fact that 25 of 26 Roman alphabet characters are included in the Code Knowledge scale as well as the large number of consonant and vowel blends including those from nonsense words. Evidence of construct validity has been demonstrated when the scales have correlated in the .50 to .70 range with the Woodcock-Johnson Word Identification Sub-Test (McGuinness, McGuinness, and McGuiness 1996).

A recent study by Rose and Parks (1998) found further evidence for construct validity of the PhonoGraphix Test. Correlations between overall performance on the PhonoGraphix Test and grade equivalence on the reading portion of the MAT7 were very high and statistically significant ($r = .82$, $p = .000$). This correlation between the two measures provides strong evidence of concurrent validity for the PhonoGraphix Test, indicating that it indeed measures students' basic reading abilities.

Code Knowledge. This 50-item scale measured students' ability to accurately identify the most basic codes that build our language including consonants, vowels, consonant digraphs, and vowel digraphs. The scale included 20 consonants and all vowels in the Roman alphabet as well as 24 digraphs of consonants (e.g., *ch*) and vowels (e.g., *oo*). Subscales include Consonants Recognition, Vowels Recognition, Consonant Digraphs, and Vowel Digraphs. Students were shown a card containing a written letter or digraph and given one point for each letter or digraph correctly pronounced. Only data from the Consonants Recognition and Vowels Recognition subscales were used for this study because of floor effects on the Consonant Digraphs and Vowel Digraphs subscales.

Phoneme Segmentation. The 18 items on this scale measured students' ability to verbally segment the sounds from a spoken word. The scale included consonant-vowel-consonant words (e.g., *pin*), consonant-vowel-consonant words with blends (e.g., *trip*), as well as three- and four-letter nonsense words (e.g. *flob*). Nonsense words are important because students who have merely memorized a large number of common words cannot do well; they must be able to segment sounds within a word. For this portion of the test, the administrator pronounced the entire word and asked students to separate the sounds.

The First Sound subscale of the Phoneme Segmentation test focused on students' ability to segment the first sound of a spoken word. For example, a correct first-sound response for the nonsense word *flob* would have been *fff*. The Second Sound subscale of the Phoneme Segmentation test focused on students' ability to segment the second sound of a spoken word. For example, a correct second-sound response for the nonsense word *flob* would have been *luh*. The Third Sound subscale of the Phoneme Segmentation test focused on students' ability to segment the third sound of a spoken word. For example, a correct third-sound response for the nonsense word *flob* would have been *ah*. The Fourth Sound subscale of the Phoneme Segmentation test focused on students' ability to segment the fourth sound of a spoken word. For example, a correct fourth-sound response for the nonsense word *flob* would have been *buh*. All 18 Phoneme Segmentation items included first, second, and third sounds, and 9 Phoneme Segmentation items included fourth sounds. Students were given one point for each sound correctly segmented, for a total possible score of 18 for each of the first three subscales and 9 for the fourth subscale.

ASSESSMENT

Ten 3-D Group researchers administered the PhonoGraphix assessment individually to students in the experimental and control groups both before and after the program (September and December 1998 for the first set of classrooms and December 1998 and March 1999 for the second set of classrooms). In an effort to maximize the number of classrooms sampled for the control group, one half of the students in each of the 19 classes were assessed during the first phase of the study, using a random-numbers table. The other half of the 19 control group classes was assessed during the second phase of the study. Thus, a pretest and posttest assessment was obtained for all students in the 19 classes over the course of the study. All 19 classrooms that participated in the control group during phase one also participated in the control group during Phase 2, except for one class that received the intervention during Phase 2.

All researchers involved in the assessment were blind to the experimental conditions of the study. Rather, they were lead to believe that *all* students being tested were participating in the BRD program and that the pretests would be used for diagnostics and the posttests for documentation.

The researchers administering the test participated in two training sessions to establish rater reliability (i.e., to ensure that they scored similar responses in similar ways). The first training session occurred 1 week before

testing, and the second was 1 week after testing began (testing lasted 2 weeks). In both sessions, all raters achieved nearly 100% agreement, yielding an almost equal number of correct and incorrect responses (virtually a perfect 1.0 interrater reliability coefficient). After completing data entry, all data were double-checked for accuracy by comparing printouts of raw data to the actual assessment coding sheets.

RESULTS

The general design of the study was to examine the effects of the BRD program on reading skills, as assessed by the PhonoGraphix Test. Improvement in Code Knowledge (consonant sounds and vowel sounds) and Phoneme Segmentation skills for students who participated in the BRD program was compared to the improvement for students who did not participate in the program. Specifically, there were 393 control-group students from 19 classrooms in nine schools and 328 BRD students from 16 classrooms in six schools. Due to attrition at the time of post testing, most comparisons were between 337 control-group students and 293 BRD students (see Table 2 for more detailed participation information).

Several analyses were undertaken to ensure equivalence of groups in terms of reading abilities. First and foremost was a comparison of the pretest scores between the two groups. As indicated in Table 3, the groups were not necessarily equivalent on all pretests; the control group performed better than the experimental group on all scales of the PhonoGraphix Test at pretest. This finding was partially expected because the control-group schools had slightly outperformed the experimental group the previous year on the 1998 Iowa Test of Basic Skills–Reading. It is rare in applied research to create two truly equivalent groups at the outset. In our case, the groups were both from low-income predominately minority populations in the same general areas of the same school district. Given that we were most interested in whether the students in the experimental group improved more than students in the control group, difference scores were calculated, which take into account initial differences in pretest scores. To examine the possibility that greater improvement resulted from lower pretest scores rather than the participation in the treatment group, interactions between pretest measures and group condition were examined for the major variables of interest (consonants, vowels, and phonemes). None of these interactions was statistically significant, which yields more confidence in the findings that it was participation in the

Table 2: Participation Information and Attrition Rates by School by Condition

Condition	School Number	Phase Participation	Number of Classrooms Participating	Students Pretested	Students Posttested	Percentage Attrition
Control Group	1	1, 2	1	21	16	23.8
	2[a]	1	3	57	46	19.3
	3	1, 2	3	67	60	23.9
	4	1, 2	3	55	48	12.7
	5	1, 2	1	24	19	20.8
	6	1, 2	1	23	20	13.0
	7	1, 2	3	57	48	15.8
	8	1, 2	3	61	54	11.5
	9	1, 2	1	28	26	7.1
	Control group subtotal		19	393	337	14.2
Experimental group	1	2	2	50	49	2.0
	2[a]	2	1	18	17	5.6
	3	1	3	59	54	8.5
	4	1 (4), 2 (1)	5	103	93	9.7
	5	1	3	56	49	12.5
	6	2	2	42	31	26.2
	Experimental group subtotal		16	328	293	10.7
	Overall total		35	721	630	12.6

a. School 2 participated in the control group during Phase 1 and the experimental group during Phase 2. All other schools were in either the control group or the experimental group but not both.

treatment condition that led to greater improvement in reading comprehension rather than initial pretest scores.

ATTRITION

As indicated in Table 2, attrition rates were quite varied across schools, with a range of 7.1% to 23.9% in the control schools and 2% to 26.2% in the experimental schools. Overall, there was a small difference in the attrition rate between the control and experimental group classrooms, such that the control group lost slightly more students (14.2%) for the posttest than the experimental group (10.7%).

Table 3: Average Percentage Correct on PhonoGraphix Scales by Group at Pretest and Posttest

PhonoGraphix Scales Code Knowledge	*Group*	N	*Percentage Correct Pretest*	*Percentage Correct Posttest*	*Improvement Difference*
Consonants	Control	338	70	80	10
	Exp	290	54	81	27
Vowels	Control	338	36	55	19
	Exp	266	27	57	30
Overall phoneme segmentation (PS)	Control	274	36	51	15
	Exp	242	27	55	28
PS first sound	Control	336	53	65	12
	Exp	285	42	70	28
PS second sound	Control	335	21	35	14
	Exp	286	15	40	25
PS third sound	Control	274	23	39	16
	Exp	245	16	43	27
PS fourth sound	Control	335	31	49	18
	Exp	289	24	56	32

To be sure that any group differences were not due to differential attrition, analyses were conducted to compare attrition between the two groups. Of the 721 students who completed the pretest, there were 91 students who were not available for posttest (35 students in the experimental group and 56 students in the control group). Pretest scores for all scales of the PhonoGraphix Test were examined for these students. The attrition analyses suggested that although the control group had slightly higher overall attrition, the differences in attrition were not related to reading ability. There were no significant differences between students who were unavailable at posttest in the experimental group versus the control group on any PhonoGraphix pretest scores (see Table 4). Thus, any differences in improvement scores between the groups cannot be reasonably attributed to differential attrition and should be attributed to real differences in learning growth between the groups.

IMPROVEMENT IN READING ABILITIES

To assess improvement in reading abilities, difference scores were calculated for each student based on subtracting pretest scores from posttest scores. In all cases, the percentages indicate the percentage correct out of the

Table 4: Group Differences on Pretest PhonoGraphix Test Means for Students Who Were Not Posttested

PhonoGraphix Scales Code Knowledge	*Percentage Correct Experimental (n = 35)*	*Percentage Correct Control (n = 56)*	t *Test Results*
Consonants	58	56	$t(89) = -0.31$, $p = .76$
Vowels	20	22	$t(82.3) = 0.32$, $p = .75$
Phoneme segmentation (PS) overall	26	34	$t(71) = 1.47$ $p = .15$
PS first sound	45	42	$t(89) = -0.43$, $p = .67$
PS second sound	15	16	$t(87) = 0.37$, $p = .71$
PS third sound	14	22	$t(71) = 1.47$, $p = .15$
PS fourth sound	21	29	$t(87) = 1.20$, $p = .23$

total possible number correct for each scale. Students with missing data on any item for any scale were not included in the analysis. There is no overall scale on the PhonoGraphix Test, so pretest, posttest, and difference scores are presented for each scale (see Table 3). To take into account any potential effects due to the clustered nature of this data, SAS PROC MIXED multilevel analyses were conducted (Little et al. 1996). Analyses were also conducted using SPSS, not taking into account the clustering, and the coefficients changed very little, suggesting that there were not significant effects due to clustering of students within classrooms within schools. The findings reported are from the multilevel model analyses. Independent-samples *t* tests were conducted to examine improvement in reading scores by group condition (experimental and control group). A conservative approach was taken, reporting all *t* values for unequal variances.

Consonants. Results suggest that BRD students demonstrated significantly greater improvement in Consonant sound recognition compared to control students, $t(502) = -7.33$, $p = .00$. BRD students were able to improve their scores by 27 points (out of a total possible of 100 points) from pretest to posttest, compared to an increase of 10 points in student scores in the control group.

Vowel Recognition. Results suggest that BRD students demonstrated significantly more improvement in accurately recognizing the sounds of vowels after receiving the program, compared to students in the control group, $t(560)$

= –4.44, $p = .00$. BRD students improved by 30 points, compared to control students, who improved by 19 points.

Phoneme Segmentation. Overall Phoneme Segmentation scores improved significantly more for students in the BRD group (28 points) compared to students in the control group (15 points), $t(512) = –7.01$, $p = .00$. Thus, BRD students were able to improve significantly more in accurately segmenting phonemes from a spoken word after participating in the program, compared to control students who received non-BRD reading instruction.

Participation in the BRD program resulted in greater improvement in Phoneme Segmentation (first, second, third, and fourth) compared to students in the control group. On average, BRD students were able to improve more in accurately segmenting first sounds after receiving the program, than control students, $t(576) = –5.12$, $p = .00$. BRD students also improved significantly in accurately segmenting second sounds after receiving the program, compared to students in the control group, $t(614) = –5.67$, $p = .00$. BRD students demonstrated significantly more improvement in segmenting the third sound of words than control students, $t(515) = –4.79$, $p = .00$. Finally, BRD students demonstrated significantly more improvement in accurately segmenting fourth sounds compared to control students, $t(613) = –5.40$, $p = .00$.

DISCUSSION

The results of this study are overwhelmingly positive regarding the impact of the BRD program on first-grade students' reading abilities. The program was so successful in the areas of consonants, vowels, and overall phoneme segmentation, that BRD students started out *lower* than control students and then actually performed *better* than the control students on the posttest. In 3 months of first-grade reading instruction, the program took low-performing readers and turned them into significantly better readers. Because of the rigor of the research design, we can be quite confident in concluding that the program, and not extraneous factors, caused increases in students' reading abilities that far exceeded increases observed with other methods of reading instruction.

The study was designed to afford considerable confidence in drawing conclusions about the effect of the BRD program on language arts skills. The inclusion of control-group students from a relatively large number of matched classrooms across many schools provided a fairly large representative no-treatment sample. This approach improved on previous efforts that

used smaller numbers of classrooms. Additional improvements on previous studies were the use of an individually administered standardized reading assessment immediately before and immediately following the program (rather than having a large time lag between testing and the program).

One difficulty often encountered in studies such as this one is the nonequivalence of groups. To address this issue, control students were drawn from schools that were similar to the experimental group schools. This procedure was not precise but did ensure that the control and experimental groups were substantially similar in terms of past achievement, poverty level, location, and racial makeup. As the analyses indicated, however, BRD students started out at a disadvantage, actually scoring lower than control students on all the scales. Thus, these findings were not the result of having "better" or brighter students in the experimental group; if anything, the opposite was true. Furthermore, there was no evidence of differential attrition related to reading abilities.

One might argue that because scores are quite similar for the experimental group and the control group at posttest, the experimental group would "naturally catch up" during the course of the year. However, this does not appear to be supported by previous research on the PhonoGraphix Test. In fact, children's relative ranking in reading scores remains very consistent across time, reading scores at pretest are excellent predictors of reading scores at posttest, and reading scores at pretest are not good predictors of rate of gain (McGuinness, McGuinness, and McGuiness 1996).

The PhonoGraphix Test was used to assess progress in the areas of code knowledge (alphabet sounds) and phoneme segmentation (separating letter sounds within spoken words). The content of the BRD program was centered specifically on these areas of reading, although more emphasis was placed on consonant sounds, vowel sounds, and phoneme segmentation. Hence, the analysis was limited to these three specific arenas and did not include the Consonant Digraphs and Vowel Digraphs subscales of the Code Knowledge scale.

As indicated in Table 3, scores on all scales on the PhonoGraphix Test improved for both the experimental and control-group students. These results indicate that all students' abilities increased over the course of 3 months during the school year. These results are not surprising in that much of the first-grade curriculum focuses on reading. Of course, the focus of the present study is not just to identify growth among the participants but to determine whether there was a difference in the growth of students who participated in the BRD program compared to students who did not participate in the program. To accomplish this goal, growth differences between the experimental and control-group students were examined.

There was significant evidence that the BRD program was a more effective method for teaching reading than other approaches used within the control classrooms. Students who participated in the BRD program significantly outperformed their peers in every area of reading measured for this study. Specifically, BRD students improved significantly more than control students did in their ability to (a) relate written consonants to the spoken sounds for those letters, (b) relate written vowels to the spoken sounds for those letters, and (c) segment phonemes from spoken words.

The variety of instructional approaches used across control classrooms provides a representative sample of teaching techniques used in the Chicago public school system. Thus, the findings suggest that the BRD program yields more positive results than the typical approaches used to teaching reading. Although we cannot conclusively determine that dance, per se, improved reading, the BRD curriculum, which incorporates dance as a teaching tool designed to improve reading comprehension, yielded more positive results than other approaches currently used.

Very few studies have been conducted that have examined dance as a means to academic achievement, and those that have been done have been either case-study approaches or theoretical in nature. Findings from this study suggest that learning through the arts, using dance as a medium, can raise academic achievement in reading. Although Eisner (1998) has argued against integrated arts instruction, these results do support his critique of the literature in that the arts-based education will most likely affect academic outcomes when the program is specifically directed toward raising academic achievement. Furthermore, this study represents an advance in the field in terms of examining arts education. As suggested by Catterall (1998), this study provides evidence for the types of learning that are likely to result from arts education and the conditions under which benefits occur. The success of this program with predominately low-income, urban, minority children is consistent with other studies that have yielded positive results with a similar population (Hanna 1992).

There are several limitations of this study that should be noted. First, although the control and experimental schools were generally matched for characteristics, such as racial and socioeconomic diversity, as well as geographic location, random assignment to treatment groups was not used, and the groups were not equivalent at pretest. Of course, random assignment would be the preferred method in designing a study, but applied research in the schools often makes this option unfeasible. Second, only one measure of reading ability was used, and the inclusion of multiple measures assessing reading acquisition would have increased the strength of conclusions. Furthermore, although this study demonstrated the effectiveness of the BRD

program for increasing students' consonant sound recognition, vowel sound recognition, and phoneme segmentation skills, it remains to be seen whether the program will be effective with more advanced areas such as digraphs. To address these limitations, future research focusing on advanced topics may be worthwhile later in the academic year when students are prepared to move on to these topics. In addition, it would be beneficial to conduct randomized controlled studies with other populations, across various grade levels, to support the findings of this study and further examine the effectiveness of the BRD program. Last, the present study provides evidence that the BRD program is better than non-BRD approaches to reading. However, future studies could compare the BRD program to one or more specific approaches to reading to determine how the program stands up to other innovative programs, not just the "standard" approach to reading.

Given the tremendously positive effects demonstrated by this study, it may be useful to examine why the arts are not being used more systematically by teachers and schools to facilitate student learning. First, there has been little systematic research conducted to examine the effects of arts-based programs in general, and dance in particular, on academic skills. Second, teachers who are interested in these techniques often prefer very specific curricula to facilitate ease of implementation, and very few programs have been created in this manner. A study conducted by MacDonald (1991b), who interviewed 19 prekindergarten through third-grade teachers, suggested that there are several reasons why teachers may not tend to use dance techniques in the classroom. The teachers interviewed did not feel comfortable with teaching dance because they did not have the following: (a) attitudes or beliefs that dance could be beneficial for their students, (b) training in teaching techniques or knowledge of how to integrate dance across the curriculum, and (c) resources available or a high priority of arts education in their schools.

These findings have several implications for school-based interventions, as working collaboratively with teachers and principals is the next step toward creating change in our educational system. Teachers have indicated they would appreciate practical ideas regarding specific demonstrations of skills in various subjects, resources on teaching the arts, and support from school administration (MacDonald 1991b). Teacher training and support are necessary to facilitate transfer of training across the curriculum. For example, if the teachers learn the BRD program, they will be equipped with many behavioral strategies that will facilitate learning in their classroom. The teachers will also internalize the strategies taught in the program, so they can apply them during the course of the week, as artists or other outside persons are only available on a limited basis. Furthermore, training teachers and

harnessing support from the administration to teach basic skills through the arts may be a cost-effective strategy for the educational system.

This study represents a significant advance in the field of arts-based education, illuminating the positive impact of a curriculum-based program that was systematically developed on the basis of theory and pilot tests. The importance of educational strategies that teach basic reading skills in fun and creative ways cannot be underestimated. The benefits of teaching through active-learning strategies enable teachers to reach all students in their classrooms, capitalizing on multiple learning styles rather than focusing on single modalities of learning.

NOTES

1. The complete curriculum is available from Whirlwind, 65 E. Wacker Place, Suite 820, Chicago, IL 60601; e-mail: www.whirlwind-results.org.

2. Blending and phoneme manipulation were not assessed with this population because at the beginning of first-grade, these children were not yet ready for these tasks. Blending is an important aspect of the curriculum, but many students in this sample did not get through this section in the last portion of the curriculum. We believed that nonsense word decoding would not be too difficult for these children, so it was administered at pretest to all children. However, it was also too difficult for the population that participated in the study, as children were unable to understand this task, so it was eliminated from the assessment at posttest.

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