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USING DEVELOPMENTAL PRINCIPLES TO ASSIST PRESCHOOLERS IN DEVELOPING NUMERACY AND LITERACY[1]

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Summary.—In a yoked control design, 4-yr.-olds ($N=39$) in a Head Start program played numerous structured games involving either the oddity principle or letter identification and letter sounds. The children's mean age was 53.2 mo.; $SD=4.1$ mo. Three were Middle Eastern, 14 were Latino, 7 were East African, and 15 were African American. Children showed better mastery of oddity after playing games directed at this concept, and numeracy scores on the Woodcock-Johnson III were better for children who had played this type of game. Woodcock-Johnson III Letter-Word scores for children who had played the oddity and seriation or letter games were equivalent. These results are consistent with other research indicating that the understanding of oddity relations may be a key transitional thinking which supports quantitative and verbal development at the preschool-kindergarten interface. The standardized test scores indicate that guided play directed at this aspect of cognitive growth or more narrowly directed at early literacy can produce equivalent knowledge of letters.

Pasnak, McCutcheon, Holt, and Campbell (1991) and Pasnak, Hansbarger, Dodson, Hart, and Blaha (1996) used learning sets (Harlow, 1959; Gagné, 1968) to teach the oddity principle and insertions into series—two early abstract thinking abilities most children develop naturally—to children who were having difficulty understanding kindergarten work. The children's verbal and quantitative abilities were substantially improved. Ciancio, Rojas, McMahon, and Pasnak (2001) showed that modifying this approach to a game-like format substantially improved learning by children in a Head Start program to form abstractions if the games were played for most of the school year. The children also did better on standardized tests of numeracy than children who were engaged in traditional preschool numeracy activities for equal sessions.

These results confirm that increased understanding of the oddity principle and insertions into series leads to broad gains in verbal and quantitative comprehension. In many ways this is not surprising, since it has long been known that classification and seriation in the broad sense are associated with both verbal and quantitative achievement in K–3 (cf. reviews by Waller, 1977; Silliphant, 1983; Pasnak, 1987). What is new is (a) the identification of specific forms of classification and seriation that are particularly important, (b) the discovery that these abstractions can be taught, and (c) the

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finding that improvement in them produces significant gains in school readiness as measured by widely used standardized tests. This finding is important for developmental psychologists because it shows that strengthening two cognitive abilities that are theoretically important does in fact set the stage for improvement in numeracy.

The same cognitive abilities, developed by the same game format, might also translate into increased early literacy. This possibility was suggested by studies that have tested the relation between various forms of classification and verbal abilities (Freyberg, 1966; Kaufman & Kaufman, 1972; Gillet, 1978; Silliphant, 1983). Specific tests of the effects of teaching the oddity concept and insertions into series and verbal achievement were conducted with kindergartners by Pasnak, *et al.* (1991), and Pasnak, *et al.* (1996). The kindergartners who were taught oddity and insertion improved significantly on a Stanford early School Achievement Test verbal measure. The project reported here was designed to test whether a similar result could be achieved with preschoolers by teaching the simplest concept, oddity. A cognitive gain that resulted from strengthening children's understanding of oddity might be robust enough to lead to improvement in the verbal sphere, or its effect might be limited to understanding quantitative concepts. The pathways from cognitive abstraction of basic relations to understanding the lessons educational settings provide on numeracy and literacy are presently unknown. It would be premature to conclude either that improved understanding of the oddity principle would have effects in only one sphere, or that they would have effects on both spheres. The focus of the research reported here was on whether improving preschoolers' grasp of the abstraction embodied in the oddity principle would lead to improvement in their comprehension of preschool instruction in literacy. Further, it was of interest whether they would progress as much as or more than children given instruction specifically in literacy, while gaining an advantage in their understanding of numeracy.

The Oddity Principle

Preschoolers distinguish objects in terms of their absolute qualities, and do not note many of the abstract relations that are obvious to elementary school children. The oddity principle is important because it embodies purely abstract relationships. It is probably the earliest pure abstraction that children develop (Klein & Safford, 1978; Pasnak, Campbell, Perry, & McCromick, 1989) and hence marks the transition from pre-operational to concrete operational thought (Inhelder, 1968). It is a form of classification that has been relatively neglected by educators and developmental psychologists, who have focused instead on lower abilities, such as sorting and hierarchical classification (Mervis, 1987; Smith & Heise, 1992; Mervis, Johnson, & Mervis, 1994) or higher forms of classification like class inclusion (Siegler, 1986;

Gold, 1987; Greene, 1994). Preschoolers ordinarily develop recognition of similarities and differences and ability to sort reasonably well, but mastery of the oddity principle requires relational responding (Rosch, Mervis, Gray, Johnson, & Boyes-Braehm, 1976; Waxman & Hatch, 1992). When confronted with a group of objects which are all identical except that one differs in size, pre-operational children try to solve the problem on an absolute basis. For example, if shown one large and three small safety pins, a pre-operational child may correctly identify the large pin as different and not belonging with the others. However, if shown one small and three large pins, the same child will not identify the small one as unlike the others, and instead may persistently select the large pins, one after the other. Another child will do the opposite, always selecting the small size (Friedman & Pasnak, 1973; Pasnak, Brown, Kurkjian, Mattran, Triana, & Yamamoto, 1987). The difficulty is not a communication problem and cannot be resolved without extensive instruction. It arises from an immature stage in the cognitive development of all children, regardless of ethnicity or social class. The child does not adequately recognize the relation between the objects in the group and instead searches for an absolute quality like "large" or "small" to govern choices. This is pervasive across dimensions of form, color, orientation, type, function, and so forth, and is only very slowly replaced by relational responding.

If upon entry to kindergarten a child has not developed a complete understanding of simple relations between such objects that make one "odd," the child is likely to struggle with many aspects of classroom instruction. Instruction and explanation in the classroom are based on the assumption that such relationships and even more abstract ones are obvious, and they are obvious to the great majority of kindergarten children. The thinking of children who have not mastered oddity is usually closely tied to one or two perceptual properties of whatever they are considering or studying. As a result, they have trouble conceptualizing similarities and differences that have a non-perceptual, abstract basis, and make poor decisions (Mandler, 1997; Oakes, Coppage, & Dingel, 1997). They too often fail to recognize and take advantage of simple relations based on size, shape, orientation, function, or some other dimension. These differences in abstraction interfere with their problem-solving, even with tangible objects and much time available for trial and error. Mental understanding of the interrelations of things or events named or described is even more demanding. When such difficulties persist, the children are at a great disadvantage in understanding what they are taught and the problems they must solve in kindergarten. They fall behind and experience difficulties in subsequent grades.

Since preschool curricula are very broad and aimed at many aspects of development, they deal only briefly with the simplest aspects of classification. Three "key" categorization experiences in the popular High/Scope curriculum that is used in many Head Start and private preschool programs are good examples. The Piagetian elements of curricula have not been shown to produce more general cognitive gains than many other enrichment activities of a more general nature. One problem is that the process of assimilation (Piaget, 1937/1954) makes advances in fundamental thinking abilities much more difficult than advances in skills or knowledge which require thinking no more abstract than that the child customarily employs. The oddity principle requires more abstraction at a level more advanced than that at which preschoolers may function when their cognitive development is hindered by disadvantages associated with poverty.

Psychological research has shown that learning sets—sets of very many examples of the principle to be learned—are needed to teach abstractions to learners who are not already functioning at an abstract level (Harlow, 1959; Gagné, 1968; Pasnak, *et al.*, 1987; Soraci, Deckner, Baumeister, Bryant, McKay, Stoddard, & McIlvane, 1991). This was the essence of Ciancio, *et al.*'s (2001) method. A very large number of different sorts of instructional materials were used to teach preschoolers the oddity principle and to insert objects into series. It is only when a child has applied a principle in a large number of contexts that the principle can be internalized enough to be applied readily to understanding classroom instruction.

Teaching Abstractions to Preschoolers

Preschoolers learn best through play. Vygotsky (1978, p. 102) expressed this well in his chapter on the role of play in development, when he said "In play a child is always above his average age, above his daily behavior, in play it is as though he were a head taller than himself." Early childhood education specialists emphasize play as a means for advancing children's thinking abilities in preschool (Eisner, 1990; Weininger & Daniel, 1992). After experiencing some failure with warm and supportive learning set instruction that did not involve play, Garrett, Busby, and Pasnak (1999) developed a way for children to enjoy play while solving a great many oddity and insertion problems. This synthesis allowed the children to both learn in the manner they liked best and enjoy the advantages of a learning set when mastering the relations involved in oddity and insertions.

In this method, numerous oddity problems are composed of small objects, several of which are identical and one different in a particular dimension. The types of objects used vary widely from one problem to another; this is as important as the number of problems for promoting generalization of what is learned. The adult and the child each have a pony or dinosaur, and the adult's animal likes to kiss, bite, stamp on, or otherwise interact with the object that is different. The adult's animal asks the child's to join in, and the two animals play at this until the child's animal is very sure which object is the different one. Children play each game as much as they like until they master it very throughly and are ready for a new one. Since each game depends on applying the oddity principle, they come to understand these ideas very thoroughly, through an inductive process.

An Active Control Group

Pasnak and Howe (1993) proposed that in educational research, an active control group of children taught by traditional methods is highly desirable. Extra adult time and attention is often beneficial to children, and many existing instructional methods are successful. A traditional passive control group, wherein children have less attention from adults or are not taught something relevant to the performance desired (dependent variable), does not answer the question of whether a new approach is really more effective than simply giving children more time and attention or having higher expectations for their subsequent performance. Hence, the control group in this research was taught letters and letter sounds with traditional preschool materials, in sessions yoked to those of the children taught oddity. Since all children had the same amount of interaction with adults on constructive activities, familiarity and related factors should be equal. Any advantage to children in either group would have to be related to the nature of the activities they experienced. Expectations might favor the experimental group on oddity but should favor the control group on letter knowledge. This design also addresses a very important practical question for developmental psychologists and early childhood educators; whether interventions aimed at cognitive development per se produce as much academic advancement as interventions aimed more narrowly at producing mastery of academic subject matter. Early development of letter knowledge is quite important in furthering early literacy. It is especially desirable to discover a cognitive intervention that can enhance cognitive development without sacrificing the gains in letter knowledge that could be obtained from an equal investment of resources.

Hypotheses

Children who played oddity games should do significantly better on tests of the oddity principle than children who did not play such games, if the games were effective. They might also do significantly better on a numeracy test because improvement on oddity can improve numeracy (Ciancio, *et al.*, 2001). These were unidirectional (one-tailed) hypotheses, because there was no reason to suppose the control group would have any advantage in these domains. However, either the improved relational thinking of the experimental group or the letter knowledge activities of the control group might produce more understanding of letters. Hence, a bidirectional (two-tailed) hypothesis test was used for this comparison.

METHOD

Participants

All 74 children from four Head Start classrooms in an urban area of northern Virginia were randomly assigned to the experimental group or the control group, with the restriction that equal numbers of children in each classroom be in each group. "Head Start" is a federally funded preschool program for children who are considered to be at risk for school failure because their families have incomes that fall below federal poverty guidelines. Head Start teachers are by policy of the same ethnicity as most of the children—in this case, three were African American, one Latino. Head Start curricula emphasize cognitive and socioemotional development and sound health and hygiene practices. The children's initial ages ranged from 3 yr., 3 mo. to 5 yr., 2 mo. ($M = 49.1$ mo., $SD = 8.2$). By the end of the second month of the project, after 34 sessions of instruction, it became apparent that the oddity concept was too advanced for the 3-yr.-olds, so the research was discontinued for children in both experimental and control groups who were less than 4 yr., 0 mo. old. Eliminating the 26 3-yr.-olds and attrition of nine 4-yr.-olds from the Head Start program left an experimental group of 11 girls and 9 boys by the end of the school year (M age $= 52.8$ mo., $SD = 4.0$). Eight were African American, 3 were East African, 7 were Latino, and 2 were Middle Eastern. The control group at the end of the school year consisted of 10 girls and 9 boys ($M = 53.4$ mo., $SD = 4.2$). Seven were African American, 4 were East African, 7 were Latino, and 1 was Middle Eastern. This sample ($N = 39$) is large enough to permit detection of large effects with alpha set at .01 (Cohen, 1992).

Materials

Instruction.—Eighty sets of ordinary objects found in homes, nature, and drug, grocery, hardware, sewing, and toy stores were used in games designed to teach children the oddity principle and to insert objects in a series. Each oddity game had three objects identical on one dimension and one which differed on that dimension. For the first 20 games, the odd object differed only in form, e.g., three wooden rectangles and a wooden square, or three straight nails and a bent one. The next 20 games each had one object that differed from the others only in size, e.g., three large paper clips and a small one, or three small buttons and a large one. In 10 cases, the odd object was larger than the others, and in 10 cases it was smaller. For 20 orientation oddity games, the four objects in each set were identical, but three were presented horizontally and one vertically or vice versa, or three were slanted 45° one way and one 45° the other or vice versa, or three faced left and the other right or vice versa. The last 20 games involved hierarchical classification. For each game, one object belonged to one class and three to a completely different class, e.g., three plastic animals and a plastic robot, or three wooden letters and a wooden number.

Phonemic awareness games were played with rubber and plastic letters similar to those found in all or nearly all preschool classrooms.

Tests

An oddity test made up of everyday objects, the classification scale from the Otis-Lennon School Ability Test Primary I, and the Woodcock-Johnson III Applied Problems quantitative and Letter-Word scales were employed.

New objects were used in a 16-problem oddity test. It had four form oddity problems, four size oddity problems, four orientation oddity problems, and four hierarchical oddity problems. This was a test of whether the children could apply the oddity principle to problems which had new objects but were similar in format to those used in instruction. Test-retest reliabilities with preschoolers over a 4-mo. period are .74 for this task, and correlations with the Slosson Intelligence Test range from .62 to .74 (Pasnak, Willson-Quayle, & Whitten, 1997).

The 12-problem Otis-Lennon classification scale was used to measure whether the children could apply the oddity principle to problems in a format that was quite different from that used in instruction. Each Otis-Lennon problem is a row of five drawings. Although all of the drawings in a row differ, four are related in some way and the other is not. The relations are very variable: one involves four different vegetables and a roast chicken, one has four letter-number-letter triads and a letter-letter-letter triad, one has black geometric figures (circle, square, triangle, and hexagon) on white backgrounds and a white diamond on a black background, and so forth. This is a measure of generalization of the oddity principle far beyond the instructional context, because the test uses booklet drawings rather than objects, none of the items in a set are ever identical, and the oddity is never in overall form, size, or orientation.

The Otis-Lennon Primary I, the lowest level, is designed for children in Grade 1 but can be given to kindergartners. Kuder-Richardson (K-R 20) reliabilities of .88–.90 are given in the manual. Previous experience indicated that the classification scale was appropriate for local Head Start 4-yr.-olds, but the more demanding Analogies and Omnibus scales were too difficult; hence, the latter scales were not used.

The first 28 problems of the Woodcock-Johnson III Applied Problems quantitative scale were used. This scale starts with "Show me just one finger" and proceeds through problems like "if you took three of these balloons away how many would be left?" to "how much money is this?" The problems refer to pictures of the objects in question. Testing is terminated when a child misses four consecutive problems.

The first 24 problems of the Woodcock-Johnson III Letter-Word Identification scale were also used. Problems 1–9 and 11–14 require the child to identify letters. Problem 10 requires the child to identify the word cat and Problems 15–24 require reading one syllable words. Testing ends when the child makes six consecutive errors. The manual gives reliability coefficients of .79 at age 4 and .86 at age 5.

Procedure

Three children at a time were invited to play the games with 20 college students, who were the trainers for the study. In each of the four classrooms, a different trainer worked with the children each day, in a weekly rotation. That is, one trainer would come on every Monday, another every Tuesday, and so forth. These trainers were supervised by the first and second authors of the study daily. Half of the children were randomly assigned to play games with letters, while the other children played oddity games. As differences in mastery became noticeable, the trainers chose trios of children whose progress was matched enough that they could play the same games. The trainer's pony or dinosaur show the children's ponies or dinosaurs how to eat or stamp on or kiss a particular letter or the odd object in each oddity game. The children's animals were than asked to try. The trainers scaffolded the game playing, speaking in a special pony or dinosaur voice. Each child had a set of objects, which were simply dumped in front of the child. The trainer's pony or dinosaur stamped on, bit, or kissed the odd object, and gave high fives, neighs, or roars when a child's did the same. Initially, the children relied on the trainer's demonstration and copied each other's efforts, but gradually they became more independent. When children were correct on their first attempt at a game on three successive days, that game was retired and a new one was introduced.

The control games with letters were very similar to the oddity games, except that the college student's pony or dinosaur showed the children's ponies or dinosaurs how to eat or stamp on or kiss a particular letter from among a group of several different letters. When a child had learned to select the letter requested—for example, an "A"—and had been correct on their first attempt for three consecutive days, they would be taught to select the next letter in the alphabet, a "B." When the games with letters had taught the children to identify all of the letters of the alphabet, the adult's animals began to emit the sounds of the letters, and the child's animals were asked to copy. If the child's animal learned the sounds of all 26 letters, they proceeded to two-consonant combinations, again in alphabetical order—bl, br, ch, cl, and so forth. These control sessions were alternated with the experimental sessions, so that each experimental and control trio alternated playing just prior to or just after each other's session, and all received the same number of sessions unless they were absent.

The games were started in early October and continued through the first week of May. They were played every day except when field trips or some unusual event intervened. Posttesting on the dependent variable was conducted by "blind" testers engaged for this purpose in late May and early June.

Results

All but three of the children in the experimental group mastered all of the games to the criterion of being correct on their first choice on three consecutive days. The three children who did not reach this criterion continued to make errors on some orientation games involving left and right orientations but mastered all of the other games.

Of the 19 children in the control group 18 mastered all of the games which required selecting the letter they were asked to select, to the criterion of being correct on their first effort on three consecutive days; the other child mastered all but seven letters. Nine mastered all of the sounds of individual letters, and four of these nine mastered all of the consonant blend sounds.

Table 1 shows that the scores for the children taught oddity were higher on all variables but the test of letter knowledge. The children in the experimental group became superior at applying the oddity concept to everyday objects. The children in the control group averaged just over six errors on the 16-item test. The children in the experimental group cut this error rate nearly in half. The effect size coefficient shows that this is a large effect in terms of normal variations in these scores. These results indicate that the children in the experimental group could apply their new thinking abilities

TABLE 1
Raw Scores and Significance Tests For Preschoolers in Experimental and Control Groups

Test	Experimental Group		Control Group		t_{37}	p	d
	M	SD	M	SD			
Oddity	12.6	3.6	9.8	3.1	2.61	< .01	.84
O-LSAT	8.2	1.7	5.8	2.2	3.81	< .005	1.23
Numeracy	16.0	3.8	12.7	3.9	2.68	< .01	.86
Letters	9.0	4.6	9.2	5.0	.12	ns	.04

to novel objects when these were presented in the same format as the objects with which they had been taught. Thus, these children learned what they were taught, although their performance was not perfect. The children who were taught oddity were also superior to the children taught letters on the Otis-Lennon oddity scale. Hence, they generalized their thinking to a workbook-like format that is commonly used to predict success in school. The difference between the experimental and control groups is about $2^1/_2$

points. This effect is rather large, statistically speaking, e.g., greater then a standard deviation. It indicates that the children applied their new ability to things (pictures and geometric designs) quite different from the objects with which they were taught, in a format and presentation that was also very different, and quite relevant to the worksheets these children would encounter in kindergarten.

The children in the experimental group also scored best on the quantitative scale, averaging about three more questions answered correctly. This is again a large effect, statistically. It is also large in a practical sense: the children scored at the same level as children normally score in the fourth month of kindergarten. They had no special instruction on numeracy, and the questions on this scale do not involve a direct application of the oddity principle. However, in this preschool, the children had many curricular activities designed to increase numeracy—the children in the control group had a score nearly equivalent to that of children entering kindergarten. One consequence of strengthening understanding of children in the experimental group of the relations involved in oddity could be an increase in their profiting from these preschool classroom activities, and that would increase numeracy. This is what occurred in the study by Ciancio, *et al.* (2001), and the effect was replicated here. Thus, learning the oddity principle appears to support the development of numeracy.

There was no significant difference in Letter-Word scores, and the absolute difference was very small. The children playing letter games got special adult assistance in learning letters 10 extra minutes per day, and appear to have benefited from it. Their average score in the final month of preschool was equivalent to the national average for children who have been in kindergarten for 2 mo. It is disappointing in the sense that they identified on average only 8.8 of 13 letters correctly. (A few children also identified the word cat). They had performed much higher during the instruction phase of the research. However, remembering the relations between arbitrary symbols and names is challenging for preschoolers, and that is what is involved in connecting letter shapes to letter names. Any instruction which helps children from impoverished families match or exceed the performance of children who do not have this disadvantage can be considered a good outcome.

Although the children in the experimental group received no experimental instruction in letters, this preschool program emphasized preschool literacy activities and provided direct instruction in letters and letter sounds. Hence, all children had ample stimulus and challenge to learn letters and letter sounds outside of the games they played as part of the research. If the increased understanding of relations could assist children in making connections between symbols and letter names, the children who learned the oddity principle would be aided in learning more letters as a consequence of the preschool literacy activities. The cognitive and letters instruction could offset each other in this one arena, and produce equivalent mastery. That seems to be the outcome obtained.

Discussion

The most important outcomes of this research are (1) that the children improved significantly in applying the oddity principle, (2) that they consequently became superior in numeracy, and (3) that their knowledge of letters was a good match for classmates who received special instruction on those topics. Hence, there appears to be a case for teaching the oddity principle in preschool classrooms.

While some effort is made to teach some form of categorization in many preschool and early elementary school programs, there are no published reports in the ERIC Clearinghouse or elsewhere demonstrating that such instruction is successful. Piaget and Inhelder (1966/1969) predicted that such instruction would not be successful. While children can be taught many things, he argued that the process of assimilation would defeat adults' efforts to teach children abstractions for which they were not "ready." Indeed, Piaget (1962) introduced the concept of school-readiness. The truth turns out to be that it is extraordinarily difficult to teach children concepts that are more abstract than those with which the children are currently functioning. There are two reports of nearly complete mastery of oddity problems after very extensive instruction, with generalization of solutions to problems similar in format to those on which the children were instructed (Pasnak, *et al.*, 1987; Soraci, *et al.*, 1991). However, the general pattern is of improvement, but not mastery, in research studies in which children receive much more instruction than they do in conventional classrooms (e.g., Pasnak, *et al.*, 1991; Pasnak, *et al.*, 1996). When improvement does occur, it is only after the use of many exemplars of the principles to be learned, i.e., learning sets.

While the foregoing has some theoretical significance, the issue for educators and applied developmental psychologists is why the oddity principle should be taught. After all, children will develop this early abstract thinking sooner or later on their own, so it may be that instructional time should be directed narrowly at the knowledge which children can only learn via adult instruction. This research indicates that the answer may be "no." The children helped to develop the abstract thinking involved in recognizing oddity also gained an advantage in numeracy. They were better able to take advantage of the classroom opportunities for developing their understanding of numeracy than classmates who could not relate one item to others in a group. In this respect, the thinking involved in applying the oddity principle may be thought of as part of the foundation for understanding some of the instruction offered in preschool. The children in the experimental group gained some proficiency in recognizing and responding to abstract relations and hence were more able to profit from numeracy activities and enrichment offered in preschool. The children in the control group, whose oddity test scores show that they could not respond so well to such relationships, did not profit so much from preschool opportunities to develop their understanding of numeracy.

The next issue is, of course, whether the 10 min. per day spent on oddity might not have been better spent teaching the children letters and sounds. The answer to this question seems to be "no." The control children's sessions were designed to ensure that all children had equal opportunities for interaction with the adults, familiarization, positive expectations, and developing approaches to problem-solving. In addition to controlling these potential confounds, however, their time was spent on activities designed to directly teach them letters and letter sounds, and they obviously profited from this. These preschoolers made an average score in May of the preschool year that corresponds to a grade equivalent of K-2. Scoring as well as children who have been in American kindergartners for 2 mo. is a praiseworthy achievement for any preschooler. The children whose thinking had improved turned out to be a good match, scoring at the K-0 level. The most sensible explanation is that they profited better from the literacy enrichment their classrooms offered. Perhaps learning the connections between arbitrary symbols and sounds was made easier for these more abstract thinkers. Their ability to keep up with children who were receiving extra instruction in literacy and to exceed those children in numeracy indicates the potential of strengthening children's understanding of the oddity principle when children are also offered the enriched environment of preschool.

Conclusion

Adding brief daily sessions of playful instruction guided by empirical research and developmental theory to a conventional preschool curriculum produced a measurable advantage in numeracy for children from economically disadvantaged families. This is potentially important because learning by playing is a central theme of early childhood education. Young children do not tolerate direct instruction very well (Eisner, 1990; Weininger & Daniel, 1992). The present research indicates that they can be engaged in the play-enriched instruction appropriate for preschoolers and learn the academic subject matter which preschools are being asked to teach. While doing so, they can simultaneously make progress in developing a cognitive skill that is desirable and normal for children at their age (Malabonga, Pasnak, & Hendricks, 1994). The form of instruction used here is easy to do for anyone comfortable with children and requires no expensive materials. Hence, it holds promise for preschool curricula. Perhaps the method can be extended to other concepts that are important in children's cognitive development, and children can be helped to make broader gains.

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