Mastery Motivation in Toddlers with Developmental Disabilities

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HAUSER-CRAM, PENNY. *Mastery Motivation in Toddlers with Developmental Disabilities.* CHILD DEVELOPMENT, 1996, **67**, 236–248. Prior research on school-age children with mental retardation indicates that they are less motivated on tasks than mental-age-matched peers. In this study, mastery motivation on two tasks was compared for 1- and 2-year-old children with motor impairment (n = 25), developmental delay (n = 25), and typical development (n = 25), matched for mental age. The groups did not differ significantly on any measure of mastery motivation. The relative contribution of premature birth, a history of seizure disorders, severity of cognitive delay, and maternal didactic interaction in predicting mastery motivation was examined for toddlers with developmental delay or motor impairment. Maternal didactic interaction added a significant proportion of variance above and beyond other variables in predicting several aspects of mastery motivation in toddlers with developmental disabilities.

Developmental theorists (Hunt, 1965; Piaget, 1952; White, 1959) have proposed that the motivation of young children to explore their environment is the foundation upon which learning occurs. Such motivation is assumed to be intrinsic, universal, and an integral part of development for all children.

Studies on mastery motivation generally have operationalized this construct as independent and persistent task-directed behavior in problem-posing situations that are moderately challenging (Morgan, Harmon, & Maslin-Cole, 1990). Task-directed persistence has been found to differ from non-goal-oriented manipulation of objects in both typically and atypically developing children (Hupp & Abbeduto, 1991). Based on White's (1959) assertion that competence produces pleasure, positive affect has often been studied in relation to mastery motivation and found to correlate with the mastery efforts of infants (Shultz & Zigler, 1970) and school-age children (Harter, 1974).

Although not redundant with tests of cognitive status, mastery motivation measures, at least during infancy, have concurrent relation to cognition and are reasonable predictors of later cognitive competence in children. Indeed, infant mastery motivation measures have been demonstrated to be better predictors of preschool cognitive indices than standardized infant developmental quotients (Messer et al., 1986). This may be because mastery motivation is an indicator of the way in which children approach learning about objects; thus, children who display high rates of persistence with problem-posing tasks may take full advantage of a range of spontaneous learning opportunities and ultimately demonstrate more advanced performance on formal tests of cognition.

Children with developmental delays and mental retardation, by definition, exhibit slower rates of learning. Early work on the motivation of children with delayed development in problem-posing situations indicated that school-aged children with retardation, in comparison to their mental-age matched peers, demonstrated lower levels of motivation on an array of measures, including variation seeking, curiosity, mastery for the sake of competence, and preference for challenging tasks (Harter & Zigler, 1974). While providing valuable information, these

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results leave unexplored a critical question: Are children with developmental disabilities intrinsically less motivated to understand the world of objects?

One way to investigate this question is to examine the behavior of children with developmental disabilities to determine if decrements in mastery motivation are evident at an early age. Research on mastery motivation involving problem-posing tasks comparing children with and without developmental disabilities is sparse, and the findings are somewhat inconsistent (Hupp, 1995). In a study comparing infants with Down syndrome to typically developing infants, MacTurk, Vietze, McCarthy, McQuiston, and Yarrow (1985) reported differences in patterns of children's exploratory behavior, but they found no difference between the two groups in task persistence or task success. In a similar study comparing toddlers with and without Down syndrome, Ruskin, Mundy, Kasari, and Sigman (1994) found no differences in these two groups in terms of ratios of non-goal-oriented play with objects to goal-directed mastery motivation, although typically developing children demonstrated longer continuous strings of goal-directed mastery and more positive affect with a set of effect production toys. In another comparative study, Jennings, Connors, and Stegman (1988) found preschool-aged children with physical disabilities to display lower levels of persistence on problem-posing tasks than their nondisabled peers.

One purpose of this investigation is to add to the small but growing corpus of findings on mastery motivation in young children with developmental disabilities. While building on the work of others, this investigation differs from prior studies in that it includes children with two types of disabilities (motor impairment and developmental delay), comparing them to each other and to mental age-matched peers. The toddler age (i.e., children at the end of the sensorimotor period developmentally) has been selected as the focus of this investigation because at this time children are beginning to become more self-regulated in their production of outcomes (Bullock & Lutkenhaus, 1988) and to perceive themselves as agents of action in behavioral-event contingencies (Heckhausen, 1993).

Although comparative studies are useful in generating an understanding of areas of development in children with developmental disabilities that are similar to or different from typically developing children, those interested in application of such knowledge raise questions about the critical environmental predictors of individual differences in development. Studies of development consistently point to maternal interaction patterns with children as one of the critical predictors (Ainsworth, Bell, & Stayton, 1974). Theoretical models (Vygotsky, 1962, 1978; Werner & Kaplan, 1963) have posited a central role for caregivers in children's learning and development. These models are supported by a broad base of empirical studies on children developing typically and a small, but growing base of empirical research on children with developmental disabilities. For example, in investigating a sample of infants with cerebral palsy, Blasco, Hrncir, and Blasco (1990) found that the quality of the infants' spontaneous play could be predicted by the extent to which mothers provided functional adaptations when interacting with their child.

Some investigators have challenged the notion that the absolute level of maternal stimulation in maternal-child interaction is the critical predictor of children's performance and instead posited a complex correspondence between certain aspects of maternal behavior and specific child outcomes (Tamis-LeMonda & Bornstein, 1994). One form of maternal behavior, didactic interaction, has been found to correspond with cognitive features of children's development such as environmental exploration during infancy (Bornstein & Tamis-LeMonda, 1990) and language comprehension and play competence during the toddler years (Tamis-LeMonda & Bornstein, 1990). Bornstein and Tamis-LeMonda (1990) speculate that the process by which didactic interaction furthers the child's cognitive development is a result of a congruence between maternal strategies that stimulate the child's engagement with objects and the child's attentional focus on the environmental stimuli.

Increasingly, research on mastery motivation is examining the mediating role of the caregiving environment (Busch-Rossnagel & Knauf, 1995; Heckhausen, 1993). During infancy some positive relations have been found between parental sensory stimulation and children's persistence with tasks (Yarrow et al., 1984). Other investigations reveal an inverse relation between children's mastery motivation and parental interference with children's autonomous attempts to engage in an activity (Frodi, Bridges, &

Grolnick, 1985; Grolnick, Frodi, & Bridges, 1984; Hauser-Cram, 1993; Lutkenhaus, 1984; Wachs, 1987). These studies point to the nature of the interaction provided by caregivers as an important mediating variable in understanding mastery motivation.

Caregiver's didactic interactive behavior with children provides a logical link to understanding children's mastery motivation during the toddler years. Caregivers who sensitively and appropriately assist children in learning to focus attention and engage in highly challenging problem-posing tasks may facilitate children's autonomous enjoyment of, and thus engagement in, self-directed task-persistent activities. Moreover, this relation may have particular importance in dyads where the child is developmentally disabled because the child may have a limited repertoire of responses, making the demands on caregivers even greater (Barnard & Kelly, 1990; Castaldi, Hrncir, & Caldwell, 1990). A second purpose of this study, thus, is to investigate the hypothesized relation between maternal didactic interaction and mastery motivation in children with developmental disabilities.

In summary, two research questions guide this study:

1. Do toddlers with developmental delays or motor impairment exhibit lower levels of mastery motivation than their mental-age-matched peers?

2. Does maternal interactive didactic behavior explain significant variation in mastery motivation in children with developmental disabilities?

Method

Subjects

Three groups of children were included in the analyses of the first research question: children with typical cognitive development (n = 25), children with motor impairment (n = 25), and children with developmental delay (n = 25). Thus, the sample was composed of 25 sets of "matched-triplets"; each child in the typically developing group was matched using raw scores from the Bayley Scales (1969) Mental Development Index (MDI) with two other children, one from each disability group. All children had a mental age of at least 8 months. The children with motor impairment and developmental delays were selected from a larger sample of children participating in a longitudinal study of children with disabilities and their families enrolled in state-supported early intervention programs (Shonkoff, Hauser-Cram, Krauss, & Upshur, 1992). The children with typical development were selected from the same geographical region but were not participating in early intervention programs.

Disability group determination was made initially by early intervention service providers and confirmed by independent review of medical records conducted by physicians participating in the research study. All children with motor impairment had abnormal muscle tone along with delayed or deviant motor development; their neuromotor characteristics included quadriparesis (with hypertonus or fluctuating tone), general hypotonia, diplegia, hemiparesis, and choreoathetosis. Children with spina bifida or diagnosed myopathy were excluded from the sample.

Children with developmental delay differed distinctly from children with motor impairment in their lack of abnormal neuromotor findings. All had demonstrated delays of at least one standard deviation below the mean in two or more areas of development other than mobility (e.g., communication, perceptual development) based on a standardized developmental assessment. The review of medical records indicated that none of the children with developmental delay at the time of entry to the study had a medical diagnosis that either identified a specific etiology or implied a prognosis for mental retardation. Children with congenital infection, inborn errors of metabolism, neurocutaneous disorders, or chromosomal disorders were excluded from the sample.

The demographic and status characteristics of children in the three subgroups are presented in Table 1. The few differences that exist were anticipated by design. First, children in the two disability groups were significantly older than comparison children but did not differ from each other in chronological age. Second, the two disability groups included some children (n = 19) who had been premature at birth (i.e., gestational age of 37 weeks or less), whereas the comparison group had been selected to exclude such children. There were no significant differences in child ethnicity or maternal education among the three groups. Although each subgroup included children whose mothers had less than a high school education, most mothers had some education beyond high school. As expected, children in the two disability groups had significantly

TABLE 1

DESCRIPTIVE CHARACTERISTICS OF THE SAMPLE

CHARACTERISTIC	SUBGROUP Motor Impaired	Developmentally Delayed	Typically Developing
Chronological age (months)[a] (mean/SD)	23.4 (4.0)	26.0 (5.8)	16.8 (6.4)
Mental age (months) (mean/SD)	18.5 (7.0)	18.5 (7.1)	18.4 (7.0)
Percent female	48.0	40.0	52.0
Percent premature	44.0	32.0	N.A.
Percent with a seizure disorder	36.0	16.0	N.A.
Bayley MDI score[b] (mean/SD)	65.6 (26.0)	60.8 (24.8)	114.6 (18.2)
Maternal education (years) (mean/SD)	13.9 (2.4)	14.2 (2.5)	14.7 (2.6)
Ethnicity (percent Caucasian)	96.0	88.0	92.0

NOTE.—N = 25 in each group.
[a] $F = 16.8$, $p < .001$.
[b] $F = 39.6$, $p < .001$.

lower standard cognitive scores than the comparison group, based on the MDI of the Bayley Scales, although the two disability groups did not differ from each other in this regard. The mean mental age for all three groups was 18.5 months.

In prior analyses, we found some differences in development for the two disability groups over a 12-month period of time (Shonkoff et al., 1992). Thus, these two groups were separated for the initial set of analyses because we anticipated that, given the differing nature of their disabilities, the children might exhibit different patterns of motivation with challenging tasks. No prior study has compared the differences in mastery motivation between these two groups.

Procedure

A home visit was conducted by two research field staff unfamiliar with the study's hypotheses. While parents were interviewed, a field staff member assessed the child using the Bayley Scales and the measures of mastery motivation, which consisted of observation of the child's behavior on two problem-posing tasks (Morgan, Busch-Rossnagel, Maslin-Cole, & Harmon, 1991). For the subsample of children with developmental disabilities, mother-child interaction was observed during a teaching task, using the Nursing Child Assessment Teaching Scale (NCATS) (Barnard, 1978).

The problem-posing mastery motivation measures and the scoring procedures were based on those developed by Morgan et al. (1991). In order to investigate motivation on tasks requiring different types of skills, two kinds of problem-posing toys were used: those involving cause-effect (e.g., slide a lever for a figure to emerge) and those involving puzzles. The cause-effect toys were commercially produced and formed the following hierarchy in terms of task difficulty: (1) a simple typewriter, (2) a surprise box, (3) a cash register, and (4) a tape recorder. The puzzles were also commercially produced and formed five levels of difficulty: (1) a balloon puzzle with six identical pieces, (2) a traffic light puzzle with six simple-shaped pieces, (3) a traffic signs puzzle with five complex geometric pieces, (4) a transportation puzzle with eight complex pieces, and (5) a three pigs puzzle with 11 interlocking pieces. The hierarchy of difficulty for these toys was tested empirically using Green's (1956) Index of Consistency in prior studies (Barrett, Morgan, & Maslin-Cole, 1993; Redding, Morgan, & Harmon, 1988). Those studies indicated that the puzzle items best met the criterion for scalability (i.e., $I > .8$), with the cause-effect toys reaching the minimal criterion ($I = .5$). For each task, the examiner selected one toy (out of the hierarchy of toys described above) that was moderately challenging to the child. Moderate challenge was defined as the child's completion of one, but not all, of the solutions within 1½ minutes. If the child was not able to complete one solution within the time interval, a less challenging task was selected. If the child completed all the solutions within the designated interval, a more challenging task was selected from the hierarchy. Between 10% and 15% of children in each group required a task level change on either type of task.

During pilot testing of 30 subjects with developmental disabilities, the two tasks were presented using counterbalanced order. Twenty-six subjects completed both tasks ($n = 11$ for puzzles first, $n = 15$ for cause-effect first), and no order effects were found for those subjects on any of the outcome variables reported in this study ($t = .70$, $p > .25$; $t = 1.10$, $p > .25$, for persistence on cause-effect and puzzle tasks, respectively; $t = .89$, $p > .25$; $t = .87$, $p > .25$, for non-goal-oriented manipulation on cause-effect and puzzle tasks, respectively; $t = .41$, $p > .25$; $t = .55$, $p > .25$, for competence on cause-effect and puzzle tasks, respectively; and $t = .14$, $p > .25$; $t = .08$, $p > .25$, for affect on cause-effect and puzzle tasks, respectively). The four subjects for whom data could not be collected on both tasks had all been presented with the puzzle tasks first. No child presented with the cause-effect toys first refused to attempt both tasks. In order to optimize data collection on both tasks, therefore, the cause-effect toys were presented before the puzzle toys to all subjects.

Specific demonstrated solutions were predetermined for each toy. The examiner presented the toy to the child, demonstrated two predetermined solutions, and then said to the child, "Now, you try it." The examiner provided an additional demonstration of the same two solutions if the child did not orient to the toy during the first 15-sec interval of scoring. For both tasks, the examiner rated the child's modal level of behavior within 15-sec blocks for a total of 4 min. In each 15-sec interval the examiner recorded whether the modal behavior was (1) persistent task-directed (i.e., child attempts to solve the problem posed by the toy); (2) apparatus-directed (i.e., the child manipulates the toy in a non-goal-oriented way); (3) own task (i.e., child develops his or her own way of playing with the toy, such as using the puzzle pieces for fantasy play); (4) looked at, but did not touch, the toy; (5) held the toy but did not manipulate it; (6) oriented to his or her mother; (7) oriented to the examiner; (8) oriented to something other than the toy, the mother, or the examiner; (9) perseverated in behavior (i.e., demonstrated identical behavior to that displayed during the prior interval; and (10) reset the toy (e.g., took all the puzzle pieces out). Interobserver reliability estimates for each of the behaviors for a subset of 25 subjects, using Pearson correlation, ranged from a low of $r = .87$ on "perseverated in behavior" to a high of $r = .98$ on "reset the toy." In addition, the trials in which the examiner provided prompts were recorded; a verbal prompt was provided after one interval of non-toy-directed activity and could be given twice during the 4-min sequence. The child's affect (positive, negative, or neutral) upon completion of a solution was recorded for each interval, as were all solutions obtained. Positive affect was recorded if the child smiled, laughed, and/or clapped; negative affect was scored if the child frowned, cried, yelled, or hit the toy. When affect was not overtly positive or negative, it was scored as neutral. Interobserver agreement on affect, using Pearson correlation, ranged from a low of $r = .77$ on negative affect to a high of $r = .89$ on positive affect.

The following scores were calculated: the percent of intervals in which the child displayed persistence at problem solving (called "persistence"); the percent of intervals in which the child displayed non-goal-oriented manipulation of the toy; and the percent of solutions that were accompanied by positive affect (called "affect"). A measure of task competence (termed "competence") was also developed by calculating the percent of different possible solutions the child achieved, weighted by the level of difficulty of the task (i.e., competence = number of different solutions/number of possible solutions $\times$ 100 + (task level $\times$ 100)). Interrater reliabilities (using Cohen's kappa) for summary scores were .87 and .89 for persistence, .88 and .86 for non-goal-oriented manipulation, .72 and .74 for affect, and .94 and .96 for competence on the cause-effect and puzzle tasks, respectively.

The Nursing Child Assessment Teaching Scale (NCATS) (Barnard, 1978) was administered only to the families of children with developmental delay or motor impairment as part of the data collection for a longitudinal study of the development of children with disabilities. This measure is composed of a set of subscales consisting of binary items rated while observing a teaching interaction between a mother and child. In order to analyze maternal didactic interaction a set of 10 items was selected from the NCATS (see Table 2). Data collectors were trained to a criterion of reliability of $r = .85$ on the NCAT; reliability checks were conducted throughout the study. Interrater reliabilities on the measure used in this investigation ranged from $r = .88$ to $r = .93$ over the course of the study. After data were collected, internal consistency was calculated using Cronbach's alpha coefficient for the set of 10 items selected to measure didactic interaction; Cronbach's alpha was .72 for the

TABLE 2

MATERNAL DIDACTIC INTERACTION MEASURE ITEMS

1. Parent describes perceptual qualities of the task materials to the child.
2. Parent uses at least two different sentences or phrases to describe the task to the child.
3. Parent uses explanatory verbal style more than imperative style in teaching the child.
4. Parent's directions are stated in clear, unambiguous language.
5. Parent uses both verbal description and modeling simultaneously in teaching any part of the task.
6. Parent verbally praises child after child has performed better or more successfully than last attempt.
7. Parent smiles and/or nods after child performs better or more successfully than the last attempt.
8. Parent responds to the child's vocalizations with verbal response.
9. Parent uses teaching loops in instruction 75% of the time.
10. Parent signals completion of the task to the child verbally or nonverbally.

NOTE.—Subset of items from the Nursing Child Assessment Teaching Scale (Barnard, 1978).

study sample on this set of items, which indicates a modest correlation among the items.

Results

Group Comparisons

Multivariate analysis of variance (MANOVA) techniques were employed to analyze the performance of the children in the three matched groups (children with typical development, motor impairment, and developmental delay). The two problem-posing tasks (cause-effect and puzzles) were considered correlated dependent measures because of their theoretical and empirical relation (Bock, 1975).

The mean scores and standard deviations for the three groups on the measures of mastery motivation are displayed in Table 3. The mean differences among the three groups on three measures of mastery motivation (i.e., persistence, non-goal-oriented manipulation, and competence) were analyzed using MANOVA. These analyses revealed no significant differences among the three groups in task persistence, $F(2, 72) = .52$, $p > .25$, and no significant group × task interactions, $F(2, 72) = .86$, $p > .25$. A significant difference was found by task, with higher persistence, $F(1, 72) = 22.78$, $p < .001$, found for the cause-effect tasks than for the puzzle tasks across all three groups.

Analyses of non-goal-oriented manipulation also indicated no significant difference among the three groups, $F(2, 72) = .02$, $p > .25$, no task × group interaction, $F(2, 72) = 1.24$, $p > .25$, and a significant difference for tasks, $F(1, 72) = 19.9$, $p < .001$, with higher levels of manipulation found for the puzzle tasks.

Analyses of group differences in competence revealed the three groups did not differ significantly from each other on the two tasks, $F(2, 72) = .82$, $p > .25$; task × group interaction also was not significant, $F(2, 72) = 1.20$, $p > .25$. Differences by task were found, $F(1, 72) = 27.89$, $p < .001$, with higher competence on the cause-effect tasks. In summary, the patterns of persistence, non-goal-oriented manipulation, and competence on tasks were similar across all three groups.

For all three groups, low levels of positive affect associated with task mastery were evident. Therefore, analyses were conducted on the proportion of children in each group who displayed at least one instance of positive affect associated with achieving a solution. Although fewer children with motor impairment displayed positive affect associated with a solution, differences among groups were not significant for either the cause-effect or puzzle tasks, $\chi^2 = 4.41$, $\chi^2 = 5.30$, $df = 2$, $p > .05$, on the two tasks, respectively.

Predictors of Mastery Motivation in Children with Developmental Disabilities

Although performing in ways similar to their mental age peers, children with disabilities demonstrated a wide range of levels of mastery motivation. Thus, a set of analyses was designed to test the hypothesized relation between maternal didactic interaction and children's mastery motivation. These analyses were conducted with a view toward answering the following question: Does maternal didactic interaction predict variability in mastery motivation of children with developmental disabilities above and beyond the variability predicted by neurological or biological status and degree of cognitive impairment?

Preliminary analyses tested whether particular demographic or risk factors were associated with different outcomes on the mastery motivation measures for the 50 children with developmental disabilities. These

TABLE 3

DESCRIPTIVE STATISTICS ON THE MASTERY MOTIVATION MEASURES FOR THREE MATCHED SAMPLES

MEASURE	SUBGROUP		
	Motor Impaired Mean (SD)	Developmentally Delayed Mean (SD)	Typically Developing Mean (SD)
Persistence (% of intervals):			
Cause-effect tasks	55.8 (36.4)	54.3 (33.8)	47.5 (34.4)
Puzzle tasks	30.0 (29.9)	40.8 (36.4)	30.5 (33.3)
Non-goal-oriented manipulation (% of intervals):			
Cause-effect tasks	8.3 (12.3)	13.7 (16.4)	10.9 (22.0)
Puzzle tasks	25.9 (30.2)	21.7 (26.5)	21.1 (28.4)
Competence (weighted score: % of solutions completed weighted by difficulty of task):			
Cause-effect tasks	261.9 (139.8)	310.8 (133.8)	299.9 (157.2)
Puzzle tasks	213.6 (118.4)	262.3 (162.4)	213.6 (150.5)
Positive affect (% of sample displaying positive affect with a solution):			
Cause-effect tasks	4.0	12.0	24.0
Puzzle tasks	0.0	20.0	16.0

NOTE.—$N = 25$ in each group.

analyses were conducted to develop the initial steps in regression equations that would impose the most conservative test of the unique variance in outcome accounted for by maternal didactic interaction. Therefore, adjustments to the alpha levels were not made in the set of preliminary analyses.

First, two specific child characteristics found in some prior studies of mastery motivation were tested: chronological age and gender. Neither of these were found to relate significantly to the three mastery motivation measures on the two tasks using correlation and t test analyses ($ps > .25$). Next, based on prior analyses of predictors of functional and cognitive development in this sample (Shonkoff et al., 1992), three types of risk factors were tested. These included one family risk factor (i.e., level of maternal education); two health risk factors (i.e., medical history of a seizure disorder and number of weeks premature); and one cognitive risk factor (i.e., degree of cognitive delay, based on the Bayley MDI, employing Naglieri [1981] extrapolations for low scores).

Significant decrements in aspects of mastery motivation were found for children with a health risk factor (seizure disorder or premature birth). Children with a history of seizures were significantly less persistent ($t = 2.57$, $p < .05$), displayed more non-goal-oriented manipulation ($t = 2.30$, $p < .05$), and were less competent ($t = 2.60$, $p < .05$) on the puzzle tasks as well as less competent on the cause-effect tasks ($t = 2.60$, $p < .05$). Greater degrees of prematurity also were associated with significantly less persistence ($r = -.30$, $p < .05$), more non-goal-oriented manipulation ($r = .27$, $p < .05$), and less competence ($r = -.28$, $p < .05$) on the puzzle tasks.

It should be noted that the measure of maternal didactic behavior, based on the NCATS, did not differ for the two disability groups ($t = .78$, $p > .25$). Also, further analyses indicated that the maternal didactic interaction measure was not related significantly to children's degree of cognitive delay ($r = .14$, $p > .25$), or degree of prematurity ($r = -.12$, $p > .25$) and did not differ for those with and without a history of seizures ($t = -.08$, $p > .25$). Furthermore, level of cognitive delay was unrelated to degree of prematurity ($r = .11$, $p > .25$), and children with and without seizure disorders did not differ on Bayley MDI scores ($t = .92$, $p > .25$).

To determine the extent to which maternal didactic behavior might relate to children's mastery motivation, a series of hierarchical regression equations was developed for the three core mastery motivation outcomes (persistence, non-goal-oriented manipulation, and competence) on both the cause-effect and puzzle tasks. The equations were developed to test a specific model based on the presumed chronological order of variables; the same set of variables were entered into all six equations to allow comparison of the beta weights (Pedazur, 1982). The child's type of disability (e.g., motor impaired, developmentally delayed), which was dummy coded, was entered first, followed by the health risk factors, which were entered as a block. Next, the severity of the child's cognitive impairment (based on the Bayley MDI score measured during infancy) was entered. The measure of maternal didactic interaction (measured during the toddler years) was entered last. The focus of this set of analyses was on determining the extent to which maternal behaviors predict children's mastery motivation, above and beyond the risk factors associated with diminished performance. Since neither the type of disability nor the type of disability × risk factor interaction term entered significantly in any of the equations, the analyses were rerun without the type of disability and interaction terms. The final equations, which are presented in Table 4, indicate that maternal didactic interaction predicted one measure of mastery motivation on the cause-effect tasks above and beyond the variance accounted for by the significant risk factors. Specifically, the measure of maternal didactic interaction added a unique 7.9% of the variance in competence on the cause-effect tasks. Mothers who displayed high levels of interactive didactive behaviors had children who were more competent at solving the task.

As Table 5 indicates, the health risk factors (degree of prematurity and history of a seizure disorder) alone accounted for a significant proportion of variance in persistence, non-goal-oriented manipulation, and competence for the puzzle tasks. Moreover, maternal didactic interaction was predictive of all three measures of mastery motivation on the puzzle tasks above and beyond the health risk factors and the degree of cognitive delay. Maternal didactic interaction added a unique 6.1% of the variance in persistence, 7.6% of the variance in non-goal-oriented manipulation, and 6.5% of the variance in competence on these tasks.

Discussion

The results of the analyses of mastery motivation in children with developmental delays or motor impairment compared to typically developing children build on the findings of previous comparative studies and raise some critical questions about the development of young children with disabilities. These data suggest that mastery motivation does not differ for young children with delayed or atypical development during the sensorimotor period *if* they are compared to children of a similar level of development and are given tasks of similar difficulty. Thus, the decrements in motivation documented in studies of preschool and school-age children with developmental disabilities on task persistence and related measures of mastery motivation (should they be replicated in future studies) must occur sometime after the sensorimotor stage of development.

The analyses conducted for this study suggest that neurobiological constraints, such as a seizure disorder, may inhibit mastery motivation. It is unclear whether the nature of that inhibition is intrinsic or whether, as in the case of a seizure disorder, it may be related to the effects of medical treatment. For example, some investigators have hypothesized that some anticonvulsant medications have specific adverse effects on cognitive development (Farwell et al., 1990). Although not investigated directly in either this or prior studies, such medications also may affect children's self-regulatory behavior, such as the ability to attend to tasks.

Children born prematurely may be another group whose diminished mastery motivation is at least partially related to neurological dysfunction. The results of this study are consistent with those of prior investigations of children born prematurely where some decrements in motivation on more, as opposed to less, challenging tasks have been documented (Harmon & Culpe, 1981). Also, the finding that premature children demonstrated less persistence on puzzle tasks is congruent with studies that have reported depressed visual-motor development in nondisabled preterm children (Klein, Hack, Gallagher, & Fanaroff, 1985; Saigal, Szatmari, Rosenbaum, Campbell, & King, 1990). Klein and her colleagues suggest that the visual-motor decrements noted for children born prematurely may have neurological origins.

Despite the hypothesis that some children with disabilities may have neurologically mediated "causes" for lower levels of mastery motivation, the overall results of this investigation underscore the importance of the social-emotional learning environ-

TABLE 4

Hierarchical Multiple Regression Predicting Mastery Motivation Measures with Cause-and-Effect Tasks for Children with Disabilities

Predictor	Persistence				Non-Goal-Oriented Manipulation				Competence			
	Beta	R^2 Increment	Model R^2	F	Beta	R^2 Increment	Model R^2	F	Beta	R^2 Increment	Model R^2	F
Health risk factors:												
Degree of prematurity	.05	...	...	...	.12	...	...	...	−.19	...	...	...
Presence of seizure disorder	−.04	.003	.003	.08	.08	.021	.021	.52	−.33	.144	.144	3.96*
Cognitive risk factor:												
Degree of cognitive delay	−.21	.041	.044	2.0	.01	.000	.021	.00	−.50	.240	.384	17.92***
Maternal facilitating factor:												
Didactic interaction	.03	.001	.045	.04	−.12	.015	.036	.70	.29	.079	.463	6.63*
Multiple r	...	...	.21	...	...	...	.19	...	...	...	.68	...

Note.—$N = 50$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

TABLE 5

Hierarchical Multiple Regression Predicting Mastery Motivation Measures with Puzzle Tasks for Children with Disabilities

Predictor	Persistence				Non-Goal-Oriented Manipulation				Competence			
	Beta	R^2 Increment	Model R^2	F	Beta	R^2 Increment	Model R^2	F	Beta	R^2 Increment	Model R^2	F
Health risk factors:												
Degree of prematurity	−.31	...	...	...	.27	...	...	...	−.28	...	...	...
Presence of seizure disorder	−.21	.137	.137	3.72*	.37	.212	.212	6.34**	−.36	.209	.209	6.22**
Cognitive risk factor:												
Degree of cognitive delay	−.41	.165	.302	10.89**	.37	.131	.343	9.17**	−.45	.192	.401	14.74***
Maternal facilitating factor:												
Didactic interaction	.25	.061	.362	4.27*	−.28	.076	.419	5.84*	.26	.065	.466	5.50*
Multiple r	...	...	.60	...	...	...	.65	...	...	...	.68	...

Note.—N = 50.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

ment on mastery motivation. While recognizing that different aspects of the caregiving environment may affect different domains of children's development (Wachs & Chan, 1986), this study points to the interactive behavior of caregivers as an important mediating variable in understanding the mastery motivation of children with developmental disabilities. In particular, children whose caregivers give clear directions and offer both verbal and nonverbal support and praise when teaching them a task appear to be more motivated to persist with other challenging tasks on their own. The data in this study build on those of previous investigations in pointing to the important role of caregivers in creating environments in which children with atypical development (e.g., Blasco et al., 1990) as well as children with typical development (e.g., Heckhausen, 1993) can learn and be encouraged to engage in self-initiated problem-solving activity.

One caution in interpreting these data is that the direction of the relation between children's mastery motivation and maternal didactic interaction is not fully understood. It is possible that children who display more positive affect and are more competent at tasks encourage their mothers to engage in more productive didactic interaction. Nevertheless, the effects of maternal didactic interaction were evident even when degree of cognitive impairment was controlled, suggesting that maternal behaviors have an effect on motivation above and beyond the child's level of cognitive skill. These findings are consistent with the view that development of all children, including those with disabilities, occurs within a transactional arena (Sameroff & Chandler, 1975; Sameroff & Fiese, 1990), and that development is sensitive to both neurobiological risk factors and social-environmental protective factors (Garmezy & Rutter, 1983; Werner & Smith, 1982).

An unanticipated finding that emerged in the analyses conducted in this study was the sensitivity of the measure of persistence on the puzzle tasks in comparison to the cause-effect tasks. Although persistence on the two tasks was significantly and moderately correlated for all three groups, as a whole, children in this study were both less persistent and less successful with the puzzle tasks. Fatigue cannot be dismissed as a factor in these findings, but the sensitivity of the puzzle tasks to both risk and facilitating factors may be due to the nature of the tasks themselves. Success on the puzzle tasks requires more sophisticated skills, such as the ability to integrate part-whole relations, and may be associated with an internal reward (i.e., seeing how the part fits into the whole) that differs from the more animated reward (i.e., making something happen) obtained from the cause-effect tasks. In fact, children tended to repeat solutions far less often on the puzzle tasks, perhaps because the appeal of puzzles is in completing the whole, whereas the appeal of cause-effect tasks may be in the attainment of individual solutions.

This study is limited by its cross-sectional design and its sample consisting of only two types of disability. Even within this sample, children with such severe motor impairment that they were not able to manipulate objects were excluded, and the results cannot be extrapolated to that group. Longitudinal analyses will need to address questions about whether mastery motivation decrements occur for this sample as they enter stages of increased cognitive complexity, and the extent to which maternal interaction patterns mediate motivation of these children in the future.

Despite these limitations, the data in this study provide an optimistic picture of mastery motivation in children with developmental disabilities and suggest an important focus for intervention. The findings are congruent with investigations of mother-child dyads in which the child is developing typically by pointing to the correspondence between maternal didactic behavior and specific child competencies (e.g., Tamis-LeMonda & Bornstein, 1994). Furthermore, they underscore the value of the mother-child relationship for children whose development may be compromised by biological vulnerability. More information on the process and mediators of development in such children should lead to the creation of a more fully articulated conceptual framework for describing and predicting emerging competencies in a wide range of functional domains. As a part of that framework, knowledge about mastery motivation may serve as an important link in understanding child competence.

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