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Home environment, metamemory, motivation, and memory performance in young school children

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HOME ENVIRONMENT, METAMEMORY, MOTIVATION, AND MEMORY PERFORMANCE IN YOUNG SCHOOL CHILDREN

by

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APPROVAL PAGE

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This study examined a theoretical model of the relationships among qualities of young school-age children's home environments, children's memory knowledge and mastery-motivation, and children's proficiency in performing cognitive tasks. Seventy-eight 2nd- and 3rd-graders were included in the study. Home environments were assessed with an observation-inventory interview administered during a home visit and a parental questionnaire assessing parental strategic instruction in the home. Metamemory was assessed with a series of open-ended questions administered to the children. Mastery-motivation was assessed with a Likert-type behavior-rating scale completed by the children's teacher. Cognitive performance was assessed with measures of study behaviors and recall performance observed during 2 study-recall memory tasks.

Multivariate and regression statistical analyses yielded evidence to support the theoretical relationships between home experiences and the acquisition of memory knowledge and between home experiences and the development of mastery-motivation. Evidence was also found to support the hypothesized mediational effect of metamemory on the relationship between the children's home environment and their recall, and to support the rationale that home experiences influence the acquisition of memory knowledge by facilitating the construction of appropriate mental representations and the internalization of related processes.

Little evidence was found to support one of the principal hypotheses, that mastery-motivation is an important component in a metamemory-memory performance model; however, evidence was found of a developmental effect on the relationship between metamemory, mastery-motivation, and memory performance. Although the sizes of the 2nd- and 3rd-grade subsamples were too small to allow direct testing of a developmental effect, the patterns of correlations suggest that with increased schooling, the development of mastery-motivation becomes an increasingly important component in a metamemory-memory performance relationship.

CHAPTER I

INTRODUCTION

General Statement of the Problem

Children display, developmentally and individually, differential performance on memory tasks. Two major challenges facing researchers of children's memory development include 1) identifying and better understanding the processes underlying differential memory performance, and 2) identifying and better understanding the environmental antecedents of the underlying processes.

Performance on memory tasks differs developmentally across age groups. Serial recall increases steadily with development, from 4 or 5 digits for 5-year-olds, to 6 digits for 9-year-olds, to 7 digits for adults (Dempster, 1981). The quantity and quality of strategy use on free recall tasks also increases with development. Ten-year-olds rehearse to-be-remembered items considerably more than 5-year-olds (Flavell, Beach, & Chinsky, 1966). Thirteen-year-olds tend to use a cumulative style of rehearsal more than 9-year olds, who tend to use a passive style (Ornstein, Naus, & Liberty, 1975). Ten- and 11-year-olds tend to use an organizational study strategy with categorizable lists of to-be-remember items, whereas 5- and 6-year-olds do not (Moely, Olson, Halwes, & Flavell, 1969). Older children construct fewer, but more stable, categories with more members, than do younger children (Moely, 1977). Older children also tend to cluster items from the same category together at retrieval, whereas younger children do not (Best & Ornstein, 1986; Furth & Milgram, 1973; Salatas & Flavell, 1976). Children tend not to use elaboration strategies to aid memory performance until adolescence (Pressley & Levin, 1977).

Performance on memory tasks also differs individually within age groups. Children of all age groups vary widely in their memory spans (Dempster, 1981; Pierce & Lange, in press); in their use of rehearsal strategies (Flavell et al., 1966; Ornstein et al., 1975); in their use of organizational strategies (Moely et al., 1969; Furth & Milgram, 1973); as well as in their responsiveness to strategy instruction (Schneider & Pressley, 1989).

Attempts to address the first problem, that is, to identify and better understand the processes underlying individual differences in memory performance, have focused on several within-child factors. Although earlier investigations have shown scores from psychometric tests (IQ) to be predictive of differential memory performance, IQ is a global measure of general cognitive performance, and does not specify the underlying mental processes by which competent behavior is generated (Sternberg, 1985). More recent investigators argue that effective memory performance involves complex interactions and interdependencies between metamemory, strategy use, content knowledge, and basic capacities (Pressley & VanMeter, in press). Accordingly, there has been an increasing focus in the research literature of the 1980's on the importance of metamemory as a crucial determinant of memory performance. Statistically, however, the explanatory power of metamemory has been disappointing (Cavanaugh & Perlmutter, 1982). An argument will be made below that motivation is an individual characteristic distinguishing children who are inclined to apply their metamemorial awarenesses to the task at hand from those who are not inclined to do so, and thus is an important component missing from a simple metamemory-memory performance model.

Little is known about the environmental antecedents of children's metamemorial awarenesses or of their motivational inclination to use the knowledge once it is acquired. Although numerous investigations have shown measures of sociometric-status (SES) to be predictive of differential memory performance, SES is a distal variable that provides an index of a family's relative standing with regard to demographic factors, but provides no direct evidence about proximal experiences that influence cognitive development (Gottfried & Gottfried, 1984). A body of research focusing on more proximal factors has related characteristics of the home environment to children's general cognitive development (Belsky, Lerner, & Spanier, 1984; Bradley & Caldwell, 1980; Gottfried, 1984; Laosa & Sigel, 1982; Wachs & Gruen, 1982). By extension, it is suggested here that similar home environmental characteristics, particularly parental strategy instruction and encouragement of planful, independent, and mature behaviors, influence the acquisition and application of metamemory and motivation.

General Objective of the Study

It is the intent of this study to examine a proposed path of influence from the child's home environment (antecedent factors) through the child's metamemorial awarenesses and motivational inclinations (mediating factors) to the child's performance on memory tasks (outcomes).

Hypotheses to be Tested

1) that metamemory and motivation considered together provide a more powerful predictor of memory performance than either construct alone.
2) that parental strategic instruction and encouragement of planful, independent, and mature behaviors predict children's metamemory.
3) that parental encouragement of planful, independent, and mature behaviors predicts children's mastery-motivation.
4) that the influence of the home environment on memory performance is mediated in part by the child's metamemory and motivational inclinations.

CHAPTER II

BACKGROUND AND LITERATURE REVIEW

Processing Differences in Children's Memory Performance

Metamemory

Theoretical background. Metacognition refers to a person's knowledge and awareness of any aspect of cognition, including cognitive abilities, states, and processes (Flavell, 1971, 1978, 1987; Flavell & Wellman, 1977). More specifically, metamemory refers to a person's knowledge and awareness of any aspect of the storage and retrieval of information (Kruetzer, Leonard, & Flavell, 1975; Flavell & Wellman, 1977).

Flavell (1987; Flavell & Wellman, 1977) has proposed a taxonomy of metamemory organized into 2 broad domains: metamemorial knowledge and metamemorial experiences. Metamemorial knowledge about strategy variables involves knowledge about storage and retrieval procedures. The subcomponents of metamemory-about-strategies most pertinent here are specific strategy knowledge, general strategy knowledge, and metamemory acquisition procedures.

Specific strategy knowledge includes unique, declarative knowledge associated with each strategy. Examples include when and where to use a specific strategy, the utility or value of the strategy, and how much effort is required to execute the strategy. General strategy knowledge includes the understanding that it takes effort to apply strategies, and that if properly applied, strategies aid memory. Metamemory acquisition procedures (MAPS) include self-testing, or otherwise comparing performances to determine relative strategy efficiency, and other on-line regulation and monitoring of one's performance.

All metamemorial influences on good strategy use interact with each other, especially specific strategy knowledge, general strategy knowledge, and metamemory acquisition procedures. For example, in monitoring her recall performance after the use of a particular strategy (MAPS), a child might realize that she had expended a considerable amount of effort (general strategy knowledge), but had realized little benefit from its use with the particular to-be-remembered materials (specific strategy knowledge), and decide to abandon its use in the current situation (MAPS).

Brown (1978) and Flavell (1978) have proposed a bidirectional link between metamemory and strategic memory performance. According to the hypothesis, metamemory directs the conscious use of strategies, including the selection, implementation, monitoring, and in-course modification of strategies. Successful memorial performance following strategy use, in turn, strengthens general strategic knowledge and contributes to specific strategy knowledge (Brown, 1978; Flavell, 1978; Borkowski, Carr, & Pressley, 1987; Pressley, Borkowski, & O'Sullivan, 1985). An assumption is made that the metamemory-about-strategies components in interaction with each other are the primary determinants of strategy use (Pressley et al., 1985), and therefore form an important part of the explanation for differential memory performance.

Research findings. Developmental differences in knowledge about organizational strategies, favoring older school-age children, are well established in the literature (Schneider & Pressley, 1989). More specifically, substantial developmental differences in metamemory occur reliably around the 2nd and 3rd grades (Kreutzer et al., 1975; Cavanaugh & Borkowski, 1980). Fifth graders know considerably more about their memory systems than do 1st graders. They are much more inclined and able than kindergartners to comprehend mnemonic problems, to consider various alternatives, and to arrive at an adequate solution. Kreutzer et al. (1975) argue that between kindergarten and the 5th grade, children gain a greater sensitivity to the presence of interitem semantic organization and an awareness of its utility in facilitating item retrievability.

An early literature review by Cavanaugh and Perlmutter (1982) of studies containing metamemory-memory performance relationship data reported only moderate to low correlations, and suggested that the failure to find stronger correlations was due to bad research designs and inadequate or inappropriate assessments. Most of the studies in their review had used only a single index of metamemory, and a strong argument was made for concurrent, multiple assessments of metamemory (Rushton, Brainerd, & Pressley, 1983; see also Kurtz, Reid, Borkowski, & Cavanaugh, 1982). In two subsequent literature reviews which included meta-analyses of substantially more studies containing metamemory-memory relationship data, Schneider (1985; Schneider & Pressley, 1989) found an impressive overall metamemory-memory performance correlation coefficient of 0.41.

The metamemory-memory performance relationship examined most often and in most detail in the literature is that between knowledge of organizational strategies, strategy use, and recall of categorizable materials. Relationships between these 3 variables can be obtained reliably with older school-age children (Cavanaugh & Borkowski, 1980; Schneider, 1986; Schneider, Borkowski, Kurtz, & Kerwin, 1986). Support for a metamemory-strategy use relationship has been found in normal populations of children (Cavanaugh & Borkowski, 1979; Kurtz et al., 1982) and in special populations, (Borkowski, Peck, Reid, & Kurtz, 1983; Kendall, Borkowski, & Cavanaugh, 1980; Pressley et al., 1985). Metamemory has been found to be a statistically significant predictor of strategic behavior even when the contribution of IQ (Kurtz et al., 1982) and cognitive tempo (Borkowski et al., 1983) are controlled for.

Causal modeling by Schneider et al. (1986) found that strategy use by American 4th graders mediated metamemorial effects on recall and that both strategy use and metamemory were predictive of superior recall. Similar modeling procedures by Kurtz and Weinert (1989) found that metamemory was an important predictor of strategy use for both average and gifted 5th- and 7th-graders, and of recall for average 5th- and 7th-graders.

Motivation

Theoretical background. Although there is convincing empirical evidence that there is a nontrivial quantitative association between metamemory and memory performance (Schneider, 1985; Schneider & Pressley, 1989), it is an overall relationship which includes different components of metamemory and a wide range of memory tasks and strategies. Different patterns of correlations are found between the different categories of metamemory (Levin, Yussen, DeRose, & Pressley, 1977; Schneider & Pressley, 1989; Yussen & Berman, 1981), different classes of memory tasks (Borkowski, Reid, & Kurtz, 1984: Schneider & Pressley, 1989), and different strategies (Borkowski et al., 1983; Cavanaugh & Borkowski, 1979; Kendall et al., 1980; Kurtz & Borkowski, 1987; Kurtz et al., 1982; O'Sullivan & Pressley, 1984; Paris, Newman, & McVey, 1982; Rao & Moely, 1989; Ringel & Springer, 1980).

The inconsistency of correlational patterns between assessments of metamemory and memory performance found in previous studies may be partially due to the omission of motivational factors from the proposed metamemory-memory relationship. Early in the development of the model, Flavell and Wellman (1977) advised that a strong relationship between metamemory and memory behavior would not be found when motivational factors were unfavorable. Kreutzer et al. (1975) suggest that one likely factor underlying age differences in the development and utilization of mnemonic knowledge and awareness is the greater planfulness of older children.

An important motivational factor that might be involved in the metamemory-memory connection involves the child's mastery motivation, that is, the child's tendency to be independent, self-directed, and generally resourceful in approaches to everyday tasks and activities (Lange, MacKinnon, & Nida, 1989). Robert White (1959) and others (eg., deCharms, 1968; McClelland, Atkinson, Clark, & Lowell,

1953) have asserted that human beings have an innate need to be competent, effective, and self-determining. However, children clearly differ in achievement/mastery motivation; that is, in their willingness or inclination to strive for success and to master new challenges (Nicholls, 1975). Those children who exhibit higher levels of mastery motivation, especially those who are more inclined to pursue and master challenging tasks, might be expected to engage in greater planfulness, more persistence, and more effortful strategy-use on memory tasks. That is, higher mastery-motivated children might be expected to have acquired and subsequently to apply metamemory to a greater degree than less mastery-motivated children. Indirect evidence of this possibility can be derived from an unpublished study by Lange, Pierce, and Rodarmel (1993). Exit interviews of preschoolers and 1st-graders who did not apply a newly learned organizational study-recall strategy to post-training sort-recall tasks revealed that several of the children remembered the strategy but declined to apply it: "I could use the trick, but I don't think I will."

Research findings. Individual differences in mastery motivation are evident as early as 6 months of age (Yarrow, McQuiston, MacTurk, McCarthy, Klein, & Vietze, 1983). Gender differences have also been observed; girls are more likely than boys to be helpless and boys are more likely to be mastery oriented (Dweck & Bush, 1976).

Much less research has been conducted to examine the motivation-memory performance connection than the metamemory-memory performance connection. Lange et al. (1989) found a significant relationship between mastery-motivation and numbers of objects recalled by preschool children (r = .53). Mastery motivation proved to be a better predictor of recall than IQ, reflectivity/impulsivity, or a weighted summary score of strategic behaviors exhibited by the children during the study period.

Previous attempts to use metamemory and motivation measures to predict memory performance have kept the 2 constructs separate (Kurtz & Borkowski, 1984; Kurtz & Weinert, 1989; Schneider et al., 1986). Theoretical considerations of motivation as complementary to metamemory, however, argue against such separate treatment. Possession of metamemorial awareness and knowledge, without the motivation to exert the required effort to the task at hand, may be insufficient to predict memory performance. As argued above, motivation acts as a complementary correlate of metamemory to influence the child's inclination to apply his metamemorial knowledge to the current memory task. A combination metamemory/motivation-memory performance relationship, therefore, is offered as a more theoretically sound and potentially a more empirically validated explanation for differential memory performance.

Environmental Antecedents of the Underlying Processes: Home Environment

Theoretical Background

It has almost become a commonplace that the home is not only the first but possibly the most important environmental influence on children's learning and development (Laosa, 1982). Wachs, Uzgiris, & Hunt (1971) have proposed a dynamic, sequential model of environmental influence on cognitive development in which early environmental stimulation promotes, or retards, certain processes or functions which are crucial for later cognitive development; abilities develop sequentially and those coming later build upon those which appear earlier.

However, it is possible that only certain cognitive functions are strongly influenced by the home environment. Hartup (1985) suggested that the cognitive functions most closely linked to social relationships, and thus to family environments, are the "executive regulators," that is, planning, monitoring, and evaluating (from Flavell & Wellman, 1977), which are important components of metamemory-acquisition-procedures. He argued that the contribution of social relationships to children's cognitive development consists of optimizing children's efforts to apply and monitor cognitive activities in every day life.

The continuity and pervasiveness of the parent-child relationship provide unique contributions to cognitive development beyond that of other social relationships, such as peers and siblings (Azmitia & Perlmutter, 1989). An emerging theory is that metamemory development, and especially effective strategy use, is the result of a slow, long-term process (Pressley & VanMeter, in press). Parents provide the environment in which much of that developmental process takes place, and influence metamemorial development in general and specific ways. General parental influences include the provision of enriched home environments and stimulating learning experiences (Kurtz & Borkowski, 1987; Sigel, 1982), which may influence the acquisition of procedural, general, and specific strategy knowledge, and the development of monitoring skills, by facilitating the construction of appropriate mental representations and the internalization of related processes.

Specific parental influences include strategy instruction and the encouragement of planfulness and self-monitoring. Parental teaching and encouragement to use strategies (Sigel, 1982) may also influence children's acquisition and use of procedural and specific strategy knowledge. Repeated teaching of and encouragement to use strategic behaviors on homework and in home tasks may induce children not only to construct a mental representation of the strategic acts required by the task, but also to internalize the process of generating appropriate strategic behaviors. Parental encouragement of monitoring behaviors and the nurturing of planfulness (Flavell, 1987) may influence the child's acquisition of metamemory-acquisition-procedures, especially monitoring behaviors, through a similar mechanism. That is, the requiring of self-monitoring and planfulness in self-care routines, in compliance with house rules, and in other independent behaviors may force children to develop self-monitoring processes.

Yarrow, Rubenstein, Pederson, and Jankowski (1973) have proposed that mastery-motivational dispositions are also strongly affected by environmental factors found in the home, and have suggested that motivational variables such as attention, foresight, and goal orientation, might be more susceptible to environmental stimulation or deprivation than specific skills. They are vague, however, as to the specific home factors that might be expected to influence mastery-motivation. It is reasonable that parental encouragement of children's independence and maturity might induce the development of mastery motivation. That is, parental requirements of independent behaviors in such activities as self-care routines, household chores, hobbies and other self-amusement and self-stimulation experiences, may compel children's development of independent, resourceful behaviors and the internalization of self-directing and self-regulating processes.

Research Findings

The research literature delineating connections between home environment and general cognitive development goes back at least as far as Van Alstyne in 1929, and is vast (see Belsky et al., 1984, for an extensive, modern review). The overall, general conclusion is that the same parenting styles, attitudes, and behaviors that facilitate positive social and emotional development, that is, authoritative parenting, also facilitate positive cognitive development (see McCall, 1974).

Some findings from the literature concerning more general cognitive development are relevant here. One of the instruments used most frequently to measure home environment relative to cognitive development is the HOME (Caldwell & Bradley, 1984). There are 3 versions of the HOME: an infant version, a preschool version, and a middle childhood version. The reliability and validity of the infant and preschool versions are well published (eg., Bradley & Caldwell, 1980; Bradley & Caldwell, 1984a; Gottfried & Gottfried, 1984). The HOME variables from the infant and preschool versions having the most frequent and consistent relationships with cognitive development are the Variety of Stimulation and the Stimulation of Academic Behavior subscales (Gottfried & Gottfried, 1984). The influence of these variables has been found to function independently of SES, mothers' intelligence, and nursery school attendance. (However, past the infancy period, HOME and SES may each contribute uniquely and additively; Gottfried & Gottfried, 1984.) There is a trend for the magnitudes of the correlations between the HOME and psychometric tests to increase with age (Bradley & Caldwell, 1976; Gottfried & Gottfried, 1984), to increase the closer the 2 measures are in time (Bradley & Caldwell, 1984a), and to be a little stronger for whites and for females (Bradley & Caldwell, 1984a). Correlations between early home environment and subsequent intellectual status may be accounted for by cross-time stability in the home environment (Bradley & Caldwell, 1984a; Gottfried & Gottfried, 1984). The newer middle childhood version of the HOME has not been as well developed as the other two versions and is currently being modified (B. Caldwell, 1992, personal correspondence); however, preliminary analyses indicate strong correlations between academic achievement scores (SRA Total) and both the HOME Total score (r = .41) and several subscales: Parental Responsivity (r = .37), Physical Environment (r = .35), Growth Fostering Materials & Experiences (r = .32), and Provision for Active Stimulation (r = .40) (Bradley & Caldwell, 1984b). It is anticipated that in the present study the HOME subscales which most directly assess parental requirement and encouragement of children's self-monitoring and self-directedness, namely, Encouragement of Maturity, Growth Fostering Materials & Experiences, and Provision for Active Stimulation, will predict measures of children's metamemory and mastery-motivation.

Although much has been written about the theoretical connection between the home environment and metacognitive development, few studies have actually examined the connection. In a study which examined the role of parental instruction, parents of 9- and 10-year-olds were found to decrease the amount of parental regulation and on-task instruction as their children developed and internalized metacognitive information (Moore, Mullis, & Mullis, 1986). Another study of the role of parental instruction found that parents who reported teaching their 2nd- and 3rd-grade children everyday strategies had children who were higher in metamemorial knowledge than peers from homes with less strategy-related instruction (Carr, Kurtz, Schneider, Turner, & Borkowski, 1989). Cross-cultural studies with American and German 2nd- and 4th-graders found that strategy instruction in the home was related to cross-national differences in the use of an organizational-rehearsal strategy and with associated metamemorial knowledge (Carr et al., 1989; Schneider et al., 1986).

Research examining relationships between home environment and mastery- or achievement-motivation are also scant. Authoritative parenting techniques have been found to correlate with achievement behaviors in preschool boys (Radin, 1971). There is limited evidence that correlations between the HOME and IQ at 12 months are mediated by early motivational variables such as the infant's goal-directedness (Bradley & Caldwell, 1984a), and physical contact at 6 months has been linked to mastery-motivation at 1 year (Yarrow et al., 1973).

There appears to be but a single study tying the 3 levels together, that is, home environment, metamemory-motivation, and memory performance. In a study of

American and German 8-year olds, Carr et al. (1989) found interrelationships between home environment, metamemory, and use of a cluster-rehearsal strategy in a cued-recall task (for Americans: home environment and recall, r = .36; home environment and metacognition, r = .22; home environment and strategy use, r = ns). In this study, the home environment was measured with an 8-item parental questionnaire assessing parental strategy instruction in a variety of home situations, and included no motivational variables. Perhaps the modest level of correlations was due to two sources: the limited scope of the home assessment, and the omission of motivation as a construct. Although the parental questionnaire did assess strategy instruction, it did not assess the nurturing of self-monitoring behaviors, nor the encouragement of planfulness, independence, and maturity.

Rationale for the Present Research

Among other components, metamemory includes an awareness that strategies aid memory, knowledge of the specific strategy that is useful for the present task, knowledge of specific strategic procedures, and monitoring of present performance. Metamemory has been shown to predict children's memory performance, although the relationships tend to be moderate and inconsistent across different measures of metamemory and memory tasks. It appears that not all children who are aware of strategic procedures and their potential usefulness are inclined to apply them, even when their application might enhance memory performance. The effective use of strategies requires planfulness and self-direction and is effortful; a disinclination to use them may be associated with low mastery-motivation, and young children who are inclined to utilize existing metamemory may be characterized by higher levels of mastery-motivation. It is argued that both metamemory and motivation are necessary but not sufficient for a complete assessment of the metamemory-memory connection; and therefore, that a composite measure of metamemory-motivation will be a stronger predictor of memory performance than either metamemory or motivation alone (unpublished findings, Lange et al., 1990).

Just as an understanding of metamemory and motivation as sources of influence on memory performance is important, so is an understanding of the environmental antecedents of metamemory and motivation. Parents make unique contributions to their children's metamemory and motivational development in general by providing enriched home environments and stimulating learning experiences. More specifically, they may encourage their children's use of strategies, planfulness and monitoring behaviors, and nurture independence and maturity.

A closer examination of the interrelationships between home environmental factors and motivational and metamemorial factors, therefore, may provide a more insightful model of memory performance than those previously provided. Previous studies using causal modeling procedures to examine the manner in which the components of metamemory directly influence memory performance have either included motivational factors as antecedent factors (Schneider et al., 1986), or maintained them as separate factors (Kurtz & Borkowski, 1984; Kurtz & Weinert, 1989). This study is designed to include metamemory, motivation, and a composite measure of metamemory and motivation as mediating factors that intervene between antecedent factors in the home environment and memory performance outcomes. Drawing on the hypothesized link between metamemory and motivation, it is proposed that neither metamemory alone nor motivation alone will be as powerful a mediator between home factors and performance, as the composite variable, metamemory/motivation. This study is also designed to provide a more thorough measure of the home environment than that afforded by previous studies, including assessments of parental encouragement of planfulness, independence, and maturity as well as of parental instruction of strategic behaviors.

CHAPTER III

METHOD

Subjects

Eighty-one 2nd- and 3rd-grade children were initially recruited from 3 public elementary schools in a mid-sized southeastern city. No constraints were imposed on the selection of children for the study, other than that they be functioning in a regular classroom. Of the 22 classrooms canvassed for inclusion in the study, 21 classroom teachers consented to have their classrooms participate. Of the 81 respondents volunteering from these classrooms, 2 children were siblings (white boys), and 2 children, although unrelated, resided in the same home (black girls). Therefore the home data for one randomly selected child in each pair were not included, in order to maintain the independence of the observations. One parent of a 3rd-grade white girl was unavailable for the home visit. Thus the final sample of the present study consisted of 53 2nd-graders and 25 3rd-graders.

The 78 children ranged in age from 79 to 114 months ($\bar{x}$ = 96 mos, sd = 7.5 mos), and included 41 boys (32 white, 9 black) and 35 girls (31 white, 4 black). Participating families represented a broad range of socio-economic positions, including upper-management and professional families (law, medicine), middle-management families, blue-collar and clerical families, as well as those receiving public assistance. The children also varied widely in intellectual ability, ranging from those participating in an academically gifted program to those receiving resource services for learning disabilities.

Design

Each of the 78 children participated in 3 sessions of data collection. In Session 1 the children were individually administered 2 study-recall tasks in a quiet room at their respective schools. In Session 2, which occurred approximately 3 days after Session 1, each child was administered a battery of 8 metamemory questions that were designed to assess their general memory knowledge, specific task-related strategy knowledge, and memory-monitoring. In Session 3, each child and the primary or custodial parent were visited in the home for the administration of a home observation-inventory and a parental strategy-instruction questionnaire.

Materials, Instruments and Instrument Scoring

Sort-Recall Tasks

Four sets of 20 colored picture-cards, each set depicting common and familiar objects representing 5 categories, were used for the study-recall tasks. The two A sets contained pictures of 1) clothes, 2) food, 3) boats or vehicles, 4) homes or parts of houses, and 5) toys or body parts. The two B sets contained pictures of 1) vehicles, 2) kitchen items, 3) animals, 4) sports items, and 5) bird or sky items. The names of the pictured objects in all stimulus sets are shown in Appendix A. The items in each set were deemed by the experimenter to be comparable to the items in the other 3 sets in terms of their familiarity and associative relatedness for the children. The 4 sets of stimulus items were assigned to 8 different sequential orders, each containing one A set and one B set for the 2 successive study-recall tasks (see Appendix A). One sequential order was randomly assigned to each child.

Metamemory Assessment

The script and scoring sheet for the Metamemory Battery are shown in Appendix B. The metamemory battery included 8 questions; questions 1 through 6 assessed general memory knowledge, question 7 assessed specific strategy knowledge, and question 8 assessed the child's concurrent memory-monitoring. The 6 general metamemory items were selected from a larger pool of items originally developed by Kreutzer et al. (1975). The general metamemory questions were chosen for use in the present study on the basis of 1) their ability to discriminate metamemorial knowledge between 1st and 3rd graders (Kreutzer et al., 1975; Cavanaugh & Borkowski, 1980), 2) their ability to predict strategy use and recall (Cavanaugh & Borkowski, 1980), and 3) their high test-retest reliability (Kurtz et al., 1982).

Kreutzer et al.'s (1975) labeling and scoring systems for the 6 general metamemory questions were retained for the present study. Some questions were more open-ended than others, and thus varied in the number of potential correct responses. Question #1, preparation object, assessed the child's knowledge of planful behavior in preparing for the future retrieval of an object by asking what the child could do that night at home to be sure she would remember to take her overnight bag to school the next morning (4 categories of potential responses; maximum score = 8). Question #2, preparation event, assessed the child's knowledge of planful behavior in preparing for the future retrieval of an event by asking what the child could do to be sure she remembered to go to an upcoming birthday party (3 categories of potential responses; maximum score = 6). Question #3, retrieval object, assessed the child's knowledge of search and inquiry skills for the retrieval of a misplaced object, specifically, a jacket lost at school (2 categories of potential responses, maximum score = 4). Question #4, rote-paraphrase, measured the child's awareness of the relative ease of gist recall over rote recall (maximum score = 3). Question #5, story-list, assessed the child's knowledge of the facilitating effect of elaboration on recall (maximum score = 4), and question #6, opposites-arbitrary, assessed the children's knowledge concerning how list structure and knowledge base might aid recall (maximum score = 2). The total maximum score possible for the 8 general metamemory questions was 27.

Question #7, which assessed the children's specific strategy knowledge, was originally developed by Lange, Guttentag, and Nida (1990), and represented a more elaborate version of Kreutzer et al.'s (1975) study plan question, in which children are asked what they can do to learn a set of pictures that are potentially clusterable into conceptual categories. Four picture panels were used in the present study, each arranged in a different structural array of 12 pictures (3 categories of 4 pictures each) taken from the Peabody Picture Vocabulary Test: a set of taxonomic category groupings, a set of color groupings, a set of random groupings, and a randomly arranged circular array. The panels were presented to the children according to a paired-comparison procedure requiring the child to select 1 of the 2 presented arrays of organized (or non-organized) pictures as easier to remember. The 5 presented pairs included taxonomic grouping versus color grouping, taxonomic grouping versus random grouping, taxonomic grouping versus random circular array, color grouping versus random circular array, and random grouping versus random circular array. Children were awarded 1 point for choosing the taxonomic category grouping over all others, and 1 point for choosing color or random grouping over the random circular array. Additionally, they were awarded 1 point for providing an adequate rationale per choice ("they're easier to remember 'cause they're all in groups of stuff like animals and food, and those are harder to remember 'cause they're all mixed up"). The maximum score for the strategy specific knowledge question was 10.

Question #8, the memory-monitoring question, was similar to one used by Levin et al. (1977), and assessed the child's knowledge of her short-term memory capacity and her ability to adjust recall estimates based on a prior recall experience. Each child was shown a sample deck of 15 picture cards and asked to estimate the number she could recall. After recording the recall estimate, the experimenter presented the pictures at 3-sec intervals and requested free recall. The experimenter recorded the recalled items, and then counted with the children the actual number recalled for the children to compare with their previous recall estimate. Immediately following, the child was presented with a 2nd deck of 15 cards with a new picture showing on top, told that the new deck consisted of the same number of pictures that were the same level of difficulty, and was asked for a 2nd recall estimate. Each child's memory-monitoring index was the inverse of the ratio, $|\underline{P} - \underline{A}|/\underline{A}$, where $\underline{P}$ equaled the number predicted on the second estimate and A equaled the actual number recalled (Borkowski et al. 1983).

Motivation Assessment

An abbreviated version of the 40-item Instrumental Competence Scale for Young Children (CompScale), developed by Lange et al. (1989), was used in the present study to assess children's mastery orientation. Fifteen items from the original CompScale were chosen for use in the present study on the basis of their high test-retest reliability (Lange et al., 1989), and their higher correlations with recall (Lange et al., 1989), and with strategy use (unpublished findings, Lange, Pierce, & Winterhof, 1991). The selection of the 15 items was also based on their agreement with theoretical arguments; that is, agreement with the definition of mastery motivation used in Lange et al. (1989): "children's tendencies to be independent, self-directed, and generally resourceful in their approaches to everyday tasks and activities." The CompScale composite used in the present study is presented in Appendix C.

Teachers assessed each child's level of mastery orientation by rating the child's preferences for working on and mastering tasks and activities in the classroom (e.g., "Likes to work on tasks that are challenging"). Teachers were asked to rate the children's mastery behaviors relative to their knowledge of most other children of the same age, by scoring the Likert-type scale from 1 (shows the behavior much less than other children) to 5 (shows the behavior much more than other children). Ratings for each of the 15 items were summed and averaged, yielding a potential score from 1.0 to 5.0.

Home Environment Assessments

The middle childhood version of the Home Observation for the Measurement of the Environment observation-interview inventory (HOME, Caldwell & Bradley, 1984c) was used to assess qualities of the home environment, including the parental nurturing and encouragement of children's planfulness, independence, and maturity. The HOME consists of 59 items that are organized into 8 subscales: Emotional & Verbal Responsivity (maximum score = 10), Encouragement of Maturity (max = 7), Emotional Climate (max = 8), Growth Fostering Materials & Experiences (max = 8), Provision for Active Stimulation (max = 8), Family Participation in Developmentally Stimulating Experiences (max = 6), Paternal Involvement (max = 4), and Aspects of the Physical Environment (max = 8). Each of the 59 items was scored by the experimenter on a "yes-no" basis; that is, "yes" received a score of 1, "no" received a score of 0 (maximum total score = 59). Nineteen of the items were scored on the basis of observation (e.g., "Parent talks to child during visit beyond correction & introduction" and "The interior of the apartment is not dark or monotonous"). The remaining 48 items required some interview and discussion before scoring (e.g., "Parent reports no more than one instance of physical punishment occurred during the past month"). The complete HOME inventory is presented in Appendix D.

The parental metacognitive-instruction questionnaire was based on an 8-item instrument used by Carr et al. (1989), and was completed by the parent. The present study employed 6 of the questions which related to metacognitive instruction in the home (e.g., "Do you check your child's school work?" and "How many games that require strategic skills does your child own?"). The 6 questions varied in the number of possible correct responses, ranging from 4 to 7, with a maximum total score of 33. The 2 questions from the Carr et al. (1989) instrument that were omitted related to parental attributions of their child's success or failure on academic tasks. The abbreviated parental questionnaire used in the present study is presented in Appendix E.

Procedures

Session 1

Following preliminary conversation with the child about the experimenter's interest in how young children remember things, the experimenter administered 2 study-recall tasks to all participating children. The 2nd study-recall task differed from the 1st task only in that children were asked to study and recall a different set of stimulus items.

In each task, the experimenter sat either at a table or on the floor with the child, showed the child a different set of 20 pictures of common objects or animals, and told the child that she had 2 minutes to study them for the purpose of remembering them when they were later removed from the table. Pictures were presented in a randomly arranged circular array, with no two items from the same category adjacent to one another. Prior to the study period, subjects named each item to insure that they knew the item names. The children were told that they could move the items around or do anything they wished with them to help themselves remember them.

Study period. The study period lasted 2 minutes, during which the experimenter recorded the occurrance (score = 1) or lack of occurrance (score = 0) of the study-sorting behavior of group naming (verbalizing a name for one or more groups) occurring within 15-s intervals. At the end of the study period, the experimenter also recorded the total number of pictures that had been sorted into taxonomic groups.

Recall period. Following the study period the stimuli were removed from the table. The child was administered a brief color-naming task, and then asked to recall as many of the item names as possible. If the child failed to recall an item for a period of 15 consecutive seconds, the experimenter asked if the child could remember any more items, and if not, terminated the recall period at that point. The experimenter recorded the recalled items and the order of recall, and noted whether the child had verbalized group names to self-cue recall. The recording sheet used to record study behaviors and recall performance is presented in Appendix F. Following recall, the experimenter thanked the child for working hard on the tasks and gave her a sticker for effort.

Session 2

In the 2nd school session, administered approximately 2-4 days after session 1, the children were asked questions from a metamemory battery. As in Session 1, the experimenter sat either at a table or on the floor with the child to administer the metamemory questions. The questions were administered to the children orally, and the experimenter recorded the children's answers. Each child received another sticker for effort at the end of the 2nd session.

Session 3

The experimenter visited the children's homes in the afternoon or evening of weekdays, or on weekends, when both parent and child were present. Fourty-four of the interviews were conducted with mothers only, one with a father only, 3 with grandmothers only, 21 with mothers and fathers together, and 9 with mothers only but with the fathers making a brief appearance. The administration of the home interview required approximately an hour to an hour-and-a-half. The experimenter began the interview by asking the parent to describe a "typical school-day" in the life of the target child. Many items on the HOME could be scored during the parent's description of the day, and further items were scored following appropriate probes. Direct questions were avoided when possible. The parents seemed eager and willing to discuss their routines and child-care beliefs, attitudes and expectations, and were forthright in disclosing incidents of physical punishment and emotional confrontations with their children. After scoring the HOME inventory, the experimenter asked the parent to complete the strategy-instruction questionnaire, and to allow the child to show the experimenter her room while the parent completed the questionnaire. Five mothers declined the bedroom visit; one mother preceded the experimenter and dimmed the bedroom lights.

In addition to gathering data from the children, classroom teachers were asked to complete the CompScale (Lange et al., 1989) as a measure of mastery motivation within the classroom. The experimenter explained the 15 items and the scoring procedure to the teachers, asked that they complete the rating scale at their convenience, and left a stamped, self-addressed envelope for them to return the completed scales to the experimenter.

CHAPTER IV

RESULTS

Preliminary Analyses

Development and Definition of Variables

The ranges, means, standard deviations, and bivariate correlations for the primary measures are shown in Table 1.

Metamemory. The 6 general metamemory questions of the metamemory battery were scored following Kreutzer et al.'s (1975) procedures described above, and summed to yield a general metamemory score (range = 2 to 19; $\bar{x} = 9.9$; $sd = 3.4$). The specific strategy question, that is, question #7, of the metamemory battery was scored following the procedures outlined above to yield a specific metamemory score (range = 0 to 10; $\bar{x} = 3.89$; $sd = 3.1$). The 8th question of the metamemory battery involved the presentation of 2 different sets of to-be-remembered picture items to assess the children's concurrent memory-monitoring behavior. The Monitoring score measured the degree to which the children adjusted their recall prediction for the 2nd presented set of stimulus items, relative to their recall performance on the 1st presented set of items. The score was obtained by first subtracting the actual number recalled on the 1st presented set of picture stimuli (A) from the recall prediction given

Table 1

Bivariate Correlations and Descriptive Statistics for the Primary Variables (N = 78)

				Correlations with:					
	Range	M	sd	1.	2.	3.	4.	5.	6.
1. StratInstruction	7 to 24	15.55	3.76						
2. Maturity Facilitation	12 to 31	23.83	4.83	0.491***					
3. Metamemory	3 to 26	13.82	5.08	0.180	0.340**				
4. MasteryMotive	1.8 to 5	3.49	0.87	0.251*	0.404***	0.200			
5. MetaMotivation	6.8 to 114.4	49.04	22.68	0.241*	0.446***	0.847***	0.658***		
6. ItemRecall	6 to 18	11.62	2.67	0.284*	0.379***	0.497***	0.240*	0.499***	
7. StrategyUse	-2.64 to 3.67	0.00	1.80	0.360**	0.440***	0.271*	0.028	0.231*	0.410***

* $p < .05$ ** $p < .01$ *** $p < .001$

for the 2nd presented set of stimuli (P). Secondly, the ratio between the absolute difference ($|\underline{P} - \underline{A}|$) and the actual number recalled (A) was obtained. Thirdly, the inverse of the ratio was calculated; that is, the inverse of $|\underline{P} - \underline{A}|/\underline{A}$ (range = 0 to 4.0, $\bar{x}$ = 0.41, sd = .64). Contrary to the findings of previous examinations (Borkowski et al., 1983; Kurtz et al. 1982), none of the initially computed correlations between the monitoring score and measures of strategy use at study or recall reached statistical significance at the $p < .05$ level. Correlations between Monitoring and the measures of number of items grouped taxonomically at study, ARC clustering at recall, and a composite measure of strategy use were $r = .08$, $r = .218$; and $r = .17$, respectively. Since Monitoring failed to predict strategy use, it was not included in further analyses. The remaining 7 items of the metamemory battery (i.e., the 6 general metamemory scores and the specific strategy knowledge score) were summed, named Metamemory (range = 3 to 26; $\bar{x}$ = 13.82; sd = 5.08), and used as the measure of metamemory knowledge in all subsequent analyses.

Motivation. The CompScale scores from the teacher assessment of children's classroom behaviors were summed over the 15 items and averaged to yield the measure of the children's mastery-motivation, MasteryMotive (range = 1.8 to 5.0; $\bar{x}$ = 3.49; sd = .87).

Metamemory/Motivation Product. Metamemory scores were multiplied by CompScale scores to yield the product score, MetaMotivation (range = 6.81 to 114.4; $\bar{x}$ = 49.04; sd = 22.68).

Home strategy instruction. The 6 questions on the parental strategy-instruction questionnaire dealing with strategy instruction in the home were scored and summed to yield the strategy-instruction measure, StratInstruction (range = 7 to 24, $\bar{x}$ = 15.55; sd = 3.8).

Home environment. The 59 items of the HOME inventory were scored on a yes (score = 1) or no (score = 0) basis, and were divided into 8 subscales. The ranges, means and standard deviations of the subscales may be found in Table 2.

Initial examinations of the frequency distributions of each HOME subscale revealed normal distributions for all the subscales with the exception of the subscale Physical Environment (coefficient of skewness = - 1.897). The Physical Environment subscale included 8 questions that assessed whether the child's physical environment was safe, clean and conducive to development; for example, "There is at least 100 square feet of living space per person in the house," and "Building has no potentially dangerous structural or health defects (e.g., plaster coming down from ceiling, stairway with boards missing, rodents)." Although the potential range of scores was 0 to 8 on this subscale, most of the children's homes scored at the high end of the scale. Only 8 cases had a subscale score equal to or less than 5, and 70 cases had a subscale score greater than 5. A new variable, PhysEnv, was created with 2 levels: 0 and 1 ($\bar{x}$ = 0.897; sd = 0.31). The 8 cases with scores on the Physical Environment subscale equal to or less than 5 were recoded for PhysEnv as 0 = not positive physical environment. The 70 cases with scores on the Physical

Table 2

Bivariate Correlations between the HOME Subscales, Process Variables, and Performance Variables

HOME subscales	Range	M	sd	Correlations with: Meta-memory	Mastery-Motive	Item-Recall	Strategy-Use
Responsivity	3 to 10	8.3	1.8	.40***	.42***	.46***	.28*
Maturity	0 to 7	4.3	1.6	.20	.26*	.16	.46**
Emotional Climate	2 to 8	5.6	1.5	.08	.16	.14	.28*
Materials & Experiences	0 to 8	4.8	1.6	.28*	.29**	.30**	.29**
Active Stimulation	0 to 8	4.0	2.0	.36**	.33**	.24*	.36**
Family Participation	0 to 6	3.4	1.4	.21	.32**	.11	.19
Paternal Involvement	0 to 4	2.1	1.4	.09	.00	.13	.10
Physical Environment	2 to 8	7.2	1.3	.20	.32**	.22*	.18
PhysEnv	0 to 1	0.88	0.32	.07	.28*	.17	.05

*$p < .05$ **$p < .01$ ***$p < .001$

Environment subscale greater than 5 were recoded for PhysEnv as 1 = positive physical environment.

One of the purposes of the present study was to examine the influence of selected aspects of the home environment on memory performance. In order to identify the HOME subscales that best reflected the construct of interest, that is, parental nurturance and encouragement of planful, independent, and mature behaviors, a factor analysis was performed on the total scores of the 8 individual subscales of the HOME inventory. The rotated factor matrix with the factor loadings of the 8 measures on the 2 principal components, their Eigenvalues, and percent of variance explained are shown in Table 3. After an initial principal components factor analysis, the factors were orthogonally rotated using the varimax procedure. Using the minimum criteria, Eigenvalue = 1.0, only 2 factors were extracted. Five subscales, Emotional & Verbal Responsivity, Encouragement of Maturity, Emotional Climate, Growth Fostering Materials & Experiences, and Physical Environment (i.e., PhysEnv), met the loading criterion of .45 for Factor 1. The 5 subscales of Factor I appear to delineate a "planfulness, independence, and maturity facilitation" dimension. The remaining 3 subscales, Provision for Active Stimulation, Family Participation in Developmentally Stimulating Experiences, and Paternal Involvement loaded on Factor 2, and appear to delineate an "out-of-home experiences" dimension. Factor I was

Table 3

Factor Analysis Table of the HOME Subscale Scores (N = 78)

	Factor Loadings		
Subscales	I	II	Communality
Responsivity	0.842[1]	0.119	0.723
Maturity	0.493[1]	0.168	0.271
Emotional Climate	0.687[1]	0.018	0.473
Materials & Experiences	0.703[1]	0.273	0.569
Active Stimulation	0.432	0.702[2]	0.680
Family Participation	0.220	0.777[2]	0.652
Paternal Involvement	0.015	0.734[2]	0.539
Physical Environment	0.550[1]	0.207	0.346
Eigenvalue	3.172	1.086	4.258
% Variance	39.65	13.58	53.23

[1] subscales loading on Factor I: Maturity Facilitation

[2] subscales loading on Factor II: Out-of-Home Experiences

named Maturity Facilitation (range = 12 to 31; $\bar{x}$ = 23.8; sd = 4.8) and was used as the measure of parental encouragement of planful, independent, and mature behaviors in the subsequent regression analyses.

Measures of study and memory performance. During the study period of the study-recall tasks, the experimenter recorded the occurrence or lack of occurrence of group-naming activity for each of the 8 15-second intervals, resulting in maximum and minimum interval-frequency scores of 8 and 0. The interval-frequency scores for each of the 2 study-recall tasks were summed and averaged to yield mean scores. Group-naming behaviors occurred for only 14 children (range = 0 to 2, $\bar{x}$ = 0.19, sd = 0.45), and therefore were omitted from subsequent analyses.

At the end of the study periods for both study-recall tasks, the experimenter recorded the number of stimulus items that had been grouped into taxonomic categories by the child. The totals from each task (actual range = 0 to 20 for each task) were summed and averaged for the study organization measure of Number of Items Grouped Taxonomically. An initial examination of the frequency distribution for the study organization measure revealed a non-normal distribution (range: 0 to 20, $\bar{x}$ = 7.3; median = 5.75; sd = 7.71; coefficient of skewness = .49). The children's scores were distributed into 3 clusters: the scores of children who grouped most or all of the stimulus items on both tasks, those of children who grouped most of the stimulus items on only 1 of the tasks, and those of children who grouped none of the stimulus items on either of the 2 tasks. The Number of Items Grouped

Taxonomically measure was recoded with 3 levels: 0, 1, and 2 ($\bar{x}$ = 0.71; sd = 0.82). The 39 cases with scores equal to or less than 5 were recoded as 0 = grouped no stimulus items. The 20 cases with scores from 6 to 14 were recoded as 1 = grouped approximately half the total stimulus items. The 19 cases with scores equal to or greater than 15 were recoded as 2 = grouped most of the stimulus items.

Following the study period all items were removed from view, and the children were asked to recall as many items as they could. The total number of items recalled (maximum range = 0 to 20 for each task) were summed and averaged across the 2 tasks for the performance measure ItemRecall (actual range: 6 to 18, $\bar{x}$ = 11.62, sd = 2.67). The adjusted ratio of clustering (ARC) scores for each task were also summed and averaged across the 2 tasks for the recall organization measure, ARC (actual range: 0.0 to 1.0, $\bar{x}$ = .46, sd = 0.26). Self-cuing at recall (i.e., verbalizing the names of taxonomic categories) was observed in only 6 subjects (range = 0 to 1, $\bar{x}$ = .06, sd = .21), and therefore was omitted from subsequent analyses.

The study organization (Number of Items Grouped Taxonomically) scores, and the recall organization (ARC) scores, were first standardized (internal standardization) and then summed to yield a composite strategy-use score, StrategyUse (range = -2.6 to 3.7; $\bar{x}$ = 0.0; sd = 1.8).

Analyses of Sex, Race, and Grade Differences

Preliminary sex(2) x race(2) x grade(2) analyses of variance (ANOVAs) were performed separately on the primary variables of interest list. The 3-way ANOVAs yielded only one significant interaction effect, a sex x race interaction for StrategyUse, $F(1,77) = 4.57$, $p < .03$. The sex x race interaction was examined using 4 2-tailed t-tests. To preserve an overall significance level of .05, the Bonferroni correction to the significance level of each individual test was used. The Bonferroni correction involved dividing the overall significance level (.05) by the number of t-tests (4), resulting in a significance level of .012 for each individual test. The individual t-tests revealed that black girls scored higher than white girls ($t(34) = 3.82$, $p < .001$) and higher than black boys ($t(12) = 7.94$, $p < .0001$); white girls scored higher than white boys ($t(62) = 3.85$, $p < .001$); and white boys scored higher than black boys ($t(40) = 13.22$, $p < .0001$).

Several main effects were also found: a main effect of race (whites scoring higher than blacks) for the measures of StratInstruction, $F(1,77) = 7.6$, $p < .01$, and MetaMotivation, $F(1,77) = 3.96$, $p < .05$; a main effect of grade (3rd graders scoring higher than 2nd graders) for the measures of Metamemory, $F(1,77) = 4.68$, $p < .03$, and ItemRecall, $F(1,77) = 6.51$, $p < .02$; and a main effect of sex (girls scoring higher than boys) for the measures of ItemRecall, $F(1,77) = 4.15$, $p < .05$, and StrategyUse, $F(1,77) = 8.33$, $p < .0001$. No statistically significant effects were found for the analyses of the Maturity Facilitation or the MasteryMotive measures.

Since none of the preliminary analyses performed on StratInstruction, Maturity Facilitation, Metamemory, MasteryMotive, MetaMotivation, or ItemRecall produced interactions between sex, race, or grade, all of the data submitted for further analyses of these measures were collapsed across the 2 levels of each of the sex(2), race(2), and grade(2) variables. Although the analysis of the means entered into the StrategyUse ANOVA produced an interaction suggesting that white boys outperformed black boys, and black girls outperformed white girls, the StrategyUse measure was also submitted to subsequent analyses independent of sex, race, or grade. The decision to collapse the StrategyUse data across sex(2) and across race(2) was made on the basis of 1) too few black subjects to examine the relationships for the race x sex groups independently, that is, white males = 33, white females = 31, black males = 9, and black females =5; 2) no empirical findings in previous studies suggesting that the predictor-outcome relationships (i.e., home environment-memory performance relationships) examined in the present study vary according to race or sex; and 3) no theoretical expectation that the predictor-outcome relationships would vary according to race or sex.

Primary Analyses of Hypotheses

The primary purpose of the present study was to examine the influence of the home environment on children's memory-task performance. In the theoretical model shown in Figure 1, it is postulated that children's memory knowledge and mastery-motivational inclinations mediate the influence of the home environment on children's memory-task performance.

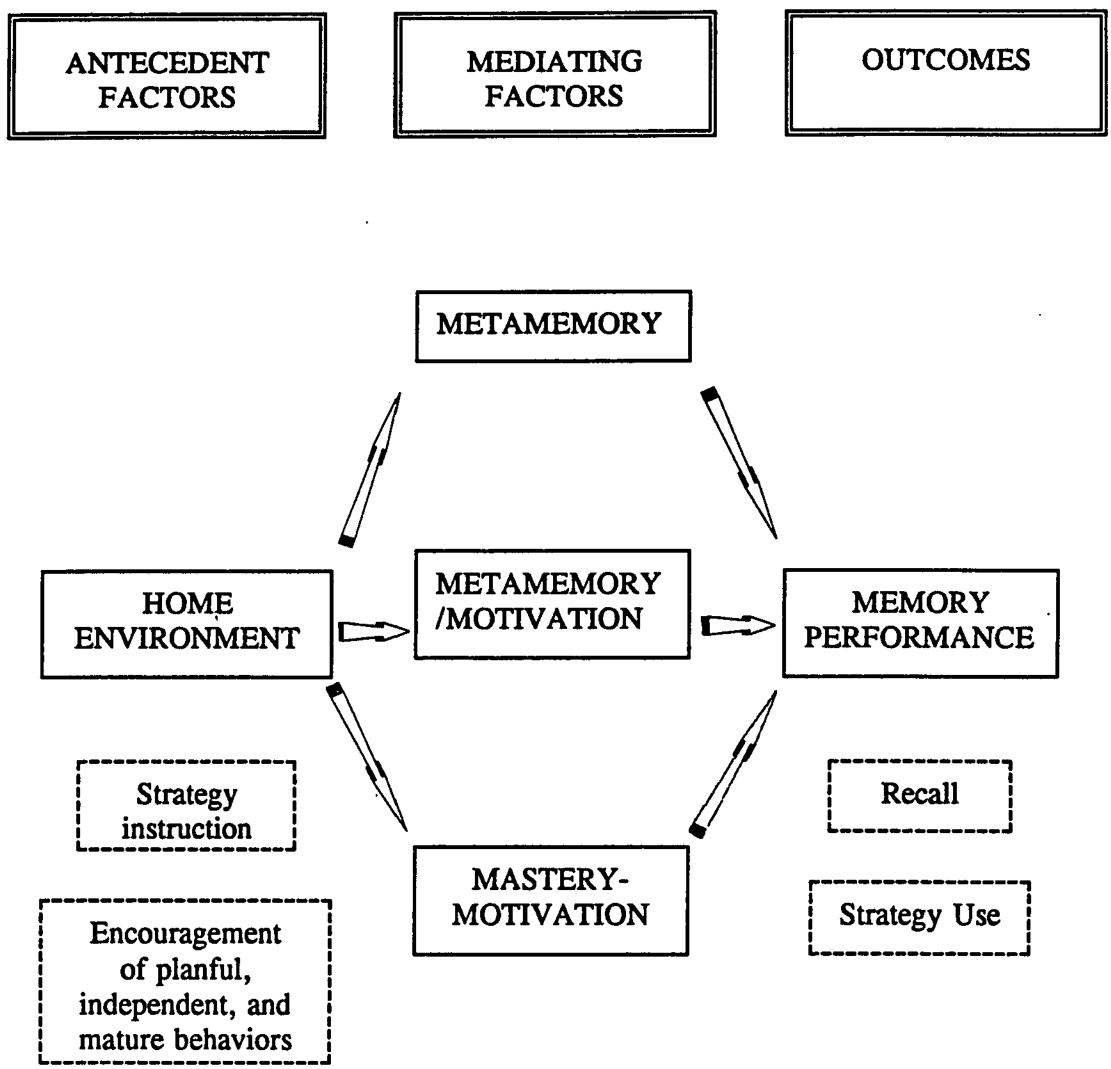

Figure 1. Theoretical model of the influence of the home environment on memory performance mediated by metamemory, mastery-motivation, and their product, metamemory/mastery-motivation.

The Contributions of Memory Knowledge (Metamemory) and Mastery-Motivation to Memory Performance

The first step in the analysis of the theoretical model was to demonstrate a relationship between the hypothesized mediational process variables, metamemory and mastery-motivation, and the memory performance measures, the number of items recalled and the composite strategy use scores. The bivariate correlations between Metamemory, MasteryMotive, MetaMotivation, and the memory performance measures, ItemRecall and StrategyUse, are shown in Table 1. As can be seen from the table, Metamemory, MasteryMotive, and MetaMotivation were each significantly related to ItemRecall at the $p < .05$ level or lower, and Metamemory and MetaMotivation were significantly related to StrategyUse at the $p < .05$ level.

To examine Hypothesis #1, that metamemory and mastery-motivation considered together provide a more powerful predictor of memory performance than either construct alone, simple and multiple regression analyses were performed using Metamemory, MasteryMotive, and MetaMotivation as predictor variables. Four regression equations were performed to estimate each of the memory performance measures, item recall and strategy use.

The results of the analyses of the 4 regression models that were used to predict item recall are shown in Table 4. Models #1, #2, and #3 involved simple regression analyses in which Metamemory, MasteryMotive, and MetaMotivation, respectively, were examined as single predictors of ItemRecall. Model #4 involved a multiple

Table 4

Four Regression Models to Predict Item Recall Using Memory Knowledge and Mastery-Motivation (N = 78)

Equation				Adj	Overall	
Estimate	Intercept	Slope	R^2	R^2	F	p
#1 ItemRecall =	8.01 +	.262 Metamemory	.247	.237	24.97(1,76)	< .0001
#2 ItemRecall =	9.08 +	.733 MasteryMotive	.057	.045	4.61(1,76)	< .05
#3 ItemRecall =	8.75 +	.059 MetaMotivation	.249	.239	25.16(1,76)	< .0001
#4 ItemRecall =	6.67 +	.246 Metamemory + .446 MasteryMotive	.268	.248	13.71(2,75)	< .0001

regression analysis, in which Metamemory and MasteryMotive were examined as multiple (additive) predictors of ItemRecall. As can be seen in Table 4, the Metamemory-only model (Equation #1, $F(1,76) = 24.97$, $p < .0001$) and the multiplicative model (Equation #3, $F(1,76) = 25.26$, $p < .0001$), each explained approximately 25% of the variance in ItemRecall. The additive model (Equation #4) explained approximately 27% of the variance in ItemRecall ($F((2,75) = 13.71$, $p < .0001$). The MasteryMotive-only model (Equation #2) explained approximately 6% of the variance in ItemRecall ($F(1,76) = 4.61$, $p < .05$).

To compare the predictive power between all possible pairs of models, z-tests of the differences between the multiple correlation coefficients were conducted using the transformation statistic known as Fisher's Z (Glass & Hopkins, 1970). The adjusted R^2s for models #1 (Metamemory only), #3 (multiplicative model), and #4 (additive model) were each statistically different (and greater) than the adjusted R^2 for model #2 (MasteryMotive only) at the $p < .01$ level. The tests for the adjusted R^{2}' among models #1, #3, and #4 failed to yield statistically significant differences. Although the additive model (Equation #4) explained slightly more variance than did the Metamemory-only model (Equation #1), the F-test for reducing the model from 2 variables (Metamemory, MasteryMotive) to 1 variable (Metamemory) was not statistically significant ($F(1,75) = 2.09$, $p = .15$).

The results of the analyses of the 4 regression models that were used to predict StrategyUse are shown in Table 5. In models #1, #2, and #3, Metamemory,

Table 5

Four Regression Models to Predict Strategy Use Using Memory Knowledge and Mastery-Motivation (N = 78)

	Equation			Adj	Overall	
Estimate	Intercept	Slope	R^2	R^2	F	p
#1 StrategyUse =	- 1.3	+ .096 Metamemory	.074	.062	6.07(1,76)	< .05
#2 StrategyUse =	- 0.2	+ .058 MasteryMotive	.000	.000	0.06(1,76)	> .10
#3 StrategyUse =	- 0.8	+ .017 MetaMotivation	.044	.032	3.55(1,76)	< .10
#4 StrategyUse =	- 1.1	+ .098 Metamemory - .056 MasteryMotive	.075	.050	3.02(2,75)	< .10

MasteryMotive, and MetaMotivation, respectively, were each examined as single predictors of StrategyUse. In model #4, Metamemory and MasteryMotive were examined as multiple (additive) predictors of StrategyUse. The Metamemory-only model (Equation #1) explained approximately 7% percent of the variance in StrategyUse ($F(1,76) = 6.07$, $p < .05$), the MasteryMotive-only model (Equation #2) explained none of the variance ($F(1,76) = 0.06$, $p > .10$), the MetaMotivation model (Equation #3) explained approximately 4% of the variance ($F(1,76) = 3.55$, $p < .10$), and the additive model (Equation #4) explained approximately 7.5% of the variability in StrategyUse scores ($F(2,75) = 3.02$, $p < .10$).

To compare the predictive power between all possible pairs of models, z-tests of the differences between the multiple correlation coefficients were conducted using Fisher's Z. Each of the adjusted R^2s for models #1 (Metamemory only) and #4 (additive model) differed significantly from the adjusted R^2 for model #2 (MasteryMotive only) at the $p < .05$. There were no significant differences found among the comparisons of the adjusted R^2s for models #1, #3, and #4 ($p < .05$).

The Contributions of the Home Environment to Children's Memory Knowledge and Mastery-Motivation

The second major step in the analysis of the theoretical model was to demonstrate a relationship between the antecedent factors in the home environment and the mediating factors, memory knowledge and mastery-motivation. The bivariate correlations between StratInstruction, Maturity Facilitation, Metamemory, MasteryMotive, and MetaMotivation are shown in Table 1.

In Hypothesis #2, it was proposed that both parental strategy instruction and parental encouragement of planful, independent, and mature behaviors predict children's metamemory. Based on the lack of a statistically significant correlation between StratInstruction and Metamemory, it was determined to perform not only the multiple regression analysis suggested by the hypothesis, using StratInstruction and Maturity Facilitation as the predictor variables and Metamemory as the dependent variable, but also a simple regression analysis using Maturity Facilitation as the only predictor variable. The results of the analyses of the two regression models that were proposed to predict Metamemory are shown in Table 6. The Maturity Facilitation-only model (Equation #1) explained approximately 11.5% of the variance in Metamemory scores ($F(1,76) = 9.88$, $p < .01$). The additive model (Equation #2) also explained approximately 11.5% of the variance in Metamemory scores ($F(2,75) = 4.89$, $p < .01$). When StratInstruction was dropped from the full model, the F-test for reducing the model from 2 variables (Maturity Facilitation, StratInstruction) to one variable (Maturity Facilitation) was not statistically significant, ($F(1,75) = 0.022$, $p = .88$).

In Hypothesis #3, it was proposed that parental encouragement of planful, independent, and mature behaviors predicts children's mastery-motivation. As can be seen in Table 1, Maturity Facilitation was significantly related to MasteryMotive,

Table 6

Two Regression Models to Predict Memory Knowledge Using Parental Strategy Instruction and Encouragement of Planful, Independent, and Mature Behaviors (N = 78)

	Equation			Adj	Overall	
Estimate	Intercept	Slope	R^2	R^2	F	p
#1 Metamemory =	5.31 +	.36 Maturity Facilitation	.115	.10	9.88(1,76)	< .01
#2 Metamemory =	5.15 +	.35 Maturity Facilitat. + .03 StratInstruct.	.115	.09	4.89(2,75)	< .01

$r = .40$, $p < .001$. The results of the analysis of the regression model that was proposed to predict MasteryMotive is shown in Table 7. A simple regression analysis revealed that Maturity Facilitation accounted for 16% of the variance in MasteryMotive scores, ($F(1,76) = 14.8$; $p < .001$).

Although there was no hypothesis proposed regarding the relationship between the antecedent factors in the home environment and the metamemory\mastery-motivation product, it was determined to examine the relationship to remain consistent with the preceding analyses and to provide a more thorough examination of the proposed model. Two regression analyses were conducted: a simple regression analysis using Maturity Facilitation as the predictor variable, and a multiple regression analysis using Maturity Facilitation and StratInstruction as the multiple predictors. The results of the analyses of the regression models that were proposed to predict MetaMotivation are shown in Table 8. The Maturity Facilitation-only model (Equation #4) explained approximately 20% of the variance in MetaMotivation scores ($F(1,76) = 18.85$, $p < .0001$). The additive model (Equation #5) also explained approximately 20% of the variance in MetaMotivation scores ($F(2,75) = 9.34$, $p < .001$). When StratInstruction was dropped from the full model, the F-test for reducing the model from 2 variables (Maturity Facilitation, StratInstruction) to one variable (Maturity Facilitation) was not statistically significant, ($F(1,75) = 0.061$, $p = .81$).

Table 7

A Regression Model to Predict Mastery-Motivation Using Parental Strategy Instruction and Encouragement of Planful, Independent, and Mature Behaviors (N = 78)

Equation				Adj	Overall	
Estimate	Intercept	Slope	R^2	R^2	F	p
#3 MasteryMotive =	1.75 +	.073 Maturity Facilitation	.163	.15	14.80(1,76)	< .001

Table 8

<u>Two Regression Models to Predict Metamemory and Mastery-Motivation Using Parental Strategy Instruction and Encouragement of Planful, Independent, and Mature Behaviors (N = 78)</u>

Equation				Adj	Overall	
Estimate	Intercept	Slope	R^2	R^2	F	p
#4 MetaMotivation	= - 0.9	+ 2.10 Maturity Facilitation	.199	.19	18.85(1,76)	< .0001
#5 MetaMotivation	= - 2.0	+ 2.03 Maturity Fac. + .18 StratInstruct.	.199	.18	9.34(2,75)	< .001

The Mediating Effect of Memory Knowledge and Mastery-Motivation on the Relationships between the Home Environment and Memory Performance

In Hypothesis #4 it was proposed that the influence of the home environment on memory performance is mediated in part by the child's metamemory and motivational inclinations. Baron and Kenny (1986) suggest that in order to test for mediation, 3 regression equations should be estimated: (a) a regression of the mediator on the independent variable, (b) a regression of the dependent variable on the independent variable, and (c) a regression of the dependent variable on both the independent variable and the mediator. In order to establish evidence of mediation, 4 conditions must be present: (a) the independent variable must affect the mediator in the first equation; (b) the independent variable must affect the dependent variable in the second equation; (c) the mediator must affect the dependent variable in the third equation, and (d) the effect of the independent variable on the dependent variable must be less evident in the third equation than in the second.

Baron and Kenny's (1986) first condition to establish mediation, demonstrating that the independent variable affects the mediator, corresponds to Hypotheses #2 and #3 of the present study, examined above. The first condition was met for the relationships between Maturity Facilitation and the 3 proposed mediator variables: Metamemory, MasteryMotive, and MetaMotivation. However, based on the relative magnitudes of the adjusted $\underline{R}^2$s of the respective models and the results of the $\underline{F}$-tests for reducing the models, it was determined that Baron and Kenny's (1986) first condition was not met for the StratInstruction measure in any of the above regression equations. It was therefore determined to omit StratInstruction from further analyses.

To examine Baron and Kenny's (1986) second, third, and fourth conditions to establish mediation, a set of 4 regression equations was estimated for each of the dependent measures, ItemRecall and StrategyUse. A simple regression was estimated to examine the second condition, that the independent variable affects the dependent variable. Three multiple regressions of the dependent variable on the independent variable and each of the three mediators were estimated to examine the third and fourth conditions.

To test Baron and Kenny's third condition, that the mediator affects the dependent variable when included in the equation with the independent variable, F-tests for reducing the model from two variables to one variable were performed for each of the 3 multiple regressions. To explore Baron and Kenny's fourth condition, that the effect of the independent variable on the dependent variable is reduced when the mediator variable is included, the amount of decrease in the regression coefficient of Maturity Facilitation in each of the 3 multiple regression equations was examined.

Number of items recalled. To examine the mediating influence of each of the three process variables on the relationship between the home environment and the number of items recalled, a simple regression equation was first estimated using Maturity Facilitation as the predictor variable, and ItemRecall as the dependent variable. As can be seen from Table 9, Maturity Facilitation, when considered alone

Table 9

Four Regression Models to Predict Item Recall Using Parental Encouragement of Planful, Independent, and Mature Behaviors, Memory Knowledge, and Mastery-Motivation (N = 78)

	Equation			Adj	Overall	
Estimate	Intercept	Slope	R^2	R^2	F	p
#1 ItemRecall =	6.63	+ .21 Maturity Facilitation	.143	.13	12.73(1,76)	< .001
#2 ItemRecall =	5.47	+ .13 Maturity Facilitation + .22 Metamemory	.297	.28	15.85(2,75)	< .0001
#3 ItemRecall =	6.08	+ .19 Maturity Facilitation + .32 MasteryMotive	.152	.13	6.74(2,75)	< .01
#4 ItemRecall =	6.68	+ .11 Maturity Facilitation + .05 MetaMotivation	.279	.26	14.53(2,75)	< .0001

(Equation #1), accounted for approximately 14% of the variance in ItemRecall ($F(1,76) = 12.725$, $p < .001$). For every 1 point increase in Maturity Facilitation scores, ItemRecall scores increased approximately .21 points. Thus, Baron and Kenny's (1986) second condition, that the independent variable affects the dependent variable, was met for the relationship between Maturity Facilitation and ItemRecall.

Three multiple regression analyses using ItemRecall as the dependent variable were estimated next, using both Maturity Facilitation and either MetaMemory, MasteryMotive, or MetaMotivation, as the predictor variables. As can be seen in Table 9, when Metamemory was added to the model (Equation #2), both predictors accounted for approximately 30% of the variance in ItemRecall ($F(2,75) = 15.86$, $p < .0001$). The F-test for reducing the model from 2 variables (Maturity Facilitation, Metamemory) to one variable (Maturity Facilitation) was statistically significant ($F(1,75) = 16.40$, $p < .001$). With Metamemory in the model, for every 1 point increase in Maturity Facilitation scores, ItemRecall scores decreased approximately .08 points; that is, the regression coefficient for Maturity Facilitation decreased from .21 to .13 when Metamemory was added to the model.

When MasteryMotive was added to the model (Table 9, Equation #3), both predictors accounted for approximately 15% of the variance in ItemRecall ($F(2,75) = 6.74$, $p < .01$). The F-test for reducing the model from 2 variables (Maturity Facilitation, MasteryMotive) to one variable (Maturity Facilitation) was not statistically significant. With MasteryMotive in the model, for every 1 point increase in Maturity Facilitation scores, ItemRecall scores decreased approximately .19 points; that is, the regression coefficient for Maturity Facilitation decreased from .21 to .19 when Metamemory was added to the model.

When MetaMotivation was added to the model (Table 9, Equation #4), both predictors accounted for approximately 28% of the variance in ItemRecall ($F(2,75) = 14.53$, $p < .0001$). The F-test for reducing the model from 2 variables (Maturity Facilitation, MetaMotivation) to one variable (Maturity Facilitation) was statistically significant ($F(1,75) = 14.13$, $p < .001$). With MetaMotivation in the model, for every 1 point increase in Maturity Facilitation scores, ItemRecall scores decreased approximately .11 points; that is, the regression coefficient for Maturity Facilitation decreased from .21 to .11 when MetaMotivation was added to the model.

Thus both of Baron and Kenny's (1986) third and fourth conditions, that the mediator affects the dependent variable when included in the equation with the independent variable, and that the effect of the independent variable on the dependent variable is reduced when the mediator is included, were met for 2 of the examined relationships: (a) Maturity Facilitation, Metamemory, and ItemRecall, and (b) Maturity Facilitation, MetaMotivation, and ItemRecall. The third and fourth conditions were not met for the relationship between Maturity Facilitation, MasteryMotive, and ItemRecall.

Strategy use. To examine the mediating influence of each of the three process variables on the relationship between the home environment and strategy use, first a simple regression equation was estimated using Maturity Facilitation as the predictor variable, and StrategyUse as the dependent variable. As can be seen from Table 10, Maturity Facilitation, when considered alone (Equation #1), accounted for approximately 19% of the variance in StrategyUse ($F(1,76) = 18.23$, $p < .0001$). For every 1 point increase in Maturity Facilitation scores, StrategyUse scores increased approximately .16 points. Thus, Baron and Kenny's (1986) second condition, that the independent variable affects the dependent variable, was met for the relationship between Maturity Facilitation and StrategyUse.

As in the case of ItemRecall, 3 multiple regression analyses were estimated next, using both Maturity Facilitation and either Metamemory, MasteryMotive, or MetaMotivation, as the predictor variables, and StrategyUse as the dependent variable. As can be seen in Table 10, when Metamemory was added to the model (Equation #2), both predictors accounted for approximately 21% of the variance in StrategyUse ($F(2,75) = 9.997$, $p < .001$). The F-test for reducing the model from 2 variables (Maturity Facilitation, Metamemory) to one variable (Maturity Facilitation) was not statistically significant. Also, with both Maturity Facilitation and Metamemory in the model, Maturity Facilitation was a statistically significant predictor of StrategyUse ($F = 12.96(1,75)$, $p = .001$), but Metamemory was not. With Metamemory in the model, for every 1 point increase in Maturity Facilitation scores, StrategyUse scores increased approximately .15 points; that is, the regression coefficient for Maturity Facilitation decreased from .16 to .15, when Metamemory

Table 10

Four Regression Models to Predict Strategy Use Using Parental Encouragement of Planful, Independent, and Mature Behaviors, Memory Knowledge, and Mastery-Motivation (N = 78)

Equation				Adj	Overall	
Estimate	Intercept	Slope	R^2	R^2	F	p
#1 StrategyUse =	- 3.9	+ .16 Maturity Facilitation	.193	.183	18.23(1,76)	< .0001
#2 StrategyUse =	- 4.2	+ .15 Maturity Facilitation + .05 Metamemory	.210	.189	9.99(2,75)	< .001
#3 StrategyUse =	- 3.3	+ .19 Maturity Facilitat. - .37 MasteryMotive	.220	.199	10.58(2,75)	< .0001
#4 StrategyUse =	- 3.9	+ .16 Maturity Facilitat. + .00 MetaMotivation	.194	.172	9.01(2,75)	< .001

was added to the model.

When MasteryMotive was added to the model (Table 10, Equation #3), both predictors accounted for approximately 22% of the variance in StrategyUse ($F(2,75) = 10.58$, $p < .0001$). The F-test for reducing the model from 2 variables (Maturity Facilitation, MasteryMotive) to one variable (Maturity Facilitation) was not statistically significant. With MasteryMotive in the model, for every 1 point increase in Maturity Facilitation scores, StrategyUse scores increased approximately .19 points; that is, the regression coefficient for Maturity Facilitation decreased .03, from .19 to .16, when MasteryMotive was added to the model.

When MetaMotivation was added to the model (Table 10, Equation #4), both predictors accounted for approximately 19% of the variance in StrategyUse ($F(2,75) = 9.01$, $p < .001$). The F-test for reducing the model from 2 variables (Maturity Facilitation, MetaMotivation) to one variable (Maturity Facilitation) was not statistically significant. With MetaMotivation in the model, for every 1 point increase in Maturity Facilitation scores, StrategyUse scores increased approximately .16 points; that is, the regression coefficient for Maturity Facilitation did not decrease when MetaMotivation was added to the model.

Thus, Baron and Kenny's (1986) third and fourth conditions were not met for any of the three examined relationships: (a) Maturity Facilitation, Metamemory, and StrategyUse, (b) Maturity Facilitation, MasteryMotive, and StrategyUse, and (c) Maturity Facilitation, MetaMotivation, and StrategyUse.

Given the weak evidence of memory knowledge and motivation as mediators of the influence of the home environment on the combined measure of children's strategy use, and the possibility that such mediation may be stronger for the influence of the home environment on one or both of the separate measures of strategy use at study and recall, additional regression analyses were carried out on the separate measures. Therefore, the same series of regression analyses carried out for the composite measure, StrategyUse, were carried out for the measure of strategy use at study, NumGrouped, and for the measure of strategy use at recall, ARC.

Strategy use at study. As can be seen from Table 11, Maturity Facilitation, when considered alone (Equation #1), accounted for approximately 14% of the variance in NumGrouped ($F(1,76) = 12.28$, $p < .001$). For every 1 point increase in Maturity Facilitation scores, NumGrouped scores increased approximately .06 points. Thus Baron and Kenny's (1986) second condition, that the independent variable affects the dependent variable, was met for the relationship between Maturity Facilitation and NumGrouped.

When Metamemory was added to the model (Table 11, Equation #2), both predictors accounted for approximately 17.5% of the variance in NumGrouped ($F(2,75) = 7.93$, $p < .001$). The F-test for reducing the model from 2 variables (Maturity Facilitation, Metamemory) to one variable (Maturity Facilitation) was not statistically significant at the $p < .05$ level. With Metamemory in the model, for every 1 point increase in Maturity Facilitation scores, NumGrouped scores increased

Table 11

Four Regression Models To Predict Strategy Use at Study Using Parental Encouragement of Planful, Independent, and Mature Behaviors, Memory Knowledge, and Memory Knowledge/Mastery-Motivation (N = 78)

Estimate	Equation Intercept	Slope	R^2	Adj R^2	Overall F	p
#1 NumGrouped =	- 0.8	+ .06 Maturity Facilitation	.139	.128	12.28(1,76)	< .001
#2 NumGrouped =	- 1.0	+ .05 Maturity Facilitation + .03 Metamemory	.175	.153	7.93(2,75)	< .001
#3 NumGrouped =	- 0.4	+ .08 Maturity Facilitat. - .26 MasteryMotive	.202	.181	9.48(2,75)	< .001
#4 NumGrouped =	- 0.8	+ .06 Maturity Facilitat. + .00 MetaMotivation	.139	.116	6.07(2,75)	< .01

approximately .05 points; that is, the regression coefficient for Maturity Facilitation decreased only .01, from .06 to .05, when Metamemory was added to the model.

When MasteryMotive was added to the model (Table 11, Equation #3), both predictors accounted for approximately 20% of the variance in NumGrouped ($F(2,75) = 9.48$, $p < .001$). The F-test for reducing the model from 2 variables (Maturity Facilitation, MasteryMotive) to one variable (Maturity Facilitation) was statistically significant ($F(1,75) = 5.90$, $p < .05$). With MasteryMotive in the model, for every 1 point increase in Maturity Facilitation scores, NumGrouped scores increased approximately .08 points; that is, the regression coefficient for Maturity Facilitation increased .02, from .06 to .08, when MasteryMotive was added to the model.

When MetaMotivation was added to the model (Table 11, Equation #4), both predictors accounted for approximately 14% of the variance in NumGrouped ($F(2,75) = 6.07$, $p < .01$). The F-test for reducing the model from 2 variables (Maturity Facilitation, MetaMotivation) to one variable (Maturity Facilitation) was not statistically significant at the $p < .05$ level. With MetaMotivation in the model, for every 1 point increase in Maturity Facilitation scores, NumGrouped scores increased approximately .06 points; that is, the regression coefficient for Maturity Facilitation did not decrease when MetaMotivation was added to the model.

Thus Baron and Kenny's (1986) third condition, that the mediator affects the dependent variable when included in the equation with the independent variable, was met for the relationship between Maturity Facilitation, MasteryMotive, and

NumGrouped. The negative effect of MasteryMotive on the prediction of NumGrouped when Maturity Facilitation is in the equation, however, is in the opposite direction of that predicted, and is not readily explainable within the present theoretical framework. The third condition was not met for the other 3 relationships that were examined. Also, the fourth condition proposed by Baron and Kenny (1986), that the effect of the independent variable on the dependent variable is reduced when the mediator variable is included in the equation, was not met for either of the 4 relationships that were examined.

Strategy use at recall. As can be seen from Table 12, Maturity Facilitation, when considered alone (Equation #1), accounted for approximately 16.5% of the variance in ARC ($F(1,76) = 14.99$, $p < .001$). Thus, the second condition, that the independent variable affects the dependent variable, was met for the relationship between Maturity Facilitation and ARC.

When Metamemory was added to the model (Table 12, Equation #2), both predictors accounted for approximately 17% of the variance in ARC ($F(2,75) = 7.49$, $p < .001$). When MasteryMotive was added to the model (Table 12, Equation #3), both predictors accounted for approximately 17% of the variance in ARC ($F(2,75) = 7.47$, $p < .001$). When MetaMotivation was added to the model (Table 12, Equation #4), both predictors accounted for approximately 16.5% of the variance in ARC ($F(2,75) = 7.40$, $p < .01$).

Table 12

Four Regression Models to Predict Strategy Use at Recall Using Parental Encouragement of Planful, Independent, and Mature Behaviors, Memory Knowledge, and Mastery-Motivation (N = 78)

Estimate	Equation: Intercept	Slope	R^2	Adj R^2	Overall F	p
#1 ARC =	- 0.1	+ .02 Maturity Facilitation	.165	.154	14.99(1,76)	< .001
#2 ARC =	- 0.1	+ .02 Maturity Facilitation + .00 Metamemory	.167	.144	7.49(2,75)	< .001
#3 ARC =	- 0.0	+ .02 Maturity Facilitation - .01 MasteryMotivate	.166	.144	7.47(2,75)	< .001
#4 ARC =	- 0.1	+ .02 Maturity Facilitation + .00 MetaMotivation	.165	.143	7.40(2,75)	< .01

None of the F-tests for reducing the model from 2 variables (Maturity Facilitation, process variable) to one variable (Maturity Facilitation) was statistically significant at the $p < .05$ level. The regression coefficient for Maturity Facilitation did not decrease or increase when either Metamemory, MasteryMotive, or MetaMotivation, was added to the model to predict ARC scores. Thus neither the third nor the fourth condition proposed by Baron and Kenny (1986) was met for any of the 4 equations to predict ARC scores.

CHAPTER V

DISCUSSION

The primary purpose of the present study was to examine a theoretical model of the relationships between children's home environment, children's cognitive processes, and children's cognitive-task performance. The proposed theoretical model postulated that the influence of the home environment on children's memory-task performance is mediated, in part, by the children's memory knowledge and mastery-motivational inclinations. The present study proposed to build upon and to extend the findings of several previous studies that had found small but significant relationships between metamemory and memory performance (c.f., Schneider & Pressley, 1989), mastery-motivation and memory performance (Lange et al., 1989), the home environment and metamemory (Carr et al., 1989; Schneider et al., 1986), and the home environment and memory performance (Carr et al., 1989). It was suggested that weaknesses in the earlier works that examined the relationships of the home environment, metamemory, and memory performance were due largely to the limited scope of the home assessments used and to the omission of mastery-motivation in the models.

In the present study, it was proposed that 2 specific aspects of the home environment, (a) parental encouragement of their children's planfulness, independence, and maturity, and (b) parental strategy instruction, would predict measures of children's metamemory, mastery-motivation, and memory performance. The instrument used to assess parental encouragement of planful, independent, and mature behaviors was the HOME inventory-questionnaire. It was anticipated that 3 of the 8 subscales included in the HOME instrument would represent the construct of parental encouragement of planful, independent, and mature behaviors: (a) Encouragement of Maturity, (b) Growth Fostering Materials & Experiences, and (c) Provision for Active Stimulation. A factor analysis of the 8 subscale scores, however, revealed that the initial understanding of the construct was too restricted. The factor analysis yielded a "maturity facilitation" dimension consisting of 5 subscales that included 2 of the anticipated subscales, Encouragement of Maturity and Growth Fostering Materials & Experiences, as well as 3 additional ones, Emotional & Verbal Responsivity, Emotional Climate, and Physical Environment.

Although not proposed initially, the inclusion of Responsivity and Physical Environment in the Maturity Facilitation factor was not surprising, in that the preliminary analyses of the HOME by the authors revealed statistically significant correlations between each of the subscales and children's achievement scores (SRA Total scores, Bradley & Caldwell, 1984b). The inclusion of the Emotional Climate subscale is similarly not surprising, in that parental warmth has consistently been found to correlate with general cognitive development in a wide variety of studies (Belsky et al., 1984; McCall, 1974).

The exclusion of the subscale Provision for Active Stimulation from the Maturity Facilitation factor, however, and its inclusion in a second factor with the remaining 2 subscales, Family Participation in Developmentally Stimulating Experiences and Paternal Involvement, were unexpected. A closer examination of the included items, however, revealed that many of the items on both the Active Stimulation and the Developmentally Stimulating Experiences subscales measured the child's participation in experiences outside the home, as opposed to in-home experiences. Out-of-home experiences, therefore, may represent the underlying construct of the second factor. The inclusion of the Paternal Involvement subscale in this factor suggests a relationship between the presence of fathers in the home and the children's participation in out-of-home experiences.

As proposed, the use of a more comprehensive assessment of the home environment than that used in the Carr et al. study (1989) resulted in finding relationships between the measures of the home environment, metamemory, and memory performance that appeared stronger than those found in the earlier study. Correlations found in the present study between the home environment and metamemory ($r = .34$, $p < .01$), between the home environment and strategy use ($r = .44$, $p < .001$), and between the home environment and recall ($r = .38$, $p <$

.001) appeared higher than those found in the earlier study (respectively, r = .22, p < .01; r = n.s.; and r = .36, p < .001).

Model Testing

The first step in the analysis of the theoretical model presented in the present study was to demonstrate a relationship between the hypothesized mediational processes, metamemory and mastery-motivation, and memory performance. The specific hypothesis to be tested, Hypothesis #1, predicted that metamemory and mastery-motivation considered together (i.e., multiplicatively) would provide a more powerful predictor of memory performance that either construct alone. A series of regression analyses revealed that the power to predict item recall scores from metamemory scores combined with mastery-motivation scores (both multiplicatively and additively) was equivalent to the power to predict item recall scores from metamemory scores alone. A duplicate series of regression analyses revealed that metamemory scores alone and metamemory scores combined additively with mastery-motivation scores provided equivalent predictive power for strategy use scores at study and recall. Based both on the tests of statistical significance conducted on the adjusted R^2s and on the principal of parsimony, it therefore appears that metamemory alone provides a preferable model for predicting both item recall and strategy use at study and recall.

The second step in the analysis of the theoretical model involved testing Hypotheses #2 and #3, and required demonstrating a relationship between the hypothesized antecedent factors in the home environment and the mediating process factors, memory knowledge and mastery-motivation. In Hypothesis #2, it was proposed that both parental strategy instruction and parental encouragement of planful, independent, and mature behaviors (maturity facilitation) would predict children's metamemory. The hypothesis followed the rationale that selected aspects of the home environment influence the acquisition of memory knowledge by facilitating the construction of appropriate mental representations and the internalization of related processes. Consistent with the correlational analyses that revealed maturity facilitation to be a moderate predictor of memory knowledge (r = .34, $p < .01$), but parental strategy instruction to be a weak predictor (r = .18, n.s.), a series of regression analyses indicated that maturity facilitation was the better predictor of metamemory. Equivalent regression analyses indicated that maturity facilitation was the better predictor of the metamemory/master-motivation combination, and that inclusion of parental strategy instruction in either model did not provide better prediction of either process variable. It was determined, therefore, to omit parental strategy instruction from further analyses.

In Hypothesis #3 it was proposed that parental encouragement of planful, independent, and mature behaviors predicts children's mastery-motivation. The hypothesis was based on the rationale that parental requirements of independent behaviors in such activities as self-care routines, household chores, hobbies and other self-amusement and self-stimulation experiences, may compel children's development of independent, resourceful behaviors and the internalization of self-directing and self-regulating processes. As proposed, the Maturity Facilitation aspect of the home environment was correlated with mastery-motivation ($r = .40$, $p < .001$), and a simple regression analysis revealed that Maturity Facilitation accounted for 15% of the variance in mastery-motivation scores. Thus, Baron and Kenny's (1986) first condition for establishing mediation, that is, demonstrating a relationship between the independent variable(s) and the mediator(s), was met for the relationship between parental encouragement of maturity and the development of children's memory knowledge, and for the relationship between parental encouragement of maturity and the development of children's mastery-motivational inclinations.

The third step in the examination of the theoretical model required demonstrating a mediational effect of the process variable(s) on the influence of the home environment on memory performance. The specific hypothesis to be tested, Hypothesis #4, stated that the influence of parental facilitation of maturity on the children's memory-task performance would be mediated, in part, by the children's memory knowledge and mastery-motivational inclinations. A series of simple and multiple regression analyses indicated mediational effects for metamemory and for the multiplicative measure, metamemory/mastery-motivation, on the influence of parental facilitation of maturity on the children's recall. Mediation was not as evident, however, for the influence of parental facilitation of maturity on the children's strategy use. Although the relationship between maturity facilitation and children's strategy use was found to be statistically significant ($r = .44$. $p < .0001$), the present examination did not find evidence of a mediational effect for metamemory, mastery-motivation, or for the multiplicative measure, metamemory/mastery-motivation. This was the case for the composite measure of strategy use, as well as for the separate measures of strategy use at study and strategy use at recall. Thus Baron and Kenny's second condition, that the independent variable must influence the dependent variable(s), was met for the relationship between parental facilitation of maturity and both children's item recall and their strategy use at study and recall. However, Baron and Kenny's third condition, that the mediator must affect the dependent variable(s) when the mediator is included in an equation with the independent variable, was met for only two of the examined relationships: (a) the relationship between parental facilitation of maturity, memory knowledge, and children's item recall, and (b) the relationship between parental facilitation of maturity, the composite memory knowledge/mastery-motivational inclination, and children's item recall. Both relationships which met Baron and Kenny's third condition also met the fourth condition, that is, that the effect of the independent variable on the dependent variable must be less when the mediator variable was included.

In summary, the present study found evidence to support the theoretical relationship between home experiences and the acquisition of memory knowledge, and to support the rationale that home experiences influence the acquisition of memory knowledge by facilitating the construction of appropriate mental representations and the internalization of related processes. The present study also found evidence to support the theoretical relationship between home experiences and the development of mastery-motivation and to support the rationale that home experiences influence the development of mastery-motivation by facilitating the development of resourceful behaviors and the internalization of appropriate self-directing processes.

The present study also found evidence to support the hypothesized mediational effect of metamemory, and of the combination metamemory/motivation, on the relationship between the home environment and children's recall performance. The findings of the present study suggest that in order to meet Baron and Kenny's four conditions required to demonstrate mediation, the originally proposed theoretical model (Figure 1) be simplified in the following manner. In the simpler model (Figure 2), it is proposed that the influence of the home environment, specifically parental encouragement of maturity, on children's item recall performance is mediated, in part, by either the children's memory knowledge, or by their memory knowledge combined with their mastery-motivational inclinations. Although the combination measure did not prove more powerful than metamemory alone, it is equally as powerful, and if couched in a developmental model which examines children's cognitive development over time (discussed below), it may prove heuristically fruitful.

Unexpected Findings and Post Hoc Analyses

The lack of evidence to support the primary hypothesis, that mastery-motivation would provide a significant addition to a metamemory-memory performance model,

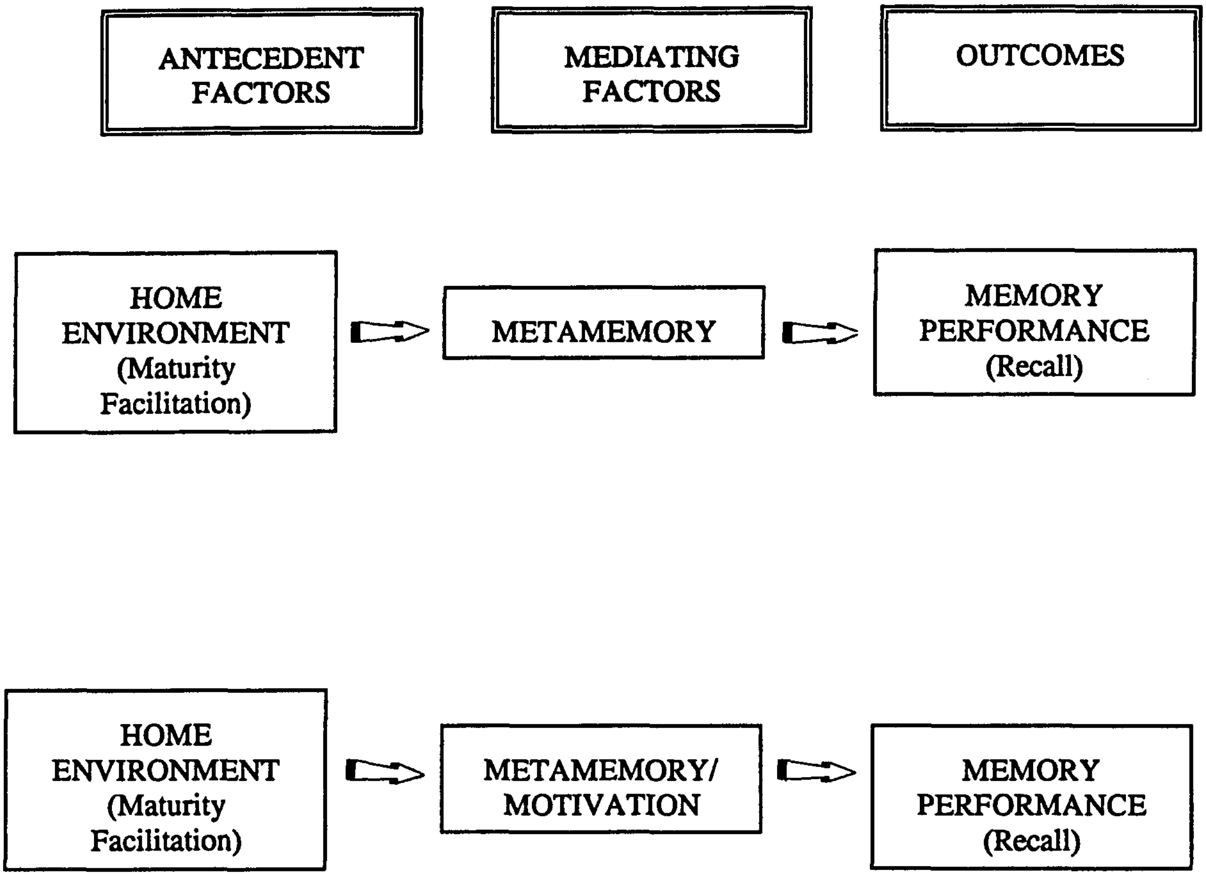

Figure 2. Two theoretical models of the influence of the home environment on memory performance mediated by metamemory and mastery-motivational inclinations.

was inconsistent with the theoretical rationale offered earlier. However, some evidence was found of a developmental effect on the relationship between metamemory, mastery-motivation (as measured in the present study), and memory performance. The ranges, means, standard deviations, and bivariate correlations for the primary variables, for the 2nd- and 3rd-grade subsamples, are shown separately in Appendix G, Tables 1 and 2. Whereas in the 2nd grade subsample, the measure of metamemory alone was the strongest process-variable predictor of item recall and strategy use, in the 3rd grade subsample, the composite measure of metamemory/mastery-motivation was the strongest process-variable predictor of item recall and strategy use. Although the sizes of the subsamples (2nd grade = 53, 3rd grade = 25) were too small to allow direct testing of a developmental effect, the patterns of correlations suggest that perhaps with increased schooling, mastery-motivation becomes an increasingly important component in a metamemory-memory performance relationship.

The present study also found little evidence to support the hypothesized mediational effect of children's memory knowledge on the relationship between their home environment and their use of an organizational strategy at study or retrieval. The findings of the present study suggest separate paths of influence from the home environment to children's recall and from the home environment to children's strategy use. Through exploratory analyses conducted after hypothesis testing, the present study found evidence that whereas metamemory had little or no mediational effect on the relationship between the home environment and strategy use, strategy use had a mediational effect on the relationship between the home environment and recall. That is, when considered within the present model, the effect of maturity facilitation on children's strategy use is direct, and its effect on recall is mediated by both metamemory and strategy use. Conceptualizing strategy use as a mediating process, as in the model in Figure 3, rather than as a performance outcome, might provide a more fruitful model of memory performance. In fact, exploratory regression analyses indicated that the effects of maturity facilitation on item recall are virtually eliminated when metamemory and strategy use are both entered into the analysis (see Appendix H for the regression analyses).

Exploratory Post Hoc Analyses

Post hoc analyses also revealed important relationships between metamemory, IQ, recall, and strategy use, although IQ scores were obtainable for only the 2nd-grade subsample. It was suggested in the Introduction that whereas IQ is a global measure of general cognitive performance, metamemory provides a measure of underlying mental processes by which competent behavior is generated. When the relative contributions of metamemory and IQ to item recall were examined in the 2nd-grade subsample, using free-entry stepwise regressions, it was found that metamemory entered the equation first with IQ entering second. The unique contribution of each predictor was significant at the $p < .05$ level. When the relative contributions of metamemory and IQ to strategy use were examined in the 2nd grade subsample, using

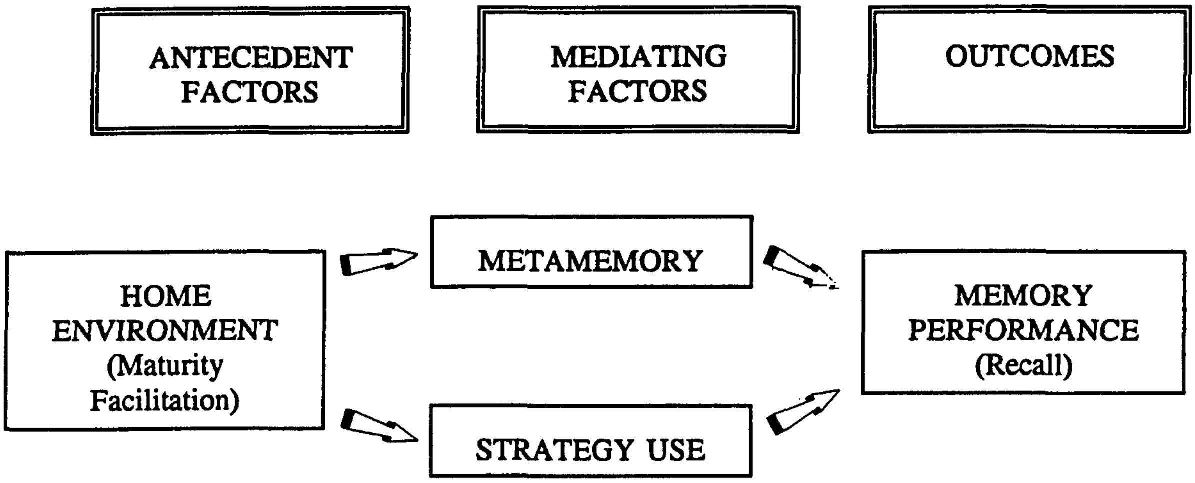

Figure 3. Theoretical model of the influence of the home environment on recall mediated by metamemory and strategy use.

free-entry stepwise regressions, it was found that only metamemory entered the equation. Metamemory was the better predictor of strategy use, and with metamemory in the model, IQ made no additional statistically significant contribution to the prediction. Evidence was found, therefore, that IQ and metamemory are not redundant measures. It may be the case that metamemory reflects procedural knowledge compared to the more specific content knowledge about objects, properties, and events, assessed by IQ measures.

Directions for Future Research

The present study suggests several directions for future research. Possible weaknesses in the present model are its linearity and unidirectionality. Strong arguments have been made recently for the expansion of models of development to include the effects of the influence that children have on their own development. Arguments for a bidirectional, reciprocal, coactive model have come from an ecological perspective (Bronfenbrenner, 1979), a transactional perspective (Sameroff, 1983), an interactive perspective (Johnston, 1987), a probabilistic epigenetic perspective (Gottlieb, 1992), as well as the perspective of behavioral genetics (Scarr, 1992). The present model does not consider the degree to which children elicit or induce nurturing or maintaining features or behaviors from their environment. Nor does the proposed model consider the potential coactions between children's performance on memory tasks, their memory knowledge and awarenesses, their mastery-motivational inclinations, and different aspects of their environments, including the home, the school, their interactions with peers, and their television-watching behaviors.

Several differences between the patterns of relationships for the primary measures in the 2nd grade subsample and in the 3rd grade subsample suggest a coactional developmental model. Differences were found in the correlational patterns (see Appendix H) between the home measures and the process measures, between the home measures and the performance measures, and between the process measures and the performance measures.

Close examination of the correlations between the home measures and the process measures for the two subsamples suggests a developmental effect. The absence of evidence for a significant relationship between strategy instruction and metamemory ($r = .18$, n.s.) was largely a function of the scores for the 3rd grade subsample. The correlations between strategy instruction and metamemory for the 2nd and 3rd grade subsamples were, respectively, $r = .25$, $p < .10$; and $r = .07$, n.s. Although the parents of the 2nd and 3rd graders appeared equivalent in the degree to which they engaged in strategy-instruction with their children, the 3rd graders exhibited greater metamemory than the 2nd graders. The higher metamemory scores for 3rd graders suggests a cumulative effect of parental strategy instruction, a schooling effect (third grade curricula may include greater strategy training), or an interaction effect of both parental instruction and schooling on the development of strategy knowledge. In addition, the relationships between (a) maturity facilitation and mastery-motivation and (b) maturity facilitation and metamemory were strong for the 2nd-grade subsample. However, in the 3rd-grade subsample, although the relationship between maturity facilitation and mastery-motivation remained strong, the relationship between maturity facilitation and metamemory appeared very weak.

An additional example of inconsistent correlational patterns that suggests non-linear effects was found between measures of the home environment and memory performance. Both measures of the home environment used in the present study were stronger predictors of item recall than strategy use in the 2nd-grade subsample, but stronger predictors of strategy use than item recall in the 3rd-grade subsample. In addition, both home measures were significantly related both to the 2nd-graders' strategy use and to their item recall. Although both measures were also significantly related to the 3rd-graders' strategy use, neither home measure was significantly related to the 3rd-graders' item recall.

As discussed earlier, the patterns of correlations in the present study between the process measures (metamemory and mastery-motivation) and the performance measures (recall and strategy use) were inconsistent between the 2nd and 3rd grade subsamples, suggesting a developmental effect on the relationships. A possible schooling effect, in which mastery-motivation becomes an increasingly important component in a metamemory-memory performance relationship, was suggested. In addition, it should be noted that although both metamemory and item recall scores increase between the 2nd and 3rd grades (main effects were found for both), the relationship between metamemory and item recall was weaker for the 3rd graders than for the 2nd graders, suggesting that the increase in the 3rd-graders's item recall was due to additional factors. The relationship between measures of mastery-motivation and item recall was stronger for the 3rd graders than for the 2nd graders. In fact, the product variable, metamemory/mastery-motivation, was the strongest predictor of item recall in the 3rd-grade subsample, suggesting the possibility that the combining of mastery-motivation with metamemory is an additional factor underlying the 3rd-graders' increased item recall scores.

Thus, inconsistent correlational patterns for the 2nd and 3rd graders in the present study were found for relationships across the three levels: home, process, and performance. Although the two measures which increased between the 2nd and 3rd grades, metamemory (process) and item recall (performance), were strongly related to the home measures in the 2nd grade, they were not significantly related to the home measures in the 3rd grade. In the present 3rd-grade subsample, there was no statistically significant predictor of metamemory, and only metamemory/mastery-motivation was a statistically significant predictor of item recall. A closer examination of the possible differences in the 3-level, mediational model would require either (a) larger subsamples of 2nd and 3rd graders to allow direct testing, or (b) a longitudinal design. Given the cross-sectional design of the present study, it is not possible to examine the relationships between the measures of children's home environments, their memory knowledge, their mastery-motivation, their strategy use, or their item recall in the 2nd grade and the same measures in the 3rd grade. It is also not possible to examine the extent to which particular relationships between key variables for 2nd-graders are related to particular relationships in later grades.

The findings of the present study support the position that mastery-motivation might be a construct which is better understood in a non-linear model, and whose influence might be better examined over time. The mastery-oriented child is one who is actively engaged in mastering the environment and extracting useful information from it. It may be that children whom teachers rate highly on a measure of mastery-orientation exhibit self-confident behaviors (self-confidence facilitated at home by parental encouragement of planfulness, independence and maturity) which in turn elicit from teachers confirming behaviors and expectations of the child's mastery and competence. It may also be that more mastery-oriented children are more active in seeking out information from their environment, both at home and at school, and are more critical in their evaluation and application of that information. The differential levels of active participation in their own development between high and low mastery-oriented children, therefore, might account, in part, for the different patterns of correlations found in the present study between 2nd and 3rd graders.

The relationships between the home and other environmental factors, knowledge about useful strategic behaviors, mastery orientations, and memory task performance may be cumulative, coactional, and either become stronger, or otherwise change, over time. A developmental model, preferably longitudinal, that includes the 2nd grader's influence on its own environment and development, therefore, is suggested by the findings of the present study, although theoretically more difficult to conceptualize and empirically more difficult to measure and to test than the static model examined in the present study.

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Appendix A

Stimulus Sets and Sequential Orders

SET A-1

Clothes	Food	Boats	Homes	Toys
sweater	bananas	sail boat	castle	doll
jacket	taco	ship	tent	bear
sock	pancakes	raft	igloo	wagon
cap	bread	house	car	
	chips			

SET A-2

Clothes	Food	Vehicles	House Parts	Body
dress	apple	boat	window	ear
shirt	hot dog	train	roof	leg
glove	bacon	plane	door	nose
scarf	corn		fireplace	hands
	fries			

Appendix A (continued)

Stimulus Sets and Sequential Orders

SET B-1

Vehicles	Kitchen	Animals	Sports	Sky
van	refrigerator	dog	baseball bat	tornado
bus	oven	horse	football	rainbow
trucks	sink	snake	racquet	clouds
car	dishwasher	turkey		moon
		camel		

SET B-2

Vehicles	Kitchen	Animals	Sports	Birds
bicycle	pan	cat	baseball	house
tricycle	coffee maker	cow	basketball	feeder
motorcycle	microwave	frog	football	bath
skateboard		giraffe	tennis	
big wheel			golf	

Sequential Orders

	Task 1	Task 2		Task 1	Task 2
1.	A-1,	B-1	5.	B-1,	A-1
2.	A-1,	B-2	6.	B-2,	A-1
3.	A-2,	B-1	7.	B-1,	A-2
4.	A-2,	B-2	8.	B-2,	A-2

Appendix B

Metamemory Questionnaire

1. Preparation Object -

"Suppose that you were going home tomorrow with your friend to spend the night, and you wanted to be sure to bring your overnight bag to school. What could you do tonight in order to remember to bring your bag to school tomorrow?"

Bag	Self
Note	Other

TOTAL

2. Rote Paraphrase -

"Suppose you had to remember a story that was on a tape given to you by your teacher. Would it be easier for you to remember the story word for word, or in your own words?"

"Why?"

"How could you study it if you had to rememer it word for word?"

TOTAL

3. Retrieval Object -

"Suppose you lost your jacket while you were at school. What could you do to find it?"

____ Search

____

____ Other

TOTAL

4. Preparation Event -

"Suppose that you were invited to a birthday party for your friend, but the party's not until next week. What could you do to make sure you remember to go to the party?"

____ Note

____

____ Self

____

____ Other

____

____

TOTAL

5. Story-list -

The children are shown 8 pictures.

"Suppose you had to remember these pictures. You could either make a list of the names, or you could make up a story about them. Which way do you think would be the easiest to learn the names?"

____

"Why?"

____

____

____

TOTAL

6. Opposites-Arbitrary -

The child is shown 2 lists of 4 word pairs, each list printed on a card and read aloud to the child.

"Suppose you had to learn the names of these words in pairs, so that when I say one of them you could tell me the other word that goes with it. These words are opposites (point) and these words are people and things that they might do (point). Which list do you think it would be easier for you to learn, or do you think they would be about the same?"

____

"Why?"

____

____

____

TOTAL

7. Strategy-specific knowledge -

The child is shown four panels depicting 12 pictures in 4 different structural arrays in 6 trials.

"Show me which of these 2 sets of pictures will be easier to remember?"

☐ v. ☐	"Why?" ______________________			☐	☐
☐ v. ☐	"Why?" ______________________			☐	☐
☐ v. ☐	"Why?" ______________________			☐	☐
☐ v. ☐	"Why?" ______________________			☐	☐
☐ v. ☐	"Why?" ______________________			☐	☐
		TOTAL		☐	

8. Memory-monitoring - Two random-ordered decks of 15 pictures of common objects are used in each of 3 steps.

Deck #1 - "How many of these pictures can you remember?" ____

Number recalled (A) _______

Deck #2 - "How many of these pictures can you remember?" (P) ____

$|P - A| / A =$ ☐

Appendix G

Tables: Correlations and Descriptive Statistics

Table G-1

Bivariate Correlations and Descriptive Statistics for the Primary Variables for the Second Grade Subsample, (n = 53)

	Range	M	sd	Correlations with: 1.	2.	3.	4.	5.	6.
1. StratInstruction	7 to 23	15.55	3.76						
2. Maturity Facilitation	12 to 31	23.74	5.17	0.544***					
3. Metamemory	3 to 21	12.75	4.60	0.254	0.433**				
4. MasteryMotive	1.8 to 5	3.48	0.91	0.213	0.364**	0.268*			
5. MetaMotivation	6.8 to 85	45.52	21.59	0.279*	0.480***	0.845***	0.712***		
6. ItemRecall	6 to 18	10.99	2.55	0.457***	0.397**	0.537***	0.220	0.489***	
7. StrategyUse	-2.64 to 3.67	0.02	1.75	0.292*	0.365**	0.273*	0.059	0.156	0.482***

* $p < .05$ ** $p < .01$ *** $p < .001$

Table G-2

Bivariate Correlations and Descriptive Statistics for the Primary Variables for the Third Grade Subsample, (n = 25)

	Range	M	sd	Correlations with: 1.	2.	3.	4.	5.	6.
1. StratInstruction	10 to 24	15.56	3.85						
2. Maturity Facilitation	14 to 29	24.04	4.11	0.365					
3. Metamemory	9 to 26	16.08	5.40	0.074	0.165				
4. MasteryMotive	2.3 to 5	3.49	0.80	0.346	0.529**	0.087			
5. MetaMotivation	20 to 114	56.49	23.58	0.186	0.395*	0.829***	0.600**		
6. ItemRecall	9 to 18	12.98	2.46	-0.034	0.390	0.253	0.343	0.402*	
7. StrategyUse	-2.64 to 3.25	-0.02	1.92	0.489*	0.643***	0.315	0.228	0.333	0.361

* $p < .05$ ** $p < .01$ *** $p < .001$

Appendix H

Table H-1

Three Models to Predict Item Recall Using Parental Encouragement of Planful, Independent, and Mature Behaviors, Memory Knowledge, and Strategy Use (N = 78)

#1: ItemRecall = 6.6 + .21 Maturity Facilitation

$R^2 = .14$
Adj $R^2 = .13$
$F(1,76) = 12.72$; $p < .001$

	Coef.	SE	t(76)	p
Maturity Facilitation	.21	.06	3.57	.001

#2: ItemRecall = 5.5 + .13 Maturity Facilitation + .22 Metamemory

$R^2 = .30$
Adj. $R^2 = .28$
$F(2,75) = 15.9$, $p < .0001$

	Coef.	SE	t(75)	p
Maturity Facilitation	.13	.06	2.31	.023
Metamemory	.22	.05	4.05	.0001

Table H-1 (continued)

Three Models to Predict Item Recall Using Parental Encouragement of Planful, Independent, and Mature Behaviors, Memory Knowledge, and Strategy Use (N = 78)

#3: ItemRecall = 7.0 + .08 MatFacilitate + .20 Metamem + .36 StratUse

$R^2 = .34$
Adj. $R^2 = .32$
$F(3,74) = 12.9$; $p < .0001$

	Coef.	SE	t(74)	p
Maturity Facilitation	.08	.06	1.31	.196
Metamemory	.20	.05	3.79	.001
StrategyUse	.36	.16	2.30	.024