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## Physical and Emotional States as Memory-relevant Factors: Cognitive Monitoring by Young Children

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The Flavell (1981) model of cognitive monitoring and metamnemonic development was tested by four experiments conducted to determine whether young children (a) recognize that mood, fatigue, and fear are variables that influence learning, and (b) self-monitor their own internal states and adjust their study behavior when tired or sad. In Experiment 1, preschoolers viewed drawings of the same child studying in different physical or emotional states and judged which context represented easier learning. Most children viewed both mood and fatigue as memory relevant factors, correctly indicating that studying is easier when one is happy or alert. In Experiments 2 through 4, happiness or sadness and fatigue or nonfatigue were evoked in preschoolers, who then scheduled a self-learning session. Preschoolers more frequently delayed their own learning when sad or tired, suggesting cognitive monitoring of internal states in a learning context.

Cognitive monitoring has been recognized as an important process in many domains of human behavior. For example, in his model of metacognitive development, Flavell (1981) assumed that monitoring of internal experiences provides one of several mechanisms for cognitive growth. Likewise, linguists (e.g., Garvey, 1984) have suggested that monitoring plays an important role in the verbal and social development of young children.

Although monitoring is assumed to be of theoretical importance, the full range of contexts in which it occurs in young children is far from established. Research on this issue, however, has demonstrated that preschool and kindergarten children monitor comprehension difficulties during play in familiar settings (Revelle, Wellman, & Karaben-

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ick, 1985; Shultz & Cloghesy, 1981) and during referential communication (Bearison & Levey, 1977; Patterson, Cosgrove, & O'Brien, 1980). Likewise, monitoring has been shown to occur within certain memory paradigms, as indicated by children reporting feeling-of-knowing experiences (Cultice, Sommerville, & Wellman, 1983; Wellman, 1977) or terminating search endeavors (Kobasigawa, 1983). Alternately, deficiencies in the process have been reported when young children are required to monitor the effectiveness of various learning strategies (Bisanz, Vesonder, & Voss, 1978; Masur, McIntyre, & Flavell, 1973) or recognize verbal ambiguity in unfamiliar situations (Markman, 1977). Although these findings suggest that even 3-year-old children monitor (Revelle et al., 1985), researchers have overlooked two important contexts in which the process may also occur: monitoring of one's emotional and physical states.

Within the realm of learning and memory, it is well established that certain physical and emotional states affect children's behavior. For example, Hill (1972) reported a series of studies in which high levels of fear and anxiety retarded the rate at which children acquired new information. Likewise, Masters, Barden, and Ford (1979) found young children's level of retention to be lower when subjects were in a negative rather than positive mood. Finally, research on massed practice has demonstrated that fatigue interferes with the establishment of new associations in serial and paired-associate learning (Doussajh, 1957; Underwood, 1961).

Surprisingly little is known, however, about the degree to which young children are aware of these effects or can monitor their own internal states and adjust activities to compensate for the negative impact each may have on behavior. In studies of metamemory, researchers (Wellman, 1977, 1978; Yussen & Bird, 1979) have verified that preschool children view certain task factors (e.g., noise or amount to learn) as memory-relevant variables. But to our knowledge, no one has studied the person variables (Flavell, 1981) of fatigue, mood, or fear/anxiety. Perhaps the closest investigation of this type was reported by Taylor and Harris (1983), who found that 7-year-old children believe that their own happy experiences will be easier to remember than sad ones. This finding, however, does not demonstrate that younger children realize that fear, fatigue, or sadness generally will retard learning in a variety of situations. Because of the lack of research in this area, and because of the theoretical importance that monitoring is assumed to play in metacognitive development (Flavell, 1981), a series of studies were conducted to learn more about its operation in conjunction with various physical and emotional states.

## EXPERIMENT 1

The first experiment was designed to determine whether young children manifest metacognitive awareness that mood, fatigue, and fear/anxiety are all factors which influence memory. In particular, we wished to assess whether they recognize that memorization is more difficult when one is sad, afraid, or tired. Because previous research (Wellman, 1977, 1978) has demonstrated that awareness of the relation between memorization and certain task variables (e.g., distraction or amount to learn) is established by 3 to 4 years of age, a pre-school sample was selected for use in this study.

### *Method*

*Task and pretesting.* As adapted from Wellman (1977), the major task involved presenting pairs of line drawings of the same child studying in contexts that differed in terms of only one dimension. Each subject then judged which situation within the pair was "easier," or whether the depicted situations were the "same" in difficulty. Thus, to be included in the sample, children first had to demonstrate comprehension of the concepts *same* and *easier* during two pretesting trials. These trials were nearly identical to those used by Wellman (1977). They involved asking potential subjects to judge whether it was easier for a child, depicted throwing a ball, to hit a large than small target; but the same in difficulty to hit a constant size target.

*Subjects.* Of 29 children between 3 and 5 years of age who were pretested, 24 children (mean CA = 49.2 months,  $SD = 8.3$  months) comprehended both pretesting concepts and served as subjects. All children were enrolled in the Child Study Center at the University of Maine.

*Testing procedures.* Immediately following pretesting, seven test trials were administered in one of two random orders, with two pictures presented on each trial. The drawings were identical within a pair, except for one difference specific to the following dimensions: mood (sad vs. happy facial expression), fatigue (tired vs. alert body posture and facial expression), fear (anxious vs. calm expression and body posture), distraction (quiet vs. noisy study conditions), amount (seven vs. two study pictures), weight (fat vs. thin child studying), and clothing (striped vs. polka-dotted shirt). The latter four dimensions were included to replicate and provide continuity with prior research of this type (Wellman, 1977, 1978).

A narration describing the key difference between the pictures comprising each pair accompanied the drawings. The experimenter also pointed to the major difference between the pictures as they

**Table 1.** Number of Children Choosing Easier Learning Context: Experiment 1

<i>Dimension</i>	<i>Level Chosen as Easier</i>				<i>Same in Difficulty</i>
Mood	Happy	17	Sad	7	0
Fatigue	Tired	4	Alert	19	1
Fear	Afraid	8	Calm	9	7
Amount	Few	17	Many	7	0
Distraction	Quiet	19	Noisy	3	2
Clothing	Striped	6	Polka-Dot	7	11
Weight	Thin	15	Fat	6	3

were described verbally. Subjects were reminded on each trial that the depicted child was trying "to learn the names of these pictures so he or she can remember them later." The terms *calm* and *alert* were clarified with the phrases *not afraid* and *not tired*. Children indicated their choices by either stating that the pictures were the same in difficulty or by pointing to the easier situation, and then they were asked to explain their choices immediately after they made each selection.

### *Results and Discussion*

For each dimension, children could pick one item as easier, or implicitly assert the factor to be irrelevant by judging both situations to be the same in difficulty. The distribution of children's choices for each of the seven dimensions are presented in Table 1. As is apparent in the table, nearly all of the children correctly viewed mood and fatigue as memory-relevant factors, whereas judgments regarding fear were less accurate.

Statistical analyses of the trends in Table 1 revealed that significantly more children recognized that memorization would be easier when happy than sad,  $\chi^2(1) = 4.16, p < .05$ , and when alert rather than tired,  $\chi^2(1) = 9.87, p < .01$ . It was not the case, however, that most children correctly viewed fear as a memory-relevant variable,  $\chi^2(2) = .25, p < .80$ . In fact, children split evenly in suggesting that memorization would be easier when not afraid than when fearful. In accord with previous findings (Wellman, 1977, 1978), most children indicated that learning would be easier with few rather than many items,  $\chi^2(1) = 4.16, p < .05$ , and in a quiet rather than a noisy room,  $\chi^2(1) = 11.6, p < .01$ . That subjects chose few rather than many items demonstrates that they were not just choosing the positive exemplar within each pair. Less accurate judgments were obtained for the irrelevant dimensions, with children divided evenly in their choices for clothing, and with most children suggesting that fat people would have a more difficult time memorizing than would thin people,  $\chi^2(1) = 3.86, p < .05$ .

## EXPERIMENT 2

Although the results of Experiment 1 demonstrated that young children recognize that mood and fatigue influence learning, a second important issue was whether they monitor their own internal states in terms of these two factors. To our knowledge, no one has investigated preschool children's self-monitoring of physical or emotional states. Certainly, parental reports of exhausted preschoolers resisting bedtime suggest that such monitoring is not widespread. Alternately, research reviewed earlier (Cultice et al., 1983; Revelle et al., 1985) suggests that cognitive monitoring by preschoolers does occur in other contexts.

Because young children's monitoring of physical and emotional states has yet to be demonstrated, and because such internal experiences have great impact on a range of cognitive behaviors (see Hill, 1972; Masters et al., 1979; Underwood, 1961), a second experiment was conducted. Its purpose was to determine whether preschoolers who are sad or fatigued monitor their internal states and more frequently choose to defer the onset of a learning task than do those who are happy or less tired.

### Method

*Subjects.* Forty-eight children between 3 and 5 years of age (mean CA = 50.4 months,  $SD = 7.7$  months) served as subjects. Each was enrolled in the Child Study Center at the University of Maine or in a local daycare center. None of the subjects had participated in previous research of this type.

*Task and conditions.* The task involved providing children with the opportunity to learn the words and movements to a new finger-game (*Tap at the Door*), either immediately or after a delay period. Just prior to making this decision, the children experienced one of four independent conditions designed to establish a high versus low level of fatigue or a happy versus sad emotional state.

Stair climbing provided the basis for varying fatigue. In the high fatigue condition, children accompanied an experimenter up and down four full flights of stairs (composed of 66 steps and one wheelchair ramp) in order to feed a pet pigeon that was housed on the top floor of their preschool building. Each child also carried a 6-pound bucket of bird feed to make the task more tiring. By contrast, those children assigned to the low fatigue condition merely carried an empty bucket while accompanying the experimenter to a room adjacent to their classroom in order to feed the bird, that is, they climbed no stairs and engaged in no apparent strenuous activity.

Two additional conditions were designed to establish either a sad or a happy emotional state in the children. The verbal mood induc-

tion procedure used by Moore, Underwood, and Rosenhan (1973) was employed for this purpose. For a period of 60-s, children in the happy condition described and thought about things that made them very happy, whereas those in the sad treatment thought about and described sad things.

*Testing procedure.* For the fatigue manipulation, 24 children were taken individually from their classroom and invited to help feed the school's new pet pigeon. They were randomly assigned to either the high or low fatigue condition and then they accompanied the experimenter as he or she directed feeding. Using a yoked-control procedure, children in the two conditions were matched on the amount of time spent with the experimenter prior to making the immediate/deferred learning choice. To occupy the time that fatigued subjects spent climbing stairs, children in the low-fatigue condition helped the experimenter wash and dry the pigeon's food dish before feeding the bird. Following feeding, children in both groups returned to the entrance of their classroom and were told they needed to learn the movements to the finger game for future group activities in their school. (Finger games comprised a normal part of the children's music curriculum.) Then they were asked if they wanted to learn the movements "now or do you want to wait until later?" Each child was also asked to justify his or her choice verbally; hidden microphones recorded all responses.

The remaining 24 children were randomly assigned to one of the two mood induction treatments. Children were tested individually in a research area near their classroom. During mood induction, if a child strayed from relating the required positive or negative content, he or she was reminded to talk only about sad or happy things. Immediately following mood induction, each child was given the choice of learning the finger game right away or later, with their rationales for either choice tape recorded for later analysis.

### *Results and Discussion*

*Fatigue conditions.* Children in the fatigue conditions spent about 7 min ( $M = 6$  min, 54 s) with the experimenter prior to making their learning choices. Although no independent assessment of fatigue level was taken, 6 of the 12 subjects in the high fatigue condition spontaneously made statements such as "These sure are long stairs," "This bucket is getting heavy," or "I'm getting tired," as they accompanied the experimenter up and down the stairs.

The major dependent measure was the number of subjects who chose immediate versus delayed learning. Tabulation revealed that



none of the nonfatigued preschoolers chose a delayed learning experience, whereas 58% of the fatigued sample (i.e., 7 children) deferred learning. This difference represents a significant condition effect,  $\chi^2(1) = 9.88, p < .01$ . Because subjects in the two conditions presumably differed only in terms of their level of fatigue, the finding demonstrates that young children self-monitor their own physical states and alter future behavioral choices accordingly. To our knowledge, this is the first report of its type with children who are this young.

Inspection of the children's explanations for their choices revealed that four of the seven subjects who made delayed choices alluded to fatigue as a basis for their decision (e.g., "I'm just too tired right now"). The remaining children offered uninformative justifications (e.g., "I don't know," "I just want to").

*Emotional state conditions.* Contrary to expectations, all of the children who experienced sad mood induction chose the immediate learning alternative, as did all but one of the children in the happy condition. Hence, no evidence was obtained that suggested the preschoolers monitored their emotional states. Verbal justifications for these choices were generally uninformative. Moreover, the content of some of the experiences related as sad during mood induction did not always seem negative in tone. Thus, it is unclear how different the two conditions really were at the end of mood induction.

### EXPERIMENT 3

Although findings from Experiment 1 indicate that preschoolers recognize that fatigue can retard learning in others, and although results from Experiment 2 suggest that young children monitor their own physical states and alter their subsequent behavior accordingly, neither data set unequivocally demonstrates that preschool children who are tired base learning deferrals on an awareness that fatigue retards memorization. Although the deferral data, in our judgment, strongly suggest the occurrence of cognitive monitoring, it is possible that young children may be used to resting whenever they realize that they are tired, regardless of whether a learning task is pending.

To explore further whether children's metacognitive knowledge predisposes differential learning choices under different levels of fatigue, a third experiment was conducted. Its design was similar to the previous study except that recognition questions, which tapped potential awareness of the relation between fatigue and learning, were administered. In addition, a more thorough evaluation of physical state was included to ensure that the two groups of children actually differed in their level of fatigue.



### *Method*

*Subjects.* Participants were 24 children between 4 and 5 years of age (mean CA = 53.4 months,  $SD = 4.7$  months). The children were enrolled in the Child Study Center at the University of Maine, and none had participated previously in research of this type.

*Materials and task.* Because the Child Study Center moved to a new one-story building between Experiments 2 and 3, an alternate method of inducing fatigue had to be developed. An exercise record, "Go You Chicken Fat, Go," was selected for use. The record contained lively music, with an animated narrator verbally directing a sequence of vigorous exercises (e.g., running in place, knee bends). In previous years, the record had been used as a large-group activity in the Center and preschoolers had commented about feeling tired after completing its exercises.

*Testing procedure.* Children individually accompanied a research assistant to a testing area and were assigned randomly to a fatigue or a nonfatigue condition. As a check on fatigue level (see Wade, Janke, Stern, & Lipsitt, 1961), the pulse rate of all subjects was measured both prior to and after the following interpolated activities. Children in the fatigue treatment completed the exercises directed by the Chicken Fat record. Nonfatigued children merely listened to the Chicken Fat record, while they helped the experimenter put away a group of light-weight, plastic blocks.

Immediately after the interpolated activity (and as they were having their pulse remeasured), children were asked if they felt tired. They were told then that they needed to learn a nursery rhyme for a large-group activity to be held in school on the following day. They were asked, "Do you want to learn it now or do you want to learn it later?" Those who requested deferred learning then were asked if they wanted to wait "because it's hard to learn when you are tired (not tired) or because you need to rest?" Those subjects who requested immediate learning were asked if they wanted to learn the poem "now because it's easy to learn when you are not tired (tired) or so you won't have to do it later?" Alternatives within each question were administered in a counterbalanced manner across subjects. As in Experiment 2, the amount of time spent with the experimenter prior to selecting a learning session was matched between the two conditions.

### *Results and Discussion*

*Physical state analyses.* When asked, all 12 children in the fatigue condition said they were tired at the end of the exercise session,

whereas none of the nonfatigued subjects said they were tired. Moreover, subjects in the fatigue condition showed an increase in pulse rate from preexercise ( $M = 89.2$ ) to postexercise ( $M = 104.3$ ). This increase was in contrast to the relatively constant pretest ( $M = 87.8$ ) to posttest ( $M = 87.0$ ) pulse rate observed in the nonfatigue condition. The postactivity pulse rate differed significantly,  $t(11) = 8.52$ ,  $p < .01$ , between the two treatments. Hence, both the verbal report and the physiological measure of fatigue suggest that the children in the high-exercise condition were more tired than those in the nonexercise group.

*Monitoring analyses.* In their learning choices, 8 of the 12 fatigue-condition subjects chose delayed learning, whereas only 1 of the 12 nonfatigued children did so. As in Experiment 2, this condition difference in choice type was significant,  $\chi^2(1) = 8.67$ ,  $p < .05$ , indicating that children may monitor their physical states and alter their behavior accordingly.

*Metacognitive analyses.* Of the 8 fatigued children who chose delayed learning, 88% (i.e., 7 subjects) justified their choice by indicating that it is difficult to learn while tired. A one-tailed binomial test ( $p < .05$ ) revealed this difference to be significant. That most of the fatigued children explained their choice in terms of the relation between fatigue and learning is in accord with the notion that metacognitive knowledge, in conjunction with cognitive monitoring of fatigue, predisposed the greater frequency of deferred choices. Of the 11 nonfatigued subjects who chose immediate learning, 6 said they just did not want to do it later, whereas 5 said they thought they would learn better while not tired. This difference in choice selection was not significant (one-tailed binomial,  $p < .90$ )

#### EXPERIMENT 4

The results from Experiment 2 offer no evidence that preschoolers monitored their emotional states prior to scheduling the learning session. It is possible, however, that such monitoring did occur, but that the negative mood that was induced was not strong enough to warrant deferred learning. In short, the mood of the positive- versus negative-set children may not have differed greatly at the end of induction. Because no secondary check on the polarity of affect was taken, this possibility could not be evaluated. It is also possible that children in the negative mood condition viewed the proposed learning experience as something that would be fun, and therefore selected immediate learning in order to cheer themselves up.

Experiment 4 was conducted to examine both of these possibilities, as well as to re-examine whether cognitive monitoring of emotional state occurs in young subjects. A more systematic technique for mood induction was developed and secondary checks on the emotional state of subjects were included. As in Experiment 3, a recognition test was administered to evaluate the degree to which metacognitive awareness of the relation between mood and learning might influence subjects' choices.

### *Method*

*Subjects.* Twenty-four children between 4 and 5 years of age (mean CA = 55.6 months,  $SD = 5.1$  months) served as subjects. All were enrolled in the Child Study Center at the University of Maine, and none had participated previously in research of this type.

*Materials and task.* A revised technique for mood induction was developed to ensure that the experience was predominantly positive or negative in tone. It involved presenting stories describing sad or happy events. A shortened version of *The Tenth Good Thing About Barney* (Viorst, 1978), which describes a child's reaction to the death of a cat, was used to induce a sad emotional state. In previous years, this book had been read during story time at the Child Study Center and many children had commented about how sad they felt about Barney. A story entitled, "The Happy Cat," which describes how much fun it is to own a pet, was written to evoke a good mood. The two stories were equated for length, with an approximate delivery time of 3.1 min.

To minimize the role of verbal skill needed to describe emotional states, a recognition question (i.e., "Do you feel happy or sad?") was administered at the end of each story. Immediately thereafter, children were told that they needed to learn their phone number as part of an ongoing Self-help Program in their school. They were given the choice of learning it "now" or "later." Those who chose deferred learning then were asked if they wished to delay learning because "it's hard to learn when you're sad (happy) or so you can do something that will make you happier?" Those who said they wanted to learn immediately were asked if they wanted to do so because "you'll do a good job while you're happy (sad) or so you don't have to do it later?" For both situations, the order of offering alternatives was counterbalanced across subjects.

*Testing procedure.* Children were taken individually to a research room and randomly assigned to either the sad or happy story condition. As an additional check on emotional state, children's facial expressions were videotaped through a one-way mirror while each

story was read. The experimenter had been trained to read the story in either a gay and cheerful manner or in a somber and melancholy style. The experimenter was well practiced, so that reading time was equivalent across the two conditions. A live recitation was chosen in preference to a tape recorded one to better maintain subjects' attention. Following each rendition, the questions described earlier were asked. Questions were repeated as necessary to ensure that children understood each alternative.

*Tape analysis.* To determine whether children differed in emotional state just prior to learning, two independent coders used a modified version of the Ekman, Friesen, and Ellsworth (1971) technique for rating the affective content of facial expression from the videotapes. The ratings were based on facial expression during the last 30 s of mood induction for each subject. As described by Ekman et al. (1971), emotional state was judged in terms of the intensity of expression and frequency of occurrence during the rating period. Ratings were made on a 5-point scale, with category labels of *very happy* (5), *happy*, (4), *neutral* (3), *sad* (2), and *very sad* (1). For each subject, one overall rating for the entire 30-s period was generated by each coder. Both of the coders were naive regarding the subjects' condition assignment, as well as the purpose of the study. Intercoder agreement, as measured by Cohen's Kappa, was .79 and .84 for the sad and happy conditions, respectively.

### Results and Discussion

*Emotional state analyses.* The mean overall ratings of facial expression were 4.27 and 1.66 for subjects in the happy and sad conditions, respectively. These scores represent a significant condition differences in rated mood,  $t(22) = 9.96, p < .01$ . When asked, all of the children in the happy condition said they felt happy and 9 of those in the sad treatment said they felt sad. Two of the remaining subjects said they did not know how they felt and the other subject said she felt "okay." Overall, the induction procedure appears to have had the intended effects on emotional state.

*Monitoring analyses.* When asked when they would prefer to learn their telephone number, 9 children in the happy condition requested immediate learning, whereas the remaining 3 children chose a delayed session. This trend was reversed in the sad condition, with 2 children requesting immediate learning and 10 subjects choosing a delayed session. This condition difference was significant,  $\chi^2(1) = 6.04, p < .05$ , indicating that (with a stronger method of mood induction than that used in Experiment 2) emotional state does influence young children's preferences for when a learning session should

begin. Most importantly, these data indicate that preschool children may monitor their emotional states and adjust subsequent behavior as a result of that process.

*Metacognitive analyses.* In response to the follow-up questions, 8 of the 9 happy subjects who chose immediate learning (i.e., 89%) said they did so because they thought they would do a good job while happy. The remaining happy child said he picked immediate learning so he would not have to do the task later, which a one-tailed binomial test revealed to reflect a significant difference ( $p < .02$ ). This justification of the predominate choice made by happy subjects is in accord with the notion that metacognitive knowledge influenced their behavior.

For those children who chose deferred learning, 6 of the 10 sad subjects justified their choice on the grounds that it is hard to learn while sad. The remaining four subjects said they wanted to do something that made them happier. Although in the predicted direction, this difference is not significant (one-tailed binomial,  $p < .90$ ).

## GENERAL DISCUSSION

Two general conclusions are supported by the findings of these studies. First, it appears that children as young as 3 possess metacognitive awareness that internal states representing fatigue and mood can affect the ease with which new information is acquired. Second, the data are consistent with the notion that young children monitor their own physical and emotional states, and then make decisions for future activities based on the outcome of that monitoring process. To our knowledge, none of these findings have been reported previously.

As demonstrated in Experiment 1, preschoolers not only recognized that mood and level of fatigue influence learning, but also correctly indicated the component of each factor (e.g., sadness vs. happiness) that is associated with most efficient memorization. Because transient states represent a category of information in the Flavell (1981) model of metacognitive development, these findings add to the store of such knowledge that young children appear to possess.

The children's recognition that mood and fatigue influence learning also fits well with a notion proposed by Wellman (1977) in explanation of why certain factors are perceived as memory-relevant before others. Basically, Wellman has suggested that children become familiar with the effects of certain variables in nonlearning situations, then use that understanding to mediate metamnemonic judgments. Presumably, children become familiar with the effects of fatigue and sadness early in life, encountering fatigue on a nightly basis. Several

investigators (Borke, 1971; Poche, Brouwer, & Swearinger, 1981) suggested that young children may experience fear less frequently than other emotions and, as a consequence, they are less aware of its general effects. Such differences in familiarity may explain why fear, unlike mood and fatigue, was not perceived as a memory-relevant factor in Experiment 1.

For the behavioral measures, the results of Experiments 2, 3, and 4 demonstrated that preschoolers chose to defer their own learning when tired or sad, which suggests self-monitoring of transient states. It is difficult for us to posit mechanisms other than self-monitoring that could have produced the condition differences in deferred learning, given that, even after random assignment to conditions, subjects were matched on a number of potentially confounding variables (e.g., amount of time spent with the experimenter, the general nature of interpolated activity, background music within the exercise context). Something predisposed children to behave differently in the various conditions, which differed only in terms of the respective physical or emotional state that was induced. Our judgment is that children recognized fatigue or sadness, and then altered their behavior accordingly. Without such recognition (which presumably entailed some level of monitoring), subjects would not have shown the diverging pattern of deferred-learning choices that was obtained. It is important to note that "performance" data of this type represents, according to Revelle, Wellman, and Karabenick (1985), strong evidence of monitoring in preschool children, because verbal-judgmental tasks typically involve levels of abstraction or casual attributions that are too difficult for young subjects.

Revelle, Wellman, and Karabenick (1985) also suggested two additional criteria that must be met to infer that monitoring has transpired. The first is that the situation and materials used to assess its occurrence be familiar to the subjects tested. The other is that the dependent measure be capable of differentiating monitoring from other ongoing processes (e.g., attention seeking). Fortunately, our data are strong on both points. Substantial care was taken in Experiments 2, 3, and 4 to select learning materials and interpolated activities that were highly similar to those normally encountered by the children (e.g., finger games similar to those used for their music training, exercise records actually used in past years to promote physical development, nursery rhymes to be learned for the day's large group activity). In short, the data were collected in contexts and with materials that were highly familiar to the children. Secondly, it is the difference in behavioral choices between conditions, not the occurrence of an ongoing activity, that provided the basis for inferring self-monitoring. Thus, because evidence of cognitive monitoring has not been



consistently reported with young children, findings from this investigation help elucidate the range of contexts in which it does occur in young children.

What is less clear from this research is the degree to which the condition differences in learning choices were based on metamnemonic awareness of the relation between memorization and the effects of physical and emotional states. On the positive side, a majority of children in both Experiment 3 and Experiment 4 chose the metamnemonic alternative as their explanation for why they preferred delayed or immediate learning. This finding is in accord with the notion that comprehension of a metacognitive principle predisposed the behavioral choice. On the other hand, when given freedom to express knowledge of the relation between learning efficacy and physical or emotional state, only 4 of the 7 subjects who deferred learning in Experiment 2 did so. Obtaining a justification of this type by means of an open-ended question may simply be too difficult for preschoolers, given their limitations in verbal skill. It is also possible, however, that the two-choice recognition format used in Experiments 3 and 4 may be "putting words in children's mouths" by pointing out a relation that they had not previously considered. For these reasons, it remains unclear whether knowledge of the metamnemonic principle served as the major determinant of the behavioral choices obtained. Although the children's responses to the recognition questions are consistent with this notion that it did, replication of this finding with alternate and multiple methodologies is needed before a firm conclusion on the issue can be drawn. For example, including a wider range of alternatives in the forced choice format (e.g., "Because you don't feel like doing anything right now") might clarify whether children are really basing decisions on a metacognitive principle. Likewise, the generality of the behavioral findings may warrant additional study, with consideration of whether similar processes occur under natural conditions (e.g., before bedtime, in the classroom).

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