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Learners' developing knowledge of strategies for regulating motivation

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ABSTRACT

This research investigated children's developing knowledge of strategies for maintaining motivation. First graders, third graders, fifth graders, and adults were presented with a motivational dilemma and asked to evaluate the effectiveness of several strategies for sustaining motivation. Adults demonstrated more knowledge of the effectiveness of a variety of strategies than did fifth graders, who demonstrated more knowledge than did third or first graders. The younger groups did, however, demonstrate understanding of concrete strategies for regulating motivation in contrast to more mental strategies, which were not understood until later in elementary school. The implications of these findings as well as the relationship between strategy knowledge and strategy use are discussed.

1. Introduction

Even the most eager students are faced with motivational challenges in elementary school. Homework assignments and in-class exercises are perceived as boring or irrelevant at times (Corno, 2001; Dembo & Eaton, 2000; Wolters, 2003) and students are required to comply with numerous demands in the face of distractions and competing goals (Corno, 1993). Even for desired tasks, learners of all ages may have difficulty getting started, staying focused, and managing their time appropriately (cf. McCann & Turner, 2004). Moreover, such motivational challenges may be especially pronounced in our current era of accountability, which has led many teachers to focus on more efficient — but arguably less interesting — methods of instruction (Amrein & Berliner, 2003). How, then, do young learners cope with these motivational obstacles?

Prior research with secondary and college students has identified a set of strategies for regulating task engagement in the face of motivational challenges, including altering the physical environment, self-administering rewards, engaging in goal-oriented self-talk, and transforming tedious tasks into games (McCann & Turner, 2004; Sansone, Weir, Harpster, & Morgan, 1992; Wolters, 1998, 2003; Zimmerman & Martinez-Pons, 1986). Very little research, however, has addressed elementary school children's understanding and use of such strategies. Examining younger populations is important because elementary school is the time when strategies for regulating motivation first become necessary and when knowledge about such strategies likely undergoes substantial development. Therefore, the goal of the present study was to chart the developmental path of elementary school children's understanding of strategies for regulating motivation.

1.1. Self-regulated learning and volition approaches

Although there has not yet been a systematic study of motivation regulation strategies among children, several literatures collectively verify the importance of such research. For example, strategy understanding and use are central components of academic success in models of self-regulated learning (Pintrich & DeGroot, 1990; Purdie & Hattie, 1996; Weinstein & Mayer, 1986; Zimmerman, 1990; Zimmerman & Martinez-Pons, 1986, 1988, 1990). The vast majority of research on self-regulated learning, however, has focused on cognitive and metacognitive strategies, and has only minimally addressed how students regulate

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motivation to cope with boredom, distraction, or other motivational obstacles. Indeed, the need for deeper investigation of motivation regulation strategies has been recognized by several researchers in the field (Boekaerts, 1995; Pintrich, 1999). In addition, research on self-regulated learning has rarely included children below the fifth grade so there is little information about the development of strategy knowledge through elementary school.

Perhaps more directly relevant to the issue of motivation regulation is research on academic volition, which deals with the processes by which students protect their intentions to achieve desired goals. Researchers have developed a taxonomy of volitional strategies, including a broad category of *motivation control*, which refers to the direct manipulation of motivation primarily through self-administered rewards and punishments (Corno, 2001; Corno & Kanfer, 1993; Kuhl, 1984, 1985; Kuhl & Kraska, 1989). Working in this tradition, Kuhl and Kraska (1989) found a linear increase in German children's understanding of motivation control from first to fourth grade, suggesting that strategy knowledge may develop gradually over the elementary school years. The broad category of motivation control, however, collapses across an assortment of strategies, some of which may be understood earlier in development than others. Indeed, Pintrich (1999) has argued that the taxonomy of volitional control strategies may be too general and coarse-grained to be maximally useful. More work needs to be done to assess children's developing knowledge of *particular* motivation regulation strategies.

Wolters (1998, 2003) has addressed this concern, in part, by adopting a more fine-grained approach to the study of motivation regulation. Using an open-ended survey, Wolters (1998) asked college students to report the strategies they used to maintain motivation when faced with boring, irrelevant, or difficult academic tasks. In contrast to the broad category of motivation control from the volition tradition, this approach revealed over a dozen distinct strategies for regulating motivation. Subsequent research has concentrated on five of these strategies that are of particular significance: *environmental structuring*, *self-consequating*, *interest enhancement*, *performance self-talk*, and *mastery self-talk*. The self-reported use of these five strategies among secondary students tends to be positively correlated with a host of adaptive behaviors and outcomes, such as effort, persistence, cognitive strategy use, self-efficacy, and GPA (Wolters, 1999; Wolters & Rosenthal, 2000). Moreover, Wolters (1998, 1999, 2003) has situated strategy use in a meaningful theoretical framework by drawing links between each of these strategies and a rich set of motivational constructs (cf. Pintrich, 1999).

The combination of a fine-grained taxonomy, a strong theoretical framework, and an explicit focus on motivation per se makes this approach an ideal starting point for charting children's developing knowledge of strategies for regulating motivation. Before turning to the present study, therefore, we consider in more detail the five strategies of Wolters (1999) and the developmental trajectory that knowledge of each might reasonably follow. Below, we group these strategies into two categories based on a distinction in the broader developmental literature between strategies that are more concrete or behavioral, on the one hand, and strategies that are more mental or abstract, on the other (cf. Harris, Olthof, & Terwogt, 1981; Yates, Yates, & Beasley, 1987). We group the strategies in this fashion both for ease of presentation and because we predicted similar developmental trends among strategies that we classified as concrete and among those that we classified as more mental or abstract.

1.1.1. Concrete strategies

The two concrete, or largely behavioral, strategies of environmental structuring and self-consequating are those that have been most explicitly addressed in the literatures on self-regulated learning and volition (e.g., Corno & Kanfer, 1993; Kuhl & Kraska, 1989; Zimmerman & Martinez-Pons, 1986, 1990). *Environmental structuring* refers to the alteration of one's physical environment in order to avoid or reduce distractions and, therefore, facilitate continued task engagement (Corno, 1993; Wolters, 2003; Zimmerman & Martinez-Pons, 1986). For example, a student might choose to work in a quiet area of the room or put distracting items out of sight in order to increase her commitment to her work. *Self-consequating* refers to the self-administration of rewards for task completion, or punishments for lack of completion, in an effort to maintain or increase motivation (Dembo & Eaton, 2000; Kuhl, 1985; Wolters, 1999, 2003; Wolters & Rosenthal, 2000; Zimmerman & Martinez-Pons, 1986). For example, a student might allow herself time spent viewing her favorite television program only if she first completes her homework.

A number of different research traditions suggest that these two strategies may be understood early in the elementary years or perhaps even at the preschool level. In a qualitative analysis of six third graders negotiating their daily homework assignments, Xu and Corno (1998) found that children spontaneously used strategies that could be classified as environmental structuring or self-consequating. For example, in order to avoid distractions, one girl reported turning off the telephone in her room and one boy reported sitting far away from his window. Other children reported calling their friends as a reward for finishing their homework. Focusing on even younger children, Holtz and Lehman (1995) found that four-, six- and eight-year-olds believed it would be easier for a girl to clean her room if she turned off her favorite television program and knew that she would receive a snack upon finishing the job, demonstrating at least a rudimentary understanding of the effectiveness of environmental structuring and self-consequating at the preschool level.

Perhaps the most relevant basis for developmental predictions comes from the literature on young children's awareness of strategies for delaying gratification (e.g., Mischel & Mischel, 1983; Yates & Mischel, 1979; Yates et al., 1987). In the traditional paradigm, children are given the choice of an immediate, small reward (e.g., one pretzel) or a delayed, larger reward (e.g., two marshmallows) if they are able to endure a waiting period during which both rewards are typically present. A rich literature has addressed the strategies that children use to endure the waiting period without succumbing to the lesser reward —strategies that are conceptually analogous to some of the motivation regulation strategies of interest to the present investigation. Thus, like the strategy of environmental structuring, one effective delay strategy is to cover the rewards in order to avoid the temptation to

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consume them (Mischel & Ebbesen, 1970). Mischel and Mischel (1983) found that, by age six, children preferred to cover the rewards rather than leave them exposed, suggesting that an understanding of environmental structuring may be in place by the beginning of elementary school. Another effective delay strategy is to engage in task-orientated ideation (e.g., reminding oneself that the reason for waiting is to obtain the larger reward; Miller, Weinstein, & Karniol, 1978). This delay strategy is comparable to the self-consequating strategy insofar as it entails thinking about the extrinsic reward that one will receive upon successful completion of the task (i.e., waiting the entire duration of time). Mischel and Mischel (1983) found that, by age five, children preferred to engage in task-oriented ideation rather than in consummatory ideation (e.g., thinking about how yummy the reward items are), suggesting that an understanding of consequating may be in place by the beginning of elementary school. It is important to note that, in this forced-choice paradigm, children may have reacted against the detrimental effect of consummatory ideation rather than truly recognizing the benefit of task-orientated ideation. Nonetheless, we expected that children in the present study would demonstrate knowledge of the environmental structuring and self-consequating strategies early in elementary school.

1.1.2. Mental strategies

In contrast to the concrete strategies discussed above, the more mental, or abstract, strategies of interest enhancement, performance self-talk, and mastery self-talk have been less thoroughly researched. *Interest enhancement* refers to efforts to make a task more immediately relevant or enjoyable, thereby increasing one's motivation to complete it (Sansone et al., 1992; Sansone, Wiebe, & Morgan, 1999; Wolters, 2003). For example, a student might mentally transform her work into a game to make it more exciting. This could include components that are both off-task (e.g., pretending to be a famous author) and on-task (e.g., challenging oneself to write as neatly as possible); the essential feature is that efforts are focused on making the task more enjoyable or interesting. The two categories of *performance self-talk* and *mastery self-talk* refer to thoughts or internal statements that serve as reminders of reasons for task engagement and, therefore, increase motivation (Wolters, 1998, 1999, 2003). *Performance self-talk* refers to thinking about performance goals, such as getting good grades or outperforming peers; for example, a student bored with studying for an exam might motivate himself by thinking about how good it would feel to set the curve for the class. *Mastery self-talk* refers to thinking about the value of a task or the desire to truly master the material; for example, a student having difficulty attending to a lecture might remind himself that the content is valuable and important. Mastery self-talk is similar to, but distinct from, interest enhancement in that it explicitly focuses on learning and task value, whereas interest enhancement focuses on more immediate rewards, such as enjoyment while completing the task.

Almost no research has been conducted on children's developing understanding of these or related strategies, but the research that does exist suggests that such strategies are likely to emerge later in elementary school. In the qualitative research of Xu and Corno (1998), for example, one child reported that she pretended to play a game in front of an imaginary audience in order to make her homework more interesting, but this was the only hint of an interest enhancement strategy among their third-grade sample. Beyond the literature on motivation regulation, several traditions of developmental research show age-related shifts from understanding behavioral or concrete strategies to understanding more mental or abstract strategies. For example, in the domain of emotion regulation, six-year-olds do not understand that unwanted emotions can be changed via mental processes, but do understand that alterations to the situation could induce change; eleven-year-olds, by contrast, show a robust understanding that unwanted emotions can be changed by redirecting mental processes (Harris et al., 1981). Similarly, in the research on delay of gratification, children show an increasing awareness of mental distraction strategies (i.e., thinking about something other than the reward) from ages six to eight, but a relatively early understanding of motor distractive strategies (e.g., playing with one's fingers; Yates et al., 1987). Finally, sixth graders, but not third graders, believe that engaging in abstract ideation (i.e., thinking about the abstract properties of yummy reward items) will result in a greater ability to endure the waiting period than engaging in consummatory ideation (Mischel & Mischel, 1983), suggesting that strategies that do not concretely apply to the task at hand may develop later than more concrete strategies. Thus, we anticipated a developmental shift from an understanding of more concrete or behavioral strategies (e.g., environmental structuring) to more abstract strategies that are based on mental — rather than physical — transformations of the task (e.g., goal-oriented self-talk).

1.2. The present study

Despite many calls for research on the developmental origins and trajectories of strategy knowledge (e.g., Corno, 1993; Corno & Kanfer, 1993; Pintrich, 1999; Pintrich & Zusho, 2002; Wolters, 2003; Zeidner, Boekaerts, & Pintrich, 2000), researchers have largely ignored elementary school populations, most likely because current approaches rely upon survey measures that are inappropriate for young children. Even the interview methods used in some studies (e.g., Purdie & Hattie, 1996; Zimmerman & Martinez-Pons, 1986) may be inappropriate for early elementary children who typically do not provide substantive responses to open-ended prompts. In order to assess children's knowledge of strategies for regulating motivation, therefore, we adopted a methodology with both forced-choice and open-ended probes (see Kuhl & Kraska, 1989) for use with first graders, third graders, and fifth graders.

Collapsing across all five strategies, we expected to see a general increase from first to fifth grade in children's recognition that strategies would help to regulate motivation and in their ability to adequately explain why. In terms of specific strategies, we expected a reasonably solid understanding of concrete strategies (i.e., environmental structuring, self-consequating) even among first graders. By contrast, we expected to see age-related increases in children's understanding of mental strategies (i.e., interest enhancement, mastery self-talk, performance self-talk) such that a reasonable understanding would not be present early in elementary school but would be in place by fifth grade.

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2. Method

2.1. Participants

Sixteen first-grade children (M_{age} = 6 years, 10 months; range = 6;5 to 7;4), 16 third-grade children (M_{age} = 9 years, 0 month; range = 8;4 to 9;7), 16 fifth-grade children (M_{age} = 11 years, 0 month; range = 10;5 to 11;5), and 16 adults (M_{age} = 20 years; range = 18–22 years) participated in this study. The children were recruited through a private elementary school that served a middle-class population and a database of families that had previously been recruited through public and private elementary schools that served middle- to upper-middle class populations. The adult group consisted of college undergraduates who were recruited through announcements made in psychology classes. Each of the groups of children consisted of approximately equal numbers of males and females, whereas all but two participants in the adult group were female. The majority of participants appeared to be Anglo-American though they were not asked to report their ethnicity.

2.2. Procedure

The same female experimenter interviewed all participants. A training phase preceded the testing phase for all the child participants, but the adult participants progressed immediately to the testing phase.

2.2.1. Training phase

The interview session began with a brief training period designed to introduce children to the basic format of the interview, eliminate response biases, encourage elaboration, and establish a comfortable relationship with the experimenter. The experimenter read children an illustrated story about a fictional character matched to their own sex who was faced with the task of picking up a large number of tennis balls. The experimenter explained that the character wanted to pick up all of the balls as fast as possible and she asked children what they would do in order to pick up the balls quickly. All responses to this open-ended question were met with positive feedback.

In the next part of the story, the fictional character introduced four strategies that could potentially help him or her to pick up the tennis balls as fast as possible. Two of these strategies were designed to be helpful (e.g., using a bucket to collect the balls) and two were designed to be unhelpful (e.g., drawing smiley faces on the tennis balls). The children were asked whether each strategy would "help" or "not help," and to provide an explanation for their decision. For these responses, the first graders (only) were presented with two buckets, one marked "help" and the other marked "not help." The experimenter pointed to the appropriate bucket each time she asked if an idea would help or not help, and encouraged the children to place a ball in one of the buckets to indicate their response. Children were encouraged to elaborate on their answers and, if they responded in an unexpected manner, to consider other perspectives (e.g., if they claimed that drawing smiley faces on the tennis balls would help). Very few children offered such unexpected responses. All children seemed to understand the procedure.

2.2.2. Testing phase

Like the training phase, the testing phase embedded the research procedure in the context of a storybook. Specifically, the experimenter read all participants an illustrated story depicting a fictional character who was faced with a motivational dilemma. The dilemma was developed based on the description of Kuhl and Kraska (1989) of their Metamotivational Knowledge Test for Children, which assesses children's judgments of the effectiveness of a set of strategies for maintaining various intentions. In the story created for the present study, a school child named Matt (or Lisa, for female participants) needed to complete a math worksheet before the end of the school day. However, Matt expressly did not feel like doing his math worksheet, and would much rather have been playing outside, as indicated in the following story script:

> Matt looks at his worksheet, looks outside, and looks at his worksheet again. He thinks about how much more fun it would be to play outside than to do his worksheet, but he knows that he has to get it done.

The accompanying illustration depicted Matt sitting at his desk and staring into space with a window (which looked out onto a playground) to his side. Participants were then asked what they would tell Matt to do or think to help him finish the worksheet. No feedback was provided for these responses. Participants' suggestions were subsequently coded using a rubric of the five motivation regulation strategies, as described in the Results section.

In the next part of the story, 10 fictional classmates each offered Matt a single strategy that might or might not help him finish the worksheet. Five of these strategies were examples of the motivation regulation strategies that were the focus of the present investigation and the other five strategies were devised to be largely ineffective. Illustrations for this part of the story depicted Matt with each of his 10 classmates; the window was no longer visible. Participants were asked to decide whether each of the 10 strategies would "help" or "not help" Matt complete his worksheet. As in the training session, first graders were encouraged to place a ball in a bucket marked either "help" or "not help" to indicate their response. No feedback was provided for these responses. Participants were subsequently asked to provide an explanation for their decision (i.e., "Why would that help/not help?"). In nearly all cases, participants were probed once to provide a more elaborate explanation of their response. The experimenter typically asked, "Can you explain that a little more?," or she repeated information from their initial response in the probe (i.e., "Why would [x] help?").

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Table 1
Motivation regulation strategies and potentially ineffective strategies used in stories (male version)

Strategy type	Example used
Environmental structuring	Set A: … turn his desk so that he can't see the playground outside the window.
	Set B: … move his desk to a quieter corner of the room.
Self-consequating	Set A: … tell himself that he gets to play on the computer only if he finishes his worksheet.
	Set B: … tell himself that he can play catch with his dog, Spot, when he gets home from school only if he gets his worksheet done.
Interest enhancement [a]	Set A: … pretend that he's a spy figuring out a secret code.
	Set B: … write each of his answers in a different color to make it more fun.
Performance self-talk	Set A: … think about how smart he will look if he gets all the problems on the worksheet right.
	Set B: … think about how great it would be to get a sticker and a big smiley face on his worksheet for doing a good job.
Mastery self-talk	Set A: … think about all the interesting things that you can figure out with math.
	Set B: … think about how cool it is to understand math.
Potentially ineffective	… think about the biggest number that he knows.
	… draw cartoons on the chalkboard.
	… think about his favorite number and why it is his favorite number.
	… move his desk closer to his friend so that they can talk.
	… watch other kids playing outside for recess to make it more fun.

Note. The same five potentially ineffective strategies were used in both set A and set B.

[a] Although interest enhancement can include both on-task and off-task components, we included only off-task examples in order to maximize the difference between these examples and those provided for mastery self-talk.

The entire testing phase of the interview was audio taped and later transcribed, with the exception of four instances in which parental permission to do so was not granted (one first grader, two third graders, and one fifth grader). In these instances, the experimenter recorded explanations in note form. A fifth (first grader) transcript was lost due to tape recorder malfunction. Thus, transcripts were available for all but one participant. Transcripts were subsequently coded for the adequacy of participants' explanations, as described below.

2.3. Materials

Examples of the motivation regulation strategies were derived from definitions provided in the relevant literature and are presented in Table 1. *Environmental structuring* was defined as structuring one's environment in an effort to avoid or reduce distractions (e.g., moving one's desk to a quieter corner of the room). *Self-consequating* was defined as promising oneself an extrinsic reward for completing the task at hand (e.g., allowing oneself to play on the computer after the worksheet is finished). *Interest enhancement* was defined as a strategy designed to make the task more immediately relevant or enjoyable (e.g., pretending to be a spy figuring out a secret code). *Performance self-talk* was defined as thinking about one's desire to achieve good grades or outperform others (e.g., thinking about how smart one would look upon correctly completing the worksheet). Finally, *mastery self-talk* was defined as thinking about the importance of the task or one's desire to learn the task materials (e.g., thinking about all the interesting things that one can figure out with math). The five potentially ineffective strategies are also presented in Table 1.

In addition to the male and female versions of the story noted above, there were two different orders of presentation that varied between participants. The orders were randomly determined with the constraint that three motivation regulation strategies and three potentially ineffective strategies were presented before the fictional character took a short lunch and recess break. The remaining two motivation regulation strategies and two potentially ineffective strategies were presented in the latter half of the story. Finally, there were two different examples of each motivation regulation strategy divided into sets that varied between participants such that each set contained one example of each type of motivation regulation strategy. Thus, the stories varied between participants on the dimensions of sex, order, and set.

2.4. Coding of explanations

A coding scheme was devised to determine the adequacy of participants' explanations for their *help* responses to each of the five motivation regulation strategies. These explanations were coded from typed transcripts by the experimenter and a second coder who was blind to both the hypotheses of the study and the grade level of the participant who gave each explanation. Approximately 20% of the explanations were used for training purposes and the remaining 80% were coded independently by the two coders. Overall agreement between the two coders was 86%; disagreements were settled by discussion and consultation with a third coder who was blind to the grade level of the participant who gave each explanation.

Explanations were coded as adequate if they implicitly or explicitly indicated that the participant understood the main purpose of the strategy. *Environmental structuring* explanations were coded as adequate if they indicated that using the strategy would reduce distractions or allow for greater concentration on the task at hand. *Self-consequating* explanations were coded as adequate if they indicated that using the strategy would make the character want to finish the task or work faster to finish the task in an effort to get the reward or enjoy it for a longer period of time. *Interest enhancement* explanations were coded as adequate if they indicated that using the strategy would make the task more fun, exciting, interesting, or enjoyable. *Performance self-talk* explanations were coded as adequate if they indicated that using the strategy would increase the character's desire to do well or to outperform others;

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Table 2
Examples of adequate and inadequate responses for each strategy

Strategy	Adequate	Inadequate
Environmental structuring	"because then it will help her more concentrate" (Grade 1) "because then nobody could distract him" (Grade 3)	"because then she'll get her work done and then she can play" (Grade 1)
Self-consequating	"because she wants to play with her dog and go home so she'll go probably really fast" (Grade 3) "it motivates you to go faster 'cause it's something that's fun to do but he can only do it *after* he finishes so he'd finish it as fast as he can" (Grade 5)	"because then he, he wouldn't have to do it" (Grade 1)
Interest enhancement	"because it would make it easier and more fun, like Agent 007" (Grade 3) "because then it's more fun to do something, you know, grown up and exciting while he's doing his worksheet" (Adult)	"because he'd be focusing on his work" (Grade 5)
Performance self-talk	"because then he sets a goal for himself to get them right" (Grade 5) "because she wants to look good for her classmates and stuff" (Adult)	"because she'll be happy if she gets it all done and gets fun time" (Grade 3)
Mastery self-talk	"because it might help her with motivating her to value math in general" (Adult) "because it would help him…see like how math would help you like if you were a cashier at a fast food place or something and you'd have to like minus money or something, like you'd have to go, 'Hmm I don't know how much money to pay him back, oh how about I give him the whole, like, I don't know, like $1000.'" (Grade 3)	"because it's a positive thing — positive ideas towards something that you have to do, to convince yourself to get it done" (Adult)

responses that could be interpreted as self-consequating were coded as inadequate. Finally, *mastery self-talk* explanations were coded as adequate if they indicated that using the strategy would increase the character's value or perceived importance of math or the task at hand. Responses were coded as inadequate if they failed to indicate that the participant understood the main purpose of the strategy, merely repeated information from the scenario, or simply reiterated that the strategy would help (e.g., "that might motivate him a little more" or "it would stimulate him"). Examples of adequate and inadequate responses for each strategy are presented in Table 2.

2.5. Data reduction

Participants' responses to each strategy were collapsed to create variables for subsequent analysis. First, the number of *help* responses to the five motivation regulation strategies was summed to create an *overall identification score*, which indicated the extent to which participants were able to correctly identify the strategies as effective. Second, the number of these *help* responses that were accompanied by adequate explanations was summed to create an *overall explanation score*, which indicated the extent to which participants could articulate a clear understanding of why the motivation regulation strategies were effective. Third, the number of *help* responses to the five potentially ineffective strategies was summed to create a *false identification score*, which indicated the extent to which participants incorrectly believed any strategy to be effective — whether logical or not. Values for each of these three summary variables could range from 0 to 5.

In addition to creating variables that collapsed across all motivation regulation strategies, we were also interested in children's understanding of concrete versus mental strategies. Therefore, an index representing participants' correct identification of concrete strategies was calculated by averaging *help* responses to the environmental structuring and self-consequating strategies. Likewise, an index representing participants' correct identification of mental strategies was calculated by averaging participants' *help* responses to the interest enhancement, performance self-talk, and mastery self-talk strategies. Two additional indices were created to represent the adequacy of participants' explanations for the concrete and mental strategies by averaging the explanation scores for the relevant strategies. Because all four indices were computed based on averages, the possible values ranged from 0 to 1.

3. Results

3.1. Overall strategy knowledge

In order to assess participants' ability to recognize and identify the motivation regulation strategies as effective, we first tested for grade level differences in their overall identification scores. A 4×2×2×2 (Grade×Sex×Order×Set) analysis of variance (ANOVA) revealed no significant main effects or interactions involving sex, order, or set.[1] The data were therefore collapsed across these variables and a one-way ANOVA was used to test for grade level differences. Importantly, and as predicted, there was a significant effect of grade on participants' overall identification scores, $F(3,60) = 16.48$, $p < .001$, $\eta^2_p = .45$. As reported in

[1] Because the majority of participants in the college sample were female, we also tested for sex differences using only the three younger age groups. Excluding the college sample produced no main effects or interactions involving sex for this and all subsequent analyses.

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Table 3
Overall strategy knowledge by grade level

Grade level	Overall identification score	False identification score	Overall explanation score
	M (*SD*)	*M* (*SD*)	*M* (*SD*)
1st Grade	$3.06\ (.93)_a$	$.31\ (.48)_a$	$1.27\ (.46)_a$
3rd Grade	$3.44\ (.96)_a$	$.44\ (.73)_a$	$2.06\ (1.18)_b$
5th Grade	$4.25\ (.69)_b$	$.31\ (.48)_a$	$2.94\ (1.06)_c$
Adult	$4.81\ (.40)_c$	$.13\ (.34)_a$	$3.69\ (.95)_d$

Note. Different subscripts indicate the values in each column that differ significantly from other values in that column according to the Student-Newman-Keuls test. For all values, the possible range is 0 to 5.

Table 3, adults had higher overall identification scores than did fifth graders, who had higher scores than did third graders and first graders. Although the data do not demonstrate the predicted increase in overall knowledge of motivation regulation strategies from first to third grade, the increase in such knowledge beyond third grade is clear.

It is possible, of course, that this effect could be driven by age-specific response biases. Approximately the same pattern of findings would have emerged if first and third graders were responding randomly or if the older participants had a tendency to report that any strategy could be helpful. In order to eliminate these possibilities, we examined participants' false identification scores for the five potentially ineffective strategies. A 4×2×2×2 (Grade×Sex×Order×Set) ANOVA revealed no significant main effects or interactions for any of the variables. Most importantly, there was no main effect of grade $F(3,34) = .46$, $p > .70$. As the means in Table 3 indicate, participants at all grade levels had very low false identification scores. This suggests that the grade level differences in overall correct identifications reported above were not due to age-specific response biases, but rather to substantive differences in strategy knowledge.

Simply examining participants' identification of strategies as effective, however, could lead to an inflated estimate of strategy knowledge. With the forced-choice response format, participants would be credited with understanding at least a few motivation regulation strategies even if they were responding randomly. Therefore, as a more conservative indicator of overall strategy knowledge, we examined the extent to which participants adequately explained why each motivation regulation strategy would be helpful. A 4×2×2×2 (Grade×Sex×Order×Set) analysis of variance (ANOVA) on participants' overall explanation scores revealed no significant main effects or interactions involving sex, order, or set. The data were therefore collapsed across these variables and a one-way ANOVA was used to test for grade level differences. As predicted, there was a significant effect of grade on overall explanation scores, $F(3,63) = 18.67$, $p < .001$, $\eta^2_p = .49$. As shown in Table 3, adults had higher overall explanation scores than did fifth graders, who had higher scores than did third graders, who had higher scores than did first graders. Thus, with increasing age, participants demonstrated increasing knowledge of why motivation regulation strategies are likely to help regulate motivation.

3.2. Knowledge of concrete versus mental strategies

In order to evaluate the hypothesis that children would understand concrete strategies before mental strategies for regulating motivation, the indices of correct identifications for concrete and mental strategies were subjected to a 4×2 (Grade×Strategy Type: Concrete/Mental) mixed ANOVA. As predicted, there were significant main effects for grade, $F(3,60) = 15.09$, $p < .001$, $\eta^2_p = .43$, and for strategy type, $F(1,60) = 33.87$, $p < .001$, $\eta^2_p = .36$. Importantly, there was also a significant grade by strategy type interaction, $F(3,60) = 6.45$, $p < .01$, $\eta^2_p = .24$.[2] There was little difference across age groups in correct identifications of the concrete strategies (*M*s from .81 to .97), but there was a clear increase in correct identifications with age for the mental strategies. Indeed, a subsequent analysis of correct identifications for just the mental strategies revealed a significant main effect of grade, $F(3,60) = 15.09$, $p < .001$, $\eta^2_p = .43$. Student-Newman-Keuls comparisons indicated that adults ($M = .96$) performed significantly better than fifth graders ($M = .77$) and third graders ($M = .60$), who performed significantly better than first graders ($M = .42$).

Similarly, a 4×2 (Grade×Strategy Type: Concrete/Mental) mixed ANOVA on the adequacy of participants' explanations revealed significant main effects for grade, $F(3,59) = 16.24$, $p < .001$, $\eta^2_p = .45$, and for strategy type, $F(1,59) = 83.71$, $p < .001$, $\eta^2_p = .59$. As predicted, the grade by strategy type interaction was also significant, $F(3,59) = 3.71$, $p < .05$, $\eta^2_p = .16$. There were small differences across age groups for the concrete strategies (*M*s from .63 to .88), but there was a clear increase in the adequacy of explanations for the mental strategies with age. Indeed, a subsequent analysis of explanation adequacy for just the mental strategies revealed a significant main effect of grade, $F(3,59) = 18.66$, $p < .001$, $\eta^2_p = .49$. Student-Newman-Keuls comparisons indicated that adults ($M = .65$) provided significantly more adequate explanations than fifth graders ($M = .44$) and third graders ($M = .27$), who provided more adequate explanations than first graders ($M = .00$).

In order to understand better children's differential knowledge of concrete versus mental strategies, we next examined their responses for each of the five individual motivation regulation strategies. Table 4 presents the percentage of participants at each grade level who correctly identified each motivation regulation strategy as effective and the percentage of those who adequately explained

[2] Although we categorized interest enhancement as a mental strategy, the particular example used in set B (i.e., writing each answer in a different color) did not involve a mental transformation of the task. Therefore, the analyses reported below were also computed with the set B responses for the interest enhancement strategy excluded from the mental indices. The pattern of findings and significance levels reported below were not substantially altered by excluding these responses. Most importantly, there remained significant grade by strategy type interactions both for participants' correct identifications, $F(3, 60)=4.72$, $p < .01$, $\eta^2_p = .19$, and for the adequacy of their explanations, $F(3, 59) = 3.02$, $p < .05$, $\eta^2_p = .13$.

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Table 4
Percentage of participants at each grade level who correctly identified and adequately explained each motivation regulation strategy

Grade level	Motivation regulation strategy				
	Environmental structuring	Self-consequating	Interest enhancement	Performance self-talk	Mastery self-talk
1st Grade					
Correct identification	100*	81*	7*	44	75*
Adequate explanation	87	40	0	0	0
3rd Grade					
Correct identification	94*	69	25	69	88*
Adequate explanation	88	38	13	38	31
5th Grade					
Correct identification	100*	94*	56	88*	88*
Adequate explanation	94	69	44	50	38
Adult					
Correct identification	100*	94*	100*	100*	88*
Adequate explanation	100	75	94	50	50

Note. The "adequate explanation" row for each grade level presents the percentage of participants who both correctly identified the strategy as effective and provided an adequate explanation for their response.

* Percentages of correct identifications that were significantly different than chance according to the binomial table (two-tailed, $p < .05$).

their response.[3] Chi-square analyses were used to test for age differences in both correct identifications and explanation adequacy for each strategy, as detailed below. In addition, the binomial test was used to determine whether the frequency of correct identifications for each strategy was different than chance, as reported in Table 4.

3.2.1. Concrete strategies

For the two concrete strategies of environmental structuring and self-consequating, chi-square analyses revealed no differences by grade level in correct identifications, χ^2s(3, $N = 64$) < 5.22, *ns*. Table 4 shows that participants at all grade levels correctly identified both of these concrete strategies as effective, with the exception of third graders whose performance did not exceed chance for self-consequating. There was also no difference by grade level in explanation adequacy for environmental structuring, $\chi^2(3, N = 63) = 2.50$, *ns*, but there was a trend for self-consequating, $\chi^2(3, N = 63) = 7.16$, $p < .10$, such that adults and fifth graders tended to provide more adequate explanations than did first and third graders. Thus, even the youngest children in the study displayed at least a reasonable understanding of the concrete strategies for regulating motivation, but there appears to be some development in knowledge of self-consequating with age.

3.2.2. Mental strategies

For the three mental strategies, the predicted grade-level differences in correct identifications emerged for interest enhancement and performance self-talk, χ^2s(3, $N = 64$) > 15.32, $ps < .01$, but not for mastery self-talk, $\chi^2(3, N = 64) = 1.42$, *ns*. Table 4 shows the expected increase in correct identifications with age for the first two mental strategies, but a surprisingly high percentage of correct identifications for mastery self-talk at all grade levels. Participants' correct identifications must be qualified, however, by the adequacy of their explanations. Indeed, there were significant differences in explanation adequacy by grade level for all three mental strategies, χ^2s(3, $N = 63$) > 9.88, $ps < .05$. As shown by the values in Table 4, there was a marked increase in participants' ability to explain interest enhancement with each grade level. For the self-talk strategies, older participants also tended to provide more adequate explanations than did first graders, although at no age did an overwhelming majority of participants provide such explanations. These data on explanation adequacy suggest that children's correct identifications of the mastery self-talk strategy likely provided an inflated estimate of their strategy knowledge. Considering participants' explanations, there seems to be a relatively poor understanding of both self-talk strategies at the early elementary level but some emerging understanding by the end of elementary school. It is notable that more adults did not provide adequate explanations for the self-talk strategies. We return to this point later.

3.2.3. Open-ended responses

Finally, we examined participants' responses to the initial, open-ended probe, "What would you tell Matt to do or think about to help him get his worksheet done?" These responses were unavailable for 6 participants due to equipment malfunction or denial of parent permission to audiotape. Of the remaining 58 participants, all of the adults ($n = 15$; 100%), most of the fifth graders ($n = 11$; 73%), a majority of the third graders ($n = 9$; 64%) and a minority of the first graders ($n = 5$; 36%) provided at least one suggestion that could be

[3] Preliminary analyses indicated that there were two cases in which participants' correct identifications differed across the example strategies for each set. Because this represented a small minority of cases (i.e., 2 of 20), data were combined across sets for analysis. These cases were, however, somewhat notable. In the first case, first graders were unusually likely to correctly identify the Set B example for performance self-talk. This may reflect an overestimate of their knowledge because their explanations revealed that they often interpreted the Set B example as a consequating strategy. In the second case, fifth graders were surprisingly unlikely to correctly identify the Set B example for interest enhancement. This may reflect an underestimate of their knowledge because their explanations revealed that they were concerned that the strategy would take too much time given the typical constraints of their classroom.

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Table 5
Percentage of responses to open-ended probe at each grade level categorized by motivation regulation strategy

Grade level	Motivation regulation strategy					
	Total suggestions	Environmental structuring	Self-consequating	Interest enhancement	Performance self-talk	Mastery self-talk
1st Grade	5	60%	40%	0%	0%	0%
3rd Grade	9	56%	22%	11%	11%	0%
5th Grade	13	46%	46%	8%	0%	0%
Adult	15	20%	73%	0%	7%	0%
Total	42	40%	50%	5%	5%	0%

Note. The "total suggestions" column reports the number of suggestions at each grade level that could be categorized as one of the five motivation regulation strategies. With the exception of two fifth graders, all participants provided only one suggestion, thus 40 participants provided the 42 suggestions presented here. Because of lack of parental consent to audiotape or equipment malfunction, open-ended responses were available only from 58 of the 64 participants (i.e., responses were not available from two first graders, two third graders, one fifth grader, and one adult).

categorized as one of the five motivation regulation strategies; a chi-square analysis revealed that this age difference was significant, $\chi^2(3, N = 58) = 14.26$, $p < .01$. Table 5 presents the percentage of responses by grade level that could be categorized as environmental structuring, self-consequating, interest enhancement, performance self-talk, or mastery self-talk. Responses that did not fit the criteria for any of these strategies were not included. These other responses primarily consisted of generic encouragements to finish (e.g., "just do it"), reassurances to the character (e.g., "he should just take his time so that he can make it nice and stuff"), or statements that the participant did not know what to suggest (e.g., "I have no idea").

As shown in Table 5, the two most common strategies offered in response to an open-ended probe were environmental structuring and self-consequating. Responses coded as environmental structuring were most often suggestions that the character keep his eyes focused on his worksheet rather than the playground outside. Examples of children's open-ended environmental structuring responses include, "I would tell Matt not to look outside and just to look at his worksheet" (first grader) and "I think she should, uhm, either turn her chair so then she's on this side so she can't see that side or just focus on her worksheet and not think about anything else" (third grader). Responses coded as self-consequating were most often suggestions that the character think about finishing his worksheet in order to subsequently play outside. Examples of children's open-ended self-consequating responses include, "maybe to think about maybe as soon as I get done with my worksheet then I can go outside and maybe that would encourage him to do it faster" (third grader) and "think like…if school's done and you haven't finished it then you would have to do it for homework and you wouldn't have any time to, you know, just goof around at home" (fifth grader). The frequent generation of environmental structuring and self-consequating strategies strengthens the conclusion that even some first grade children possess a robust understanding of these strategies for regulating motivation. Interestingly, no participants offered a mastery self-talk strategy and very few participants offered an interest enhancement or performance self-talk strategy. Although this may be due, in part, to younger children's inability to understand these more mental strategies, it also suggests that certain motivational strategies may be more natural remedies than others for the particular motivational dilemma used in the present study (cf. Wolters, 1998).

4. Discussion

Children's understanding that strategies can be used to effectively sustain motivation appears to increase through the elementary school years. In terms of both correct identifications and adequacy of explanations, adults demonstrated more knowledge of strategy effectiveness than did fifth graders, who demonstrated more knowledge than did third graders or first graders. By examining children's responses to the individual strategies, however, it was clear that age-related shifts primarily occurred in their understanding of the more mental, or abstract, strategies for regulating motivation. Indeed, no first graders and relatively few third graders could adequately explain why interest enhancement, performance self-talk, or mastery self-talk strategies would be helpful. By contrast, even the youngest children in the study demonstrated a reasonably solid understanding of the more concrete, or behavioral, strategies for regulating motivation.

Children's understanding of environmental structuring was particularly robust even among the first graders in the study. Similarly, the majority of children at all grade levels recognized that self-consequating would be effective, although there was a shift between third and fifth grade in the quality of their explanations. Perhaps early elementary children recognize self-consequating as a useful strategy because consequences are frequently imposed on them by adults, but lack a true understanding of *why* consequences can be motivating until the later elementary years. Indeed, previous research has shown that preschoolers draw on familiar social scripts to understand the motivational implications of means-end contingencies, although they do not necessarily know the underlying principle (Lepper, Sagotsky, Dafoe, & Greene, 1982).

The overall increase in knowledge of motivation regulation strategies from first grade to fifth grade is consistent with the linear increase Kuhl and Kraska (1989) observed from first to fourth grade, which supports the position that this type of strategy knowledge gradually develops over the elementary years. Moreover, the shift from understanding only concrete strategies to understanding mental strategies is consistent with the broader developmental literature on children's strategy knowledge in the domains of emotion regulation (Harris et al., 1981) and delay of gratification (Mischel & Mischel, 1983; Yates et al., 1987). There were, however, some surprisingly inadequate displays of knowledge among the older age groups in the present study. Most notably, only about half of the fifth graders and half of the adults provided adequate explanations for the self-talk strategies.

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Because secondary students have reported using self-talk strategies in previous research (Wolters, 1999; Wolters & Rosenthal, 2000), one would certainly expect adults to demonstrate a robust understanding of why these strategies would be effective. It is therefore likely that the explanations data in the present study provided an underestimate of participants' strategy knowledge. Indeed, participants were not repeatedly questioned about the justifications they provided, largely because such repeated probes appeared to make pilot participants uncomfortable. In order to encourage elaboration without creating an undue level of stress, perhaps future researchers could ask younger participants to provide explanations to a puppet.

Regardless of the number of prompts given, one might argue that an open-ended response format necessarily underestimates the knowledge of young children, who may have difficulty expressing their ideas. That a majority of even the youngest children in the study were able to adequately justify their responses for the concrete strategies speaks against this concern; nonetheless, it is possible that young children simply do not have the vocabulary or expressive skills to provide adequate justifications for the more mental strategies. It is for this reason that the *help*/*not help* question was essential. Even on this forced-choice measure for which language skills were largely irrelevant, there was an increase in correct identifications with age for the mental strategies but not the concrete strategies. This finding is particularly informative given the absence of age-based differences for the ineffective strategies, which rules out several alternative accounts based on response biases. If used alone, however, children's correct identifications may inflate their true knowledge of motivation regulation strategies. Indeed, a majority of even the youngest participants identified the mastery self-talk strategy as effective — perhaps because the particular examples used sounded too positive and task-relevant — but their explanations suggested a more limited understanding. Across these examples, it is clear that participants' open-ended and forced-choice responses must be considered in concert, and that future research with young children should include both response formats.

It is also important to consider the particular motivational dilemma that was presented to participants — a character who "thinks about how much more fun it would be to play outside than to work on his worksheet, but…knows that he has to get it done." This is especially true for participants' responses to the initial open-ended question about what the character might do or think to help him finish the worksheet, which relied heavily on the particular dilemma described and its accompanying illustration. Although we intentionally generated a dilemma that characterized the underlying motivational problem rather broadly, it is possible that our dilemma was more conducive to some motivation regulation strategies than others (cf. Wolters, 2003). For example, environmental structuring and self-consequating could be particularly useful strategies for this dilemma in that the former serves to block out the distraction of the playground (which was clearly and specifically depicted in the illustration) and the latter serves to focus attention on a potent reward that is contingent upon task completion. This conclusion is supported by the high frequency with which these two strategies were provided. Specifically, 40% of the open-ended responses were coded as environmental structuring and 50% were coded as self-consequating. The remaining 10% of responses were coded as either interest enhancement or performance self-talk, which suggests that the dilemma was, in fact, broad enough to support these types of responses. The appearance of these mental strategies at all in the open-ended responses is impressive given that the vast majority of participants provided only one response. Probing for additional responses in future research, therefore, may evoke more suggestions to use some of the less obvious, more sophisticated strategies — at least among older participants.

Future research on children's knowledge of motivation regulation strategies in different contexts may also generate a different variety of responses. For example, an illustration that does not include a view of the playground may be less conducive to environmental structuring or self-consequating responses and thereby evoke a greater variety of suggested strategies. Likewise, an illustration depicting a report card and colored pens may be more conducive to performance self-talk and interest enhancement responses, respectively. More generally, children's ability to identify and explain the effectiveness of motivation regulation strategies may differ if they are faced with tasks that are explicitly described as irrelevant, tedious, or difficult (see Wolters, 1998). It is possible that young children would show a better understanding of mental strategies for coping with an explicitly irrelevant task as compared to the unspecified worksheet described in the present study. On the other hand, it is notable that the youngest children in the present study were largely unable to see *any* possible value of the mental strategies when asked explicitly about their effectiveness. Indeed, first graders thought that using the interest enhancement strategy (e.g., pretending to be a spy cracking a code) would be categorically unhelpful.

More broadly, it is important to consider the cultural context in which children develop an understanding of these motivation regulation strategies. For example, American children (particularly white, middle class children) may be explicitly or implicitly taught that they are supposed to deny themselves indulgences until their work has been completed successfully, at which point they have earned the right to enjoy tangible rewards (Spence, 1985). In this vein, it would be interesting to explore the possibility that less materialistic cultures may employ self-consequating less readily than their American counterparts. It would furthermore be worthwhile to compare capitalist and non-capitalist cultures insofar as it has been suggested that the inherent competitiveness of the former may contribute to a desire to win or outperform others (Spence, 1985). One might expect, therefore, that the use of performance self-talk as a means of motivation regulation would differ dramatically across these contexts. These hypotheses aside, it is quite likely that the particular manifestation of motivation regulation strategies observed in the present study was influenced by the culture in which participants were embedded.

Another important direction for future research concerns how children's knowledge of strategies bears on their actual use of such strategies when faced with motivational obstacles. Researchers in the self-regulated learning tradition have argued that strategy knowledge is a necessary condition of effective strategy use (Dembo & Eaton, 2000; Pintrich & DeGroot, 1990; Wolters, 2003; Wolters & Rosenthal, 2000). Indeed, it is difficult to imagine that students would regularly use motivation regulation strategies if they did not understand when, how, or why such strategies should be implemented. In support of this argument, Kuhl and Kraska (1989) found that German children's knowledge of volitional control strategies was systematically related to their

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ability to focus on a task in spite of an attractive distractor. Similar links between strategy knowledge and strategy use have been found in the literature on resistance to distraction (Holtz & Lehman, 1995) and delay of gratification (Rodriguez, Mischel, & Shoda, 1989). It is likely, then, that children's knowledge of the five motivation regulation strategies tested in the present investigation would predict the use of these strategies for coping with motivational obstacles, but future research is needed to support this hypothesis.

Considering the relationship between strategy knowledge and strategy use also begs the question of whether or not motivation regulation strategies would be helpful if they were explicitly taught. Research on children's task engagement in other domains has shown that young children are capable of using mental or abstract strategies effectively following explicit instruction, even though they do not spontaneously generate such strategies of their own accord (e.g., Moore, Mischel, & Zeiss, 1976; Patterson & Mischel, 1975). For example, Lepper and Gilovich (1982) found that four- to six-year-old children completed a monotonous task more quickly when taught to use an interest enhancement strategy (e.g., pretending to be a space robot) than when not given a strategy to use. Although it is unclear if these children would spontaneously use such strategies in the future, their receptivity to instruction suggests that explicit motivation strategy instruction in early education is an important topic for future research (see also Corno, 2001; Corno & Kanfer, 1993; Dembo & Eaton, 2000; McCann & Turner, 2004). Of course, strategy instruction is inherently challenging (see Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989), but if teachers and parents introduced these tactics at the elementary level, perhaps more children would have the tools to sustain motivation and achievement through the rest of their years in school.

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