

# Interpreting Correlations Between Children's Perceived Control and Cognitive Performance: Control, Agency, or Means–Ends Beliefs?

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The types of beliefs responsible for correlations between children's perceived control and cognitive performance were investigated in 180 2nd, 4th, and 6th graders. Children were interviewed for control beliefs regarding the attainment of desired goals, for agency beliefs regarding the accessibility of different types of means to the self, and for means–ends beliefs regarding the efficacy of different types of means. Cognitive performance variables included fluid and crystallized intelligence as well as short-term and recognition memory. Of the three types of beliefs, only agency beliefs were strongly and consistently related to cognitive performance. Correlations were greater than zero beginning in 4th grade, increased monotonically from 2nd to 6th grade, and occurred for all cognitive performance measures.

Children who believe important outcomes are contingent on their own actions or attributes have repeatedly been found to show higher levels of performance on school grades, standardized intelligence tests, and achievement test scores, as compared with children who believe that important outcomes are not contingent on their own actions and attributes (Findley & Cooper, 1983; Stipek & Weisz, 1981). In the terminology of locus-of-control theory, cognitive performance tends to correlate positively with *internal*, and negatively with *external* locus of control. In Findley and Cooper's meta-analysis of 98 studies of the relation between locus of control and cognitive performance, 98% of the significant correlations reported were in the direction stated. The average correlation was low ( $M_r = .18$ ), but the probability of such a cumulative effect is less than one in a million.

Although such findings have proved to be robust, interpretation is difficult because of ambiguities regarding the locus-of-control construct. For example, previous research has not clearly distinguished between locus of control as such and expectations of success, but expectations of success have also been found to correlate with cognitive performance (see review by Eccles, 1983). Thus, internal locus of control might correlate with cognitive performance, not so much because of the relative

internality or externality of the causes involved, but simply because children believe that internal causes are more likely to lead to success.

Another ambiguity regarding the locus-of-control construct involves the very meaning of *internality* and *externality*. On one hand, these terms can refer to the *general* location of control, internality to causes (such as effort and ability) that reside within persons, and externality to causes (such as powerful others or luck) that reside outside persons in general. On the other hand, these same terms are often used to refer to the extent to which a *particular* person has access to an effective cause; in this case, internality refers to the individual's possession of the cause (e.g., high ability) and externality to the lack of it (e.g., low ability). These two usages have not been clearly differentiated in most conceptualizations of locus of control. Thus, internality has been understood to mean that a given individual has access to a cause that also tends to reside within persons generally, and externality has been variously used to refer to an individual's lack of access to certain causes or to the prevalence of causes that lie outside persons in general. The importance of separating these different usages has been discussed by a number of commentators representing developmental psychology (M. M. Baltes & Baltes, 1986; Weisz, 1983; Weisz & Stipek, 1982), self-efficacy theory (Bandura, 1982), the reformulated learned helplessness theory (Abramson, Seligman, & Teasdale, 1978), sociological perspectives (Gurin & Brim, 1984), and action-theoretical approaches to developmental psychology (Chapman & Skinner, 1985; Schneewind, 1985; Skinner & Chapman, 1984).

Finally, the bipolarity of the locus-of-control construct has also been questioned. Typically, locus of control has been conceptualized and measured in terms of a single, bipolar dimension of internality–externality. Thus, Lefcourt (1976, p. 27) referred to “the generalized expectance of internal *as opposed to* [italics added] external control of reinforcement.” Critics of the bipolar construct have argued instead (a) that beliefs in internal control and beliefs in external control may be independent of

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one another in their relations to performance and (b) that both internality and externality may have various aspects that also function more or less independently of each other (Connell, 1985; Lachman, 1986; Levenson, 1973; Skinner & Chapman, 1984). For example, beliefs in external control by powerful others may be differently related to performance outcomes than beliefs in external control due to chance, luck, or unknown causes.

In order to determine which aspects of children's perceived control account for the reported correlations between such beliefs and cognitive performance, a measurement scheme is necessary in which those various aspects are differentiated. One such measurement scheme is provided by the authors' action-theoretical conceptualization of perceived control (Skinner, Chapman, & Baltes, 1988a, 1988b).

### Conceptualization of Perceived Control

Our approach to the study of perceived control is based on the general distinction between agents, means, and ends in action theory (Boesch, 1976; Brandtstädter, 1984; Chapman, 1984; Eckensberger & Meacham, 1984; Frese & Sabini, 1985; von Cranach, Kalbermatten, Indermühle, & Gugler, 1982). Persons' beliefs about the extent of their control over desired outcomes (ends) can be conceptualized in terms of their beliefs regarding the pairwise relations between themselves as agents and the means and ends of their potential actions (Skinner & Chapman, 1984; Skinner et al., 1988a). In particular, we have argued that the distinction between agents, means, and ends gives rise to three different types of beliefs. (a) *Control beliefs* refer to persons' beliefs about their capacity for obtaining desired goals without explicit reference to the means involved. (b) *Agency beliefs* refer to persons' beliefs about the relative accessibility of different categories of means to themselves as agents. (c) *Means-ends beliefs* refer to beliefs about the extent to which different categories of means are likely to result in a particular goal. In short, control beliefs refer to the relation between agents and ends, agency beliefs to the relation between agents and means, and means-ends beliefs to the relation between means and ends. The term *perceived control* is used in this article in a generic fashion to refer to all types of beliefs having to do with individuals' control over important outcomes, including the three types of beliefs just described.

This tripartite conceptualization was designed in part to provide a measurement scheme that avoids the ambiguities inherent in previous conceptualizations of perceived control. Thus, the assessment of control beliefs allows the investigation of children's expectations of success as such, and the distinction between agency beliefs and means-ends beliefs preserves the difference between the two senses of internality and externality mentioned earlier. Furthermore, both agency beliefs and means-ends beliefs are assessed for a variety of potential means, including some (effort and ability) that are generally located within agents and some (powerful others and luck) that are generally located "outside" agents. A detailed comparison between this conceptualization and previous ones is provided by Skinner et al. (1988a).

Evidence that the three sets of beliefs can be distinguished from each other empirically is also reported by Skinner et al.

(1988a). A total of 155 children from Grades 2, 4, and 6 were given the Control, Agency, and Means-Ends Interview (CAMI; see Skinner, Chapman, & Baltes, 1982, 1988a, 1988b) in order to assess their control, agency, and means-ends beliefs for the goal of "doing well in school." Agency beliefs included subscales defined by four categories of means (effort, ability, powerful others, and luck) and means-ends beliefs included subscales defined by five categories of means (effort, ability, powerful others, luck, and unknown causes). In factor analyses of individual items, the predicted three-factor solution was obtained, with factors marked by control, agency, and means-ends items, respectively. These results provide evidence for the psychological independence of control, agency, and means-ends beliefs and allow for the possibility that the three sets of beliefs will also be differently related to cognitive performance.

### Alternative Hypotheses Regarding Beliefs and Cognitive Performance

The major purpose of the present study was to determine what aspects of children's perceived control would correlate with their cognitive performance. On the basis of previous research literature, three alternative (but nonexclusive) hypotheses were considered:

1. Control beliefs would correlate positively with cognitive performance. This hypothesis is based on previously reported correlations between children's cognitive performance and their expectancies for success (Eccles, 1983), which in turn resemble control beliefs as described in the previous section.

2. Agency beliefs would correlate positively with cognitive performance. This hypothesis follows from the fact that cognitive performance has been found to correlate with self-efficacy beliefs (Bandura, 1982) and competency beliefs (Weisz & Stipek, 1982), both of which resemble agency beliefs as described in the previous section (see Skinner et al., 1988a, for a detailed comparison).

3. Means-ends beliefs for effort and personal attributes would correlate positively—and means-ends beliefs for powerful others, luck, and unknown causes would correlate negatively—with cognitive performance. This hypothesis is based on the assumption that internal locus of control (e.g., effort and personal attributes) should correlate positively with cognitive performance (Lefcourt, 1976; Rotter, 1966), and external locus of control should correlate negatively. Such negative correlations between cognitive performance and beliefs regarding powerful others, luck, and unknown causes have in fact been reported by Connell (1985).

As indicated in the references cited, evidence has been reported in support of each of the foregoing hypotheses. However, the evidence is not sufficient for discriminating among them because of the ambiguities in most measures of perceived control, as previously described. They can be disentangled only with a measurement scheme that differentiates the different types of beliefs involved.

### Developmental Trends

The second purpose of this study was to investigate age-related changes in correlations between perceived control and

cognitive performance in middle childhood. Consistent with the results of Findley and Cooper's (1983) meta-analysis, correlations were expected to emerge with development and become stronger with age across the primary grades. Such a developmental trend could result from either or both of two different causal effects: (a) Children's perceived control could increasingly reflect past performance (effect of performance outcomes on beliefs), or (b) children's perceived control could affect the amount of effort they exert in cognitive tasks and thereby the formation of cognitive skills over time (cumulative effect of beliefs on performance). In addition, spurious correlations between perceived control and cognitive performance could result if both variables changed linearly with age and individuals differed in the rates at which both changes occurred (P. B. Baltes, Reese, & Nesselroade, 1977). Although almost any measure of cognitive performance can be expected to show improvement with age, children's scores on the Control, Agency, and Means-Ends Interview generally do not increase with age during middle childhood. No age trend is found from 7-8 to 11-12 years in control beliefs or in agency beliefs for effort or for personal attributes, and a decreasing trend is found in agency beliefs for luck and in all means-ends beliefs scales. Only for agency beliefs for powerful others are age increases found (Skinner, Chapman, & Baltes, 1988b). Therefore, spurious positive correlations between these beliefs scales and cognitive performance should not result from correlated age changes, except possibly in analyses involving agency beliefs for powerful others.

### Domains of Cognitive Performance

One final question pursued in this study was the generality of correlations between perceived control and cognitive performance with respect to different domains of cognition: whether correlations would be limited to more narrowly defined intellectual skills such as are assessed by tests of psychometric intelligence, or whether perceived control would also correlate with broader information-processing abilities such as are used in short-term and recognition memory tasks. Psychometric intelligence measures were differentiated into fluid and crystallized intelligence (Cattell, 1971; J. L. Horn, 1978) in order to determine whether and to what extent perceived control would correlate differently with relatively content-rich measures of (crystallized) intelligence as opposed to relatively content-free measures of (fluid) intelligence.

### Method

#### Subjects

A total of 180 children, including 30 boys and 30 girls in the second, fourth, and sixth grades were sampled from the three elementary schools in a single school district of a major city in West Germany. Mean ages by grade were 8 years 3 months for second graders, 10 years 3 months for fourth graders, and 12 years 3 months for sixth graders. Children came from predominantly middle-class to lower middle-class backgrounds.

#### Measures

Each child was administered (a) the CAMI, (b) the BTS (Begabungstestsystem), a standard German intelligence test for children based on

the theory of primary mental abilities (W. Horn, 1972), and (c) a small battery of memory tasks, including measures of both short-term and recognition memory. These measures were administered in three 45-min sessions in the schools. The beliefs measures were administered to fourth and sixth graders in groups of approximately 10 children each, and to second graders individually. The BTS was administered in groups of 10 to all three grades. Memory tasks were administered to all children individually.

*Control, Agency, and Means-Ends Interview.* The CAMI is a 64-item inventory for assessing children's control, agency, and means-ends beliefs regarding school performance. A complete description of the instrument, its construction, psychometric properties, and individual items is provided by Skinner et al. (1988a). In general:

1. Control beliefs items ( $n = 8$ ) refer to the capability of the agent (the respondent) in obtaining positive performance outcomes (or avoiding negative ones) without explicit reference to any intervening means. Examples of control beliefs items include "If you decide to learn something really hard, can you do it?" (positive outcome), and "I'll bet you don't like to get bad grades. Can you do anything to keep from getting any?" (negative event).

2. Agency beliefs items ( $n = 16$ ) refer to the extent to which the agent can access four potential means (effort, ability as a personal attribute, powerful others, and luck) in the pursuit of a goal. Examples of agency beliefs items include "What do you think? Do you try as hard as you can in school?" (agency for effort), "Are you smart in school—even without studying a lot?" (agency for ability), "When you want them to, will your teachers help to see that you do good in school?" (agency for powerful others), and "What do you think—are you a person who has luck with your homework?" (agency for luck). Because agency beliefs items pertain to the means for performance outcomes rather than to the outcomes themselves, positive and negative outcomes are not distinguished.

3. Means-ends beliefs items ( $n = 40$ ) refer to the effectiveness of potential means in bringing about positive performance outcomes or avoiding negative ones. Five types of means were considered: effort, ability as a personal attribute, powerful others, luck, and unknown causes. In positive items, children were asked if the presence of the means results in the occurrence of the outcome: "When kids give the right answers to teachers' questions, is it because they try really hard?" (effort), "What would you say: When a kid does good in school, is it because the kid's just smart?" (ability), "Let's say a kid gets good grades. Is that because the kid gets along good with the teacher?" (powerful others), "Is doing well in school a matter of luck?" (luck), and "When kids do better than usual in a subject, it is hard to tell why?" (unknown). In the corresponding negative items, children were asked if the absence of the means results in the nonoccurrence of the outcome: "A teacher asks a kid a question and the kid gives the wrong answer. Is that because the kid isn't trying hard enough?" (effort), and similarly for the other types of means.

Children responded to each CAMI item by choosing one of four possible choices on a 4-point scale ranging from *almost never*, through *not very often* and *often*, to *almost always*. In individual administration (recommended for children 8 years of age or under), children answered the examiner's question with *yes* or *no*, and were then asked to choose between the two remaining alternatives on the 4-point scale. If children replied *yes*, then they were asked "*Often?* or *almost always?*" and so on. In group administration, the examiner reads the questions aloud and children answer by marking one of the four alternatives on their own copy of the questionnaire.

As reported by Skinner et al. (1988a), the internal consistency of control beliefs was .81, that of agency beliefs scales ranged from .61 to .76 ( $M = .68$ ), and that of means-ends beliefs ranged from .70 to .90 ( $M = .80$ ). These estimates of reliability compare favorably with those of other frequently used measures of children's perceived control (Halpin & Ottinger, 1983). Because age differences in correlations involving

CAMI scales were of interest in this study, an important preliminary was to determine whether the reliabilities or variances of the scales were equivalent across age. Otherwise, correlations might be differentially attenuated with age (P. B. Baltes et al., 1977). As reported by Skinner et al. (1988b), neither the reliabilities nor the variances of CAMI scales varied appreciably by age. Average split-half reliabilities across scales were .65 for 7–9-year-olds, .57 for 9–10-year-olds, and .61 for 11–12-year-olds. Average standard deviations were .54, .55, and .51 for the same three age groups, respectively. Therefore, age differences in correlations involving CAMI scales are unlikely to result from age differences in the reliabilities of or variances of those scales.

In the present study, one of the parallel-half forms of the CAMI was used (Skinner et al., 1988a). In addition, means–ends beliefs for luck and for unknown causes were combined into a single category of *indeterminate causes*. Thus, the total number of items was reduced to 28 (4 for control, 8 for agency, and 16 for means–ends). Because of theoretical considerations (described in the Discussion section), as well as previous empirical analyses, positive and negative scale items were not expected to correlate differently with cognitive performance. In factor analyses of both individual items and scale scores, control beliefs and means–ends beliefs for positive and negative items always loaded positively on the same factors (Skinner et al., 1988a). Intercorrelations between positive and negative subscores for each scale were relatively high, ranging from .40 to .81 ( $M_r = .57$ , all  $ps < .001$ ). In order to check the assumption of no positive–negative differences, however, correlations involving positive and negative items taken separately were compared, as reported in the Results section.

**Intelligence scales.** In order to tap relatively “context-free” and “content-rich” aspects of psychometric intelligence (i.e., fluid and crystallized intelligence, respectively), four subscales from the BTS were included in this study: figural patterns, letter series, arithmetic, and spelling. Two of these scales were chosen as marker variables for fluid intelligence (figural patterns and letter series) and two as markers for crystallized intelligence (arithmetic and spelling). Spearman-Brown split-half reliability coefficients for the fluid and crystallized intelligence measures were .92 and .97, respectively. These reliabilities did not differ by age: .88 and .92 for second graders, .89 and .92 for fourth graders, and .84 and .95 for sixth graders, respectively. Raw scores on each measure were standardized for the following analyses.

**Memory tasks.** Short-term memory was assessed by backward and forward digit span. In each case, scores were the maximum number of digits children correctly recalled on two of three trials. In other respects, administration followed the procedures prescribed for the backward and forward digit-span subscales of the Wechsler Intelligence Scale for Children (Wechsler, 1974). Because the differences between backward and forward digit span was of no interest in this study, the two scores were added together to form a combined digit-span score.

Recognition memory for words was assessed by presenting children with 20 to-be-remembered items, 10 of which occurred twice, and 10 of which occurred a total of four times. Because frequency of occurrence was of no interest in this study, frequency was ignored in computing the error scores described later. Items were presented by tape recorder at the rate of 4-s per word. Order of presentation was counterbalanced across subjects.

In the test phase of the task, children were presented with lists of 40 words, including the 20 items they had previously seen, plus 20 new items. Children’s scores were the sum of their errors (misses plus false alarms). This measure of “sensitivity” is known to be highly correlated with  $d'$  (Underwood, 1974). Spearman-Brown split-half reliability was .84, and did not differ appreciably by age: For second, fourth, and sixth graders, respectively, the estimated reliabilities were .86, .86, and .76. Scores on short-term and recognition memory were standardized and combined in an overall memory performance score.

Table 1  
*Correlations Between Overall Cognitive Performance and CAMI Summary Scores*

CAMI scores	Grade		
	2	4	6
Control beliefs	-.04	.27*	-.11
Agency beliefs	-.02	.40**	.54**
Means–ends beliefs	-.12	-.01	.19

Note. Each correlation is based on 60 subjects. CAMI = Control, Agency, and Means–Ends Interview.

\*  $p < .05$ . \*\*  $p < .01$ .

## Results

### *Control, Agency, or Means–Ends Beliefs?*

Estimates of the association between overall cognitive performance and the three types of beliefs measured by the CAMI were obtained by correlating a linear combination of the individual cognitive performance measures (equally weighted) with control beliefs scores and with linear combinations (equally weighted) of individual agency beliefs and means–ends beliefs scale scores, respectively. These correlations are presented by grade in Table 1.

Control beliefs were significantly correlated with cognitive performance at a relatively low level ( $r = .27$ ) for fourth graders only, and agency beliefs were significantly correlated with cognitive performance for both fourth and sixth graders ( $r = .40$  and  $.54$ , respectively). Means–ends beliefs were not significantly correlated with performance at any grade. The hypothesis that the correlations for control, agency, and means–ends beliefs were different from each other within each grade was tested using Steiger’s  $X_2$  statistic. As described by Steiger (1980),  $X_2$  is a test statistic based on generalized least squares estimators for comparing two or more elements of a correlation matrix. Among second graders, correlations involving the three types of beliefs did not significantly differ,  $X_2(2) = .49$ . Among fourth graders, the difference was marginally significant,  $X_2(2) = 5.77$ ,  $p < .06$ , and among sixth graders, it was highly significant,  $X_2(2) = 13.64$ ,  $p < .005$ . Follow-up tests indicated that in Grade 4, the correlation for agency beliefs was higher than that for means–ends beliefs,  $X_2(1) = 5.60$ ,  $p < .02$ , but not higher than that for control beliefs,  $X_2(1) = .62$ . In Grade 6, the correlation for agency beliefs was higher than that for both control beliefs,  $X_2(1) = 13.43$ ,  $p < .001$ , and means–ends beliefs,  $X_2(1) = 4.84$ ,  $p < .05$ .

### *Grade Differences*

To determine whether the magnitude of the relation between agency beliefs and cognitive performance differed significantly by grade, a test of homogeneity of regression was computed (Cohen & Cohen, 1975). The logic of this analysis is analogous to that of analysis of variance, except that between-group differences between the slopes of regression curves are tested, rather than differences between means. In addition to the over-

Table 2  
*Homogeneity of Regression Analysis*

Equation	$\beta$	$R^2$	<i>F</i> (2, 175) for $R^2$ change
1. Cognitive performance regressed on Agency beliefs	.24**	.57**	—
Grade	.81**		
2. Cognitive performance regressed on Agency beliefs	.25**	.62**	10.17**
Grade	-.20		
Agency $\times$ Grade			
Grades 2 vs. 4 + 6	.96**		
Grades 4 vs. 6	.40*		

*Note.* Test statistics relevant to the hypotheses are indicated in italics. The overall test of grade differences in the relation between agency beliefs and cognitive performance is given by the test of  $R^2$  change. Tests of specific grade comparisons are given in the significance levels of the corresponding  $\beta$  weights.

\*  $p < .05$ . \*\*  $p < .001$ .

all test of between-group differences, tests of specific group differences can also be built into the analysis.

The homogeneity of regression analysis is presented in Table 2. The overall test of between-group differences is obtained by comparing two regression equations in terms of the amount of explained variance ( $R^2$ ). In Equation 1, cognitive performance is regressed on agency beliefs and grade. In Equation 2, cognitive performance is regressed on the same variables, plus two Agency  $\times$  Grade interaction terms representing orthogonal comparisons (a) between Grade 2 and Grades 4 and 6 and (b) between Grades 4 and 6. As shown in the column labeled "*F*(2, 175) for  $R^2$  change," Equation 2 explains significantly more variance in cognitive performance than does Equation 1, indicating that the relation between agency beliefs and cognitive performance differs significantly by grade. Tests of the specific group comparisons are given in the significance levels of the corresponding beta ( $\beta$ ) weights. As shown at the bottom of the table, the  $\beta$ s of both Agency  $\times$  Grade comparisons were statistically significant, indicating that regression slopes differed significantly both (a) between second grade and the two higher grades and (b) between fourth and sixth grades. In summary, the strength of relation between agency beliefs and cognitive performance increased monotonically from second to sixth grade.

### *Individual Measures*

In addition to the correlations between overall cognitive performance and CAMI summary scores presented in Table 1, correlations were also computed between individual cognitive performance measures and individual CAMI scales. The purpose of this analysis was to determine if the pattern of correlations found for summary scores was representative of that for the individual variables. The correlations between the individual

CAMI scales and the individual cognitive performance measures are presented by grade in Table 3.

For control beliefs, the only significant correlation was with crystallized intelligence in Grade 4. For agency beliefs, the effort, ability, and luck scales conformed to the general pattern found for the summary score. In Grade 2, none of these three scales correlated with any of the individual cognitive performance measures; in Grade 4, five of the nine possible correlations involving these scales were statistically significant; in Grade 6, all nine possible correlations were statistically significant. Agency beliefs for powerful others did not conform to this pattern. This scale correlated negatively with fluid intelligence in Grade 2 and positively with both crystallized intelligence and memory performance in Grade 4. For means-ends beliefs, three low, but significant correlations were found. However, this number did not differ greatly from that expected by chance ( $=1.8$ ), nor did the significant correlations conform to any discernable pattern.

### *Positive Versus Negative Outcomes*

The possibility that the CAMI control beliefs and means-ends beliefs scales might not have correlated with cognitive performance because they mix items pertaining to positive and negative outcomes was examined by comparing correlations computed for positive and negative items separately. Using Steiger's (1980)  $X_2$  statistic, five positive-negative comparisons (one each for control beliefs and for the four means-ends beliefs scales) were tested within each grade. In order to maintain an overall alpha level of .05 within grade, a Bonferroni criterion of .01 ( $= .05/5$ ) was used for each comparison. This analysis revealed only one significant difference: In Grade 6, the correlations between overall cognitive performance and means-ends beliefs for effort (positive vs. negative items) were  $r = -.01$  and  $r = .36$ , respectively,  $X_2(1) = 8.02$ ,  $p < .005$ . The belief that school success is attributable to effort was unrelated to cognitive performance, but children who believed that failure is attributable to lack of effort tended to have higher cognitive performance scores than did children without this belief.

### Discussion

Within the limits of the measures used and the age range sampled, the results of this study provide tentative answers to the questions raised at the beginning: (a) By sixth grade, agency beliefs were more strongly correlated with cognitive performance than were control beliefs or means-ends beliefs. (b) Correlations between agency beliefs and cognitive performance emerged between second and fourth grades, and further increased in strength from fourth to sixth grade. (c) Among fourth graders, agency beliefs were correlated with both fluid and crystallized intelligence, and among sixth graders, they were correlated with all three individual measures of cognitive performance.

The fact that agency beliefs were most strongly and consistently correlated with cognitive performance suggests that previously reported correlations between internal locus of control and cognitive performance (Findley & Cooper, 1983; Stipek & Weisz, 1981) might have resulted more from subjects' beliefs

Table 3  
*Correlations Between Individual Cognitive Performance Measures and CAMI Scales*

CAMI scales	Cognitive performance measures (by grade)								
	Fluid			Crystallized			Memory		
	2	4	6	2	4	6	2	4	6
Control beliefs	-.04	.21	-.19	-.09	.33**	-.02	.03	.07	-.06
Agency beliefs									
Effort	-.08	.24*	.28*	.07	.42**	.38**	.15	.04	.42**
Ability	.05	.04	.24*	-.09	.26*	.50**	-.07	.09	.47**
Powerful others	-.22*	.15	-.02	-.15	.26*	.05	-.09	.28*	-.04
Luck	.16	.23*	.34**	.14	.40**	.44**	-.01	.18	.38**
Means-ends beliefs									
Effort	.02	.03	.15	-.14	.15	.15	-.14	.06	.18
Ability	-.03	-.06	-.01	.15	-.07	.22*	.06	-.23*	.10
Powerful others	.04	.21	.13	-.13	.09	.14	-.20	-.14	-.06
Indeterminate	-.22*	-.05	-.03	.02	-.06	.03	-.03	-.05	-.08

Note. Each correlation is based on 60 subjects. CAMI = Control, Agency, and Means-Ends Interview.  
 \*  $p < .05$ . \*\*  $p < .01$ .

that effective means were available to themselves as agents (agency beliefs) than from mere expectancies for success (control beliefs) or from beliefs about the effectiveness of different types of means (means-ends beliefs). As described earlier, bipolar conceptualizations of the locus-of-control construct confound these different types of beliefs. At the very least, the finding that agency beliefs correlated with performance, and means-ends beliefs did not, underscores the empirical importance of distinguishing between them. This finding cannot merely be attributed to the fact that agency beliefs items refer to the self and means-ends beliefs items to children in general; means-ends beliefs items referring to the self have also been found not to correlate with performance outcomes (Skinner, Schindler, & Tschechne, 1988). The difference between agency beliefs and means-ends beliefs with respect to correlations with cognitive performance is therefore likely to reflect the intended differences in their respective structures (access to means vs. means-ends relations). The fact that agency beliefs for powerful others showed a different pattern of correlation with cognitive performance than did the other agency beliefs scales, further indicates the usefulness of assessing different categories of means separately.

#### *Positive Versus Negative Outcomes*

The present finding that control beliefs and means-ends beliefs for positive versus negative outcomes did not correlate with cognitive performance in opposite directions contrasts with the results of previous studies (Crandall, Katkovsky, & Crandall, 1965; Mischel, Zeiss, & Zeiss, 1974; Nolen-Hoeksema, Girgus, & Seligman, 1986). We would argue that the latter findings reflect the fact that causal attributions typically mix means-ends beliefs and agency beliefs. For example, if children endorse a positive attributional item such as, "When I do well in school, it's because I'm smart," they affirm both (a) that ability is an important means for school success (means-ends belief) and (b) that they are smart themselves (agency belief). Such chil-

dren are unlikely also to endorse the corresponding negative item, "When I do poorly in school, it's because I'm dumb," because the latter implies the opposite agency belief (i.e., "I'm dumb"). Furthermore, positive and negative attributions are likely to be related differently to actual performance to the extent that children's agency beliefs about their own abilities accurately reflect performance outcomes.

If agency beliefs and means-ends beliefs are measured separately, however, children may affirm with perfect consistency both (a) that ability is a primary means for school success (means-ends belief for positive outcomes) and (b) that lack of ability is a primary cause of failure (means-ends belief for negative outcomes.) Therefore, one could predict that positive and negative means-ends beliefs would be positively correlated with each other (as in fact they are—see Methods section). Moreover, if causal attributions correlate with actual performance primarily because of their agency beliefs component, then means-ends beliefs measured separately (whether positive or negative) would not necessarily be expected to correlate with performance. With the exception of the significant correlation involving means-ends beliefs for effort (negative outcomes), the present results were generally consistent with this expectation. Explaining this exception raises the broader question regarding the causal mechanisms underlying children's beliefs and cognitive performance in general.

#### *Causal Mechanisms*

The developmental emergence of correlations between agency beliefs and cognitive performance could result from at least two different causal processes: Children's beliefs about their own capacities as agents might begin to be affected by veridical perceptions of their own past performance beginning in fourth grade. Alternatively, agency beliefs might actually begin to regulate children's performance sometimes after the fourth grade, so that children's beliefs regarding their access to effective means for achieving success in school might lead to a higher

investment of effort in cognitive tasks and thereby to higher performance levels (Kukla, 1972; Skinner & Chapman, 1984). These two interpretations are not mutually exclusive; reciprocal relationships might also be involved (Chapman & Skinner, 1985; Lachman, 1986).

Either interpretation might be invoked as well in explaining the positive correlation between means-ends beliefs for effort (negative events) and cognitive performance among sixth graders. Children who think failure can be avoided through effort might try harder and thereby perform better, or children who have tried hard and performed better in the past might be more likely to believe that effort is a good way to avoid failure. Because the general pattern across all grades and CAMI scales was one of no differences between correlations for positive and negative events, this result should not be overinterpreted.

The exact nature of the causal connection between agency beliefs and cognitive performance needs to be investigated in further longitudinal or experimental research. However, the identification of the specific aspects of beliefs involved in beliefs-performance relationships and the determination of the age at which such relationships emerge in development is an important preliminary to the testing of specific causal models. The present research suggests (a) that a multidimensional conception of agency beliefs regarding the individual's access to effort, ability, powerful others, and luck is likely to prove useful and (b) that relationships between agency beliefs and cognitive performance first emerge between second and fourth grade (roughly between 8 and 10 years of age).

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