DOCUMENT RESUME

ED 255 564 TM 850 207

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TITLE	tamemory and Motivatio: A Comparison of Strategy . e and Performance in German and American Children.
SPONS AGENCY	National Institutes of Health (DHHS), Bethesda, Md.; Volkswagen Foundation, Hanover (West Germany).
PUB DATE	Mar 85
GRANT	NIH-HD17648
NOTE	43p.; Paper presented at the Annual Meeting of the American Educational Research Association (68th, Chicago, IL, March 31-April 4, 1985).
PUB TYPE	Speeches/Conference Papers (150) -- Reports - Research/Technical (143)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Attribution Theory; Cognitive Style; Cross Cultural Studies; Cultural Influences; Foreign Countries; Grade 4; *Intelligence; Intermediate Grades; Learning Strategies; *Metacognition; Pictorial Stimuli; Predictor Variables; *Recall (Psychology); *Self Concept; *Student Motivation; Transfer of Training
IDENTIFIERS	Causal Models; *West Germany

ABSTRACT

The interrelationships among metamemory, intelligence, attributional beliefs, self-concept, and strategy use were observed in German and American children. Ninety-one American and 102 German fourth graders participated. After pretest assessment, children in the experimental conditions were trained to use a cluster rehearsal strategy on a Sort Recall task. Posttraining assessment included strategy maintenance and near-transfer tasks, and task-related metamemorial knowledge. The two samples differed in significant ways on metamemorial, attributional, strategic, and performance variables. Latent Variable Partial Least Squares (LVPLS) modeling procedures showed that different causal models were required to explain relationships among the cognitive and personality/motivational variables in the two samples. (A 39-item reference list is included.) (Author)

Metamemory and Motivation: A Comparison of Strategy Use and Performance in German and American Children

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Paper presented at the annual meeting of the American Educational Research Association, Chicago, 1985.

This research was supported, in part, by a grant from the Stiftung Volkswagenwerk and by NIH Grant #HD17648

Paper 2/1985

Abstract

The interrelationships among metamemory, intelligence, attributional beliefs, self-concept, and strategy use were observed in German and American children. Ninety-one American and 102 German fourth graders participated. After pretest assessment, children in the experimental conditions were trained to use a cluster rehearsal strategy on a Sort Recall task. Posttraining assessment included strategy maintenance and near-transfer tasks, and task-related metamemorial knowledge. The two samples differed in significant ways on metamemorial, attributional, strategic, and performance variables. LVPLS modeling procedures showed that different causal models were required to explain relationships among the cognitive and personality/motivational variables in the two samples.

Metamemory and Motivation: A Causal Analysis of Strategy Use in German and American Children

Metacognition refers to a person's knowledge about mental states, abilities and cognitive-communication processes. Metamemory, a specific type of metacognition, is defined as knowledge about memory processes and strategies (Brown,1978; Flavell, 1978; Flavell and Wellman, 1977). Knowledge about strategies provides essential information for the subsequent development of new learning skills and strategies during the early elementary school years. The first generation of research on metamemory established correlational relationships between metamemory and strategy use, with modest success (Schneider, 1985). Metamemory has been shown to be a predictor of children's use of learning strategies and their transfer of newly-acquired strategies (Brown, Campione, and Barclay, 1979; Borkowski and Cavanaugh, 1980; Waters, 1982). Nevertheless, an important causal question remains: is metamemory a prerequisite for strategy use, especially on difficult transfer tests?

The second generation of research on the causal consequences of metamemory is characterized by theoretical and methodological advancements (Pressley, Borkowski, and Sullivan, 1984; Schneider, Körkel, and Weinert, 1984). At a theoretical level, metamemory has been classified into four major components: specific strategy knowledge (i.e., information about how, when, where and why to use a wide range of strategies); relational strategy knowledge (i.e., comparative information useful in identifying similarities and differences among strategies); general strategy knowledge (i.e., recognition that effort often produces success and beliefs that learning outcomes can be controlled by effortful strategy deployment); higher-order knowledge about the use of superordinate, executive processes (Borkowski, Johnston, and Reid, 1985; Chi, 1983; Pressley et al., 1984). In terms of methodology, the use of experimental manipulations (Paris and Jacobs, 1984); Palinscar and Brown, 1984) and causal modeling procedures (Kurtz and Borkowski, 1985) have been used to investigate the ways in which various components of metamemory directly influence strategy use and performance. For example, Schneider, Körkel, and Weinert (1984) employed causal modeling to assess relationships among potentially interrelated concepts, including attributions, metamemory and memory behavior. A causal connection was established between metamemory, strategy use, and memory performance when intelligence, self concept, and causal attributions were partialed out. However, intelligence and motivation were found to have an impact on metamemory which in turn had a significant direct effect on strategy use and memory performance. Thus, the second generation of research on metamemory phenomena searches for causal properties and interactive variables, such as general intelligence, motivation, and self-esteem. This approach is particularly important for understanding successes and failures in strategy generalization (Borkowski and Cavanaugh, 1979).

The purpose of the present study was to examine the interrelationships among metamemory (specific strategy knowledge about a to-be-learned strategy as well as knowledge about other "irrelevant" strategies), intelligence, attributional beliefs, perceived competence, and strategy use. The rationale is tied to a hypothesized link between metamemory theory and personality-motivation theory (Borkowski, Johnston, and Reid, 1985). Children who possess a mature understanding of the importance of strategy use for producing good performance tend to believe that their own effort is responsible for success rather than uncontrollable factors such as luck or task difficulty. A long-term reciprocal pattern of strategy use and emerging beliefs about controllable learning outcomes would likely heighten self-esteem (cf. Harter, 1981; Weiner, 1983).

Literature from diverse areas gives credibility to the hypothesized links between metamemory, strategy use, attributional style, and perceptions of self-competence. For instance, Weiner (1979) found that people who attribute success to their own ability or to effort had greater subsequent achievement motivation and a greater likelihood of engaging in challenging tasks. Carrying the scenario one step further, Fabricius and Hagen (1984) found that causal beliefs predicted strategy use better than verbalized statements about memory processes. In addition, Kurtz and Borkowski (1984) discovered that among strategy-trained children, those who attributed success to effort were higher in metamemory and more strategic on transfer tests than those who attributed task outcomes to noncontrollable factors. Salili, Maehr, and Gillmore (1976) found striking cultural differences in the development of causal attributions. For instance, Iranian children chose ability as a reason for successful performance more often than U.S. children, who preferred effort as the most appropriate explanation. This study sets the stage for contrasting the emergence of strategy use in young children from two Western cultures (the U.S. and West Germany) as a function of motivational variables and cognitive training.

In the initial sessions of the experiment, fourth graders were given several tests of intelligence and metamemory. General metamemorial knowledge about a variety of rehearsal and retrieval processes, specific metamemorial knowledge about organizational processes (the to-be-trained strategy), attributional beliefs, and reports about self-competence were assessed. Next, a picture memory task, requiring organizational activity for good performance, was presented. Following the sorting of the pictures, children were asked to predict how many items they would recall (memory monitoring) and then to actually recite as many pictures as possible. Then strategy training commenced: children in an experimental condition were given instructions on a clustering-rehearsal strategy useful for improving recall, and children in a control condition were given no strategy instructions. In the final sessions, near generalization, strategy maintenance and metamemory were tested in order to determine the long-term impact of training. The intent of this longitudinal study was to use causal modeling procedures to assess the respective roles of metamemory, motivation, and personality in leading to strategy transfer.

Method

Subjects

Ninety-one fourth grade children from three parochial schools in South Bend, Indiana, and 102 children from Munich, West Germany, served as subjects. All children were Caucasian; half were female and half male. The mean age of the U.S. sample was 9.7; the mean age of the German sample was 9.4. In the U.S. sample, 70 children were assigned to the training condition, and 80 children were in the German training condition. Seven U.S. children and 17 German children failed to complete all of the testing sessions.

Design

Each subject participated in seven 30-minute sessions with all testing and training conducted within the classroom in groups of 15 to 20. The design and tasks are shown in Table 1. Pretraining assessment of strategic behavior, know-

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Insert Table 1 about here

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ledge, and attributional variables was conducted in Sessions

1 through 3. In Session 1 the Culture Fair Intelligence test (Cattell and Weiss, 1977), the Verbal Comprehension subtest and the word classification subtest of the Cognitive Abilities Test (Heller, Gädicke and Weinläder, 1976), three subtests of Harter's Scale of Intrinsic Versus Extrinsic Orientation to the Classroom (1980), and the general attribution questionnaire (Krause, 1983) were given. In Session 2 the Perceived Competence Scale (Harter, 1979), and a Sort Recall for Pictures (Picture) task were given. A metamemory battery was given in Session 3. At this point, children were randomly assigned to experimental or control conditions. In Sessions 4 and 5, children in the experimental group were taught how to use taxonomic organization to improve recall. A Sort Recall for Words (generalization test) and self concept tasks were given in Session 7. Sessions were separated by one week intervals, except for a 5-week period between Sessions 6 and 7.

Materials and Procedure

The Culture Fair Intelligence Test (Cattell and Weiss, 1977) consisted of twelve geometric patterns with one part missing in each item. The child was instructed to identify which of five possible answers correctly completed the geometric pattern; 5 min. were provided. The verbal comprehension subtest of the Cognitive Ability Test (Heller, Gädicke et al. 1976) contained 25 items. Children selected a word out of five possible choices that corresponded most closely in meaning to the key word. All items were read aloud to the children as they scanned the booklet. In the Word Classification Test, children were given three or four semantically related words, and were asked to select from a list of five or six the word that was most closely related to the cue words. One point was given for each correct answer with a total of 25 items. The first three items were read aloud by the experimenter; children worked alone for seven minutes on the remaining items.

The Curiosity-Interest, Independence Mastery, and Preference for Challenge subtests of Harter's Scale of Intrinsic Versus Extrinsic Orientation in the Classroom were given, using six items from each subtest. Items consisted of bipolar statements designed to measure locus of control. Children were instructed to choose one of the two clauses in each item that most accurately described their feelings, and then to mark their degree of confidence -- that is, whether the statement was really true for them or sort of true for them. (e.g.,"Some kids read things because they are interested in the subject, but other kids read things because the teacher wants them to.") Mean scores for the three subtests were computed for each child; a score of 4 represented an intrinsic orientation and a mean score of 1 represented an extrinsic orientation.

A general attribution questionnaire, developed by Krause (1983), consisted of four success and four failure situations in the classroom, such as a spell-down, geography test, composition assignment, and math homework. For example, "You got all the words right on the weekly spelling test. Why did this happen?" For each item, the child ranked two of five conditions as being the first or second most important reason for success and failure. The five conditions were: luck, outside help, effort, ability, and task characteristics (it was hard/ /it was easy). Three points were given for the reason ranked first and 1 point was given for a reason ranked second. Thus each child had ten scores: five for success and five for failure questions, each with a maximum of 16 points. Krause (1983) has shown that this method of assessing attributions about academic successes and failures has adequate psychometric properties.

In Session 2, the Perceived Competence Scale (Harter, 1979) and the Picture task were given. Portions of the Cognitive and Social subtests of the Harter scale were used. Three items were included from each category, each containing two bipolar statements, one indicating perceived competence and the other indicating perceived incompetence. Children were told to select the statement for each item that most accurately represented their self-perceptions. For example, "Some kids find it hard to make friends but for other kids it's pretty easy". One point was given for each response that showed high perceived competence.

In the Picture task each child was given a magnetic board and a set of 24 pictures of common objects, mounted on 4 x 4 cm cardboards with a magnet attached to the back of each. The pictures were classified according to categories (e.g., clothes, vehicles, animals) with six items in each category. Each child was given a metal magnetic board, instructed to arrange the pictures on the board, and then study them. After two minutes of study, the metal boards were collected. The children were first asked to write down their prediction of how many pictures out of 24 they would remember correctly; then they were given three minutes to write down all of the individual items they could remember. Finally, a second estimate was made of the number of pictures that might be remembered if a new set of 24 pictures was presented, using the same procedure and length of study time. The arrangement on each metal board was photographed and served as a record of organizational behavior; ARC scores were computed from the study arrangements (Roenker, Thompson, and Brown, 1971). This score provided a measurement of clustering behavior for each subject independent of the number of correctly recalled items.

A metamemory test was given in Session 3. The test included 11 items, four of which were originally developed by Kreutzer, Leonard, and Flavell (1975). The test measured task-related strategy knowledge (organization and rehear al) and unrelated strategy knowledge (strategies for retrieving information, remembering an event, memory prediction accuracy, ease of gist vs. rote recall). All questions in the batt ere read aloud by the experimenter. The total possible score for task-unrelated metamemory knowledge was 16 points. The maximum score for task-specific metamemory knowledge (i.e., knowledge of organizational strategies) was 12 points. See Kurtz and Borkowski (1984) for more details about procedures and subtests.

Sessions 4 and 5 were training sessions. Strategy training generally adhered to procedures developed by Gelzheiser (1984) for teaching clustering-rehearsal. Session 4 focused on the purposes and uses of taxonomic organization. Children in the experimental condition were told that the objective of taxonomic organization is to put things that are alike into groups, and that the purpose of organization is to improve memory. Other methods of organization (e.g., by time, pattern or random order) were contrasted with taxonomic organization. Emphasis was placed on understanding organization through performing two practice sets and discussing reasons for specific organizational behaviors. In Session 5 the children were taught a four-step study strategy to improve recall. The steps were: (1) group objects into taxonomic categories, (2) name each group, (3) study the items in groups using rehearsal, and (4) cluster the items while recalling them. The steps were reviewed several times, until the children could name all of the steps and the reasons why they should be used. A quiz was given at the end of each training session to assure that the instructions had been understood.

Subjects in the Control condition spent an equal amount of time with the experimenter in Sessions 4 and 5, but received no strategy instructions. They were exposed to the same stimuli (overheads and quizzes) but with different questions and dialogues. For example, pictures from the overheads were used to tell stories; other activities included identifying which of the objects children had seen on the way to school, choosing "favorite" objects, and identifying which could be drawn the most easily.

In Session 6, the Word task was given as a measure of near generalization. Twenty-four words, consisting of 6 items within each of four categories (e.g., names, fruits, vehicles) were mounted on 1 x 4 cm magnetized boards for the generalization test. The children were asked to arrange the words on the metal boards in any way they wished in order to aid studying. Two minutes were given to arrange and study the items. The children were then asked to write as many words as they remembered on a recall sheet. Individual photographs were taken of the item arrangements following the study period, providing an index of clustering behavior; from these records, ARC scores were computed as measures of organization activity. Next, a Self-Concept task was given in which the children ranked themselves in terms of their abilities in relation to the rest of the class, ranging from "best in the class" to "worst in the class". Academic (e.g., reading, spelling, memory for texts) and non-academic (e.g., height, sports) items were included. For each item, a child's face on a bar graph was circled to represent relative postion in the group. Scores ranged from 12 to -12, with a high score representing a positive self-concept.

In Session 7 the Picture task was given as in Session 2. Again, prior to recall children predicted how many words they would remember. ARC scores were computed for study and recall behavior. The task-related portion of the metamemory battery was presented at the end of the session to assess changes in metamemorial knowledge due to intervening training.

Results

Training Effects

In order to document the absence of pretraining differences between experimental groups, a 2(Country) x 2(Groups) multivariate analysis of variance (MANOVA) was performed, using Study ARC, Recall ARC, and Recall scores from the pretraining Picture task as dependent variables. The two Countries were German and American children, and the two Groups were the strategy-trained and control conditions. Only the main effect of Countries was significant, $F(3,188) = 24.94$. The absence of a Group effect or Country x Group interaction indicated that pretraining differences between trained and control children were not significant. The main effect of Country reflected high pretraining strategic behavior on the part of the German children. For instance, the mean Study ARC score of the German sample was .615, in contrast to .175 for the Americans. Recall means paralleled strategy differences, with German children recalling 13.12 items compared to 8.09 for American children.

Because the two samples differed before training, analysis of covariance (ANCOVA) was used to analyze training effects, using pretraining strategy and recall scores as the covariates. 2(Country) x 2(Groups) x 2(Sessions) repeated measures ANCOVAs were performed separately on Study ARC, Recall ARC, and Recall scores from the memory tasks, using tasks as the repeated factor (Picture Task at maintenance;

Word Task at transfer). Pretraining Study ARC, Recall ARC, and Recall were used as the covariates in the respective analyses. Although the main effect of Session was significant for Study ARC and Recall scores--indicating that children were more strategic at maintenance than transfer--none of the interactions involving Sessions were significant. Therefore the following results reflect mean scores averaged across the maintenance (Picture) and transfer (Word) tasks. Mean Study ARC, Recall ARC, and Recall scores from maintenance and transfer, and posttraining metamemory scores are displayed in Table

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Insert Table 2 about here

The ANCOVA on Study ARC scores showed a significant Country x Group interaction, $F(1,137) = 9.04$. The Bryant-Paulson generalization of Tukey's test was used for all contrasts among means adjusted for covariates (Huitema, 1980). Harmonic means were used in comparisons involving unequal cells. Analysis of the Country x Group interaction showed that within the U.S. sample, the trained group was more strategic than the nontrained group, $Qp(1,2,85) = 7.47$. Differences between the two experimental groups within the German sample were nonsignificant. Significant main effects of Country and Group indicated that the German children were more strategic than the American children, and trained children were more strategic than controls, $Qp(1,2,189) = 5.65$ and 5.45, respectively.

The ANCOVA on Recall ARC scores found that only the Country x Group interaction was significant, $F(1,189) = 6.50$. Comparisons among means showed that within the US sample, experimental children were more strategic than control children, $Qp(1,2,85) = 2.95$. Differences within the German sample were not significant.

The ANCOVA on Recall scores showed significant main effects of Country and Group, $F(1,189) = 14.03$ and 9.34. Strategy-trained children recalled more items than control children, and Americans recalled more than Germans with pretraining differences controlled. An examination of the unadjusted means shows that German posttest recall was higher than American; adjusted means show the opposite trend, because German recall was better before training, and American training gains were relatively greater.

A 2(Country) x 2(Group) analysis of covariance was performed on posttraining metamemory scores, using pretraining metamemory as the covariate. The main effects of Country and Group were significant, $F(1,189) = 9.92$ and 10.61, respectively. American children were higher in metamemory than German children, and trained children were more metacognitively aware than control children in both countries.

In summary, training was effective, particularly for the American children. Pretraining analyses showed that, although American children were higher in metamemory, German children had higher strategy and recall scores on the memory tasks. Because the German strategy scores were high before training, training effects were more pronounced for the American children.

Predicting Memory Behavior and Performance

In order to determine which variables were the most powerful predictors of performance in the two samples, multiple regression analyses were performed using metamemory, IQ, pretraining strategy use, academic self-concept, task self-concept, causal attributions, intrinsic motivation, and perceived competence as the predictor variables. Metamemory scores were the combined task-related and general metamemory scores from posttraining. Scores from the Culture Fair, Vocabulary, and Word Classification tasks were combined to create a measure of IQ. Because of questions regarding Recall ARC as a valid predictor of strategy use (Bjorklund, 1985; Lang, 1978) Study ARC was used as the pretraining strategy measure. The attribution score was a weighted difference between effort scores, and the sum of ability, luck, task, and help scores for both failure and success items. (I.e., Effort - (1/4)(Luck + Ability + Task + Help).) Academic self-concept was the sum of the academic items in the Self-Concept task; Task Self-Concept used only the item concerning the memory task. Intrinsic motivation and perceived competence used summed subscale scores from the two Harter tests (Preference for Challenge, Curiosity/Interest, and Independent Mastery; Cognitive and Social).

Regression analyses were performed separately for the German and American samples, using only strategy-trained children. The dependent variables examined were posttraining metamemory, maintenance Study ARC, transfer Study ARC, and and Recall scores from all sessions. The same predictor variables were used in all analyses.

Results of the regression analyses for the U.S. and German samples are shown in Tables 3 and 4, respectively. For

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Insert Tables 3 and 4 about here

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all analyses, only those variables are reported which exceed a probability level of .10. In general, metamemory was the best predictor of strategy use in the American sample, while pretraining strategic behavior was the best indicator for the German children. Pretraining metamemory was the best predictor of metamemory at posttest for both samples. Additional step-wise regression analyses found that pretraining metamemory accounted for 32.7% of the variance in posttraining metamemory in the U.S. sample, and 20.4% of the variance for the German children. Metamemory was also an important predictor of recall for both samples.

Multiple R-square values for strategy scores ranged from .25 to .31 in the two samples; the R-square for posttraining metamemory was .38 for the American children, and .30 for the Germans. Multiple R-squares for the recall analyses ranged from .28 to .34 in the U.S. sample. In contrast, recall at transfer for the German sample showed an R-square value of .16; maintenance recall and pretraining recall values were .22 and .37, respectively.

Thus the regression analyses showed different patterns of results among German and American children. Metamemory and IQ were the most important predictors of strategic behavior in the American sample, while pretest strategy scores emerged as an important predictor variable for the Germans. Step-wise regression analyses affirmed the importance of metamemory as a performance predictor for both samples.

Causal modeling

A causal modeling procedure was used to assess the impact of intelligence, self-concept, attributional style, and intrinsic motivation on strategy use during pretest, metamemory, strategy use in the transfer and maintenance tasks, and recall accuracy on the maintenance task. Identical structural equation models were constructed for both the German and American samples (experimental groups only). The computer program LVPLS (Latent Variable Partial Least Squares) developed by Lohmöller (1983, 1984) was used to estimate the model. Given the fact that sample sizes were relatively low and that the multivariate normality assumption did not hold for all variables included in the analysis, important requirements for the use of confirmatory maximum-likelihood estimation procedures such as LISREL were not met. As a consequence, an exploratory 'soft modeling' approach was preferred that relied on a distribution-free least-square estimation procedure. LVPLS aims only at consistency and is insensitive to impurities in the model and the data (cf. Wold, 1982).

With regard to the measurement model relating observed variables and latent constructs, the following assumptions were made: The intelligence factors was assumed to consist of the subtest 'matrices' of the Culture Fair Intelligence Test and the two subtests of the Cognitive Abilities Test mentioned above. The Self-Concept construct included three variables, namely, the cognitive and social competence subscales of Harter's Perceived Competence Scale and the subtest of the Self-Concept Task assessing academic self-concept. The three subtests of Harter's Scale of Intrinsic Versus Extrinsic Orientation in the Classroom were used to represent intrinsic motivation, and the attribution factor was represented by two components, namely, effort attributions in success and failure situations.

These four latent variables (intelligence, self-concept, locus of control, and attributions) were used as exogeneous factors in the model. Therefore they are not further explained in the model. It was assumed that the exogeneous constructs should influence strategy use during pretest (represented by the two ARC scores for study and recall organization), which in turn should influence metamemory (represented by the task-related and general metamemory components). The exogeneous constructs, strategy use during pretest, and metamemory were expected to predict strategy use at transfer and maintenance, both of which should directly influence recall performance during posttest. Both strategy factors were represented by ARC scores for study and recall organization, whereas the performance factor had only a single, observed variable to define it.

Figures 1 and 2 show the path diagrams obtained for the American and German samples, respectively. Only the structural coefficients among the nine latent variables are included in order to guarantee greater clarity. The intercorrelations among the four latent exogeneous constructs and the other latent variables are depicted in Table 5.

The results of the LVPLS analyses indicate that different structural models must be assumed for the German and American samples. Obviously, a more parsimonious solution was obtained for the American sample. Moreover, a slightly better data fit was obtained for this model than for that of the German sample. The model estimated for the American sample explained more variance in the posttest strategy and recall measures (44% and 44%), than the model for the German sample (38% and 35%).

By and large, the IQ variable had the largest impact on strategy use and metamemory in both samples, compared with the influence of the remaining exogeneous constructs. IQ predicted strategy use during pretest in the German sample but not in the American sample. The path structures of the two models reflect the different relationships between performance and strategy use at pretest, and the different effect of training within the two samples: Although strategy use at pretest did not have an important influence on metamemory and subsequent strategy use in the American sample, there was a remarkably stronger impact of strategy use at pretest on metamemory and strategy use during transfer and maintenance for the German children. Given the relatively high levels of strategy use in the German sample for all three memory tasks and the lack of inherent attractiveness in this type of task, it is not surprising that intrinsic motivation influenced strategy use at transfer and maintenance. On the contrary, differences in motivation did not play an important role in the prediction of strategy use after training for the American children, probably due to the fact that training benefits were equally beneficial for all subjects.

An interesting difference in the structural pattern of results concerns the roles of self-concept and causal attributions in the two samples: In the German sample, self-concept was related to strategy use at pretest, whereas causal attributions primarily influenced metamemory. In contrast, attributional style influenced strategy use at pretest in the American sample, and self-concept had a strong impact on metamemory.

The causal modeling procedure used in the present study allows for a test of the so-called "bidirectionality hypothesis" (Flavell, 1978): strategy use influences metamemory, and metamemory in turn influences subsequent strategy use. As can be seen from Figures 1 and 2, results for the American and German samples were different with regard to this hypothesis. For the American sample, strategy use at pretest affected subsequent metamemory, and metamemory in turn positively influenced strategy use at both transfer and maintenance. This finding seems to confirm the "bidirectional hypothesis". On the other hand, only the first part of that hypothesis could be confirmed for the German sample. That is, strategy use at pretest influenced subsequent metamemory, but no further impact of metamemory on subsequent strategy use was found. One possible explanation for this finding is that clustering during sorting and clustering during recall were already high at pretest for the German subjects, so that no significant improvements during transfer and maintenance could occur for these children. Probably as a consequence, metamemory had an important direct influence on recall performance for the German sample.

Taken together, these findings underline the importance of metamemorial knowledge for children's performance in sort/recall tasks, compared to the effects of the motivational and personality variables assessed in the present study.

Some of the differences in the structural patterns of the causal modeling results between the two samples are reflected in the intercorrelations among the latent constructs depicted in Table 5. An inspection of Table 5 reveals that the most striking differences between samples concern the correlations

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Insert Table 5 about here

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of the self-concept variable and pretest strategy use with the remaining factors. Whereas the differences found for the strategy use variable are not surprising (see above), the considerable differences found for the self-concept construct may indeed reflect cross-cultural differences. That is, they may be due to a more pronounced emphasis on the formation of positive self-esteem in American children. But as there are no empirical data available comparing educational practices in American and German elementary schools, one can only speculate about this point.

Discussion

Flavell (1978, 1979) has suggested that cognitive experiences have contextual roots in the home, school, and community. Little is known, however, about the exact ways in which these sources of influence impact the emergence of cognitive skills in young children. The present study represents an initial attempt to discover if personal, motivational, and intellectual factors, which are likely culturally-specific, require different or similar theoretical models in order to explain strategy based performance in German and American children. The data lead us to conclude that distinct models are necessary to understand the remote causes--but not the proximate cause--of strategy transfer. In both countries, the proximate cause of recall was the same: an appropriately applied strategy. This is consistent with a large body of evidence (Borkowski and Cavanaugh, 1979), showing the essential role of strategic behavior in producing superior performance, especially in young children or deficient learners. In addition, metamemory (which in both samples was influenced by personal or motivational factors) was directly related to high levels of recall for all children.

The remote causes of strategy use, however, were disparate in the two samples. For German children, who displayed spontaneous use of the clustering strategy prior to training, strategy use at pretest showed the stronges path to strategy use at posttest, with self-concept and intrinsic motivation also having direct links. In contrast, the attributional style and IQ of American children showed the strongest relationships with strategic use at posttest. Hence, an interesting picture of different causes of strategy use and metamemory emerged in the two samples. Although both strategy use and metamemory are predictive of superior recall independent of cultural contexts, the factors which influence these constructs appear to be different in the two cultures. What seems clear is that personal-motivational factors are related to both strategy use and metamemory; how these patterns develop, however, remains an unanswered question. The data point to two constructs that might clarify the issue: spontaneous strategy use and attributional style.

German children generally displayed an effective use of the clustering-rehearsal strategy without experimenter prompting. We suspect that early school experiences lead German children to approach problem-solving tasks with a greater emphasis on the deployment of strategic skills. Although U.S. children were superior to German children in memory knowledge, they were less likely to display that knowledge through task-appropriate strategic behavior at pretest. With minimal training, however, they successfully learned and utilized the strategy to the same extent as the German children. We are tentatively persuaded that German children are superior in "attack" or deployment skills that lead them to use existing metamemorial knowledge more efficiently. This scenario squares with pretest and posttest strategy use scores, which were in both instances influenced by IQ and, in the latter case, by prior strategy use. If this hypothesis is correct, cultural differences are likely to be found in tests of problem-solving and executive functioning (c.f. Borkowski et al., 1985).

With respect to attributional styles, interesting differences emerged. Kurtz and Borkowski (1984) found that young American children who successfully acquired and generalized a new strategy tended to attribute their final successes to effort expended rather than to non-controllable factors such as luck or ability. Consistent with these data, attribution styles (reflecting the importance of effort) were directly linked to strategy use in the U.S. but not in the German sample. In fact, in explaining the reason for succsessful classroom performance in a hypothetical situation (e.g., a spelling test), American children were twice as likely to choose effort as German children, who tended to choose effort, luck, and ability with equal probability. Children in the U.S. sample rarely selected luck as the reason for their classroom successes. With respect to failure outcomes, the same pattern emerged: German children were twice as likely as the Americans to claim they were simply unlucky when explaining classroom failures.

Weiner and colleagues hypothesized that cultural contexts may alter the motivational pattern for causal attributions (Weiner, 1974; 1979; Weiner and Peter, 1973). With cognitive development the child has an increased capacity to reflect on the reasons for academic achievements and failures in a more complex fashion. Whereas the young child typically focuses on outcome rather than effort expended, the older child understands more about the value of work in actualizing learning potential. It is important to recognize that culture alters this pattern of attributional development. For instance, Salili et al. (1976) found different attributional patterns in Iranian and U.S. children and adolescents, with ability more positively valued in Iran but effort dominant in both cultures in explaining positive outcomes. In the same vein, the present data suggest differential attributional patterns in U.S. and German children (with both ability and luck chosen more frequently in the German sample). More important, cultural differences in self-attributions produced different linkages with spontaneous and acquired strategy use.

In summary, culturally-linked attributional styles were underlying factors explaining individual differences in strategy use for U.S. children but not for German children. It should be noted that in the latter group, but not the former, self-concept was highly related to strategy use on multiple occasions, lending credibility to our interpretation of differential personal-motivational factors influencing metacognition and cognition in German and American grade school children. We believe that theoretically salient environmental factors in the home and school need to be measured and then related to personal, motivational, and metacognitive factors to create more accurate and comprehensive models of cognitive performance in different cultural settings. The net results should be broader theories of cognition that focus on the multiple causes and multiple consequences of metacognition and motivation.

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Table 1: Overview of sessions and test instruments

I. Session 1
   A. Culture Fair Intelligence Test
   B. Vocabulary Test
   C. Word classification test
   D. Harter's Scale of Intrinsic Versus Extrinsic Orientation to the Classroom -- 3 subtests
      1. Curiosity interest
      2. Independent mastery
      3. Preference challenge
   E. General attribution questionnaire

II. Session 2
   A. Perceived Competence Scale
   B. Sort Recall for Pictures (Picture) task

III. Session 3
   A. Metamemory test

IV. Session 4
   A. Training--explanation of taxonomic organization

V. Session 5
   A. Training--how to use taxonomic organization to improve recall

VI. Session 6
   A. Sort Recall for Words (Word) task
   B. Self-concept task

   5 week interval

VII. Session 7
   A. Sort Recall for Pictures (Picture) task
   B. Metamemory test for task-related items

Table 2. Strategy, recall, and metamemory means after training

		USA	FRG
Strategy-trained	Maintenance Study ARC	.674 (.449)*	.886 (.274)
	Transfer Study ARC	.578 (.470)	.786 (.358)
	Maintenance Recall ARC	.588 (.310)	.614 (.368)
	Transfer Recall ARC	.590 (.344)	.601 (.368)
	Maintenance Recall	12.90 (3.31)	13.61 (4.00)
	Transfer Recall	12.40 (3.95)	12.59 (3.74)
	Posttraining Metamemory	7.86 (3.15)	5.65 (1.87)
		n = 70	n = 80
Control	Maintenance Study ARC	.409 (.506)	.886 (.315)
	Transfer Study ARC	.166 (.406)	.777 (.356)
	Maintenance Recall ARC	.419 (.333)	.640 (.428)
	Transfer Recall ARC	.540 (.343)	.760 (.376)
	Maintenance Recall	12.45 (4.38)	12.04 (3.91)
	Transfer Recall	10.80 (4.73)	11.42 (2.98)
	Posttraining Metamemory	6.00 (3.08)	4.92 (2.22)
		n = 20	n = 24

* Standard deviations appear in parenthesis

Table 3: Multiple regression analyses--American sample

Dependent Variable	Predictor Variable	Beta	Simple Correlation Coefficient	*t*	*p* (2-tail)
Transfer Study ARC	Pretest Metamemory	.38	.43	2.56	.01
	IQ	.26	.37	1.96	.05
Maintenance Study ARC	Pretest Metamemory	.41	.46	2.83	.01
	IQ	.27	.42	2.04	.05
Posttest Metamemory	Pretest Metamemory	.49	.58	3.61	.001
Pretest Recall	Pretest Study ARC	.46	.47	4.13	.0001
	Perceived Competence	.22	.30	1.81	.07
Transfer Recall	Pretest Metamemory	.34	.48	2.35	.02
	IQ	.25	.40	1.96	.05
	Perceived Competence	.23	.35	1.86	.07
Maintenance Recall	Pretest Metamemory	[illegible]	.41	1.74	.09
	IQ	.23	[illegible]	1.68	.10

Table 4: Multiple regression analyses--German sample

Dependent Variable	Predictor Variable	Beta	Simple Correlation Coefficient	*t*	*p* (2-tail)
Transfer Study ARC	Pretest Study ARC	.43	.49	3.89	.0002
	IQ	.22	.33	1.98	.05
Maintenance Study ARC	Pretest Study ARC	.43	.40	3.80	.0003
	Task Self-concept	.25	.16	1.95	.05
Posttest Metamemory	Pretest Metamemory	.49	.46	4.48	.0001
	Perceived Competence	.22	.23	1.92	.06
Pretest Recall	Pretest Metamemory	.44	.53	4.22	.0001
Transfer Recall	Attributions	.21	.28	1.81	.07
	IQ	.22	.29	1.78	.08
Maintenance Recall	Pretest Metamemory	.34	.39	2.90	.01
	IQ	.22	.32	1.84	.07

Table 5: Intercorrelations among the latent factors

American sample

		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	IQ	.26	.29	.14	.10	.51	.34	.48	.42
(2)	Self-concept		.35	.20	.07	.45	.20	.21	.17
(3)	Motivation			-.02	.17	.27	.18	.25	.29
(4)	Attribution				.15	.33	.02	-.09	.12
(5)	Strategy use (pretest)					.23	.01	.15	.25
(6)	Metamemory						.34	.46	.42
(7)	Strategy use (transfer)							.57	.33
(8)	Strategy use (posttest)								.61
(9)	Recall (posttest)								--

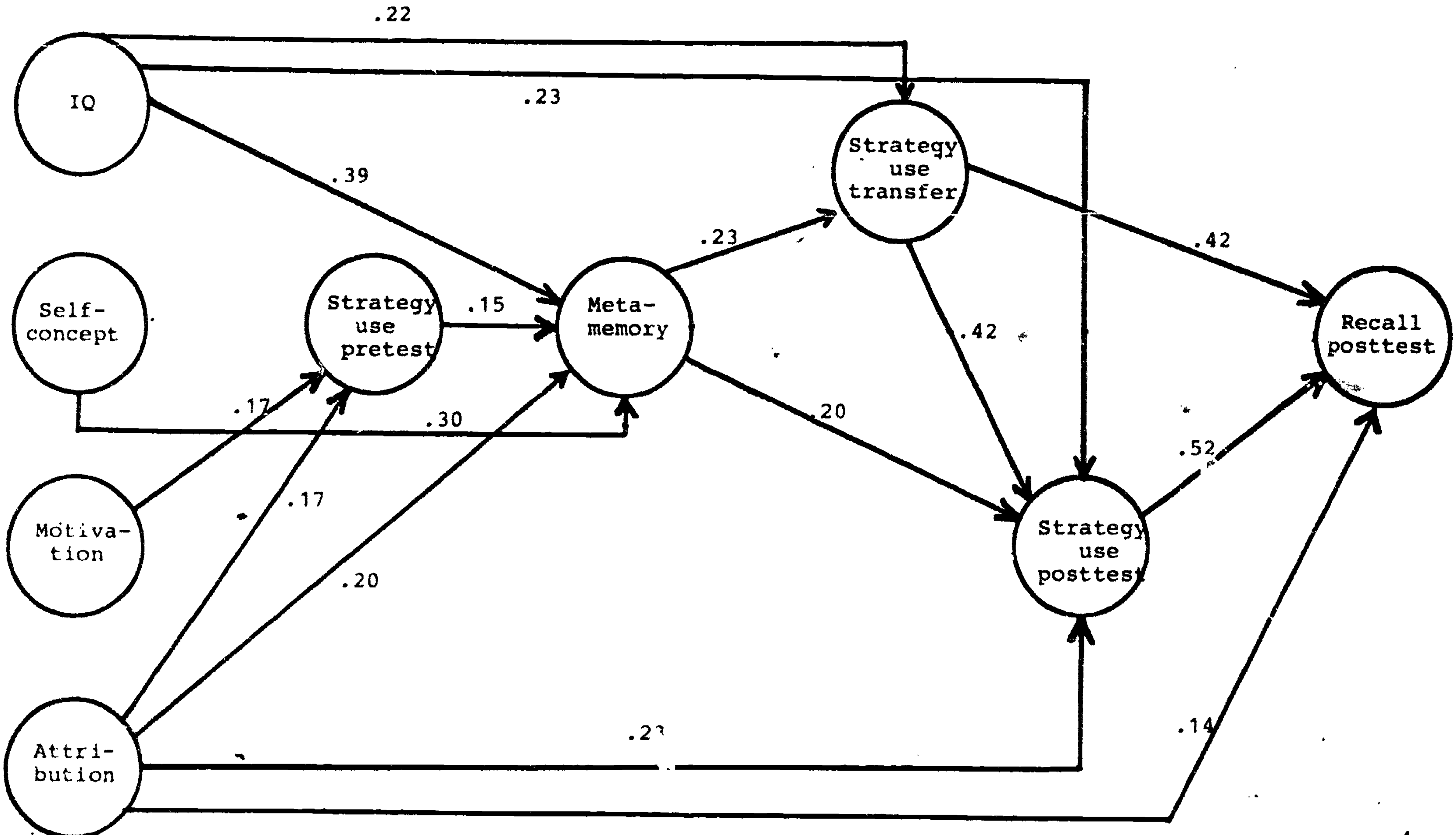
German sample

		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	IQ	.13	.12	.05	.37	.26	.23	.36	.39
(2)	Self-concept		.10	.23	.25	.01	.08	-.03	.06
(3)	Motivation			.01	.11	.07	.29	.30	.18
(4)	Attribution				.14	.36	.14	-08	-15
(5)	Strategy use (pretest)					.36	.47	.46	.21
(6)	Metamemory						.17	.25	.41
(7)	Strategy use (transfer)							.46	.24
(8)	Strategy use (posttest)								.45
(9)	Recall (posttest)								--

Figure Captions

Figure 1. LVPLS model for the American sample

Figure 2. LVPLS model for the German sample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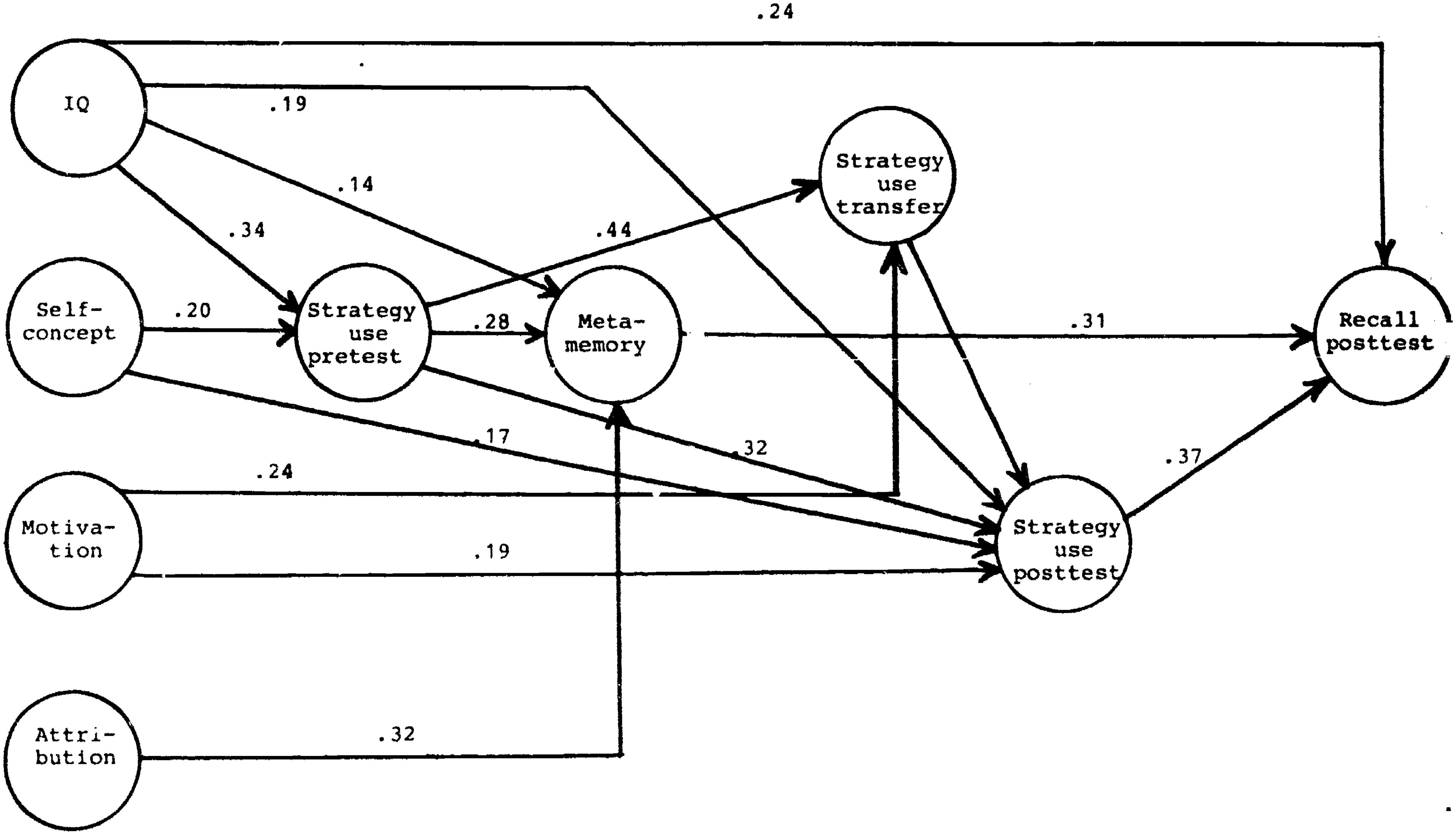
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