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Interpersonal cognitive problem-solving and creativity: A longitudinal study

Miller, Karen Lynn, Ph.D.

The Ohio State University, 1991
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PUBLICATIONS AND PRESENTATIONS


FIELD OF STUDY

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Chapter I

INTRODUCTION

Methodological problems have plagued past research efforts in discovering quantitative and qualitative developmental differences in children's interpersonal cognitive problem solving (ICPS) skills and creative abilities, operationalized as ideational fluency and flexibility. Furthermore, these past studies have explored age or grade differences in ICPS skills and creative abilities within a cross-sectional design, using different subjects of different ages. These investigations have often found that older children receive higher scores on measures of ICPS skills and creative abilities than younger children. While these higher scores suggest an increase in ICPS skills and creative abilities with age, they cannot demonstrate it since the subjects in the younger and older groups are not the same. Only when the same subjects are studied over a period of time can true developmental change be documented. There is a need for future research to investigate developmental differences in ICPS skills and
creativity using the same subjects within a longitudinal design.

In addition, few potential correlates of ICPS skills have been explored in the literature. Creativity, one such possible correlate, has been regarded as a form of "problem solving," (Dewey, 1910) and has been associated inconsistently with various measures of intelligence and impersonal problem solving tasks. Ideational fluency and flexibility in thinking have been viewed as forms of creativity. Flexibility in thinking has also been inconsistently associated with impersonal problem solving tasks. Intuitively, it stands to reason that if a child were more flexible in his/her thinking about both impersonal and interpersonal problems he/she would be more likely to solve the problem. In the case of interpersonal problem solving, the flexible child may demonstrate superior social skills.

Furthermore, ICPS skills have been inconsistently correlated with social competence and/or behavioral adjustment in normal children. In addition, the nature of the relationship between ICPS skills and social competence has been called into question. Cavell (1990) has proposed a model suggesting that interpersonal problem solving skills, in addition to other abilities, are components of the construct of social competence. While there are no empirical data to support Cavell's
model, he raises interesting questions regarding the components comprising social competence. Future research needs to more thoroughly explore the relationship between ICPS skills and social competence and behavioral adjustment, as well as reconsider the role ICPS skills may play in defining social competence.

The goal of the present longitudinal study was to examine the development of ICPS skills and creative abilities within the same 200 children, from grades K-2-4-6-8 and 10, over a two year period. In addition, a cross sectional sample comprised of children in grades 2, 4, 6, and 8, who had not participated in the first assessment, served as a control group to help determine if grade-related changes in ICPS skills and creative abilities established at Time 1 were true developmental differences or cohort effects, and if any increases in scores from Time 1 and Time 2 are results of repeated testing. The study entailed the administration of a test of ICPS skills—the Test of Interpersonal Problem Solving (TIPS), and a measure of creativity which will be administered to all children.

Specifically, the intended research had four major objectives: (a) to examine any changes in the development of ICPS skills in the same children over a two year period, (b) to explore any changes in the development of creative abilities in the same children
over a two year period, (c) to investigate the relationship between ICPS skills and creative abilities over time, and (d) to examine the relationship between ICPS skills and teacher ratings of social competence and behavioral adjustment.

In the following chapters, a thorough literature review will be presented discussing the following areas: a) current models guiding ICPS skills research, b) an examination of cross sectional studies which imply developmental change in ICPS skills, c) factors influencing the development of ICPS skills, and d) an examination of the construct of creativity as one such possible factor, e) a review of correlational studies exploring the relationship between ICPS skills and social competence and behavioral adjustment, and f) an examination of comparative and training studies, which allow us to make greater inferences about the relationship between ICPS skills and behavioral adjustment. After presenting the methodology and results for the current study, the findings will be discussed with regards to the stability and change of ICPS skills and creative abilities over time. In addition, implications of the current results for applied use as well as for models of ICPS skills will be discussed. Finally, limitations of the study and needs for future research will be addressed.
Chapter II
REVIEW OF THE LITERATURE

Assumptions Underlying Interpersonal Cognitive Problem Solving Skills Research

Until recently, research into human problem solving processes has focused almost exclusively on the measurement of cognitive styles and abilities relevant to problems of nonsocial content, such as puzzle-type tasks, anagram problems and various intellectual creativity tasks (Urbain & Kendall, 1980). Jahoda (1953), was among the first to specifically emphasize the relation of effective interpersonal problem solving to social and emotional adjustment. She proposed that psychological health is related to a problem-solving sequence characterized by the tendency to recognize and admit a problem, to reflect on possible solutions, to make a decision, and to take action (Jahoda, 1953).

Since Jahoda's work, others have elaborated on the suggestion that there is a relationship between effective interpersonal problem solving and adjustment. D'Zurilla and Goldfried (1971) postulate an information processing model that defines problem solving as a behavioral
process. This process encourages the generation of a variety of response alternatives to an interpersonal problem and increases the probability of selecting the most effective response from among the alternatives. There are two underlying assumptions regarding D'Zurilla and Goldfried's (1971) conceptualization of ICPS skills: (a) that ineffectiveness in coping with problematic situations, along with its personal and social consequences, is often a necessary and sufficient condition for an emotional or behavior disorder requiring psychological treatment; and (b) that general effectiveness may be most efficiently facilitated by training individuals in general procedures or skills which would allow them to deal independently with the critical problematic situations that confront them in day-to-day living (D'Zurilla & Goldfried, 1971).

These assumptions have led researchers interested in investigating the area of interpersonal problem solving to adopt the position that there are a set of interpersonal cognitive problem solving (ICPS) skills that mediate healthy human functioning (Spivack & Shure, 1976; D'Zurilla & Goldfried, 1971). While there has been a plethora of research investigating these different skills and their relation to behavioral adjustment and social competence, there is still no theory describing and explaining the development of ICPS skills.
Definitions of Problem Solving

Since Jahoda's original proposal of a problem solving sequence in 1953, researchers have more precisely defined problem solving. D'Zurilla & Goldfried (1971) have defined problem, problem solving and solution. According to them, the term "problem" refers to a specific situation or set of related situations to which a person must respond in order to function effectively in his environment. "Problem solving" was defined as a behavioral process which (a) makes available a variety of response alternatives for dealing with a problematic situation, and (b) increases the probability of selecting the most effective response from among these alternatives. A "solution" (i.e., an effective response) in a problematic situation is specifically defined as a response or pattern of responses which alters the situation so that it is no longer problematic to the individual (D'Zurilla & Goldfried, 1971). "Interpersonal problem solving" may be defined simply as the analysis and resolution of problems with other people (Marsh, Serafica & Barenboim, 1981). Tisdelle and Lawrence (1986) point out that interpersonal problem-solving skills should be differentiated from emotional problem solving, which involves the ability to cope with one's own negative emotional states (i.e., anger, anxiety,
etc.). This latter task has been found to correlate with IQ, but does not differentiate clinical from normal populations (Platt et al., 1974; Siegel & Platt, 1976).

Given these definitions, it is important to emphasize the distinction made between "problem solving" and "emitting an effective response in a problematic situation" (D'Zurilla & Goldfried, 1971). As it has been defined here, problem solving clearly refers to a process or technique by which one attempts to formulate a solution to a problem. The problem solving task is one of learning to combine previously acquired responses in a novel way so as to produce a new response or response pattern and to form a new association between this response pattern and the particular problematic situation in question. Emitting an effective response, on the other hand, refers to the performance or execution of the response, which is only one possible outcome of an individual's problem solving attempts, an outcome which is a function not only of problem solving but of other factors related to the individual's learning history as well (e.g., anxiety, motivation, behavioral deficits). Thus, it is possible for an individual to solve a problem symbolically but fail to carry out the response in the actual problematic situation because of such obstacles as response inhibitions or other motivational problems, or to carry it out inadequately because of certain

**Approaches to the Study of Problem Solving**

In 1910, John Dewey offered an initial attempt at a problem-solving model for creativity by suggesting the following steps: (1) awareness that a problem exists, (2) analysis of the problem, (3) an understanding of the nature of the problem, (4) suggestions for possible solutions, and (5) testing the alternative solutions and accepting or rejecting them (Dewey, 1910).

Building on Dewey's (1910) initial model, D'Zurilla & Goldfried proposed an information processing model which emphasizes the behavioral nature of the problem solving process. This model delineates five steps, each requiring a specific problem solving skill: (1) general orientation, which is the individual's "mind set" when approaching the problem, (2) problem definition and formulation, which is the individual's ability to define all aspects of the situation in operational terms and classify elements of the situation appropriately so as to separate relevant from irrelevant information, identify his primary goals, and specify the major subproblems, issues, or conflicts, (3) generation of alternatives, which is the individual's ability to generate possible solutions appropriate to the particular problem, (4)
decision making, which involves determining the "goodness" of any particular course of action, and (5) verification, which takes place after the chosen course of action has been carried out and is designed to assess the actual outcome so as to make self-correction possible (D'Zurilla & Goldfried, 1971).

D'Zurilla and Goldfried (1971) also specify techniques for accomplishing each of the aforementioned steps. In regards to "general orientation" the type of orientation which is likely to promote independent problem-solving behavior should include the set or attitude to (a) accept the fact that problematic situations constitute a normal part of life, and that it is possible to cope with most of these situations effectively, (b) recognize problematic situations when they occur, and (c) inhibit the tendency to respond either on the first "impulse" or to "do nothing". Once the subject has accomplished this, he must then (a) define all aspects of the situation in "operational" terms and (b) formulate or classify elements of the situation appropriately so as to separate relevant from irrelevant information, identify his primary goals, and specify the major subproblems, issues, or conflicts. During the next stage, generation of alternatives, the basic method for accomplishment is "brainstorming". D'Zurilla and Goldfried postulate that the critical
technique to be employed at this stage is the ability to generate as many alternatives as possible without evaluation. This leads to the maximization of the likelihood that the most effective solution will be present within the list of the alternatives generated (D'Zurilla & Goldfried, 1971). In choosing from the list of alternatives generated in the previous step, the subject is involved in making a subjective estimate of the probability that each particular alternative will achieve any given outcome, as well as subjective determination of the value of the various outcomes. Finally, if the problem solver is to be maximally effective, he must take steps to obtain accurate information about the actual consequences of his chosen course of action so that he/she can determine whether his/her choice was, in fact, the "best" one (D'Zurilla & Goldfried, 1971).

Alternatively, Spivack & Shure (1976) postulate that there are a set of several interrelated skills that contribute to the resolution of interpersonal problems. Spivack and Shure have identified a series of six interpersonal cognitive problem solving skills: (1) generation of alternatives, the ability to generate a variety of solutions to problems, (2) consideration of consequences of social acts, the tendency to consider the consequences of one's social actions on oneself and
others, and the ability to generate a range of possible consequences for a complete action, (3) means-ends thinking, the ability to generate the step-by-step means by which an interpersonal problem could be resolved, (4) development of social-causal thinking, the recognition that one's actions and feelings are reciprocally related to the actions and feelings of others, (5) sensitivity to problems, the awareness of the variety of problems that arise in human interactions in general and in particular interaction, and (6) dynamic orientation, the recognition that behavior may reflect motives or antecedents that are not discerned readily or easily (Spivack, Platt & Shure, 1976).

Of the two aforementioned models of ICPS skills, D'Zurilla's and Goldfried's model has been criticized for not exploring developmental issues (Kendall & Fischler, 1984). For example, there was no consideration given to how and when the components of the social problem solving process developed. While Spivack and Shure have, to a limited extent, attempted to place ICPS skills within a developmental perspective (Spivack and Shure, 1974; Spivack, Platt & Shure, 1976), their attempts at theorizing have fallen short on a number of conceptual and empirical issues. For one, the linearity of the sequence of skills has not been fully explored. For example, do individuals generate all possible solutions
and then evaluate their consequences, or, do individual's think of one possible solution, evaluate its consequences and then discard that solution if not functional and generate another alternative, etc.

Secondly, development of each of the problem solving skills is likely not an "all-or-none" process; rather children show evidence of each of these abilities to varying degrees throughout childhood. Thus, sensitivity to some interpersonal problems may appear long before children can articulate alternative strategies. For example, Zahn-Waxler, Iannotti and Chapman (1982) indicated that 2-year olds are sensitive to needs for help-giving and help-seeking and are able to deal strategically with these problems before they could possibly generate verbal solutions to hypothetical versions of dilemmas (Rubin & Krasnor, 1986).

For these and other reasons (see Tisdelle and Lawrence, 1986), a new wave of researchers have attempted to construct models to aid us in our further understanding of the development of ICPS skills. For example, McFall (1982) has put forth a conceptual model which has the potential of successfully merging the D'Zurilla and Goldfried (1971) model of problem solving with a more comprehensive information processing model. The first stage, decoding, involves the perception and interpretation of incoming stimuli. This corresponds to
the problem recognition stage and is influenced by sensory skills, attentional factors as well as environmental stimuli. The next stage, the decision stage, involves searching among alternatives, evaluating potential consequences and choosing an appropriate response. The decision stage combines alternate thinking, consequential thinking and choosing a solution into a single stage. Finally, the encoding stage requires translation of decisions into behavioral performance (McFall, 1982). McFall's model expands upon D'Zurilla and Goldfried's model. However, to date there is no empirical evidence to validate it.

Rubin and Krasnor (1986) have also put forth an information processing model of social problem solving. In formulating their own model, Rubin and Krasnor drew heavily from Newell and Simon's (1972) model of problem solving information flow, Schank and Abelson's concept of "scripts" and Flavell's (1981) work regarding the conditions under which active social cognition is likely to occur.

Briefly, Newell and Simon's model involves (1) encoding of the problem and relevant associated material; (2) selecting a specific problem solving strategy; (3) applying the strategy; (4) dependent on the outcome the individual may attempt another strategy, reformulate the goal or abandon the solution; and finally (5) the
strategy may produce a new problem or sub-goal which may be attempted or set aside (Newell and Simon, 1972).

In conjunction with the use of the information processing model, Rubin and Krasnor include Schank and Abelson's construct of the "script" to explain the automaticity in problem solving. Schank and Abelson (1977) defined a script as a general event representation consisting of an ordered sequence of actions tied to a specific type of event. Specific action sequences, thus, were stored awaiting evocation by specific features that could be either internal or external (Schank & Abelson 1977). Abelson (1982) suggested that three conditions were necessary for scripted social behavior: (1) a stable cognitive representation of the script; (2) a context which contained elements evoking the script; and (3) entrance into the script by the individual. The existence of a script means that the individual has an accessible routine sequence of actions corresponding to a familiar social situation. If the script can be successfully implemented, there is little "problem" in the classical sense. Once an individual enters a script, the scripted behaviors unfold in a relatively automatic fashion (Rubin & Krasnor, 1986). However, scripts may be blocked when appropriate eliciting conditions are not present or when an obstacle prevents an action from being completed.

Finally, Rubin and Krasnor agree with Flavell's (1981)
speculations concerning those conditions under which active social cognitions are likely to occur. These conditions include situations which demand conscious processing, such as a hypothetical-reflective interview, and situations that are novel, significant, or violate expectations or have had unsuccessful resolutions in the past. Perhaps when the activation of scripts are blocked, as they are in the aforementioned conditions, the more intentional (effortful) problem solving process, as outlined by Spivack and Shure (1976) is implemented.

Utilizing the above information, Rubin and Krasnor (1986) have proposed their own information processing model of social problem solving. The central features of their model involve (a) the selection of a social goal, which is, by definition, a representation of the end state of the problem solving process; (b) consideration of the social environment, for example, the age and sex of the protagonist; (c) accession and selection of strategies given consideration of features (a) and (b); (d) strategy production; (e) strategy outcome; and (f) strategy sequencing following an initial social problem solving failure. With regards to the access and selection of strategies, it should be pointed out that strategy retrieval may be relatively automatic or scripted. Alternatively, retrieval may be conscious and deliberate. However, the strategies must already exist
in the individual's repertoire. In addition, new strategies may be constructed by the individual through cognitive transformation of available strategies. Again, to date, there is no empirical support for this model. While Rubin and Krasnor begin to consider the child's immediate environment during the problem solving process, other factors most likely affecting ICPS skills, such as memory of past events and their outcomes, ability to delay gratification, and verbal and nonverbal acts, to name just a few, have been ignored. The next two models reviewed, have attempted to include the myriad factors potentially affecting children's social functioning. Interestingly, in doing so, these models have expanded from models of interpersonal problem solving to models of social competence of which ICPS skills are a component.

Models of Social Competence which Include ICPS Skills as a Component

In an attempt to better understand children's social functioning, researchers have recently begun to broaden their perspectives and to view ICPS skills as a component of social competence. Dodge (1986) acknowledges the aforementioned models, and in his own proposed social information processing model he integrates and extends upon these ideas in a logical manner emphasizing the role of memory. According to Dodge (1986) a child comes to a
particular social situation or task with a biologically
determined set of response capabilities and a data base
(his or her memory store of past experiences, which
predisposes the child toward a particular goal or way of
responding), and he or she receives as input from the
environment a set of social cues. Arriving at a social
sicuation with the aforementioned attributes, the first
step of social information processing for the child is to
encode the social cues in the environment. The child
must receive cues through sensory processes and then
perceive them. Because of the tremendous amount of
information present in the social environment at a single
moment, the child must learn skills of attending to
appropriate cues, chunking information, and using
rehearsal and mnemonic devices in order to store the
information. Once cues have been encoded, the next step
for the child is to engage in a mental representation and
interpretation process. The child must integrate the
cues with his or her memory of past experiences and come
to a meaningful understanding of the cues. The third
step in processing social information is a response
search. This step is akin to a combination of Spivack
and Shure's (1976) generation of alternatives and
evaluation of consequences. Once the child has
represented the encoded information in a meaningful way,
he or she can engage in a generative process of searching
for possible behavioral responses. The next step of processing is a response decision step. Ideally, the child learns to evaluate the potential consequences of each generated response and to estimate the probability of favorable outcomes. Finally, the child, after having chosen a behavioral response appropriate for his or her own behavioral capabilities and befitting of environmental demands, must enact his or her solution (Dodge, 1986).

Dodge (1986) also states that this processing occurs in sequential stages, or steps, and that each step is a necessary part of competent responding. The steps, however, are not necessarily acted upon in a conscious manner. Awareness of processing occurs only during highly novel or complex tasks, or when a cue is given to call the process into awareness (Dodge, 1986). Rubin and Krasnor (1986) address this issue when they refer to the accession and selection of strategies being relatively automatic or scripted. To date, there has been no empirical evidence to support Dodge's model.

While these theoretical positions vary in the specific processes described, they have in common several characteristics. Each assumes that stimulus cues in the environment may be conceptualized as a problem or task which confronts the individual. The individual's behavior is goal-directed. Each theorist describes a set of
cognitive operations which are thought to be necessary in order to complete the task or to perform in a competent manner. Each describes the process in its ideal form, implying that deficiencies occur in the form of deviations from the ideal. This ideal form consists of a set of processes which must occur in a sequential temporal order. These processes seem to include encoding and interpreting environmental cues, deriving a behavioral response, and enacting the chosen response in behavior (Dodge, 1986).

Recently, in an attempt to merge many of the previous suggested models, Cavell (1990) proposed a tri-component model of social competence. Briefly, he defines social competence as a multilevel construct composed of the following three constructs: social adjustment, social performance and social skills. Social skills are defined similarly, although more comprehensively, than McFall's (1982) encoding, decision and enactment skills. Specifically, encoding skills include the reception, perception and interpretation of task-related stimuli (McFall, 1982). This is similar to D'Zurilla & Goldfried's (1971) problem recognition and problem definition tasks. Furthermore, Cavell includes within encoding skills, empathy, role taking, and perspective taking (Chandler, 1973; Selman, 1980);
 attributions to self and others (Dweck, 1981); and intention-cue detection (Dodge et al., 1984).

Specifically, decision skills, in accordance with McFall's (1982) formulation, are skills which involve the searching, testing and selection of a possible response. Cavell (1990) also includes the following within this component; generation of alternative responses and decision making (D'Zurilla & Goldfried, 1971); alternative, consequential and means-end thinking (Spivack, Platt and Shure, 1976); self-efficacy and outcome-expectancy evaluations (Bandura, 1977a; Wheeler & Ladd, 1982); and so-called functional skills such as proposing and justifying an action and evaluating its impact on other's feelings (Selman et al., 1986).

Finally, enactment skills include the execution and monitoring of an attempt to solve the problem (McFall, 1982). In addition, Cavell (1990) suggests that enactment skills are also associated with the following concepts: representation of behavioral scripts (Abelson, 1976); self-regulating delay of gratification, and behavioral planning (Mischel, 1984); self-instruction (Meichenbaum & Goodman, 1971); and execution of overt behaviors, including verbal and nonverbal acts (Trower, 1980). Finally, Cavell (1990) states that social skills, as defined above, are necessary but insufficient for the production of effective social performance
(Cavell, 1990). Cavell's model is very comprehensive, and future tests of its validity are eagerly awaited.

The prevailing assumption has been that children's social skills, including ICPS skills, are predictive of, as well as a prerequisite to competent social behaviors (Spivack & Shure, 1974; Kelly, 1982). It appears that it is the current trend among investigators (Dodge, 1986; Cavell, 1990) to view ICPS skills as a component of social competence. This new viewpoint emphasizes our need to understand the development and correlates of ICPS skills in order that we can further comprehend the construct of social competence. Researchers interested in this area have used a multitude of assessment tools to measure ICPS skills. And although measures vary somewhat across the various models of ICPS skills, in general, assessment involves the oral presentation of a hypothetical story or dilemma to a child, followed by queries to the child. Depending on the skill that is being assessed, questions may require the child to think of solutions, to describe possible consequences if a particular solution is attempted, to describe causes for a given outcome, or to explain what is wrong with an interpersonal exchange. It is then customary to examine the relation between performance on these measures and various indices of social and behavioral adjustment.
Given the aforementioned assumptions regarding ICPS skills and social competence, psychologists have conducted numerous developmental, correlational, comparative, and training studies. A brief review of these studies ensues, with special emphasis being paid to the models from which the studies were derived (i.e., the Spivack and Shure or the D'Zurilla and Goldfried model) and the design of the developmental studies in which ICPS skills have been assessed to detect age and/or grade differences.

Development of Interpersonal Problem Solving

Among the aforementioned ICPS skills outlined by Spivack and Shure (1976), the development of means-ends thinking, generation of alternative solutions, and consideration of consequences have been studied extensively and have been found to show age or grade differences.

Platt et al. (1974), in a cross-sectional study, found that different mediators of adjustment were pertinent at different ages. Specifically, for older children, especially those in the 9 to 12 year old range, alternative solution thinking appears to be a strong mediator of adjustment and prime target for intervention. Means-ends thinking emerges prior to or during this period as a significant interpersonal-problem solving
skill. By adolescence, means-ends thinking appears to have become the most important ICPS correlate of adjustment, although generation of alternative solutions still covaries with measures of adjustment to a considerable degree (Platt, Spivack, Altman, Altman, & Peizer, 1974).

Further evidence for the developmental changes of ICPS skills is found in the work of McGillicuddy-DeLisi (1980) and Rubin and Krasnor (1983). McGillicuddy-DeLisi tested 120 preschool, first and second grade first born children in their ability to generate strategies about two types of hypothetical problems that might arise within the context of a friendship relationship. Children's reasoning about types of initial and follow up strategies and predicted success of interpersonal strategies varied with age and the type of interpersonal problem. Specifically, preschool age children predicted effectiveness of their initial strategies most often, first graders predicted effectiveness least often and predicted effectiveness of initial strategy was higher for teaching items than conflict items across all groups. McGillicuddy-DeLisi concluded that, "the quality as well as the quantity of interpersonal problem solving strategies appear to develop from four to eight years of age and the content of the interpersonal situation
appears to affect both number and type of strategies that children propose," (McGillicuddy-DeLisi, 1980).

Similarly, Rubin and Krasnor (1983) found that the type of strategy chosen to acquire an object varied depending upon the sex and somewhat upon the age of the person from whom the object was being acquired. Specifically, Rubin and Krasnor examined the responses of 120 preschoolers and 77 kindergartners to a measure consisting of five stories in which a protagonist sought to acquire an object from a same-or-different age or same-or-different sex target. Age differences in the numbers and types of strategies were few. However, kindergartners showed a greater flexibility in strategy sequencing (as measured by the extent of sequential changes in strategy after failure). This effect was not due simply to differences in the number of strategy categories used by the children, since no significant age-related differences were found for this variable. Using the same number of categories as the younger group, the older children showed a different sequencing pattern. They were more likely to change strategy techniques after being informed that their original strategies would result in failure. In addition, prosocial strategies were more often directed to older targets; agonistic strategies were more often directed to younger targets. Furthermore, girls suggested more prosocial strategies
when girls sought an object from boy targets. The authors conclude that in future research attention be paid to flexibility in problem solving, as well as target characteristics (Rubin & Krasnor, 1983).

Finally, White and Blackham (1985) examined ICPS skills, as measured by the Purdue Elementary Problem Solving Inventory, in 463 second, fourth and sixth graders, from which 179 students were sociometrically identified as populars, rejecteds, neglecteds and controversials. Results revealed significant grade differences in ICPS skills, but no significant differences were found among sociometric categories. Specifically, sixth graders scored significantly higher than fourth and second graders. Furthermore, fourth graders scored significantly higher than second graders. These study demonstrates age differences in alternative thinking and means-ends thinking which imply developmental change. However, because different children of different ages were used, true developmental change cannot be concluded.

Similarly, ICPS skills derived from the D'Zurilla and Goldfried (1971) model have also been found to show age or grade differences. Feldgaler (1979), in his study of kindergarten, fourth and eighth graders, found grade-related changes in both the quantity and quality of children's overall and specific ICPS skills.
Specifically, older children when compared to younger children were better able to identify a problem, analyze pertinent information regarding the problem, evaluate possible consequences to proposed solutions and select an adequate solution to the problem. Interestingly, Feldgaier (1979) did not discover age-related differences in children's ability to generate alternative solutions to problems. He also found that younger children tended to define conflict situations in more concrete, behavioral terms and also tended to generate more forceful solutions than did older children (Feldgaier, 1979).

In the same study, Feldgaier & Serafica (1980) also found evidence that ICPS skills go through developmental changes. Their study of kindergartners, fourth graders, and eighth grader boys showed that overall problem solving ability and each type of ICPS skills, except for alternative thinking, increased or improved with age or grade. They account for this lag in alternative thinking by hypothesizing that the eighth graders in the study were selectively choosing alternatives that they thought appeared reasonable (Feldgaier & Serafica, 1980).

Marsh (1982) administered a measure of interpersonal problem solving ability to pupils in grades K, 2, 4 and 6. She found that for problem definition, there was a significant increase only between grades two and four;
for all other abilities (alternative thinking, consequential thinking, and solution adequacy), there were significant increases only between grades four and six. Marsh concludes that, "The period from grades four to six appears to be particularly important for the development of general problem solving skills," (Marsh, 1982).

The results of these two studies appear to be discrepant with regards to the development of alternative thinking. Specifically, Marsh (1982) found that the ability to think of alternatives to a problem continued to increase from kindergarten through sixth grade. Conversely, Feldgaier and Serafica (1980) did not find the same linear trend for alternative thinking. The eighth grade boys in their study had lower alternative thinking scores than the fourth grade boys.

In a more recent investigation, Feldgaier (1987) examined the age-related differences in the ICPS skills of adjusted and non-adjusted 6-7 and 10-11 year old boys. Results indicated that for overall ICPS skills as well as specific ICPS skills, with the exception of problem recognition, that older children performed better than their younger age counterparts. Furthermore, older boys are more capable of defining initial problems in a clear, concise manner. They also propose significantly fewer forceful solutions and tend to generate consequences.
which focus on the psychological aspects of the problem more so than the behavioral aspects (Feldgaier, 1987). These later results appear to suggest that alternative thinking proceeds in a linear fashion. Perhaps one explanation for the discrepancy between Feldgaier's and Serafica's 1980 study and Feldgaier's later study is that different grade groups were used.

In an attempt to clarify these developmental differences, as well as address Rubin and Krasnor's (1983) observation regarding the "critical scarcity of normative data," Goldman et al. (1987) examined developmental differences in 200 children's ICPS skills in grades K-2-4-6-8 utilizing a new measure of interpersonal problem solving, the Test of Interpersonal Problem Solving (TIPS) (Feldgaier & Serafica, 1980). Several researchers (Rubin and Krasnor 1983, 1986; McGillicuddy-DeLisi, 1980) have criticized previous measures of ICPS skills for only examining the quantitative aspects of ICPS skills. The TIPS measures both quantitatively and qualitatively (i.e., content) overall problem solving capabilities, as well as specific skills, such as problem definition, problem conceptualization, alternative thinking, consequential thinking, and solution adequacy. (Feldgaier & Serafica, 1980).
Goldman, Serafica and Clark (1987) found significant grade differences with respect to overall problem solving ability, as well as specific problem solving abilities. Briefly, there were significant grade differences in overall problem solving ability between all grades, with older children scoring higher than younger children, except fourth to sixth, and fourth to eighth. With regard to specific ICPS skills, the results demonstrated that older children (grades 4, 6, and 8) considered psychological and conceptual aspects more often than younger children when defining a problem. Results also revealed that eighth, sixth and fourth graders showed significantly higher scores in their ability to conceptualize a problem over grades K and 2. Furthermore, second graders also showed a significant increase in their ability to conceptualize a problem over kindergartners. Results of post hoc comparisons for alternate thinking revealed significant increases for eighth graders over grades K, 2, 4, and 6. Furthermore, there were significant increases in alternate thinking for sixth graders over grades K and 2. Fourth graders showed a significant increase in alternate thinking over kindergartners and second graders demonstrated a significant increase in alternate thinking ability over kindergartners. With regard to consequential thinking, Goldman et al. (1987) found significant increases for
eighth graders over grades K and 2. Sixth and fourth graders showed a significant increase in the ability to generate consequences to a proposed alternative solution over grades K and 2. Finally, both fourth and second graders showed a significant increase in consequential thinking over kindergartners. Finally, the post hoc comparisons for solution of the problem revealed significant increases for eighth graders over grades K, 2, 4, and 6 (Goldman, Serafica & Clark, 1987).

The results from the reviewed studies imply developmental change in children's ICPS skills. Overall, it appears that a child's ability to define a problem occurs early on and remains stable throughout development. The other ICPS skills seem to develop later on, and as Marsh (1982) noted, their emergence seems to coincide with children's advance to formal operations. However, the developmental path of alternative thinking is still not clear. Longitudinal studies are needed in order to assess the development of ICPS skills within individuals as well as cross sectionally. Eisenberg and Harris (1984), in their review of the few developmental studies of ICPS skills conducted to date, conclude that "developmental issues should be a major concern of practitioners and researchers who deal with interpersonal problem-solving skills," (Eisenberg & Harris, 1984).
Again, all the aforementioned studies can do is imply developmental change because of their cross sectional design. To date, the developmental differences in children's ICPS skills have not been truly demonstrated because different children of different ages have been used in the studies. Longitudinal studies are needed in order to study the development of ICPS skills within the same children over time in order to rule out the possibility that previous findings have been due to cohort effects. While the following studies have not employed a longitudinal design, they have attempted to gain more information regarding ICPS skills by exploring potential variables that may contribute to the development and acquisition of ICPS skills.

Factors that Influence the Development of ICPS skills

McKim et al. (1982) found a positive relationship between both means-ends thinking and role-taking in a sample of suburban third graders. However, those relationships dropped out when IQ effects were controlled. (McKim et al., 1982). Differential linkages between problem-solving skills and adjustment for different age and sociodemographic groups may help to explain both the success of Spivack and Shure's (1974) ICPS interventions with black inner-city children, and
failure of investigators to replicate those findings with other samples. (McKim et al., 1982).

Similarly, Marsh et al. (1980) found that perspective-taking training had a significant effect on eighth graders interpersonal problem analysis abilities (Marsh, Serafica & Barenboim, 1980). These results prompted the investigators to further explore the relationship between perspective taking and interpersonal problem solving. Marsh, Serafica and Barenboim (1981) assessed the relationship between affective and social perspective taking and means-ends and analytical interpersonal problem solving with teacher and self-ratings of interpersonal functioning of 68 eighth graders. Results indicate that both dimensions of perspective taking and interpersonal problem solving are significantly related to one another. Interestingly, affective and not social perspective taking was found to correlate significantly with interpersonal functioning, leading the authors to conclude that feelings may play a more important role in interpersonal relations than cognitions (Marsh, Serafica & Barenboim, 1981). The authors suggest that different social-cognitive competencies are not equally likely to mediate interpersonal functioning. This raises the question of whether or not IQ mediates ICPS skills and social functioning.
Findings regarding a relationship between ICPS skills and behavioral adjustment and IQ have been equivocal. Several researchers have found IQ to be a significant mediating variable between ICPS skills and behavioral adjustment (McKim et al., 1982; Rubin & Daniels-Beirness, 1983; Kendall & Fischler, 1984). Conversely, other researchers have found significant relationships between ICPS skills and behavioral adjustment when IQ effects are held constant (McKim et al., 1982; Gesten et al., 1982; Enright & Sutterfield, 1980).

More recently, investigators have begun to explore the relationships between children's interpersonal negotiation strategies and attributional and response biases to ICPS skills and social functioning. Leadbeater et al. (1989) examined the relationship between ICPS skills and interpersonal negotiation strategies (INS) in adolescents engaged in problem behaviors. Results indicated a moderate positive correlation between level of interpersonal negotiation strategy and ICPS skills for both males and females (Leadbeater et al., 1989).

Downey and Walker (1989) examined the relationships between ICPS skills, attributional and response biases and adjustment in children at risk for psychopathology due to parental maltreatment of and/or parental psychopathology. Using a modified version of the Marsh
et al. (1980) measure of interpersonal problem solving skills, they found that overall, maltreated children were more poorly adjusted than other children, and that children with higher levels of ICPS skills and older children without a hostile attributional or an aggressive response bias were better adjusted. These findings suggest that family relationship factors may affect children's acquisition of ICPS skills.

Pettit, Dodge and Brown (1988) found several dimensions of family experience to be predictive of both children's classroom social competence and ICPS skills. Specifically they found that early experience with peers was significantly related to the number of solutions generated to hypothetical social problems. Results also indicated that the proportion of relevant solutions and the proportion of prosocial solutions was marginally related to early experience. Whereas for other experiences, such as exposure to deviant maternal values and expectations, the relation to social competence with peers was mediated by the child's social problem solving skills and patterns. The authors conclude by suggesting that there may be a developmental path running from maternal values and expectations to child social cognition to child social competence with peers. (Pettit et al., 1988). Similarly, Shure (1978) found that how a mother solved adult interpersonal problems was related to
how a mother would solve child-related problems. Furthermore, she found that how a mother thought about child related problems directly influenced her child rearing style (Shure, 1978).

Further support for a relationship between parental functioning and children's ICPS skills is found in Putallaz's (1987) work examining the relation between maternal behavior and children's ICPS skills and the relation between children's ICPS skills and their social status. Results indicated that the quality of a child's solutions to hypothetical social problems was found to be predictable from maternal behavior, and a child's ICPS skills in turn predicted that child's social status (Putallaz, 1987).

Roopnarine (1987) also examined the relationship between parental modes of functioning and children's peer group behaviors, and the association between peer group behavior and interpersonal awareness and ICPS skills. The analyses indicated that maternal involvement and reasoning guidance of both mother and father were significant predictors of children's positive behaviors directed at peers. As expected, maternal reasoning guidance showed an inverse relationship with negative behaviors directed at peers. Interestingly, interpersonal awareness, but not problem solving ability, was an effective predictor of behavior with peers. While
these results are in general accordance with Baumrind's (1967) research regarding parental discipline modes and children's social behavior, they have to be regarded cautiously. Roopnarine's sample was predominantly Mormon, and was probably not reflective of the general population.

Finally, Rubin's and Daniels-Beirness (1983) study of the concurrent and predictive correlates of sociometric status in 72 kindergarten and first grade children raises the question of whether creativity is a potential correlate of ICPS skills. The subjects were administered measures of social problem solving, peer popularity, MA, as well as teacher ratings of social competence. The results indicate that status in kindergarten and Grade 1 was concurrently and positively correlated with the use of prosocial problem solving strategies and positive social interaction and concurrently and negatively correlated with solitary-dramatic play. In an attempt to explain their findings, the authors cite the work of Rubin, Fein & Vandenberg (1983) who found that while there was no correlation between exploratory activity and peer status, exploratory activities during which children cautiously investigate aspects of their environment was been found to precede temporally and developmentally creative, playful, problem-solving and cooperative
endeavors (Rubin, Fein & Vandenberg, 1983). This study suggests that creativity may be an unexplored potential correlate of ICPS skills.

Definitions of Creativity

The term "creativity" suffers severely from surplus meaning. Creativity is attached to such diverse elements ranging from intelligence to people to finance. A number of theorists have attempted to provide some working definitions of the term "creativity".

In his attempt to understand the components of intelligence, Guilford (1967), using factor analytic methods, derived three categories in the structure of intellect; content, products and operations. Within the operations category were five distinct abilities; evaluation, convergent thinking, divergent thinking, memory and cognition. Children's creativity essentially refers to performance on tests of the divergent thinking type (Guilford, 1967).

Specifically, Guilford (1967) saw the traits of fluency, flexibility and originality as being responsible for what is usually called creativity. Fluency involves the process of association. A second aspect of fluency is called "ideational fluency". Where as a person rapidly thinking up many synonyms or antonyms in a word association test is employing fluency, a person
describing different concepts, theories or explanations is demonstrating ideational fluency (e.g., "Tell me all the different ways a cork can be used?") (Guilford, 1967).

Flexibility also involves two domains of thought: adaptive and spontaneous flexibility. Adaptive flexibility involves changing directions in problem solving as one confronts new conditions. Spontaneous flexibility, on the other hand, involves coming up with new ideas without a specific problem in mind. Originality, the third process, involves the ability to think in uncommon modes with clever, unique or even "way-out" concepts (Guilford, 1967). As a result of Guilford's work, creativity is no longer viewed as a single process but as a series of processes in the service of divergent thinking.

In 1977 Guilford revised his structure-of-intellect (SOI) model, in which 30 different divergent production (DP) abilities are distinguished. They come in five sets, each set characterized by a different kind of informational content utilized in perception and thinking; visual, auditory, symbolic, semantic and behavioral. Symbolic information includes numbers, letters and word (in print). Semantic items of information are meanings. Behavioral information is what we know of the thoughts, feelings and intentions of persons we observe (Guilford, 1985).
Within each content set, six DP abilities are distinguished in terms of basic kinds of products, or ways in which items of information are structured; units, classes, relations, systems (organizations of interdependent parts), transformations (changes), and implications (associated items). A particular DP ability is characterized by its unique combination of three features; its kind of operation, kind of content and kind of product. For example, it could deal with DP of visual relations or with DP of semantic transformations (Guilford, 1985). Of particular interest to the present research will be the relation between DP-behavioral transformations (flexibility) and DP-behavioral implications (fluency) to ICPS skills.

Based largely on Guilford's original factor analytic work, Torrance (1965) defines creativity as the "process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty, searching for solutions, making guesses, or formulating hypotheses about deficiencies, testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results". (Torrance, 1965). Torrance appears to regard creativity as little else than problem solving and clearly his definition follows Dewey's (1910)
earlier attempts at formulating a problem-solving model for creativity.

Creativity: How it is Measured

Torrance has devoted a great deal of his career to developing assessment measures of creativity. The famous Minnesota Tests of Creative Thinking are the result. Torrance's early tests were primarily verbal in content. For example, subjects were asked to respond to items such as the following: "Select one title from the list below as a subject for a story. Do not be afraid to make it unusual" (Torrance, 1970);

The Man Who Cries
The Woman Who Can but Won't Talk
The Flying Monkey
The Lion that Won't Roar

Torrance considered the response to be "creative" if they included fluency, flexibility, originality and imagination (Torrance, 1962). These are similar to Guilford's concepts of the criteria constituting a creative response.

Another example of an assessment item is the "unusual-uses" approach. The researcher asks for unusual uses for everyday objects: "How many uses can you think of for a tin can or a brick?" Creative people tend to generate many original ideas for possible uses demonstrating ideational fluency (Torrance, 1962). In many ways, the skills necessary to successfully complete
the unusual-uses test are the same skills necessary to generate a large number of alternative solutions to interpersonal problem situations. Both involve the ability to change one's thinking about the original "stimulus," and to see it in a "new light," as well as forming as many associations to the stimulus as possible, maximizing the chance of finding an effective solution.

More recently, Torrance has added some nonverbal assessment items, such as the incomplete drawings. In this test, a subject is shown an incomplete drawing and asked to complete the figure in such a way as to make it more interesting (Torrance, 1970).

Mednick (1962) developed a test of "Remote Associates". This procedure relies on the ability to produce remote (far-out) associations for concepts. For example; "What word is related to all three words in the example? Railroad, girl, class" (Mednick, 1962). The answer is "working". The major limitation is that the Remote Associates test of creative association produces items that have only one answer.

Problem solving or finding uncommon solutions to difficult problems has also been used as an assessment procedure. For example, Guilford's Insight Problem; (Guilford, 1977).
A man went to hunt a bear one day. He left and hiked due south for 10 miles, then due west for ten miles. At this point, he killed a bear. He dragged the bear back to camp, a distance of 10 miles. What was the color of the bear? Why?

The answer is white because the directions could only be followed at the North Pole, where only Polar bears exist. The difficulty with these tests are that the solution may be more "tricky" than creative (Guilford, 1967).

Wallach and Kogan's (1965) assessment procedures for elementary age children are probably the most comprehensive. Using a whole battery of tests, they found that valid discriminations could be made with 6 to 12 year old children. Their procedures included questions such as (Wallach & Kogan, 1965):

1) Name all the round things you can think of
2) Name all the things that make noise
3) Name all the things that are square

These responses are scored for fluency (number of answers generated) and for uniqueness. A second assessment procedure developed by Wallach and Kogan (1965) is similar to Torrance's "unusual-uses" items already discussed. Wallach and Kogan (1965) also developed nonverbal tests of creativity; the Line Meaning Test and the Pattern Meaning Test (Wallach & Kogan, 1965). The items are incomplete abstract drawings. These tests are similar to the Rorschach Inkblot test, in that the subject adds the meaning to the stimulus. The subjects
responses are then scored for uniqueness (Wallach & Kogan, 1965).

Overall, the instruments used to measure divergent production ability are scored for fluency, flexibility or originality. Furthermore, the processes involved in performing well on these tests are similar to the processes needed to solve interpersonal problem successfully.

Processes Involved in Divergent Production

What are the processes involved in divergent production? In two major publications, Wallach (1970, 1971) outlined the positive and the negative side of creativity research. Wallach (1970) espoused a "breadth-of-attention deployment" interpretation as the major explanatory construct responsible for superior performance on divergent thinking tasks (Kogan, 1983). This construct refers to extensive and adaptive scanning of the external environment and memory storage. Such scanning is presumed to take place in an associational rather than strictly logical manner and may be purposeful (i.e., when problem solving) or less purposeful (i.e., when daydreaming) (Wallach, 1970). Ward's (1969) observation that ideationally fluent children are more likely than their less fluent peers to seek out cues in the external environment as an aid when responding to
divergent thinking tasks supports the adaptation of Wallach's (1970) breadth-of-attention deployment explanation (Kogan, 1983).

In marked contrast to an attention-deployment interpretation of creative thinking, Wallach (1971) introduced a more negative interpretation of highly productive divergent thinkers. According to Wallach (1971), performing well in the divergent thinking domain may be symptomatic of such tendencies as obsessiveness, suggestibility and susceptibility to experimenter demand characteristics (Wallach, 1971). Thus, ideationally fluent children are presumed to be unable to let go of an item, preferring to go on in a nitpicking fashion if necessary rather than stopping and proceeding to the next item. Further, such children are seen as particularly eager to please an examiner, hence generating a large number of responses to make a good impression (Kogan, 1983).

Which of Wallach's interpretations is correct? In an attempt to answer this question, Caudel (1976) manipulated experimenter variables, producing three different "types" of experimenters; neutral-control, authoritarian-demanding and role playing-creative. Results indicated that an experimenter demanding that subjects produce more creative responses proved effective in eliciting higher levels of ideational
fluency from subjects, however, such a condition either had no effect or depressed the number of high quality responses generated. Conversely, the experimenter gently encouraging subjects to role-play a creative person produced a significant enhancement in quality level (Caudel, 1976). Contrary to earlier claims, fluency and quality may not necessarily represent alternate means of measuring the same thing.

Further evidence for the importance of a quality vs. quantity distinction is offered by Harrington, Block and Block (1983). They found that quality appears to be superior to quantity in predicting an external creativity criterion (Harrington, Block & Block, 1983). It appears that there may be good reason, at least in early childhood, to believe that fluency and quality reflect distinctively different aspects of the divergent thinking domain. These findings highlight the importance of considering the quality of children's responses as well as the quantity.

Research by Kogan and Morgan (1969) offers further evidence on differential task context effects in elementary school children (fifth graders). Kogan and Morgan compared test-like to game-like experimental conditions on the outcome of the alternate-uses task. Test-like conditions generated higher levels of fluency and uniqueness. Yet spontaneous flexibility (the number
of different response categories) remained unaffected. Kogan and Morgan (1969) suggest that test-like conditions encourage a category-exhaustion strategy where to speed the associative flow, children will seize upon some pivotal category (e.g. cutting in the case of a knife) and proceed to exhaust the exemplars that flow from it (e.g., cutting bread, butter, fruit, etc.). Under such circumstances, the child may think of something to cut that is unique to the sample. Because a strategy of category exhaustion necessarily implies the building up of specific categories, it does not encourage the child to frequently switch across categories. Hence, spontaneous flexibility remains unaffected (Kogan & Morgan, 1969).

The evidence to date regarding task context effects is equivocal. Wallach (1971) makes a strong claim for the irrelevance of testing conditions—"Creativity and intelligence are claimed to be distinct modes of thought quite apart from the game-like or test-like context in which each is assessed" (Wallach, 1971). As further support for lack of task context effects, Hattie (1977) states," There is little evidence against using timed test-like conditions as the norm for administering creativity tests," (Hattie, 1977). However, contrary evidence supporting differences in the discriminant validation for convergent and divergent thinking tasks
under test-like and game-like conditions has been found by Nicholls (1971), Milgram and Milgram (1976) and even Hattie (1980).

While examining the effects of context upon divergent thinking production is relevant to further understanding the processes involved in DP, the effects are not directly observable. LaGreca (1980) has attempted to study strategies of divergent thinking in a more direct manner through interviews of third and sixth graders exposed to both verbal (instances and alternate-uses) and figural (Rorschach cards) tasks. The results suggested that children employ several strategies on creativity tasks including recalling unusual uses for an object, placing an object in a familiar context or situation, recalling daily activities, considering the "attributes" of the stimulus, scanning the immediate environment, and imagining an object in an unusual manner. LaGreca also found that providing children with category and content cues may facilitate performance and this effect appears to be greater for younger vs. older children. Of particular interest was that category cues may be more effectively used by high-creative children, regardless of age. LaGreca recommends that developmental differences in the use of strategies be explored in future research (LaGreca, 1980).
It is clear that the processes involved in divergent thinking are susceptible to experimenter and environmental cues. In respect to the latter, it is plausible that children faced with an interpersonal problem, may draw upon clues from their immediate environment to aid them in solving the problem (e.g., a child may pick up another toy nearby, rather than continue to argue over the toy in conflict).

Individual Differences in Divergent Production

A number of individual differences in children's divergent thinking abilities have been found. Where creativity refers to task performance on dimensions variously labelled "divergent thinking," "ideational fluency," "associative productivity," "originality," "uniqueness," "spontaneous flexibility," or other related constructs, consistent sex differences have not been found. Some studies do report male superiority (e.g., Hudson, 1968; Torrance, 1972), and others female superiority (e.g., Guilford, 1967; Wallach & Wing, 1969; Johnson, 1976), but the majority of studies have failed to uncover a systematic superiority of one sex over the other (Feldhusen & Denny, 1965; Klausmeier & Wiersma, 1965; Torrance, 1965; Wallach & Kogan, 1965). In sum, the foregoing empirical outcomes strongly suggest that
neither sex is at an advantage in regard to creativity (Kogan, 1974).

The differences in divergent thinking ability with regards to race and SES are not as clear cut. Again, like individual differences in ICPS skills, these studies are confounded by the unintentional, yet simultaneous manipulation of race and SES. Warden and Prawat (1975) tested both black and white, higher and lower status adolescents (tenth graders), on two divergent thinking and three convergent thinking tasks taken from Guilford (1967). In the case of the former, no significant race or SES effects were observed. For the convergent thinking tasks, in contrast, significant race and SES effects were found that favored whites and higher status adolescents (Warden & Prawat, 1975). Results virtually identical to Warden and Prawat's (1975) were obtained in a sample of sixth and seventh graders given the Wallach and Kogan (1965) tasks by Rosenbaum (1974). Rosenbaum (1974) also varied the race of the experimenter and the task context (test vs. game), but neither of these interacted with the race or SES of the subject in affecting divergent thinking performance (Rosenbaum, 1974).

One of the most extensive investigations of SES and race on children's cognitive performance was performed by Yando et al. (1979) on samples of second and third
graders. Included within that study were two divergent thinking tasks of the Guilford-type scored for fluency, flexibility, and originality. Both a matched-groups and typical-groups design were employed. In the former, children in the four race-by-SES groups (black and white, lower and higher SES) were matched for MA and IQ: in the latter, the groups were equated only for chronological age. In the matched groups design, no significant race or SES differences in divergent thinking were obtained. Of course, such a design necessarily implies that the children in the demographic subgroups are somewhat atypical, given the linkage in the population between race and SES on the one hand, and MA and IQ on the other hand. This problem did not arise in the typical groups portion of the research. Here, one finds that the disadvantaged (lower SES) children yielded higher fluency and flexibility scores despite the higher IQ of the advantaged children. On the other hand, the latter children produced a larger percentage of original responses than did their disadvantaged peers. It is important to note that the significant effects described were confined to SES, no significant race effects were found (Yando et al., 1979).

Yando et al. (1979) explain the patterning of the three divergent thinking measures in respect to SES as indicative of lesser concern for the quality in the
responses of disadvantaged children. It is argued that the more advantaged children engage in self censoring of responses that do not meet an internalized standard of acceptability. Because the disadvantaged children do produce high quality, as well as low quality responses. Yando and her associates maintain that the SES difference is stylistic rather than of an ability character. The disadvantaged children are presumed to be more adventuresome and spontaneous, the advantaged children more constructed and self-critical (Yando et al., 1979).

In a further attempt to understand the differences in divergent thinking, examiners have investigated children's differences in play. As Kogan (1983) suggests, there is a strong association between play and creativity (Kogan, 1983). Dansky (1980a) attempted to elucidate the mediating variables responsible for the linkage between play and divergent thinking. To achieve a fuller understanding of the issue, Dansky proposes an examination of individual differences among children in their spontaneous make-believe play behaviors. Thus, when children are encouraged to play for a duration of time with a specified set of toy materials, there is no reason to expect that all the children exposed to this condition would necessarily engage in make-believe play. If it could be shown, Dansky reasons, that children who engage in make-believe play are more strongly influenced
by a congruent play treatment (in the sense of enhanced divergent thinking scores) than are children who show no natural inclination toward make-believe play, a strong case could then be made for the disposition toward make-believe as the mediator of the play/divergent thinking association (Dansky, 1980a).

The Dansky (1980a) investigation employed preschool children who were observed in a free play setting over four 5-minute periods. Children who engaged in make-believe play more than 25% of the time were labeled players: those manifesting make-believe less than 5% of the time were labeled nonplayers. The children within each category were then randomly assigned to experimental treatments, that is free play, imitation, and convergent problem solving treatments. Greater alternate-uses fluency was found in the free play relative to the other conditions and among players in comparison with nonplayers. Of particular interest, however, was the evidence of a significant interaction in which children in the free play/player cell generated significantly more uses than subjects in any of the other cells comprising the study design (Dansky, 1980a).

In sum, the outcomes of the Dansky (1980a) research strongly reinforce the view that the make believe elements in symbolic play have much in common with the
cognitive processes characterizing skill in divergent thinking.

In a longitudinal study Clark et al. (1988) also studied the relationship between play and divergent production in a group of 133 kindergarten children. Having corrected flexibility and originality scores for the effects of fluency (Clark et al., 1986), Clark et al. (1988) found that symbolic or pretend play was related to fluency at Time 1 for the group as a whole and for males. This pattern was only marginally evident for females. Three years later, when the children were in second grade, that same Time 1 symbolic play was not found to be related to fluency, but was found to be related to flexibility and originality for the group as a whole and for males at Time 2. Interestingly, at Time 2 for females, a significant relationship was found between play and fluency. In interpreting their findings, the authors suggest that flexibility and originality may be a developmentally more mature manifestation of a divergent cognitive style (Clark et al., 1988).

Further support for this hypothesis was found by Goldman et al. (1987) in a study examining the development of and relationship between interpersonal cognitive problem solving skills and divergent production in 200 children in grades K-2-4-6 and 8. Results revealed no significant grade effects for fluency,
however, there were significant grade effects for flexibility. Specifically, there were significant increases in flexibility between grades K and 2, K and 4, K and 6, and K and 8. Like the Clark et al. (1988) findings, older children appear to be more flexible than younger children, and this difference in flexibility appears approximately around second grade (Goldman et al., 1987).

Pepler and Ross (1981) have also addressed the question of the nature of play that facilitates divergent and convergent thinking by examining the differences between groups of children exposed to different types of toys. Children 3 and 4 years old were provided with an assorted set of colored pieces, each of which fit into a form board (convergent play), or with the pieces alone, which consisted of free standing animals, vehicles, regular shapes, random shapes and squares (divergent play). Observations of the children indicated that the provided materials fostered the kinds of play intended. All of the participating children were then given convergent tasks (e.g., puzzles involving color or form matching with irrelevant cues) and divergent tasks (e.g., alternate uses).

The results indicated that divergent play enhanced the uniqueness of responses offered on divergent thinking tasks, even though such tasks bore little formal
similarity to the play materials. No such effects on divergent tasks were found for children in convergent play or no play groups. Further, relatively broad transfer effects observed within the divergent task domain in the divergent play group also extended to the convergent domain. Children engaging in divergent play "appeared to be more flexible in abandoning ineffective strategies as they sought problem situations" (Pepler & Ross, 1981 p. 1210). Comparable effects have also been reported by Dansky (1980b), by Sylva, Bruner and Genova (1976) and by Smith and Dutton (1979). Convergent play, by contrast, seemed to enhance performance exclusively on convergent thinking tasks similar to those employed during the play period (Pepler & Ross, 1981).

In sum, the Pepler and Ross (1981) work is of particular significance in its demonstration that the beneficial effects of divergent play are not confined to divergent thinking tasks, but rather are suggestive of a heightened flexibility in problem solving performance conceived more generally (Kogan, 1983).

**Correlates of Creativity**

Possibly, the major preoccupation of creativity research through the early 1970's concerned the discriminant-validational issue of the statistical independence of divergent and convergent thinking
(Wallach, 1971). The relationship between creativity and intelligence is exceedingly complex and is further complicated by difficult problems of measurement. In general, it seems best to summarize the studies examining the relationship between divergent thinking ability and intelligence by saying that the correlations vary widely (from zero upward) depending upon the DP tests, the heterogeneity of the sample, and the testing conditions (Barron & Harrington, 1981).

Torrance (1967) summarized 388 correlations involving intelligence measures and the Torrance Tests of Creative Thinking (TTCT) and reported a median correlation of +.06 for his figural DP tests and +.21 for his verbal DP tests (Torrance, 1967). Guilford (1967) reported average correlations of +.22 for his figural DP tests, and +.40 for symbolic DP tests, and +.37 for semantic DP tests in a sample of 204 ninth graders but a range of DP X IQ correlations from -.04 to +.70 (Guilford, 1967).

Overall, the findings regarding the relationship between IQ and DP are equivocal, with some researchers suggesting modest relationships (Guilford & Christensen, 1973; Getzels & Jackson, 1962; Cline, Richards, & Needham, 1963) while others have found negligible correlations (Flescher, 1963; Wallach & Kogan, 1965). Currently, it is generally believed that divergent
thinking and intelligence are relatively independent of one another (Kogan, 1983).

The findings regarding the correlation between creativity and academic achievement have also been equivocal. Some researchers have found significant correlations between academic achievement and scores on Guilford and Torrance-type creativity tests (Cline et al., 1963; Getzels & Jackson, 1959, 1962; Torrance, 1960a; Yamamoto, 1964a, 1964b, 1964c). High-creativity individuals are also significantly superior to low creativity individuals on all subtests of the Iowa Test of Educational Development when the effects of intelligence are controlled statistically (Yamamoto, 1964c). Conversely, others have obtained no significant relationships between creativity and academic achievement (Flescher, 1963; Edwards & Tyler, 1965).

Considerable research has been conducted on the personality characteristics of persons who have been rated by competent judges as creative in such areas as art, architecture, literature and science. In general, these traits are consistent with what one would expect of original and talented individuals who have achieved success and recognition in their chosen fields. On the cognitive side, creative individuals tend to be original, perceptive, insightful, independent in judgement, open to new experience, skeptical, and verbally facile. They are

In their relations with others creative people are unconventional, rebellious, disorderly, self-centered, exhibitionistic, and prone to retreat to the role of observer (Barron, 1963, 1968, 1969; Drevdahl, 1956; Drevdahl & Cattell, 1958; Hammer, 1961; MacKinnon, 1960, 1961, 1962). Several researchers have also found correlations between measures of divergent thinking and cognitive problem solving with affective traits, such as tolerance for ambiguity, locus of control and self-esteem (Houtz et al., 1980; Tetenbaum & Houtz, 1978). Karheck and Hogan (1983) found that pretest verbal fluency scores best predicted improvement on cognitive problem solving measures (Karheck & Hogan, 1983).

Overall, it appears that divergent thinking is relatively independent of intelligence, equivocally related to academic achievement, strongly related to several personality characteristics and related to impersonal as well as interpersonal cognitive problem solving.
Interpersonal Cognitive Problem Solving, Social Competence and Behavioral Adjustment

Correlational Studies. Due to Spivack and Shure's (1976) and D'Zurilla and Goldfried's original position, that there are a set of ICPS skills mediating healthy human functioning, many investigators have spent considerable time and effort exploring these relationships. However, findings attempting to link ICPS skills with behavioral adjustment have been mixed, with significant correlations and/or treatment effects emerging for some measures and population samples but not for others.

Support for a relationship between ICPS skills and behavioral adjustment has been found by Rubin and Clark (1983). Results indicated that negative affect alternative strategies correlated significantly with teacher ratings of preschoolers on the Behar Preschool Behavior Questionnaire (Rubin and Clark, 1983). Similarly, Marsh et al. (1981) found a consistent and positive relationship between interpersonal problem solving and interpersonal functioning.

In another study attempting to link ICPS skills with behavioral adjustment, Kendall and Fischler (1984) found alternatives and consequential thinking correlated with behavioral measures among 6 and 7 year old boys and 6 and 11 year old girls. The behavioral measure consisted of
observations made during an interactional problem-solving task that involved the child's family. Means-ends thinking did not covary, however, with observed behavior, and ICPS skills were not systematically related to adjustment, as assessed through several parent and teacher rating scales. The authors note that one of the difficulties inherent in this area of research, as well as a possible explanation for the discrepant findings with previous research, is the lack of support for the ecological validity of the ICPS measures (Kendall & Fischler, 1984). Conversely, McKim et al. (1982) found a positive relationship between means-end thinking, role taking and behavioral adjustment in a sample of suburban third graders. Furthermore, in the same study, alternative thinking related consistently to teacher estimates of adjustment among urban children (McKim et al., 1982).

While there is some evidence that ICPS skills (i.e., the process) play an important role in adjustment, there is little to suggest that this relationship is evident in actual interpersonal problem-solving behavior (i.e., the outcome). Indeed, several recent reviews (Butler & Meichenbaum, 1981; Kendall, Pellegrinin, & Urbain, 1981; Krasnor & Rubin, 1981) point to the need for research documenting the ecological validity of ICPS measures.
Finally, other researchers have found that interpersonal problem solving skills share little common variance with observed behavior (Enright & Sutterfield, 1980; Sharp, 1981; Rickel, Eshelman, & Loigman, 1983; White & Blackham, 1985).

The aforementioned studies were all correlational, and as such do not imply a causal relationship. However, group comparison studies can suggest the direction of the relationship.

*Group Comparison Studies.* Denham and Almeida's (1987) meta-analysis found that scores on ICPS measures do differentiate between adjusted and nonadjusted children. Further support for a relationship between ICPS skills and behavioral adjustment has been found by Spivack and Shure (1980).

Spivack and Shure (1980) found more socially competent preschoolers to differ from their less socially competent peers with respect to the ability to generate alternative solutions. Fostering the ability to generate alternatives in intervention programs proves to be effective in enhancing social and behavioral adjustment.

Other researchers have chosen to examine peer sociometric choices as an index of ICPS skills. Rubin, Daniels-Beirness and Hayvren (1982) obtained sociometric popularity for 123 preschoolers and 111 kindergartners. All children were observed and the level of their social
and cognitive play, as well as their conversational partners, the initiator of the activity and the affective quality of each social interchange were recorded. Social competence (as rated by teacher) and social problem-solving ability were also assessed, and found to be significantly correlated. Peer rejection was consistently related to agonistic behavior. Furthermore, unpopular children were observed to engage in less mature forms of play and to interact less with others than were their more popular agemates (Rubin, Daniels-Beirness & Hayvren, 1982). Based on these findings the authors conclude that the quality as well as the quantity of children's ICPS skills played a role in determining a child's sociometric status.

Similarly, Richard & Dodge (1982) examined the ICPS skills in samples of popular, aggressive, and isolated boys. It was found that the popular group of subjects generated more solutions than either the aggressive or isolated groups, which did not differ. Interestingly, the initial solutions of all groups were rated as "effective," in most cases by independent coders. Subsequent solutions, however, varied as a function of subject status. Popular subjects continued to generate effective solutions, whereas deviant subjects generated aggressive and ineffective solutions (Richard & Dodge, 1982).
Asarnow and Callan (1985) also examined the relationship between peer sociometric ratings and ICPS skills. Specifically they found that boys rated negatively by their peers generated fewer alternative solutions, proposed fewer assertive and mature solutions, generated more intense aggressive solutions, showed less adaptive planning, and evaluated physically aggressive responses more positively and positive responses more negatively than did boys rated as popular (Asarnow & Callan, 1987). These results are similar to those of Dodge et al. (1984), who found that normal children (popular and average) were found to score more highly than deviant children (neglected and rejected) on a test of intention-cue detection. Interestingly, the errors by deviant children tended to consist of erroneous labels of prosocial intentions as hostile (Dodge et al., 1984).

Gouze (1987) examined the relationship between ICPS skills and selective attention in aggressive and nonaggressive preschool boys. She found that compared to their nonaggressive peers, aggressive preschool boys tend to focus their attention on aggressive social interactions in their environment. They also provide aggressive solutions to interpersonal conflict situations more often that their less aggressive peers (Gouze, 1987).
Feldgaier (1987) found evidence suggesting a link between ICPS skills and adjustment, as well. Specifically, adjusted children were better at problem recognition, problem analysis, consequential thinking and solution adequacy than children rated as either Externalizers, Internalizers or "Mixed" (children who fell into neither group) according to parent's ratings on the Child Behavior Checklist (Achenbach, 1981).

These comparative studies, as well as Denham and Almeida's meta-analysis, have firmly suggested that ICPS skills can differentiate between adjusted and nonadjusted groups of children. However, these studies still do not provide conclusive evidence regarding the relationship between ICPS skills and behavioral adjustment. However, training studies, in which a group of children are trained in ICPS skills and then assessed on some measure of behavioral adjustment do allow us to make inferences about cause and effect relationships between ICPS skills and behavioral adjustment.

Training Studies. Not surprisingly, several ambitious researchers have designed programs for implementation within the school setting to facilitate the acquisition of interpersonal cognitive problem solving skills. Shure and Spivack (1974) undertook a prevention study evaluating 131 inner-city black nursery school and kindergarten children. The study was designed
to assess if whether enhancing ICPS skills of these youngsters could improve inhibited and impulsive behavior where it already existed, and prevent it from occurring where it did not. Furthermore, Shure and Spivack were interested in whether or not implementing the program in nursery school verses kindergarten would make a difference in later adjustment. The results suggest that ICPS skills training does reduce and prevent inhibited and impulsive behaviors, and that the ICPS skills and behavioral impact of such training lasts at least one full year following intervention (Spivack and Shure, 1974).

However, several methodological problems plagued this study. It is unclear from this study, whether significant results were due to teacher/rater bias in making behavioral adjustment ratings, lack of random assignment of children to treatment groups, or the intervention program itself (Rickel, Eshelman, and Loigman, 1983).

In an attempt to clarify these problems, Rickel's et al. (1983) replicated Spivack and Shure's study, remedying the aforementioned methodological shortcomings. Support was found for cognitive effectiveness of social problem solving training with aberrant children at post test in that they gained significantly in their ability to generate alternative solutions to interpersonal
problems. However, this differential effect was not sustained at follow-up, nor did blind teacher ratings reveal significant behavioral training effects at post test or at follow up. The authors attribute the changes seen in both their own and Spivack and Shure's (1974) study's to "natural maturational processes and general educational stimulation" (Rickel et al., 1983).

Nevertheless, given such initially favorable results, others have adopted Spivack and Shure's strategy in designing their own school based preventative programs. The findings to date have been equivocal. While several studies using somewhat different training programs, populations, and measures have indicated that ICPS skills can be taught, relationships between ICPS skills and behavioral adjustment gains have been absent (Gesten et al., 1982; Weissberg & Gesten, 1981a; Weissberg et al., 1981b; Olexa and Foreman, 1984). Conversely, Ridley and Vaughn (1982) found a significant increase in both cognitive and behavioral ICPS skills in an experimental group of preschoolers who had undergone a 10 week ICPS intervention program. Furthermore, these changes were maintained at follow-up testing 3 months later (Ridley & Vaughn, 1982).

Further evidence for the effectiveness of ICPS skills training programs in improving behavioral adjustment has been found with aggressive preschoolers
(Vaughn et al, 1984), aggressive 9 and 10 year-old boys (Lochman & Curry, 1986), children at risk for developing later psychopathology (Yu et al., 1986) and emotionally disturbed boys (Elias, 1983).

Finally, results were found by Seaman & Sloane (1984) who examined the effects of ICPS skills training on randomly assigned kindergarten children. Results indicated that after training, experimental children generated significantly more solutions to interpersonal conflict situations. However, the greater number of solutions by these children were all in categories considered socially inappropriate. Furthermore, there were no significant differences found between the experimental and control children in the use of solutions defined as socially appropriate (Seaman & Sloane, 1984). Results of this study, as well as the comparative study of Richard and Dodge (1982) lend support to the idea that when scripts become blocked and effortful processing is called upon, that aggressive, isolated and sometimes "normal" children can resort to socially inappropriate resolutions of social problems.

It appears that ICPS training programs can be successful in teaching children specific ICPS skills. However, what remains equivocal is whether or not this training translates into behavioral change. These mixed results suggest that other variables, such as creativity,
may be mediating the relationship between children's ICPS skills, social competence and behavioral adjustment. Furthermore, these findings indicate a need to better understand the development of ICPS skills in order that we may better understand the variables influencing ICPS skills.

Statement of the Problem

There is still no formal theory guiding ICPS skills research, although several researchers have put forth models. Traditionally, investigators (Spivack & Shure, 1976; D'Zurilla & Goldfried, 1971; McFall, 1982; Rubin and Krasnor, 1986) have attempted to build models to describe the problem solving process and its relation to social competence and behavioral adjustment. More recently, researchers (Dodge, 1986; Cavell, 1990) have begun to view ICPS skills as a component of social competence, and have proposed models of social competence of which ICPS skills are a part. This shift to including ICPS skills as a component of social competence highlights the need to better understand the construct of interpersonal cognitive problem solving as a means to better comprehending social competence. This includes gathering knowledge about the development and correlates of overall and specific ICPS skills. While past research has demonstrated age or grade related changes in
ICPS skills (Marsh, 1982; Feldgaier & Serafica, 1980; White & Blackman, 1985; Feldgaier, 1987; Goldman et al., 1987), these studies have employed a cross-sectional design, and as such can only imply, rather than demonstrate, developmental change. Because the aforementioned studies have failed to assess the same subjects over time, it is possible that previous age or grade differences in ICPS skills are attributable to cohort effects. The literature suggests that future research be conducted within a longitudinal design in order that we can more fully understand the development of ICPS skills (Kendall, 1984; Rubin & Krasnor, 1986; Goldman et al., 1987).

The literature also suggests that future research be directed toward discovering other correlates of ICPS skills (Urbain & Kendall, 1980; Rubin & Krasnor, 1986). Specifically, research by Fry and Addington (1984), Rubin and Krasnor (1983), Elardo and Caldwell (1979), and Goldman et al. (1987) suggests that a relationship between flexibility in thinking or creativity exists and is in need of further exploration.

Finally, research findings demonstrating a relationship between ICPS skills and behavioral adjustment have been equivocal (Platt et al., 1974; Spivack & Shure, 1974; Marsh et al., 1981; Enright & Sutterfield, 1980; Sharp, 1981; White & Blackman, 1985).
Therefore, the purposes of this investigation were as follows: 1) to investigate the development of ICPS skills within the same children over a two year period, 2) to investigate the development of creative abilities within the same children over a two year period, 3) to demonstrate a relationship between overall and specific ICPS skills and creativity, and 4) to investigate the link between ICPS skills and social competence and behavioral adjustment as rated by teachers.

Hypotheses

The hypotheses tested (stated in the null form) regarding the investigation of children's interpersonal cognitive problem solving skills and creative abilities within the longitudinal sample were:

H1o: For each grade, there are no statistically significant changes in quantitative and qualitative responses in overall and specific ICPS skills over a two year period as measured by the TIPS (Feldgaier & Serafica, 1980) when IQ is statistically adjusted.

H2o: For each grade, there are no statistically significant changes in creative abilities, specifically fluency and flexibility, over a two year period, as measured by the Alternate Uses Test (Wallach & Kogan, 1965) when IQ is statistically adjusted.

H3o: There are no statistically significant sex differences in overall and specific ICPS skills as measured by the TIPS (Feldgaier & Serafica, 1980) when IQ is statistically adjusted.

H4o: There are no statistically significant sex differences in creative abilities,
specifically fluency and flexibility, as measured by the Alternate Uses Test (Wallach & Kogan, 1965) when IQ is statistically adjusted.

H5o: There are no statistically significant relationships between interpersonal cognitive problem solving skills and creative ability at Time 2.

H5a: There are no statistically significant relationships between ICPS skills and ideational fluency when sex, grade and IQ are statistically adjusted, at Time 2.

H5b: There are no statistically significant relationships between ICPS skills and flexibility when sex, grade and IQ have been statistically adjusted at Time 2.

H5c: There are no significant relationships between problem analysis, alternate thinking or consequential thinking and ideational fluency when sex, grade and IQ are statistically adjusted at Time 2.

H5d: There are no statistically significant relationships between problem analysis, alternate thinking or consequential thinking and flexibility when sex, grade and IQ are statistically adjusted at Time 2.

Some fairly specific predictions were made regarding longitudinal changes in children's ICPS skills at the beginning of this study. Specifically, past research, which had utilized a cross sectional design, (Goldman et al, 1987; Marsh, 1982;) allows us to predict that there should be changes in children's overall problem solving ability between second and fourth grade and sixth and eighth grade. With regards to specific quantitative ICPS skills, past research (Goldman et al., 1987; Marsh, 1982)) again predicts that there should be changes in
problem analysis between second and fourth grade. For alternative thinking, there should be changes between second and fourth and/or sixth and eighth grades (Goldman et al., 1987; Marsh, 1982). For consequential thinking, there should be changes from second to fourth grade (Goldman et al., 1987) or sixth to eighth grade (Marsh, 1982). Finally, for solution adequacy, there should be changes between sixth and eighth grade (Goldman et al., 1987; Marsh, 1982).

With regards to predictions based on qualitative changes in children's ICPS skills, past research (Goldman et al., 1987) would suggest that a change should occur between second and fourth grade in children's consideration of behavioral versus psychological and conceptual aspects when analyzing a problem.

Finally, with regards to predictions about children's creative abilities, past research (Goldman et al, 1987) would suggest that changes in fluency would occur prior to kindergarten. For flexibility, change should occur either before second grade (Goldman et al., 1987) or between second and fourth and fourth and sixth grade (Torrance, 1961).

Predictions based on past research (Marsh, 1982; Goldman et al., 1987; Shure et al., 1971; Dodge et al., 1984) suggested that no significant sex differences would be found in children's ICPS skills. Likewise, past
research (Feldhusen & Denny, 1965; Goldman et al., 1987) predicted no significant sex differences would be found regarding children's creative abilities.

The hypotheses tested (stated in the null form) regarding the investigation of children's ICPS skills and creativity between the cohort and longitudinal (Time 2) sample were:

H1o: There are no statistically significant differences in grade-related changes in overall and specific ICPS skills as measured by the TIPS (Feldgaier & Serafica, 1980) when IQ is statistically adjusted.

H2o: There are no statistically significant differences in grade-related changes in creative ability, specifically fluency and flexibility, as measured by the Alternate Uses Test (Wallach & Kogan, 1965) when IQ is statistically adjusted.

H3o: There are no statistically significant sex differences in ICPS skills as measured by the TIPS (Feldgaier & Serafica, 1908) when IQ is statistically adjusted.

H4o: There are no statistically significant sex differences in creativity, specifically fluency and flexibility, as measured by the Alternate Uses Test (Wallach & Kogan, 1965) when IQ is adjusted statistically.

H5o: There are no statistically significant differences in the relationships between ICPS skills and creativity.

H5a: There are no significant differences in the relationships between ICPS skills overall and ideational fluency when sex, grade and IQ are statistically adjusted.

H5b: There are no statistically significant differences in the relationships between ICPS skills overall and flexibility when sex, grade and IQ are statistically adjusted.
H5c: There are no statistically significant differences in the relationships between problem analysis, alternate thinking or consequential thinking and ideational fluency when sex, grade and IQ are statistically adjusted.

H5d: There are no significant differences in the relationships between problem analysis, alternate thinking or consequential thinking and flexibility when sex, grade and IQ are statistically adjusted.

H6o: There are no statistically significant relationships between children's ICPS skills and teacher's ratings of their social competence as measured by the Teacher's Rating Scale of Child's Actual Behavior (Harter, 1985) for the cohort and Time 2 samples.

H7o: There are no statistically significant relationships between children's ICPS skills and behavioral adjustment as measured by the Teacher's Report Form (Achenbach & Edelbrock, 1986) for the cohort and Time 2 samples.

Based on past research (Marsh, 1982; Feldgaier & Serafica, 1980; Goldman et al., 1987) specific predictions were made regarding grade-related changes in children's ICPS skills. Specifically, it was predicted that older children would consider more aspects of the problem, as well as generate significantly more alternative and consequential responses than younger children. Furthermore, older children would consider more psychological and conceptual aspects of the problem, while younger children would tend to focus on the more concrete, behavioral aspects of the problem. Finally, with respect to creative abilities, past research (Goldman et al., 1987) suggested that older children
would be more flexible in their thinking than younger children, and that this difference would appear at approximately second grade.

Refer to previous predictions regarding grade and sex differences in ICPS skills and creative abilities. Based on a recent meta-analysis (Denham & Almeida, 1987) it was predicted that a relationship between ICPS skills and teachers ratings of social competence and behavioral adjustment would be found.
Chapter III
Methodology

Subjects

The subjects for this longitudinal study were 175 out of the original 200 children or 88% of those who participated in the original study two years earlier. In addition, a new cohort sample of 91 children, who had not participated or ever taken the measures used were assessed. This new cohort sample was included, first to control for potential effects of repeated testing, and secondly, to ascertain if previous differences found between grades, were true grade-related effects or cohort effects.

The subjects were drawn from the same public school system which had cooperated in the study two years earlier. The subjects represented five grades (2-4-6-8-10) in the longitudinal sample, and four grades (2-4-6-8) in the cohort sample. Twenty-five children or 12% of those who had participated in the first study did not participate at Time 2. Seventeen of those children had moved out of the school district, mainly due to parents changing jobs. The remaining eight children
stated that they were no longer interested in participating in the project. Furthermore, because of the large number of children participating in the original study within the schools assigned, it was not possible to have an equally large cohort sample. There were simply not enough children left who had not participated in the original investigation. In addition, no tenth graders agreed to participate in the cohort sample. No specific reasons were identified as to why this was so. Perhaps the tenth graders felt too old to participate in such a project or their interests were attuned to other subjects (i.e., driver's education). There were an unequal number of boys and girls in the Time 2 and cohort samples (See Table for the number of boys and girls participating in the study by grade for each sample). Finally, the subjects were not matched for IQ or SES (See Table for the mean and standard deviation for IQ and SES of all samples tested).

Comparability of Sample A and B at Time 1

As can be gathered from the tables, the original sample (Sample A) and the smaller subsample (Sample B) did not differ appreciably in IQ or SES. Little change in socioeconomic status was found within the longitudinal sample. The mean educational level for the subject's parents in the Time 1 sample was 15 years, including
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TABLE 2
MEANS AND STANDARD DEVIATIONS OF PARENTS' EDUCATIONAL LEVEL, IQ, AND SES FOR TIME 1, TIME 2, AND COHORT SAMPLES

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</tr>
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<td>EDUC. LEVEL</td>
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<td>0.43</td>
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</table>

approximately 3 years of college. The occupational prestige level for these parents, as calculated by the Duncan Measure of Socioeconomic Status, was 46.5 (Stevens & Featherman, 1981). The mean educational level for the subjects parents at Time 2 was 14.8 years, including approximately 3 years of college. The occupational prestige level, as calculated by the Duncan Measure of Socioeconomic Status, was 45.8. (Stevens & Featherman, 1985). Professions characteristic of both these samples are for example, registered nurses, sales representatives, secretaries chemical technicians and clerical assistants. Other than being smaller, sample B is comparable to sample A.
Comparability of Longitudinal Sample (Time 2) and Cohort Sample

Similarly, the cohort sample did not differ appreciably from the longitudinal sample with regards to IQ or SES. The cohort sample was also found to be from a middle class suburban background, whose parents had similar levels of education (15 years of education, 3.2 years of college) and the mean level of occupational prestige was 47.2 (similar to types of professions mentioned above). This is not surprising, as the samples were drawn from the same schools and neighborhoods. The major difference between the longitudinal and cohort samples is the number of subjects. Clearly, the number of subjects participating in the cohort sample (N=91) is smaller, especially in the eighth grade (N=10).

Grades K-2-4-6-8 were originally chosen to allow possible developmental differences to be demonstrated utilizing different children in different grades. Formal operational thought should emerge approximately between fourth and sixth grade and should consolidate by eighth grade (Piaget, 1962). The presence of formal operational thought should lead to an increased ability to consider all possible solutions and their respective consequences to a proposed hypothetical problem. Examining these grades allows us to observe any changes in the ability to generate alternatives or consequences to hypothetical
problems. In addition, while past researchers have investigated subsets of ages or grades in a cross-sectional design (i.e., kindergartners and first graders or second, fourth, sixth and eighth graders), past research has never studied such an extensive age range longitudinally. Examining the same children's ICPS skills and creative abilities in grades K-2-4-6 and 8 over a two year period will provide a normative data base from which observations regarding true developmental change can take place.

**Measures**

**Test of Interpersonal Problem Solving (TIPS).** This test assesses both overall problem solving ability and specific problem solving skills. The latter include: (1) problem recognition, identification that a problem exists; (2) problem analysis, recognizing the major aspects of the problem situation in order to resolve it; (3) alternative thinking; (4) consequential thinking, the ability to evaluate the consequences of each alternative; (5) solution adequacy, the evaluation and selection of the best solution (Feldgaier & Serafica, 1980).

TIPS consists of four stories simulating interpersonal problems with peers frequently confronting children. Story dilemmas present conflict situations along with a picture depicting the characters in the
situation. After a review to insure that the child understands the story outline, the child is asked if a problem exists, and if so, to define it, analyze, and break the problem down into each of the specific parts mentioned above. Relevant responses are scored for frequency of each problem solving skill. A subtest total score is calculated by summing the individual scores within that subtest. A total problem solving score is calculated by summing the subtest total scores. Test-retest reliability for the total score is .74. Test-retest reliability over a mean interval of 4 weeks for the various subtests comprising the TIPS total score are as follows: problem recognition=.72, problem analysis=.56, alternate thinking=.60, consequential thinking=.62 and solution adequacy=.64. Concurrent validity for TIPS, using the Interpersonal Problem Solving Test as the criterion measure (Marsh, 1982), for total score was .45. All scores were highly significant at the p< .0001 level, (Goldman et al., 1987).

Interrater reliability was established for the TIPS total and subscale scores by comparing the scoring of the principal investigator with that of a trained independent rater on 15% of randomly selected protocols.

Alternate Uses. Creativity was assessed using this test which asks subjects to generate unusual uses for everyday objects, such as, "Tell me all the different
ways you could use a newspaper". The subjects responses were then scored for fluency (number of responses generated) as well as flexibility (number of category shifts in responding) (Wallach & Kogan, 1965). In order to avoid the "confounding" effects of list length (fluency) on flexibility (Clark et al., 1986), each flexibility score was divided by its fluency score. This way, flexibility could be examined as an independent but related construct to fluency and ICPS skills.

Teacher's Rating Scale of Child's Actual Competence. To assess the child's social competence, this scale was filled out by the subject's teacher. It asks the teacher to rate the child's actual competence in such areas as scholastic competence, social acceptance, physical competence and behavioral conduct. For example, the rated item may be, "This pupil is really good at his/her school work," or "This pupil can't do the school work assigned". The teacher then decides which of the items is "really true" of the subject, or "sort of true" of the subject. The teachers ratings are then totaled and a competence score is assigned the subject. Internal consistencies as indicated by subscale reliabilities, based on Cronbach's Alpha, range from .71 to .86 (Harter, 1985).

Child Behavior Checklist-Teacher's Report Form (TRF). Behavioral adjustment was measured on this rating
scale which is designed to obtain teachers' reports of their pupils' school performance, adaptive functioning and behavior problems in a standardized format (Achenbach & Edelbrock, 1986). The current study was most interested in teacher's ratings of their students behavior problems.

Behavior problem scores are based on teachers responses to a 118-item rating scale plus additional items corresponding to physical problems or problems not mentioned elsewhere when applicable. Behavior problem items are rated on a 3 point response scale, with 0 indicating that the item is not true of the child, 1 indicating that the item is somewhat or sometimes true of the child, and 2 indicating that the item is very true or often true of the child.

Factor analyses of the 118 items filled out by teachers of 1700 children referred to special school services or mental health services for behavioral and socio-emotional problems, yielded eight reliable factors for both groups of boys and girls aged 6-11, while for the 12-16 year-old girls there were nine such factors. Second-order principal components analyses of these narrow-band behavior problem scales revealed two broad-band groupings which have been repeatedly identified in other multivariate analyses (Achenbach & Edelbrock, 1986). They reflect a distinction between
fearful, inhibited, overcontrolled behavior, and aggressive, antisocial, undercontrolled behavior. They have been variously called Inhibition versus Aggression (Miller, 1967), Internalizing versus Externalizing (Achenbach, 1966), and Overcontrolled versus Undercontrolled (Achenbach & Edelbrock, 1978). The current study focused on these broad-band groupings.

Furthermore, normalized T scores were computed for the total behavior problem score, as well as both the narrow-band and broad-band groupings. For the total behavior problem score, normalized T scores were based entirely on percentiles up to a T score of 70 (98th percentile). Achenbach and Edelbrock (1986) suggest that children not be classified as Internalizers or Externalizers unless (a) their total behavior problem score exceeds the 89th percentile for their sex/age group, and (b) there is a difference of at least 10 points between their Internalizing and Externalizing T score.

Test-retest reliability at 7 days, 15 days, 2 months and four months demonstrated adequate test-retest reliability (ranging from .68 to .90) (Achenbach & Edelbrock, 1986). Furthermore, interteacher agreement for all ages was found to range from .30 to .84, (with a median r of .57) all of which were significant at the p<.05. To test the association between teacher's ratings
of TRF items with referral for help, Achenbach & Edelbrock, compared the scores obtained on every item by 1100 pupils referred for services for behavioral or social/emotional problems and 1100 demographically similar nonreferred pupils. The referred pupils obtained significantly higher scores (p<.005) than the nonreferred pupils on all the TRF problem items except an item assessing shyness or timidness, and lower scores on all the adaptive functioning items (p<.001) than the nonreferred pupils (Achenbach & Edelbrock, 1986).

The rating scale was scored according to the standard procedures set out by Achenbach and Edelbrock (1986). T scores were obtained for the broad-band Externalizing and Internalizing groupings.

**Peabody Picture Vocabulary Test-Revised (PPVT-R).** This measure assesses an individual's general intelligence through his/her receptive or hearing vocabulary. It consists of 150 plates with four pictures on each plate. The plates are arranged in increasing level of difficulty from one year, 9 months, to 18 years. The subject is asked to point to the picture representing the word given by the investigator. Reliability coefficients reported for the PPVT-R range from .67 at age 6 years to .84 ages 17 and 18 years (Dunn & Dunn, 1981).
Procedure

Subject Recruitment. The primary investigator first contacted the principals of the schools in which data was to be collected and arranged for an appointment to meet and enlist the voluntary help of the teachers for this project. Having explained the project thoroughly to the teachers' and enlisted their cooperation, the investigator then entered each teacher's classroom and made a presentation to the class. (See Appendix A for a script of the presentation). Interested children's names were taken. A letter and permission slip were mailed home to their parents, to be returned in a self-addressed envelope to the principal investigator. Approximately 50% of the permission slips were not returned in the mail. The investigator then made a follow-up phone call to the child's parents and gained verbal permission to allow the child's participation in the study. A permission slip was given to the child, who then returned it to the investigator once his or her parent had signed it.

Testing Procedure. All of the subjects were tested in the school, but individually outside of the classroom by the investigator or a trained undergraduate psychology student. All children were first administered the PPVT-R. Then, in order to control for possible order effects, half the subjects first received the TIPS (Test
of Interpersonal Problem Solving, Feldgaier & Serafica, 1980), the other half started with the Alternate Uses test (Wallach & Kogan, 1965).

Furthermore, teachers rated subjects' social competence (Harter, 1983) and behavioral adjustment (Achenbach & Edelbrock, 1986).

To insure confidentiality of results and to preserve anonymity of the subjects, only subject code numbers were used to record the data.

Data Analyses

The Statistical Analysis System (SAS Institute, 1982) programs for Repeated Measures of Analysis of Covariance (ANCOVA) for unequal sample sizes (SAS GLM procedure), Multiple Regression Analysis, Multivariate Analysis of Variance (MANOVA) for unequal sample sizes, were used to analyze the data.

A 3-way repeated measures design was utilized to examine the longitudinal data. Grade and sex served as the between factors and time served as the within factor. Both the interpersonal cognitive problem solving (TIPS) and creativity (fluency and flexibility) measures yield total scores, which served as the main dependent variables in the data analysis.

Specifically, with regards to the longitudinal data, in order to test the null hypotheses that there were no
time or grade effects on children's overall ICPS skills and creative abilities, a series of 3-way repeated measure ANOVA's and ANCOVA's were performed. In order to test the null hypothesis that there were no time effects on children's specific ICPS skills, a series of 3-way repeated measures MANOVA's and MANCOVA's were performed. The following subtest total scores of the TIPS served as the dependent variables: 1) problem recognition, 2) problem analysis, 3) alternate thinking, 4) consequential thinking, and 5) solution adequacy. Having found significant main effects, univariate analyses of covariance were performed on each of the subtest scores. Where appropriate, Tukey's HSD procedure was utilized to examine post hoc mean differences. In order to test the null hypothesis that there were no grade related differences in children's overall ICPS skills and creative abilities at Time 2, a series of ANOVA's and ANCOVA's were performed.

Having found significant main effects, univariate analyses of covariance were performed on the separate subtest scores. Again, Tukey's HSD method was used to examine post hoc mean differences. Finally, chi square analyses were performed in order to determine if there were any differences in the frequency of children's qualitative responses to the TIPS with respect to grade and sex.
In order to test the null hypotheses that there are no significant correlations between ideational fluency, flexibility and overall and specific ICPS skills, when sex, grade and IQ are statistically adjusted, partial correlation coefficients were computed for the total score of the TIPS, fluency and flexibility, as well as the subtest scores of the TIPS. Multiple regression analysis and stepwise multiple regression analyses were used to determine if fluency and/or flexibility were predictive of overall and specific ICPS skills.

In order to determine if previous findings regarding grade related differences in children's ICPS skills and creative abilities were true grade related differences or cohort effects, the data from the cross sectional group and the longitudinal group (Time 1) were compared. Specifically, in order to test the null hypothesis that there were no group differences in children's overall ICPS skills and creative abilities, a series of ANOVA's and ANCOVA's were performed on total scores of the TIPS, fluency and flexibility. In order to test the null hypothesis that there were no group differences in children's specific ICPS skills, a series of MANOVA's and MANCOVA's were performed. The subtest total scores of the TIPS again served as the dependent variables. Having found significant main effects and interactions, univariate analyses were performed on the subtest scores.
Where appropriate, Tukey's HSD procedure was used to compare group differences. Chi square analyses were performed in order to determine if there were any significant differences between groups in the frequency of children's qualitative responses to the TIPS with respect to grade and sex. In order to determine if there were any significant correlations between the three dependent variables when sex, grade and IQ were statistically adjusted, a series of partial correlations were performed. In order to assess if creativity influenced problem analysis, alternate thinking and consequential thinking, separate regression analyses were performed. Finally, in order to determine if teacher's ratings of social competence and behavioral adjustment were related to children's ICPS skills, correlational and, when indicated, multiple regression analyses, were performed.
CHAPTER IV
RESULTS

This study first explored overall and specific grade-related developmental changes in the same children's ICPS skills and creative abilities over a two year period. It also examined grade-related differences in children's overall and specific ICPS skills and creative abilities at Time 2. Then separate analyses were performed on a cohort sample in order to demonstrate that grade differences found at Time 2 were true grade differences and not a cohort effect nor the results of repeated testing.

Furthermore, the relationship between interpersonal cognitive problem solving (ICPS) skills and creative abilities, specifically ideational fluency and flexibility, was explored in a longitudinal sample and a cohort sample. In addition, this study investigated the relationship between children's ICPS skills and teacher's ratings of social competence and behavioral adjustment. Finally, this study explored whether children's ICPS skills were predictive of teacher's ratings of social competence and behavioral adjustment.
To minimize redundancy, only significant main effects and interactions will be reported. Furthermore, it should be noted that Tukey's HSD procedure was used to analyze all post hoc mean comparisons.

Preliminary Analyses

Distributions and Frequencies at Time 2. Due to violations of the assumptions of normality for the distribution and frequency of the main dependent variables at Time 1 (see Goldman et al., 1987 for details), distributions and frequencies were calculated for the smaller Time 2 and cohort samples. Results indicated that none of the main dependent variables (total scores for TIPS, fluency and flexibility) achieved a normal distribution. In order to meet the assumptions of normality required for the analyses, the scores were submitted to a square root transformation. Having done so, the distribution for TIPS total score achieved a normal distribution (p<.13). Neither fluency or flexibility achieved normal distributions after the square root transformation.

Within the cohort sample, none of the main dependent variables achieved a normal distribution, even after a square root transformation had been performed.

There are several possible reasons that could account for the lack of normality seen in the creativity
variables. First, a random sample of children tested were "normal" children, some of whom were very bright. Accordingly, the histograms show some outliers, skewing the distribution to the right for both fluency and flexibility. When one eliminates these outliers, the distributions appear normal. Furthermore, not all skills develop in a linear or curvilinear manner (Cohen & Cohen, 1983).

Therefore, not all skills measured will necessarily achieve a normal distribution. Because the statistical procedures used (ANOVA, ANCOVA, MANOVA, and MANCOVA) are robust analyses, and because the sample size was large, a .05 significance level was adopted. Nevertheless, due to the violation of the assumption of normality, the data must be interpreted cautiously.

**Interrater Reliability.** Interrater reliability was established for both the quantitative and qualitative scores of the TIPS. A trained undergraduate research assistant and the primary investigator independently scored the test protocols. Interrater reliability was established by comparing the scores from 15% of the protocols.

The formula used for calculating reliability was number of agreements divided by number of agreements + disagreements.
Agreement on TIPS total score was used to obtain overall reliability for the quantitative portion of the TIPS at Time 2, which was 88%. Agreement on the scoring of content in children's responses was used to obtain reliability for the overall qualitative portion of the TIPS at Time 2, which was 83%.

Agreement on the same scores was used to determine interrater reliability for the cohort group. Overall reliability for the quantitative portion of the TIPS for the cohort group was 86%, and for the qualitative portion it was 84%.

For TIPS subtest scores, interrater reliability for the longitudinal sample's quantitative responses were: problem recognition, 100%; problem analysis, 84%; alternative thinking, 87%; consequential thinking, 85%; and solution adequacy, 85%. For the cohort group, interrater reliability for TIPS subtest scores were as follows: problem recognition, 100%; problem analysis, 81%, alternate thinking, 83%, consequential thinking, 86%, and solution adequacy, 82%.

For TIPS subtest scores, interrater reliability for the longitudinal sample's qualitative responses were: problem recognition, 89%; problem analysis, 86%; alternate thinking, 82%; consequential thinking, 86%; and solution adequacy, 81%. For the cohort group, interrater reliability for TIPS subtest qualitative scores as
follows: problem recognition, 88%; problem analysis, 82%; alternate thinking, 85%; consequential thinking, 84%; and solution adequacy, 83%.

Comparability of Longitudinal Sample A and B at Time 1

As was previously discussed, the samples do not differ in IQ or SES, and there are relatively the same number of males and females in each cell, although Sample B has fewer subjects.

In order to demonstrate that Sample A and Sample B are comparable, differences in results from post hoc analyses from Sample A and B will be briefly discussed below. A fuller, more detailed analysis follows.

Samples A and B demonstrated comparable grade-differences in overall and specific ICPS skills, with a few exceptions. Specifically, eighth graders did not show a significant increase over sixth graders in overall problem solving ability at Time 2, where they had at Time 1. Furthermore, fourth graders did not show a significant increase over second graders in consequential thinking at Time 2, when they had at Time 1.

Finally, there were no significant grade-differences in solution adequacy at Time 2, where eighth graders had demonstrated higher solution adequacy scores over second, fourth and sixth graders at Time 1. However, the pattern that older children score higher on measures of overall
and specific ICPS skills appears in the original sample and the smaller, Time 2 subsample. Overall, the two groups appear comparable with respect to ICPS skills.

With regards to creative abilities, there were no significant grade-differences in fluency scores at Time 1 or Time 2. Results of the post hoc mean comparisons for flexibility at Time 1 revealed that second, fourth, sixth and eighth graders scored significantly higher than kindergartners. At Time 2, sixth, eighth and tenth graders scored significantly higher than second and fourth graders on flexibility. While there were some discrepancies with regards to flexibility, the two samples had more similarities than differences.

Comparability of Longitudinal Sample B and Cohort Sample

As was discussed previously, the number of students at each grade, the number of males to females overall and at each grade were fairly different between the longitudinal sample and the cohort sample. However, the two samples were comparable with regards to IQ and SES.

Again, in order to demonstrate that the longitudinal and cohort samples are comparable, a brief discussion of differences in post hoc mean comparison ensues, followed by a more elaborate reporting of results.

The Time 2 and cohort samples demonstrated comparable grade differences in overall and specific ICPS
skills with a few exceptions. Specifically, post hoc mean comparisons revealed that eighth graders did not receive higher scores than sixth graders in overall problem solving ability at Time 2, where they had in the cohort sample. Furthermore, sixth and fourth graders did not achieve higher scores over second graders in the cohort sample, where they had in the longitudinal sample.

With regards to specific ICPS skills, again, there were more similarities than differences. Specifically, the longitudinal sample had higher problem recognition scores than the cohort sample. There were no significant grade differences in problem analysis or alternate thinking in the cohort sample, where there had been in the longitudinal sample. Finally, within the cohort sample, sixth graders did not score higher than second graders on consequential thinking, where as within the longitudinal sample, sixth graders did score higher than second graders.

Again, while there were some specific differences between the longitudinal and cohort samples, there were many more similarities. Furthermore, older students appear to score higher than younger students on overall and specific ICPS skills in both groups. Overall, the two groups appear to be comparable with regards to ICPS skills.
For creative ability, grade differences in fluency were found within the cohort sample, but not within the longitudinal sample. For flexibility, results of post hoc mean comparisons revealed that sixth and eighth graders scored higher on flexibility than second and fourth graders in the longitudinal sample, whereas in the cohort sample, sixth and eighth graders did not score higher than fourth graders.

Overall, there are more similarities than differences between the longitudinal sample and the cohort sample with regards to creativity. While there may be a few specific grade-related differences between the groups, the pattern that older students score higher than younger students on measures of creativity appears in both groups.

Development of Interpersonal Problem Solving

The means and standard deviations for the total and subscale scores of the TIPS, fluency and flexibility for Time 1, Time 2 and the cohort samples appear in Tables 3-6.

Longitudinal Changes. In order to test the null hypothesis, that there are no time effects on children's ICPS skills, when adjustments have been made for IQ statistically, a series of repeated measure ANOVA's and ANCOVA's were performed. An analysis of covariance was
Table 3

Means & Standard Deviations by Grade for TIPS Total Score, Fluency and Flexibility
for Time 1, Time 2, & the Cohort Samples

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<thead>
<tr>
<th>Grade</th>
<th>TIPS Time 1</th>
<th>TIPS Time 2</th>
<th>TIPS Cohort</th>
<th>FLUENCY Time 1</th>
<th>FLUENCY Time 2</th>
<th>FLUENCY Cohort</th>
<th>FLEXIBILITY Time 1</th>
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Table 4
Means and Standard Deviations by Grade
for Subtests Comprising the TIPS - Time 1

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<thead>
<tr>
<th>Problem Recognition</th>
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<th>Alternate Thinking</th>
<th>Consequential Thinking</th>
<th>Solution Adequacy</th>
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<td>M</td>
<td>SD</td>
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Table 5
Means and Standard Deviations by Grade
for Subtests Comprising the TIPS - Time 2

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<thead>
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<th>Consequential Thinking</th>
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Table 6
Means and Standard Deviations by Grade for Subtests Comprising the TIPS Cohort Group

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<th>Problem Analysis M</th>
<th>SD</th>
<th>Alternate Thinking M</th>
<th>SD</th>
<th>Consequential Thinking M</th>
<th>SD</th>
<th>Solution Adequacy M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
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<td>.10</td>
<td>8.6</td>
<td>3.7</td>
<td>11.3</td>
<td>3.6</td>
<td>15.5</td>
<td>6.2</td>
<td>11.2</td>
</tr>
<tr>
<td>4</td>
<td>3.8</td>
<td>.10</td>
<td>8.3</td>
<td>3.2</td>
<td>10.5</td>
<td>3.5</td>
<td>16.0</td>
<td>5.9</td>
<td>11.2</td>
</tr>
<tr>
<td>6</td>
<td>3.7</td>
<td>.08</td>
<td>9.7</td>
<td>3.1</td>
<td>11.7</td>
<td>2.9</td>
<td>18.1</td>
<td>4.7</td>
<td>10.4</td>
</tr>
<tr>
<td>8</td>
<td>3.7</td>
<td>.13</td>
<td>11.5</td>
<td>2.6</td>
<td>14.7</td>
<td>2.3</td>
<td>35.0</td>
<td>14.6</td>
<td>11.8</td>
</tr>
</tbody>
</table>
used to explore the effects of sex, grade and time on the TIPS total score because previous research findings (Goldman et al., 1987) found that these variables were significantly related.

The results of the 3-way ANOVA, with sex and grade serving as the between factors and time serving as the within factor, revealed a significant main effect for time $F(1,167)=77.88$, $p<.0001$, for TIPS total score. Across grades, students' TIPS total score at Time 2 was higher than at Time 1.

The results of the ANCOVA (with IQ, fluency and flexibility adjusted statistically) revealed no significant main effect for time. It appears that when IQ, fluency and flexibility are statistically adjusted, increases in children's ICPS skills over time drop out.

Using a MANOVA procedure on the TIPS subscale scores, there was no significant main effect nor any significant interactions for time. Similar results were found using a MANCOVA procedure on TIPS subscale scores.

**Stability Coefficients for Overall and Specific ICPS Skills**

Results of Pearson Product correlation coefficients revealed that the total score for the TIPS at Time 1 and Time 2 was moderately and significantly correlated (See Table 7). All specific ICPS skills were also found to be
moderately and significantly correlated (See Table 8). These results suggest that overall and specific ICPS skills are relatively stable over time.

**Grade-related Differences at Time 2**

**Overall ICPS Ability.** In order to test the null hypothesis, that there are no grade-related differences in children's ICPS skills at Time 2, when adjustments have been made for IQ, fluency and flexibility statistically, the aforementioned analyses were examined for grade differences in children's ICPS skills.

**Table 7**

Stability Coefficients Total Score for TIPS, Fluency, Flexibility, and IQ at Time 1 and Time 2

<table>
<thead>
<tr>
<th></th>
<th>TIME 1</th>
<th>TIME 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TIPS</td>
<td>FLUENCY</td>
</tr>
<tr>
<td>TIPS</td>
<td>.28***</td>
<td>.18**</td>
</tr>
<tr>
<td>FLUENCY</td>
<td>.16*</td>
<td>.34***</td>
</tr>
<tr>
<td>FLEXIBILITY</td>
<td>.04</td>
<td>.03</td>
</tr>
<tr>
<td>IQ</td>
<td>.03</td>
<td>.12</td>
</tr>
</tbody>
</table>

* P < .05  
** P < .01  
*** P < .001  

### Table 8
Stability Coefficients between Problem Recognition, Problem Analysis, Alternate Thinking, Consequential Thinking and Solution Adequacy at Time 1 & Time 2

<table>
<thead>
<tr>
<th></th>
<th>Problem Recognition</th>
<th>Problem Analysis</th>
<th>Alternate Thinking</th>
<th>Consequential Thinking</th>
<th>Solution Adequacy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time 1</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Problem Recognition</td>
<td>.23***</td>
<td>.11</td>
<td>.09</td>
<td>.06</td>
<td>.10</td>
</tr>
<tr>
<td><strong>Time 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem Analysis</td>
<td>.02</td>
<td>.21**</td>
<td>.10</td>
<td>.21**</td>
<td>.08</td>
</tr>
<tr>
<td>Alternate Thinking</td>
<td>.01</td>
<td>.29**</td>
<td>.22**</td>
<td>.29**</td>
<td>.04</td>
</tr>
<tr>
<td>Consequential Thinking</td>
<td>.09</td>
<td>.19*</td>
<td>.21**</td>
<td>.29**</td>
<td>.00</td>
</tr>
<tr>
<td>Solution</td>
<td>.06</td>
<td>.19**</td>
<td>.19**</td>
<td>.21**</td>
<td>.15*</td>
</tr>
</tbody>
</table>

***p<.001  **p<.01 *p<.05
The 3-way repeated measure ANOVA revealed a significant main effect for grade on the TIPS total score, $F(4,167)=23.13$, $p<.0001$. The results of the ANCOVA (with IQ, fluency and flexibility adjusted statistically) also showed a significant main effect for grade for the TIPS total score, $F(4,156)=11.79$, $p<.0001$ (See Table 9). Post hoc mean comparisons indicated that tenth graders scored significantly higher in problem solving ability over grades 2, 4 and 6. Eighth graders scored significantly higher in problem solving ability.

Table 9

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
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</thead>
<tbody>
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<tr>
<td>Grade</td>
<td>4</td>
<td>9475.36</td>
<td>2368.84</td>
<td>11.79</td>
<td>.00</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>96.65</td>
<td>96.65</td>
<td>.48</td>
<td>.49</td>
</tr>
<tr>
<td>Grade x Sex</td>
<td>4</td>
<td>884.74</td>
<td>221.18</td>
<td>1.10</td>
<td>.36</td>
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<tr>
<td>IQ</td>
<td>1</td>
<td>35.87</td>
<td>35.87</td>
<td>.18</td>
<td>.67</td>
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<tr>
<td>Fluency</td>
<td>1</td>
<td>2315.73</td>
<td>2315.73</td>
<td>11.52</td>
<td>.00</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>46.09</td>
<td>46.09</td>
<td>.23</td>
<td>.63</td>
</tr>
<tr>
<td>Error</td>
<td>156</td>
<td>31346.82</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
over grades 2 and 4. Sixth and fourth graders scored significantly higher in problem solving ability over grade 2. For the TIPS there were significant grade differences in overall problem solving ability between all grades, except between 4 and 6, 6 and 8, and 8 and 10.

Specific ICPS Skills. Using the MANOVA procedure, there was a significant overall effect for grade (Wilk's lambda=.6180, F(20, 535)=4.17, p<.0001, on the TIPS subscale scores. A significant overall effect for grade (Wilk's lambda=.6908, F(20,511.71)= 3.02, p<.0001) was also found when a MANCOVA was performed with IQ, fluency and flexibility as covariates. In light of this significant grade effect, univariate analyses of variance were performed on all subtests comprising the TIPS.

Univariate analysis of variance revealed a significant grade main effect for problem analysis, F(4,167)=8.40, p<.0001). Similarly, a univariate analysis of covariance revealed a significant main grade effect for problem analysis, F(12,156)=5.45, p<.0001 (See Table 10).

Results of post hoc mean comparisons revealed that at Time 2, tenth, eighth, sixth and fourth graders demonstrated significantly higher scores over second graders in their ability to analyze a problem. Furthermore, tenth graders exhibited significantly higher
Table 10
Univariate Analysis of Covariance for Problem Analysis as Measured by the TIPS for Time 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
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<th>Value</th>
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<tr>
<td>Total</td>
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<td>Grade</td>
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<td>Sex</td>
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<td>3.42</td>
<td>.25</td>
<td>.70</td>
</tr>
<tr>
<td>Grade x Sex</td>
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<td>60.11</td>
<td>15.03</td>
<td>1.09</td>
<td>.36</td>
</tr>
<tr>
<td>IQ</td>
<td>1</td>
<td>.89</td>
<td>.89</td>
<td>.06</td>
<td>.80</td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>81.22</td>
<td>81.22</td>
<td>5.89</td>
<td>.02</td>
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<td>Flexibility</td>
<td>1</td>
<td>1.57</td>
<td>1.57</td>
<td>.11</td>
<td>.74</td>
</tr>
<tr>
<td>Error</td>
<td>156</td>
<td>2149.70</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
scores over fourth graders. There were no significant grade differences in the ability to analyze a problem between grades 4 and 6, 4 and 8, 6 and 8, and 8 and 10 at Time 2.

Univariate analysis of variance revealed a significant grade main effect for alternative thinking, \( F(9.167) = 13.02, p < .0001 \). Likewise, a univariate analysis of covariance for alternative thinking revealed a significant grade main effect \( F(4,156) = 7.33, p < .0001 \) (See Table 11).

Results of post hoc mean comparisons for alternative thinking ability at Time 2 revealed significantly higher scores for tenth, eighth, sixth and fourth graders over second graders. Furthermore, tenth graders scored significantly higher in alternative thinking ability over sixth graders. There were no significant grade differences in alternative thinking ability between grades 4 and 6, 4 and 8, 4 and 10, 6 and 8, and 8 and 10 at Time 2.

Univariate analysis of variance revealed a significant grade main effect for consequential thinking, \( F(4,167) = 21.10, p < .0001 \). A univariate analysis of covariance revealed a significant grade effect for consequential thinking, \( F(4,156) = 11.61, p < .0001 \) (See Table 12).
### Table 11

Univariate Analysis of Covariance for Alternative Thinking as Measured by the TIPS for Time 2

<table>
<thead>
<tr>
<th>Source</th>
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<td>Grade</td>
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<td>303.63</td>
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<td>7.33</td>
<td>.00</td>
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<td>.018</td>
<td>.00</td>
<td>.96</td>
</tr>
<tr>
<td>Grade x Sex</td>
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<td>1.61</td>
<td>.17</td>
</tr>
<tr>
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<td>3.55</td>
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<td>.55</td>
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<tr>
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<td>68.19</td>
<td>.58</td>
<td>.01</td>
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<tr>
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<td>3.77</td>
<td>.36</td>
<td>.54</td>
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<tr>
<td>Error</td>
<td>156</td>
<td>1616.21</td>
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</table>
Table 12

Univariate Analysis of Covariance for Consequential Thinking as Measured by the TIPS for Time 2

<table>
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<tr>
<th>Source</th>
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<tr>
<td>Grade</td>
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<td>2844.55</td>
<td>711.14</td>
<td>11.61</td>
<td>.00</td>
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<td>75.28</td>
<td>1.23</td>
<td>.27</td>
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<tr>
<td>Grade x Sex</td>
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<td>.74</td>
<td>.57</td>
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<td>94.28</td>
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<td>.22</td>
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<td>593.33</td>
<td>9.68</td>
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</tr>
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<td>6.75</td>
<td>.11</td>
<td>.74</td>
</tr>
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<td>Error</td>
<td>156</td>
<td>9559.07</td>
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</table>
Results of post hoc analyses for consequential thinking at Time 2 revealed that tenth and eighth graders scored significantly higher over second, fourth and sixth graders. Sixth graders also scored significantly higher in consequential thinking over second graders. There were no significant grade differences in consequential thinking between grades 2 and 4, 4 and 6, and 8 and 10 at Time 2.

Univariate analysis of variance revealed a significant grade main effect for solution adequacy, \( F(4,167)=5.63, p<.0003 \). A time by grade interaction for solution adequacy was also significant, \( F(4,167)=2.89, p<.02 \). A univariate analysis of covariance also revealed a significant grade main effect, \( F(4,156)=3.88, p<.005 \) (See Table 13). Again, the time by grade interaction was significant, \( F(4,156)=2.61, p<.04 \), (See Table 14).

Results of post hoc comparisons for solution adequacy at Time 2 revealed no significant grade differences in the ability to choose a "best" solution between grades. Hence, the trend toward a significant time by grade interaction is explained by the presence of grade differences in solution adequacy at Time 1, but not at Time 2.

Qualitative Aspects. The results of the chi square analyses on the TIPS at Time 2 revealed that older children (grades 6, 8, and 10) consider psychological
Table 13
Univariate Analysis of Covariance for Solution Adequacy as Measured by the TIPS for Time 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
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<th>Mean Squares</th>
<th>Value</th>
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<tr>
<td>Grade</td>
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<td>63.03</td>
<td>3.88</td>
<td>.00</td>
</tr>
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<td>.06</td>
<td>.00</td>
<td>.95</td>
</tr>
<tr>
<td>Grade x Sex</td>
<td>4</td>
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<td>15.21</td>
<td>.94</td>
<td>.44</td>
</tr>
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<td>21.75</td>
<td>1.34</td>
<td>.24</td>
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<td>.30</td>
<td>.02</td>
<td>.89</td>
</tr>
<tr>
<td>Error</td>
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<td>2536.03</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Source</td>
<td>df</td>
<td>Sum of Squares</td>
<td>Mean Squares</td>
<td>Value</td>
<td>Prob. &gt;F</td>
</tr>
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<td>----------------</td>
<td>--------------</td>
<td>-------</td>
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</tr>
<tr>
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<td>8.70</td>
<td>.62</td>
<td>.43</td>
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<tr>
<td>Time x Grade</td>
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<td>146.57</td>
<td>36.64</td>
<td>2.61</td>
<td>.04</td>
</tr>
<tr>
<td>Time x Sex</td>
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<td>8.75</td>
<td>8.75</td>
<td>.34</td>
<td>.56</td>
</tr>
<tr>
<td>Time x Grade x Sex</td>
<td>4</td>
<td>39.70</td>
<td>9.93</td>
<td>.71</td>
<td>.59</td>
</tr>
<tr>
<td>Time x IQ</td>
<td>1</td>
<td>.60</td>
<td>.60</td>
<td>.04</td>
<td>.84</td>
</tr>
<tr>
<td>Time x Fluency</td>
<td>1</td>
<td>53.09</td>
<td>53.09</td>
<td>3.79</td>
<td>.05</td>
</tr>
<tr>
<td>Time x Flexibility</td>
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<td>29.80</td>
<td>29.80</td>
<td>2.13</td>
<td>.17</td>
</tr>
<tr>
<td>Error</td>
<td>156</td>
<td>2187.29</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(p<.0001) explanations more often when analyzing a problem than younger children. Also, they (grades 6, 8, and 10) consider psychological (p<.0001) and conceptual (p<.05) reasons more often when evaluating consequences to a problem.

Summary
To summarize, results suggest that there are grade differences in children's overall and specific problem solving abilities. The pattern established at Time 1 (see Goldman et al., 1987), that older children score significantly higher on measures of overall and specific ICPS skills, appears to have been replicated at Time 2.

Sex Differences in ICPS Skills
The results of the ANOVA on TIPS total score at Time 2 revealed no significant main effects for sex. Similarly, the results of the ANCOVA on TIPS total score at Time 2, revealed no significant main effect for sex as well. Chi square analyses at Time 2 revealed no significant sex differences.

Therefore, the hypothesis regarding sex differences in children's ICPS skills can be rejected.
Development of Creativity

Longitudinal Changes. In order to test the null hypothesis that there are no increases in creative ability, specifically ideational fluency and flexibility, over time, a series of ANOVA's and ANCOVA's (with IQ adjusted statistically) were performed.

Fluency. The results of the 3-way ANOVA revealed a significant time main effect for fluency, $F(1,156)=20.09$, $p<.0001$.

However, the results of the 3-way ANCOVA did not reveal any significant main or interaction effects. It appears that when IQ and flexibility scores are adjusted statistically, increases over time in fluency drop out.

Flexibility. Results of the ANOVA revealed a significant time main effect for flexibility $F(1,154)=37.29$, $p<.0001$. Furthermore, a significant time by grade interaction was found for flexibility, $F(4,154)=5.64$, $p<.0003$. Results of the ANCOVA for a time main effect for flexibility was also significant, $F(1,143)=5.90$, $p<.02$), indicating that flexibility scores were higher at Time 2 (See Table 15).

Stability Coefficients for Fluency, Flexibility and IQ

Scores for fluency at Time 1 and Time 2 were found to be moderately and significantly correlated. Surprisingly, flexibility was not found to be
Table 15

Analysis of Covariance by Time for Flexibility

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
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<td>4.70</td>
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<td></td>
<td></td>
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<tr>
<td>Time</td>
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<td>0.17</td>
<td>0.17</td>
<td>5.90</td>
<td>.02</td>
</tr>
<tr>
<td>Time x Grade</td>
<td>4</td>
<td>146.57</td>
<td>36.64</td>
<td>2.61</td>
<td>.04</td>
</tr>
<tr>
<td>Time x Sex</td>
<td>1</td>
<td>8.75</td>
<td>8.75</td>
<td>.34</td>
<td>.56</td>
</tr>
<tr>
<td>Time x Grade x Sex</td>
<td>4</td>
<td>39.70</td>
<td>9.93</td>
<td>.71</td>
<td>.59</td>
</tr>
<tr>
<td>Time x IQ</td>
<td>1</td>
<td>.60</td>
<td>.60</td>
<td>.04</td>
<td>.84</td>
</tr>
</tbody>
</table>
significantly correlated at Time 1 and Time 2. Not surprisingly, IQ was also found to be significantly correlated at Time 1 and Time 2 (See Table 7). These results suggest that fluency and IQ are relatively stable over time. However, flexibility appears to be less stable.

Grade-related Differences in Creativity

**Fluency.** The results of the ANOVA revealed a significant grade main effect for fluency $F(4,156)=8.98$, $p<.0001$. The results of the ANCOVA for a grade main effect for fluency were also significant $F(4,145)=2.64$, $p<.04$ (See Table 16).

Results of post hoc mean comparisons showed that at Time 2, tenth graders scored significantly higher on a measure of fluency than second graders.

**Flexibility.** The results of the ANOVA revealed a significant grade main effect for flexibility, $F(4,154)=17.97$, $p<.0001$. The results of the ANCOVA revealed a significant grade main effect for flexibility, $F(4,143)=7.25$, $p<.0001$ (See Table 17).

Results of the post hoc comparisons revealed that at Time 2, sixth, eighth and tenth graders scored significantly higher on flexibility than fourth and second graders.
### Table 16
Analysis of Covariance for Fluency at Time 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>165</td>
<td>10815.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td>4</td>
<td>928.79</td>
<td>232.20</td>
<td>1.80</td>
<td>.13</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>54.96</td>
<td>54.96</td>
<td>1.18</td>
<td>.28</td>
</tr>
<tr>
<td>Grade x Sex</td>
<td>4</td>
<td>600.41</td>
<td>150.10</td>
<td>2.57</td>
<td>.04</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>3487.31</td>
<td>3487.31</td>
<td>4.84</td>
<td>.00</td>
</tr>
<tr>
<td>IQ</td>
<td>1</td>
<td>51.53</td>
<td>51.53</td>
<td>1.02</td>
<td>.31</td>
</tr>
<tr>
<td>Error</td>
<td>154</td>
<td>7327.94</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 17
Analysis of Covariance by Grade for Flexibility at Time 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>165</td>
<td>1.59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td>4</td>
<td>.23</td>
<td>.06</td>
<td>.16</td>
<td>.00</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.69</td>
</tr>
<tr>
<td>Grade x Sex</td>
<td>4</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
<td>.99</td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>.05</td>
<td>.05</td>
<td>.23</td>
<td>.00</td>
</tr>
<tr>
<td>IQ</td>
<td>1</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.87</td>
</tr>
<tr>
<td>Error</td>
<td>154</td>
<td>1.30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The null hypothesis regarding grade-related differences in creative ability must be retained for fluency and flexibility.

**Sex Differences in Creative Ability**

**Fluency.** There was no significant main effect for sex on fluency at Time 2. Nor were any significant sex by grade, sex by time or sex by grade by time interactions found at Time 2.

**Flexibility.** There were no significant main effects for sex for flexibility found at Time 2. Furthermore, no sex by grade, sex by time nor sex by grade by time interactions were found to be significant at Time 2.

Therefore, the null hypothesis regarding differences in sex differences in children's creative abilities at Time 2 can be accepted for both fluency and flexibility.

**Problem Solving and Creativity**

In order to test the null hypothesis, that at Time 2, no significant correlations exist between ideational fluency, flexibility and ICPS skills, when sex, grade and IQ were statistically controlled, partial correlation coefficients were computed for the three main dependent variables (TIPS total score, fluency and flexibility). Results indicated that fluency was significantly correlated with problem analysis (p<.01), alternate
thinking \( (p<.0001) \) and consequential thinking \( (p<.0001) \). The correlation between flexibility and consequential thinking was also significant \( (p<.05) \) at Time 2 (See Table 18).

In order to determine if fluency and/or flexibility were predictive of overall problem solving ability, problem analysis, alternative or consequential thinking, a series of multiple regression analyses were performed. The results indicated that at Time 2, fluency and flexibility together accounted for 14.3% of the variance \( (p<.0001) \) for overall problem solving ability (See Table 19), 5.1% of the variance for problem analysis \( (p<.001) \) (See Table 20), 13.2% of the variance for alternative thinking \( (p<.0001) \) (See Table 21), and 16.7% of the variance for consequential thinking \( (p<.0001) \) (See Table 22).

A stepwise regression analysis revealed that at Time 2 (See Table 20) fluency uniquely accounted for 12% of the variance for overall problem solving score \( (p<.001) \), while flexibility uniquely contributed an additional 2.3% of the variance \( (p<.03) \). Fluency uniquely accounted for 4.1% of the variance for problem analysis \( (p<.001) \), while flexibility did not contribute significantly to the variance. Fluency uniquely accounted for 11.8% of the variance for alternative thinking \( (p<.0001) \), while flexibility uniquely contributed an additional 1.4% of
Table 18

Partial Correlations Between the Total Scores for the TIPS, Fluency and Flexibility at Time 2 with IQ, Sex and Grade Partialled Out

<table>
<thead>
<tr>
<th></th>
<th>TIPS</th>
<th>Fluency</th>
<th>Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIPS</td>
<td>1.00</td>
<td>.31***</td>
<td>.10</td>
</tr>
<tr>
<td>Fluency</td>
<td>.31***</td>
<td>1.00</td>
<td>.15*</td>
</tr>
<tr>
<td>Flexibility</td>
<td>.10</td>
<td>.15*</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*** p<.0001
** p<.01
* p<.05
Table 19
Multiple Regression Analysis for Total Problem Solving Score as Measured by the TIPS at Time 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>170</td>
<td>41956.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>5020.22</td>
<td>5020.22</td>
<td>25.46</td>
<td>.00</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>960.86</td>
<td>960.86</td>
<td>4.49</td>
<td>.04</td>
</tr>
<tr>
<td>Error</td>
<td>168</td>
<td>35975.08</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 20
Multiple Regression Analysis for Problem Analysis as Measured by the TIPS at Time 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>170</td>
<td>1767.42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>68.65</td>
<td>68.65</td>
<td>3.54</td>
<td>.03</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>2.91</td>
<td>2.91</td>
<td>.29</td>
<td>.59</td>
</tr>
<tr>
<td>Error</td>
<td>168</td>
<td>1695.86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 21
Multiple Regression Analysis for Alternate Thinking as Measured by the TIPS at Time 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>170</td>
<td>1799.52</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>211.53</td>
<td>211.53</td>
<td>12.73</td>
<td>.00</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>25.25</td>
<td>25.25</td>
<td>2.71</td>
<td>.10</td>
</tr>
<tr>
<td>Error</td>
<td>168</td>
<td>1562.75</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 22
Multiple Regression Analysis for Consequential Thinking as Measured by the TIPS at Time 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>170</td>
<td>15210.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>2044.05</td>
<td>2044.05</td>
<td>17.02</td>
<td>.00</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>518.60</td>
<td>518.60</td>
<td>6.89</td>
<td>.00</td>
</tr>
<tr>
<td>Error</td>
<td>168</td>
<td>12647.44</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
the variance (p<.10). Finally, fluency uniquely accounted for 13.4% of the variance for consequential thinking (p<.0001), while flexibility uniquely contributed an additional 3.4% (p<.001).

Overall, it appears that creativity, specifically ideational fluency and flexibility are predictive of overall and some specific ICPS skills.

**Interpersonal Cognitive Problem Solving**

**Group Differences.** In order to test the null hypothesis, that there are no differences between the longitudinal and cohort groups ICPS skills when adjustments had been made for IQ, fluency and flexibility statistically, a series of ANOVA's and ANCOVA's were performed. An analysis of covariance was used to explore the effects of sex, grade and group on the total score of the TIPS due to previous findings (Goldman et al., 1987) suggesting that ICPS skills, fluency and flexibility are significantly correlated.

The results of the ANOVA and ANCOVA did not reveal a significant main effect for group for the TIPS total score. Nor were any interactions significant.

Using the MANOVA procedure, a significant main effect for group was found on the TIPS subscale scores (Wilk's lambda=.9000, F(5,210)=4.67, p<.0005. Also, a significant interaction effect for group by grade on TIPS
subscale scores was found, (Wilk's lambda=.8539, 
F(15,580)=2.28, p<.004. Similarly, a significant main 
effect for group on TIPS subscale scores (Wilk's 
lambda=.8876, F(5,198)=5.01, p<.0002) was also found 
using a MANCOVA procedure, with IQ, fluency and 
flexibility serving as covariates. Finally, a 
significant group by grade interaction (Wilk's 
lambda=.8486, F(15,547)=2.23, p<.005) was found on TIPS 
subscale scores using a MANCOVA procedure.

Univariate analysis of covariance for the TIPS 
revealed a significant group main effect on problem 
recognition F(18,220)=7.47,p<.007 (See Table 23). 
Results of post hoc comparison across grades found that 
students in the longitudinal sample scored higher on 
problem recognition than those in the cohort group.

Univariate analysis of covariance revealed a 
significant group by grade interaction for consequential 
thinking, F(18,220)=3.56, p<.02 (See Table 24). Post hoc 
mean comparisons revealed that eighth graders in the 
cohort sample generated more consequences to proposed 
solutions than eighth graders in the longitudinal sample.
Table 23  
Univariate Analysis of Covariance for Problem Recognition by Group for Cohort Sample

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>220</td>
<td>75.21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td>3</td>
<td>.36</td>
<td>.12</td>
<td>.31</td>
<td>.81</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>.52</td>
<td>.52</td>
<td>.49</td>
<td>.49</td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
<td>2.51</td>
<td>.46</td>
<td>7.47</td>
<td>.007</td>
</tr>
<tr>
<td>Grade x Group</td>
<td>3</td>
<td>.33</td>
<td>.11</td>
<td>.32</td>
<td>.81</td>
</tr>
<tr>
<td>Sex x Grade</td>
<td>3</td>
<td>2.32</td>
<td>.78</td>
<td>2.25</td>
<td>.08</td>
</tr>
<tr>
<td>Sex x Group</td>
<td>1</td>
<td>.82</td>
<td>.82</td>
<td>1.67</td>
<td>.20</td>
</tr>
<tr>
<td>Sex x Grade x Group</td>
<td>3</td>
<td>.60</td>
<td>.20</td>
<td>.62</td>
<td>.60</td>
</tr>
<tr>
<td>IQ</td>
<td>1</td>
<td>.46</td>
<td>.46</td>
<td>.73</td>
<td>.40</td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>.03</td>
<td>.03</td>
<td>.00</td>
<td>.97</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>1.29</td>
<td>1.29</td>
<td>.11</td>
<td>.75</td>
</tr>
<tr>
<td>Error</td>
<td>202</td>
<td>65.97</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 24

Univariate Analysis of Covariance for Consequential Thinking for Cohort Sample

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>220</td>
<td>22116.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td>3</td>
<td>4783.85</td>
<td>1594.62</td>
<td>14.98</td>
<td>.00</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>1.94</td>
<td>1.94</td>
<td>.04</td>
<td>.84</td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
<td>117.71</td>
<td>117.71</td>
<td>3.26</td>
<td>.07</td>
</tr>
<tr>
<td>Grade x Group</td>
<td>3</td>
<td>889.55</td>
<td>296.52</td>
<td>3.56</td>
<td>.02</td>
</tr>
<tr>
<td>Sex x Grade</td>
<td>3</td>
<td>144.16</td>
<td>48.10</td>
<td>2.12</td>
<td>.10</td>
</tr>
<tr>
<td>Sex x Group</td>
<td>1</td>
<td>.78</td>
<td>.78</td>
<td>.61</td>
<td>.43</td>
</tr>
<tr>
<td>IQ</td>
<td>1</td>
<td>576.48</td>
<td>576.48</td>
<td>2.92</td>
<td>.09</td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>45.74</td>
<td>45.74</td>
<td>.04</td>
<td>.85</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>1468.58</td>
<td>1468.58</td>
<td>.69</td>
<td>.41</td>
</tr>
<tr>
<td>Error</td>
<td>205</td>
<td>13433.19</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results of the chi square analyses for the TIPS scores revealed that sixth grade boys in the longitudinal sample were more likely to consider the psychological (x²=13.43, p<.009) and conceptual (x²=10.23, p<.03) when considering consequences than sixth grade boys in the cohort sample.

Overall, while there were some discrepancies between groups, there were more commonalities than differences. However, because there were specific group differences between grades in children's ICPS skills, the null hypothesis stating that there are no significant differences in children's ICPS skills between the cohort and longitudinal samples must be rejected.

**Grade-related Differences in the Cohort Sample**

The results of the ANOVA revealed a significant grade main effect for TIPS total score F(7,90)=5.36, p<.002. The results of the ANCOVA also (with IQ, fluency and flexibility statistically adjusted) revealed a significant main effect for grade for TIPS total score, F(10,85)=4.49, p<.006 (See Table 25).

Results of the post hoc comparisons for the main grade effect on the cohort sample revealed that the eighth graders scored significantly higher on overall problem solving ability than second, fourth and sixth graders.
Table 25
Analysis of Covariance for Total Score for the TIPS for the Cohort Sample

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>85</td>
<td>32429.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td>3</td>
<td>6569.03</td>
<td>2189.77</td>
<td>4.49</td>
<td>.006</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>125.23</td>
<td>125.23</td>
<td>.17</td>
<td>.68</td>
</tr>
<tr>
<td>Grade x Sex</td>
<td>3</td>
<td>1905.91</td>
<td>635.30</td>
<td>2.05</td>
<td>.11</td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>794.66</td>
<td>794.66</td>
<td>.03</td>
<td>.87</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>43.41</td>
<td>43.41</td>
<td>.19</td>
<td>.67</td>
</tr>
<tr>
<td>IQ</td>
<td>1</td>
<td>50.16</td>
<td>50.16</td>
<td>.16</td>
<td>.69</td>
</tr>
<tr>
<td>Error</td>
<td>75</td>
<td>22914.33</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Using the MANOVA procedure, there was a significant overall effect for grade (Wilk's lambda= .5520, F(15, 218.49)=3.50, p<.0001) on the TIPS subscale scores. A significant overall test effect for grade (Wilk's lambda= .5487, F(15, 196.40)=3.18, p<.0001) was also found when a MANCOVA was performed with IQ, fluency and flexibility serving as covariates.

Univariate analysis of covariance for the TIPS revealed a significant grade main effect on consequential thinking F(10, 85)=9.42, p<.0001 (See Table 26). Results of post hoc comparisons for consequential thinking revealed that within the cohort group, eighth graders scored significantly higher on consequential thinking than second, fourth and sixth graders.

There were no significant grade differences in the ability to foresee consequences to proposed solutions between grades 2 and 4, 2 and 6, and 4 and 6.

Qualitative Aspects. Separate chi square analyses on the cross sectional sample alone revealed that older boys (grades 6 and 8) considered more psychological (p<.03) aspects when evaluating consequences than younger boys (grades 2 and 4). Also older girls (grades 6 and 8) considered more psychological (p<.03) reasons when analyzing a problem than younger girls (grades 2 and 4).

Overall, there were significant grade-differences in children's ICPS skills. Therefore, the null hypothesis
Table 26

Univariate Analysis of Covariance for Consequential Thinking for the Cohort Sample

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>85</td>
<td>10153.49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td>3</td>
<td>3232.05</td>
<td>1077.50</td>
<td>9.42</td>
<td>.00</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>31.83</td>
<td>31.83</td>
<td>.17</td>
<td>.69</td>
</tr>
<tr>
<td>Grade x Sex</td>
<td>3</td>
<td>688.74</td>
<td>229.58</td>
<td>3.14</td>
<td>.06</td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>813.64</td>
<td>813.64</td>
<td>.00</td>
<td>.99</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>16.08</td>
<td>16.08</td>
<td>.33</td>
<td>.57</td>
</tr>
<tr>
<td>IQ</td>
<td>1</td>
<td>36.70</td>
<td>36.70</td>
<td>.52</td>
<td>.47</td>
</tr>
<tr>
<td>Error</td>
<td>75</td>
<td>5334.44</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
stating that there were no significant differences in children's ICPS skills must be rejected. As in the longitudinal sample, it appears that as children get older, their ICPS skills improve.

Sex Differences in ICPS Skills in the Cohort Sample

The results of the ANOVA revealed no significant main or interaction effects for sex for TIPS total score. The results of the ANCOVA were similar.

The results of the MANOVA on the TIPS subscale scores also did not reveal a significant overall or interaction effect for sex. Similar results were also found when a MANCOVA procedure was used with IQ, fluency and flexibility serving as covariates.

Overall, within the cohort sample, there were no sex differences in boys and girls overall and specific ICPS skills. Therefore, the hypothesis regarding sex differences within the cohort sample can be rejected.
Development of Creativity in the Cohort Sample

**Group Differences**

In order to test the null hypothesis that there are no group differences in children's creative abilities, specifically ideational fluency and flexibility, when IQ and TIPS total score were adjusted statistically, a series of ANOVA's and ANCOVA's were performed.

**Fluency.** The results of the ANOVA did not reveal a significant group difference. Results of the ANCOVA, with IQ and flexibility serving as covariates, showed a significant group by grade interaction, $F(17,220)=4.77$, $p<.003$ (See Table 27). Results of post hoc mean comparisons revealed that second graders in the cohort sample were more fluent than the second graders in the longitudinal sample. Furthermore, all older grades in the cohort sample were more fluent than the second graders in the longitudinal sample.

**Flexibility.** The results of the ANOVA did not reveal a significant main effect for group. Again, results of the ANCOVA, with IQ and fluency as covariates, showed a significant group by grade interaction, $F(17,220)=3.41$, $p<.02$ (See Table 28). Results of post hoc mean comparisons revealed that second graders in the cohort sample were more flexible than second graders
Table 27
Analysis of Covariance by Group for Fluency

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
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<tbody>
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<td>18739.70</td>
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</tr>
<tr>
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<td>1387.37</td>
<td>462.46</td>
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<tr>
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<td>285.88</td>
<td>285.88</td>
<td>.22</td>
<td>.64</td>
</tr>
<tr>
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<td>54.08</td>
<td>1.68</td>
<td>.19</td>
</tr>
<tr>
<td>Sex x Grade</td>
<td>3</td>
<td>12.83</td>
<td>4.28</td>
<td>1.45</td>
<td>.23</td>
</tr>
<tr>
<td>Grade x Group</td>
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<td>37.97</td>
<td>12.66</td>
<td>4.77</td>
<td>.00</td>
</tr>
<tr>
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<td>814.51</td>
<td>9.73</td>
<td>.00</td>
</tr>
<tr>
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<td>15483.38</td>
<td>4660</td>
<td>.00</td>
</tr>
<tr>
<td>Error</td>
<td>207</td>
<td>663.68</td>
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Table 28

Analysis of Covariance by Group for Flexibility

<table>
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<tr>
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<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
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<td>Grade</td>
<td>3</td>
<td>.30</td>
<td>.10</td>
<td>11.94</td>
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</tr>
<tr>
<td>Sex</td>
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<td>.00</td>
<td>.67</td>
<td>.42</td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
<td>.00</td>
<td>.00</td>
<td>1.09</td>
<td>.30</td>
</tr>
<tr>
<td>Grade x Group</td>
<td>3</td>
<td>.07</td>
<td>.02</td>
<td>3.41</td>
<td>.02</td>
</tr>
<tr>
<td>IQ</td>
<td>1</td>
<td>.00</td>
<td>.00</td>
<td>.01</td>
<td>.90</td>
</tr>
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<td>Fluency</td>
<td>1</td>
<td>.07</td>
<td>.07</td>
<td>8.68</td>
<td>.00</td>
</tr>
<tr>
<td>Error</td>
<td>210</td>
<td>1.51</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
in the longitudinal sample. Furthermore, all older grades in the cohort sample were more flexible than the second graders in the longitudinal sample.

Grade Differences in Creativity in the Cohort Sample

**Fluency.** The results of the ANOVA failed to reveal a significant main effect for grade. Results of the ANCOVA, with flexibility and IQ statistically adjusted, revealed a significant main grade effect, $F(14, 85)=6.46$, $p<.0001$. Post hoc mean comparisons revealed that fourth, sixth and eighth graders scored higher than second graders on fluency.

**Flexibility.** The results of the ANOVA revealed a significant main effect for grade, $F(7, 85)=7.93$, $p<.0001$. Similarly, the ANCOVA showed a significant main effect for grade, $F(7, 85)=7.93$, $p<.004$ (See Table 30). Results of post hoc mean comparisons revealed that also within the cohort sample, eighth, sixth and fourth graders scores in flexibility were higher than second graders.

In summary, within both the cohort and longitudinal samples, it appears that fluency is a skill that develops very early, at least by kindergarten or second grade according to this study, and does not change appreciably in either direction through at least eighth grade.
Table 29

Analysis of Covariance for Fluency for the Cohort Sample

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>85</td>
<td>8515.87</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Grade</td>
<td>3</td>
<td>549.01</td>
<td>2838.62</td>
<td>7.13</td>
<td>.00</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>267.61</td>
<td>267.61</td>
<td>.06</td>
<td>.81</td>
</tr>
<tr>
<td>Sex x Grade</td>
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<td>83.75</td>
<td>27.92</td>
<td>1.83</td>
<td>.15</td>
</tr>
<tr>
<td>TIPS</td>
<td>1</td>
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<td>253.96</td>
<td>.03</td>
<td>.87</td>
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<tr>
<td>Flexibility</td>
<td>1</td>
<td>6812.39</td>
<td>6812.39</td>
<td>2269</td>
<td>.00</td>
</tr>
<tr>
<td>IQ</td>
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<td>323.96</td>
<td>323.96</td>
<td>2.62</td>
<td>.11</td>
</tr>
<tr>
<td>Error</td>
<td>75</td>
<td>225.21</td>
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Table 30
Analysis of Covariance for Flexibility for the Cohort Group

<table>
<thead>
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<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>85</td>
<td>1.64</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td>3</td>
<td>.36</td>
<td>.12</td>
<td>8.74</td>
<td>.00</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>.02</td>
<td>.02</td>
<td>1.09</td>
<td>.30</td>
</tr>
<tr>
<td>Sex x Grade</td>
<td>3</td>
<td>.03</td>
<td>.01</td>
<td>.60</td>
<td>.62</td>
</tr>
<tr>
<td>TIPS</td>
<td>1</td>
<td>.00</td>
<td>.00</td>
<td>.01</td>
<td>.92</td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>.02</td>
<td>.02</td>
<td>1.17</td>
<td>.28</td>
</tr>
<tr>
<td>IQ</td>
<td>1</td>
<td>.04</td>
<td>.04</td>
<td>1.53</td>
<td>.22</td>
</tr>
<tr>
<td>Error</td>
<td>75</td>
<td>1.17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
However, because of significant grade differences in the cohort sample, the null hypothesis regarding grade differences in children's fluency can not be rejected. Similarly, flexibility, seems to appear some time between kindergarten and fourth grade, and then remains fairly constant through eighth grade.

However, because there were grade differences in flexibility within the cohort sample, the null hypothesis must also be retained.

Sex Differences in Creative Ability in the Cohort Sample

Fluency. There was no significant main effect of sex on fluency. Nor were there any significant sex by grade nor sex by group interactions.

Flexibility. There was no significant main effect of sex on flexibility. Nor were there any significant interactions.

Therefore, the null hypothesis regarding sex differences in cohort sample's creative abilities can be rejected for fluency and flexibility.

Problem Solving and Creativity

In order to test the null hypothesis, that no significant correlations exist between ideational fluency, flexibility and ICPS skills, partial correlation
coefficients were computed for the three main dependent variables (TIPS total score, fluency and flexibility) controlling for sex, grade and IQ. The results (See Table 31) indicated that the overall problem solving score was not significantly correlated with either fluency or flexibility, although the correlation between overall problem solving score and fluency approached significance (P<.08). This suggests that had the cohort sample been larger, a significant relationship between overall problem solving score and fluency would have been established.

Furthermore, the results (See Table 32) indicated that fluency was significantly correlated with consequential thinking (p>.0001), and alternative thinking (p<.02). Fluency was not found to be significantly correlated with problem analysis.

Table 31
Partial Correlations Between the Total Scores for the TIPS, Fluency, and Flexibility for the Cohort Group with IQ, Sex, and Grade Partialled Out

<table>
<thead>
<tr>
<th></th>
<th>TIPS</th>
<th>FLUENCY</th>
<th>FLEXIBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIPS</td>
<td>1.00</td>
<td>.20*</td>
<td>.06</td>
</tr>
<tr>
<td>FLUENCY</td>
<td>.20*</td>
<td>1.00</td>
<td>.02</td>
</tr>
<tr>
<td>FLEXIBILITY</td>
<td>.06</td>
<td>.02</td>
<td>1.00</td>
</tr>
</tbody>
</table>

* P < .05
<table>
<thead>
<tr>
<th></th>
<th>Problem Recognition</th>
<th>Problem Analysis</th>
<th>Alternate Thinking</th>
<th>Consequential Thinking</th>
<th>Solution Adequacy</th>
<th>Fluency</th>
<th>Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Recognition</td>
<td>1.000</td>
<td>.57***</td>
<td>.56***</td>
<td>.36***</td>
<td>.60</td>
<td>-.27</td>
<td>-.05</td>
</tr>
<tr>
<td>Problem Analysis</td>
<td>1.000</td>
<td>.66***</td>
<td>.55***</td>
<td>.68***</td>
<td>-.02</td>
<td>-.01</td>
<td></td>
</tr>
<tr>
<td>Alternate Thinking</td>
<td>1.000</td>
<td>.81***</td>
<td>.69***</td>
<td>.17*</td>
<td>.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consequential Thinking</td>
<td>1.000</td>
<td>.31***</td>
<td>.20***</td>
<td>.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solution Adequacy</td>
<td>1.000</td>
<td>-.15</td>
<td>.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluency</td>
<td>1.00</td>
<td>.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***p<.001
**p<.01
*p<.05
Similar to findings in the longitudinal sample, flexibility was not significantly correlated with specific ICPS skills.

In order to determine if fluency and/or flexibility were predictive of alternate thinking and consequential thinking, a multiple regression analysis was performed. Results of the multiple regression analysis performed revealed that together fluency and flexibility accounted for 15.1% of the variance for consequential thinking (p<.001) (See Table 33). Fluency and flexibility together accounted for 5.6% of the variance for alternative thinking, however this only approached significance (p<.09). Again, this suggests that if the cohort sample had been larger, more variance for

Table 33

Multiple Regression Analysis for Consequential Thinking as Measured by the TIPS for the Cohort Sample

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>Value</th>
<th>Prob. &gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>85</td>
<td>10153.49</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fluency</td>
<td>1</td>
<td>1458.90</td>
<td>1458.90</td>
<td>7.43</td>
<td>.001</td>
</tr>
<tr>
<td>Flexibility</td>
<td>1</td>
<td>82.67</td>
<td>82.67</td>
<td>.80</td>
<td>.37</td>
</tr>
<tr>
<td>Error</td>
<td>83</td>
<td>8694.59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
alternative thinking would have been accounted for by fluency and flexibility.

A stepwise regression analysis revealed that fluency uniquely accounted for 14.4% of the variance for consequential thinking ($p<.0003$). Furthermore, fluency uniquely accounted for 5.3% of the variance in alternative thinking ($p<.03$). Flexibility did not account for any significant amount of variance for either consequential or alternative thinking.

In summary, significant correlations were not found between fluency, flexibility and overall problem solving scores, in either the cohort or Time 2 samples. However, significant correlations were established between fluency and alternative and consequential thinking for both groups. Evidence was insufficient to reject the null hypothesis regarding the relationship between fluency, flexibility and ICPS skills. It appears that children's creative abilities are predictive of their ability to foresee consequences to solutions. Differences in the results of the correlational, multiple regression and stepwise analyses for the longitudinal versus cohort samples could possibly be attributed to the differences between the cohort sample size ($N=91$), and the Time 2 sample size ($N=175$).
Summary of Cohort Analyses

Results regarding ICPS skills in the longitudinal and cohort groups reveal specific group differences. The students in the longitudinal sample had significantly higher scores on problem recognition than those in the cohort sample. Furthermore, eighth graders in the cohort sample had significantly higher scores on consequential thinking than eighth graders in the longitudinal sample.

Regardless, the patterns of grade differences for the two groups were similar. Within both groups, older students had higher scores in overall problem solving ability over younger children within both groups. Furthermore, the grade-related trends in specific ICPS skills were also replicated.

Older students demonstrated greater abilities to evaluate consequences to a problem than younger students. Perhaps if the cohort sample had been larger, grade-related differences in problem analysis and alternative thinking would have emerged.

Similarly, results regarding creative abilities revealed specific differences between the longitudinal and cohort samples, but suggested similar grade-related trends. Second graders in the longitudinal sample were more fluent and flexible than second graders in the cohort sample. As was the case with ICPS skills, the grade-related patterns in creative abilities were
similar. Specifically, older students were more flexible than younger students.

The current study failed to replicate all specific grade differences within the cohort sample that were demonstrated within the longitudinal sample. However, there were clearly more similarities than differences between the two samples.

Furthermore, specific trends (i.e. older children show increases in ICPS skills and creative abilities over younger children) were replicated. Therefore, one must interpret grade-related differences in the longitudinal sample as developmental trends only tentatively.

Interpersonal Cognitive Problem Solving, Social Competence and Behavioral Adjustment

ICPS Skills and Social Competence

In order to test the null hypothesis, that there are no significant relationships between teacher's ratings of social competence and children's ICPS skills, a series of Pearson-product correlation coefficients were first computed between the total score for the TIPS and the five subscales from the Teacher's Rating Scale of Child's Actual Behavior (Harter, 1985). Different measures were used to assess social competence at Time 2 and with the cohort sample than had been used at Time 1. Therefore,
the results of the analyses will be reported separately, and no direct comparisons with Time 1 will be made.

**Longitudinal Sample.** Of the 175 subjects tested at Time 2, teachers returned ratings on 106 children only. Results of the partial correlational analyses with sex, grade and IQ statistically controlled, revealed a significant correlation between the TIPS total score and social acceptability ($p < .03$) (See Table 34), as measured by Harter's Scale. Similarly, a multiple regression analysis revealed that children's ICPS skills, as measured by the subscores comprising the TIPS, accounted for 15.8% of the variance for teacher's ratings of social acceptability ($p < .02$).

In order to better understand which ICPS variables were contributing to the explained variance, a stepwise regression analysis was performed, in which the social acceptability score from the Teacher's Rating Scale of the Child's Actual Behavior (Harter, 1985) served as the dependent variable.

The results indicated that for teacher's ratings of social ability, when problem recognition was entered into the equation it accounted for 8.9% of the variance and was the best one variable model found ($p < .002$). When the variable alternate thinking was entered into the equation, together problem recognition ($p < .02$) and alternate thinking ($p < .13$) accounted for 10.9% of the
Table 34
Partial Correlations Between Teacher's Rating Scale of Child's Actual Competence Subscale Scores & TIPS Total Score at Time 2

<table>
<thead>
<tr>
<th></th>
<th>TIPS Total</th>
<th>Social Acceptability</th>
<th>Athletic Competence</th>
<th>Physical Appearance</th>
<th>Scholastic Competence</th>
<th>Behavioral Conduct</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIPS Total</td>
<td>1.000</td>
<td>.20*</td>
<td>.02</td>
<td>.13</td>
<td>.14</td>
<td>-.02</td>
</tr>
<tr>
<td>Social Acceptability</td>
<td>1.000</td>
<td>.41***</td>
<td>.48***</td>
<td>.13</td>
<td></td>
<td>.35***</td>
</tr>
<tr>
<td>Athletic Competence</td>
<td>1.000</td>
<td>.29***</td>
<td>.19*</td>
<td>.13</td>
<td></td>
<td>.13</td>
</tr>
<tr>
<td>Physical Appearance</td>
<td>1.000</td>
<td>.15</td>
<td>.21*</td>
<td>.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scholastic Competence</td>
<td>1.000</td>
<td>.62***</td>
<td></td>
<td>.21*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioral Conduct</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***p<.001
**p<.01
*p<.05
variance, and served as the best 2 variable model found. Alternate thinking uniquely accounted for 1.99% of the variance, but was not significant. When the variable problem analysis was entered into the equation, together problem recognition (p<.02), alternate thinking (p<.04) and problem analysis (p<.15) accounted for 12.7% of the variance. Problem analysis uniquely accounted for 1.85% of the variance, but was not significant. However, when alternate thinking was replaced by consequential thinking in the equation, together problem recognition (p<.001), consequential thinking (p<.02) and problem analysis (p<.07) accounted for 13.6% of the variance, and served as the best 3 variable model found (See Table 35). Variables were no longer added to the equation at this point in order to avoid an increase in error rate.

Finally, although not statistically significant, negative correlations between the total score for the TIPS and the behavioral conduct scale were observed. These findings suggest that as children's scores on ICPS skills increase, teacher's ratings of behavioral problems decrease.

Overall, results from the longitudinal sample suggest that ICPS skills are related to and predictive of teacher's ratings of social competence. The results indicate that problem recognition, consequential
Table 35

Stepwise Regression Analysis for Social Acceptability as Measured by the Teacher's Rating Scale of Child's Actual Competence and TIPS Subscale Scores at Time 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
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<th>Mean Squares</th>
<th>Value</th>
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<td>580.53</td>
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<tr>
<td>Problem Recognition</td>
<td>1</td>
<td>27.04</td>
<td>27.04</td>
<td>11.05</td>
<td>.00</td>
</tr>
<tr>
<td>Consequential Thinking</td>
<td>1</td>
<td>11.45</td>
<td>11.45</td>
<td>5.41</td>
<td>.02</td>
</tr>
<tr>
<td>Problem Analysis</td>
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<td>17.22</td>
<td>17.22</td>
<td>3.18</td>
<td>.07</td>
</tr>
<tr>
<td>Error</td>
<td>101</td>
<td>501.86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
thinking and problem analysis are the best predictors of teacher's ratings of children's social competence.

Cohort sample. Of the 91 children in the cohort sample, teacher's returned ratings on 71 children. Results of the partial correlational analyses with sex, grade and IQ statistically controlled, found no significant correlations between TIPS total score and the five subscale scores for scholastic competence, social acceptability, athletic competence, physical appearance and behavioral conduct. Similarly, a multiple regression analysis revealed that children's ICPS skills, as measured by the subscores comprising the TIPS did not significantly account for the variance in teacher's ratings of children's social competence. Again, although not statistically significant, negative correlations were observed between the total problem solving score of the TIPS and teacher's ratings of behavioral conduct. These results suggest that children's ICPS capabilities do not significantly predict teacher's ratings of social competence. But because of the relatively small sample size and the even smaller number of teacher's ratings returned (N=71), this may not be an adequate sampling of teacher's ratings of children's social competence.

Overall, it is equivocal whether children's ICPS skills are predictive of teacher's ratings of social competence. While the results were significant in the
larger, longitudinal sample, they were not significant in the cohort sample. Therefore, the null hypothesis regarding the relationship between student's ICPS skills and teacher's ratings of social competence must be retained.

**ICPS Skills and Behavioral Adjustment**

In order to test the null hypothesis, that there are no significant relationships between student's ICPS skills and teachers' ratings of behavioral adjustment as measured by the Teacher's Report Form (Achenbach and Edelbrock, 1987), a series of correlations and partial correlations (with sex, grade and IQ statistically controlled) were performed.

**Longitudinal Sample.** Results of correlational and partial correlational analyses revealed no significant correlations between student's overall and specific ICPS skills and behavioral adjustment (Internalizing, Externalizing and Total Behavior Score).

However, negative but insignificant correlations were observed between the TIPS total score and behavioral adjustment as measured by the aforementioned scores. These findings suggest that as students scores on ICPS skills increase, teacher's ratings of behavioral difficulties decrease.
Cohort Sample. Results for both correlational and partial correlational analyses revealed no significant correlations between children's overall and specific ICPS skills and behavioral adjustment (Internalizing, Externalizing or Total Behavior Scores). These results are not surprising, given that both the cross sectional and longitudinal samples were comprised of "normal" children, and very few of the children were actually classified as Internalizers or Externalizers on the TRF. Therefore, the null hypothesis regarding the relationship between children's ICPS skills and teacher's ratings of behavioral adjustment must be retained.
The current investigation examined the stability and change of children's overall and specific ICPS skills and creative abilities, operationalized as ideational fluency and flexibility, in the same children over a two year period. In order to rule out any grade-related differences as being due to cohort effects, a new cohort sample was tested as well. This investigation also explored the relationship between children's ICPS skills and creativity in a longitudinal and cohort sample. Finally, this study examined the relationship between children's ICPS skills and teacher's ratings of social competence and behavioral adjustment.

Longitudinal Changes in ICPS Skills and Creativity

ICPS Skills. The finding of a time effect when IQ and fluency were not statistically controlled suggests that changes in children's ICPS skills did occur over time. However, when IQ and creativity were statistically controlled, no main time effect occurred. A close examination of the data suggests that creative ability is
partially responsible for this increase in ICPS skills. However, the data also suggest that overall problem solving ability is relatively stable over a two year period. Further support for this was found in the results of the stability coefficients for TIPS total score and the subscale scores. Significant moderate correlations were found for overall and specific ICPS skills over time. These moderate versus highly correlated findings suggest that the skills are still developing.

Furthermore, while there were no significant changes over time, grade-related differences in overall and specific ICPS skills were found. This is in accordance with our predictions as well as previous research (Marsh, 1980; Goldman et al., 1987).

However, our specific predictions regarding developmental change for specific skills at specific grades were not supported. Perhaps a two year period is not enough time to detect true developmental change. In fact, an examination of the grade-related differences in ICPS skills suggests that the majority of changes took place over a four year period.

Results suggest that among the higher range of the grade spectrum, students ICPS skills are more stable and differences amongst these grades are more rare. There appear to be more differences between the older and younger children's ICPS skills, and this was typically,
although not always, a four year period in the current study. Exceptions were found in the Time 2 sample between second and fourth graders for all skills except consequential thinking, and between sixth and eighth graders on consequential thinking. Within the cohort sample, there were differences between sixth and eighth graders on overall ICPS skills and consequential thinking ability. The grade-difference in consequential thinking was largely responsible for the significant overall problem solving main grade effect.

It is possible that for younger children, change in the development of ICPS skills is occurring more rapidly, and thus changes in two years could be detected, as was the case in the Time 2 sample. Perhaps because the sample was not balanced between younger and older students, change in younger students overall and specific ICPS skills over time were not detected. However, changes between second and fourth graders were not detected in the cohort sample, suggesting that either change takes longer than two years or, as is discussed more fully later, the second graders in the cohort sample were very good problem solvers. And although not statistically significant, their scores were higher than the second graders in the longitudinal sample, and high enough not to produce differences with the fourth graders from the cohort sample. Regardless, the current results suggest
that as children get older, these skills begin to stabilize and changes become more gradual, and most likely coincide with changes in cognitive development.

Upon closer examination it appears that the two year change in consequential thinking observed between sixth and eighth graders is consistent with previous research (Platt et al., 1974) which found that means-ends thinking, a process underlying consequential thinking, emerges between 9-12 years of age (approximately fifth through seventh grade). Therefore, the two year difference in consequential thinking between sixth and eighth graders in the Time 2 and cohort samples is most likely due to the emergence of means-ends thinking, which was measured in the current study between grades six and eight.

Overall, changes in overall and specific ICPS skills were typically detected between older and younger students over a four year period. While there is no longitudinal literature in the area of ICPS skills to consult, research by Selman (1980) in the area of the development of children's social understanding found that it takes four to five years to advance one full stage in social reasoning. He concludes that changes in social reasoning are gradual (Selman, 1980). Perhaps developmental changes in ICPS skills are equally
gradual, and thus would not have been detected in this two year longitudinal study.

**Fluency.** The absence of a significant main time effect and the presence of significant moderate correlations for fluency at Time 1 and Time 2 suggests that fluency is a fairly stable ability. This is in accordance with previous research (Kogan & Pankove, 1972) which discovered that ideational fluency remains stable between fifth and tenth grade.

**Flexibility.** Results of the ANCOVA and the stability coefficients found that changes occurred in children's flexibility over time across grades. Furthermore, results from the cohort sample do not indicate that these changes are the results of cohort or practice effects. These results are somewhat in accordance with previous research (Torrance, 1961) which also found that flexibility was not a stable construct over time. Specifically, Torrance (1961) found that various indices of creativity increase between grades 1 and 3, decline in fourth grade, and then continue to increase again between grades 5 and 6.

**Grade-related Differences in ICPS Skills and Creative Abilities**

**Overall ICPS Skills.** Results from both the longitudinal and cohort groups support a clear developmental progression: as children get older their
interpersonal problem solving abilities improve. Specifically, for both groups, the results of the ANCOVA (with IQ, fluency and flexibility statistically adjusted) revealed a significant main grade effect for overall problem solving ability. The results of the post hoc mean comparisons within the longitudinal group demonstrated significant increases in total problem solving ability between grades 10 and 2, 10 and 4, 10 and 6, 8 and 2, 8 and 4, 6 and 2, and 4 and 2. The only difference between Time 1 and Time 2 is a failure for eighth graders to significantly increase their problem solving ability over sixth graders at Time 2. It is possible, as Feldgaier and Serafica (1980) suggest in their study, that eighth graders in the current study were selectively screening out inappropriate or poor solutions to problems. This may have resulted in lower total problem solving scores for eighth graders, and thus did not produce a significant difference between sixth and eighth graders total problem solving scores at Time 2.

Results of post hoc comparisons for the cohort group revealed that eighth graders demonstrated significant increases in problem solving ability over grades 2, 4, and 6. No other grade differences were found. These results are discrepant with the longitudinal sample which did show significant increases between grades 2 and 4,
and 2 and 6, and did not find significant increases between grades 4 and 6, and 6 and 8.

Regardless, a consistent finding appears to be that the period between grades 4 and 6, for both the longitudinal and cohort samples, appears to be a time when no significant changes in overall problem solving ability take place. This is in contrast to previous research by Marsh (1981) who found significant changes between grades 4 and 6 in children's problem solving abilities. One possible explanation for this discrepancy is that the general philosophy of the school district in which most of the current data was collected is very problem-oriented. As was discussed previously (Goldman et al., 1987) the school personnel encourage their students to actively engage in the problem solving process. This encouragement begins early on and is crystallized in eighth grade when students participate in the QUEST program. One of the main objectives of the QUEST program is to encourage children to use problem solving skills, similar to those outlined by D'Zurilla & Goldfried (1971). Perhaps the schools encouragement of active problem-solving allows differences in problem solving ability to be exposed at younger grades.

In order to better understand these results regarding overall problem solving ability, it is necessary to examine the developmental sequence of
specific problem solving skills. The results of the MANCOVA procedure for both the longitudinal and cohort group found a significant overall effect for grade for the subtests comprising the TIPS. Furthermore, a significant overall group, and group by grade interaction was found for the cohort sample when a MANCOVA procedure was used.

Problem Recognition

Univariate analyses of covariance revealed no significant main effects for grade, sex, or time for both the longitudinal and cohort samples. It appears that by at least grade 2, if not by kindergarten, that children have acquired the ability to recognize the presence of a problem, and that this ability remains stable over time. Interestingly, trends observed at Time 1, regarding children's negative responses to the question of whether the protagonist has a problem, were observed again at Time 2 and in the cohort sample as well. Namely, there were differences observed between younger and older children when they responded, "No," to the question of whether the protagonist has a problem. For example, the handful of younger children in grade 2, who did not recognize the protagonist as having a problem, would offer explanations such as, "No, because he just doesn't," or "No, because she'll just figure it out."
However, by fourth grade the quality of these negative responses was quite different. As at Time 1, fourth, sixth, eighth and at Time 2, tenth graders who did not think the protagonist had a problem, offered explanations such as, "No, he already said he'd play with Tommy. That's pretty much making a commitment," or, "No, because she can take Jenny with her and spend another day with her friends." In both of these responses not only has the subject recognized a problem, they've solved it. This suggests that possibly as children get older, and have had more experience in solving interpersonal problems, that the meaning of "having a problem" changes. Again, these findings were not significant and only a handful of children responded negatively to the question of whether the protagonist has a problem. However, these observations do warrant further investigation into what it means to children of different ages to "have a problem."

Univariate analysis of covariance revealed a significant main group effect for problem recognition, indicating that students in the longitudinal sample had higher recognition scores than students in the cohort sample. It appears that in this case, recognition meant that students in the Time 2 sample, remembered some of the TIPS stories. This was evident from their spontaneous responses, such as "Oh yea, I remember this one."
However, remembering the story and the fact that the protagonist had a problem is different from being able to recall all the possible solutions and consequences, etc., given at Time 1. The latter is a much more involved and complex process. It is easier to remember an affirmative or negative response, than detailed solutions. Therefore, most likely, the students in the Time 2 sample were able to recall some of the stories and possibly even their responses to the question of whether or not the protagonist had a problem. However, the absence of significant group differences for the remaining ICPS skills suggest that practice effects or memory were not responsible for their other answers.

**Problem Analysis**

Results of univariate analyses of covariance within the longitudinal samples found a significant grade main effect for problem analysis. No significant main grade effect was found within the cohort sample. No main effects for sex, time or group were found, nor were any significant interactions discovered. At Time 1, grades 4, 6, 8, and at Time 2, grade 10, were all found to have significantly higher scores in their ability to analyze a problem over second graders. Grade-differences between second and all other grades for problem analysis appears to be stable.
It is not clear why grade-differences were not found within the cohort sample. Furthermore, discrepancies remain within the longitudinal sample with regards to the exact time in which an increase in problem analysis occurs. Within the longitudinal sample, it appears that increase occurs sometime between grades 2 and 4. However, within the cohort sample, it appears that an increase occurs some time prior to second grade. One possible explanation for these differences could be that, as was previously discussed, the second graders within the cohort sample were particularly good problem solvers. While not statistically significant, the second graders in the cohort sample had higher overall and specific ICPS skills than the second graders in the longitudinal sample. And because of this, their scores on problem analysis were sufficiently high enough so that no significant grade differences emerged.

Regardless, the trend that older children (at least grades 8 and 10, and possibly grades 4 and 6) are better at analyzing a problem than younger children (certainly second grade, and possibly fourth grade) appears to be stable.

Alternate Thinking

Results of univariate analyses of covariance revealed a significant grade main effect for alternate
thinking. No significant main effects for sex, group or time, nor were any significant interactions found. Overall, older children generated significantly more alternative solutions than younger children. Specifically, at Time 1, second, fourth, sixth and eighth graders showed significant increases in alternative thinking over kindergartners. In addition, eighth graders demonstrated significant increases in alternative thinking over second, fourth and sixth graders. Furthermore, sixth graders demonstrated significant increases in alternative thinking ability over second graders. Similarly at Time 2, fourth, sixth, eighth and tenth graders showed significant increases in alternative thinking ability over second graders. In addition, tenth graders demonstrated significant increases in alternative thinking ability over grades 2, 4, and 6. No grade differences were found with respect to alternative thinking within the cohort sample.

While the trend that older children generate more alternative solutions than younger children is replicated, some specific discrepancies remain. Namely, that at Time 2, fourth graders had higher scores on alternative thinking than second graders, where this was not the case at Time 1 or within the cohort sample. Further discrepancies exist within the cohort sample. When examining the means of the scores of the dependent
variables in the cohort sample, the cohort sample scored higher on most variables, although not necessarily significantly higher. There is less variance in scores in the cohort sample. Furthermore, because the second graders within the cohort sample scored very well, differences between grades are not as easily detected.

The failure to replicate an increase in alternative thinking in the cohort sample is most likely attributed to the second graders unusually high, although not statistically significant, problem solving scores that have been previously discussed. It is unclear why fourth graders scored higher than second graders at Time 2. This finding, as well as the other findings on alternative thinking are discrepant with previous research. Specifically, Marsh found increases in alternative thinking only between grades 4 and 6 (Marsh, 1982). In addition, the Time 1 findings are discrepant with Feldgaller and Serâfica's (1980) findings that alternative thinking ability did not increase between grades 4 and 8.

One possible explanation for this finding is that some of the eighth graders in the longitudinal sample and all the eighth graders in the cohort group were tested later in the year. As was discussed previously (Goldman et al., 1987), the general philosophy of the school district in which the majority of the data was collected is very problem-oriented and encourages its students to
actively participate in the problem solving process. Furthermore, the eighth graders had the added benefit of having participated in the QUEST program. Again, one of the main objectives of the QUEST program is to encourage children to use problem solving skills, similar to those outlined by D'Zurilla & Goldfried (1971). The majority of the eighth graders tested in the cohort group had already received this problem solving training by the time they were tested for the study. Therefore, it is possible that their scores are inflated, due to the additional training they had received, although not to a statistically significant point in the cohort sample. Overall, at least within the longitudinal sample, it appears that older students (grades 8 and 10) have higher scores in alternative thinking ability over younger children (grades K, 2, and 4) and this pattern remains stable.

Consequential Thinking

Results of univariate analyses of covariance revealed a significant grade main effect and a significant group by grade interaction. There were no significant sex or time main effects, nor were any other significant interactions found. Post hoc comparisons revealed that at Time 1, fourth, sixth and eighth graders had higher scores in consequential thinking ability over
kindergartners and second graders. Furthermore, second and fourth graders had higher scores than kindergartners. At Time 2, eighth and tenth graders had higher scores in consequential thinking ability over second, fourth and sixth graders. In addition, sixth graders showed had higher scores in consequential thinking ability over second graders. Similarly, within the cohort group, eighth graders had higher scores in consequential thinking ability over second, fourth and sixth graders.

One possible reason for the discrepancies between the current research and past findings (Marsh, 1982), again, may be due to the general philosophy of the school district in which the majority of the data was collected. As was discussed earlier, the school district is very problem-solving oriented and actively encourages its' students to participate in the problem solving process. Therefore, it is possible that the school's philosophy encourages children to problem solve and they do so often. This may help to further highlight differences between grades in overall and specific problem solving ability.

With regards to the group by grade interaction, post hoc mean comparisons revealed that eighth graders in the cohort group had higher consequential thinking scores than eighth graders in the longitudinal sample.
Overall, the trend that older children show increases in consequential thinking ability appears to have been replicated. While there are many similarities among the data for consequential thinking, there are also some discrepancies. Specifically, according to the results from Time 2 and the cohort sample, it appears that children in grades 8 and 10 had higher scores in consequential thinking than children in grades 2, 4, and 6. However, there were no significant grade-related differences found in consequential thinking between children in grades 4, 6, and 8 at Time 1.

This discrepancy is most likely explained by the fact that the majority of eighth graders in the Time 2 and cohort samples were tested later in the year, after they had participated in the Quest program discussed earlier. Whereas only some of the eighth graders in the Time 1 sample had participated in the Quests program at the time of their testing. Therefore, it is likely that eighth graders in the Time 2 and cohort samples demonstrated increases in consequential thinking over grades 4 and 6, in part, because of their participation in the Quest program. Furthermore, all of the eighth graders in the cohort sample had participated in the QUEST program and only some of the eighth graders in the Time 2 sample had participated in the program, it is possible that the cohort sample's higher scores in
Consequential thinking are due to having had more exposure to the problem solving process through QUEST.

Again, these results are discrepant with previous research which has found increases in consequential thinking ability only between grades 4 and 6 (Marsh, 1982). However, as was discussed previously, the results are consistent with past research when one considers the underlying process involved in consequential thinking. Consequential thinking involves means-ends thinking. A subject must be able to take the suggested solution and hypothesize about what might happen if that solution was carried out. Platt et al. (1974) found that during the 9-12 year old range, means-ends thinking emerges as a significant interpersonal problem solving skill and remains significant throughout the remainder of adolescence (Platt et al., 1974). Interestingly, the emergence of both means-ends and consequential thinking coincide with the emergence of the transition to formal operational thought, allowing one to hypothesize about future events.

The current results support the presence and importance of means-ends thinking during the 9-12 year old period. In both the longitudinal and cohort samples, it appears that consequential thinking emerges at approximately fourth grade and remains fairly stable throughout the end of seventh or the beginning of eighth
grade, where there then appears to be another increase in consequential thinking ability between eighth and tenth grade.

Solution Adequacy

Results of univariate analyses of covariance revealed a significant grade main effect for solution adequacy at Time 1. In addition, a significant time by grade interaction was found for solution adequacy within the longitudinal sample. However, this interaction is explained by the presence of grade differences at Time 1 but not at Time 2. Post hoc analysis at Time 1 revealed that eighth graders had higher scores in their ability to pick the "best" solution over grades K, 2, 4, and 6 at Time 1. However, these grade differences were not replicated at Time 2 or within the cohort sample. It is unclear why eighth graders at Time 1 demonstrated superior ability to pick a "best" solution over younger grades.

Qualitative Differences in ICPS Skills. The emergence of the transition to formal operational thought would account for the finding that older children at Time 1 and at Time 2 considered significantly more psychological aspects when analyzing a problem than younger children. Furthermore, at Time 2 it was found that older children consider significantly more psychological and conceptual
aspects when evaluating consequences to a problem than younger children. In addition, older boys considered more psychological aspects when evaluating consequences than younger boys within the cohort group. Older girls considered more psychological reasons when analyzing a problem than younger girls within the cohort group. Finally, while there were reported differences between the longitudinal and cohort sample for specific grades, the trend that older children continue to consider psychological and conceptual abilities when analyzing or evaluating consequences to a problem and younger children tend to focus on more concrete behavioral aspects of problems was maintained. Again, these differences are most likely explained by parallel growth in cognitive development. The transition from concrete operational thought to formal operational thought marks a change from a focus on the concrete and more obvious aspects of one's environment to being able to hypothesize about more complex and subtle aspects of one's surroundings (Piaget, 1963). Hence, younger children tend to focus on the more obvious, behavioral aspects of problems, while older children are able to consider the more complex psychological and conceptual aspects of the problem.
Sex Differences and ICPS Skills

Results did not yield any main or interaction effects for sex in overall or specific ICPS skills. However, the results of the chi square analyses demonstrated that at Time 1, girls considered conceptual aspects significantly more often than boys when defining a problem as measured by the TIPS. Furthermore, girls also identified psychological aspects of consequences significantly more often than boys. These findings were not replicated at Time 2 or within the cohort sample. These differences between boys and girls are most likely attributable to socialization factors, rather than true sex differences. Maccoby and Jacklin (1974) found that girls were more interested in social and less interested in aggressive activities than boys. Perhaps, this being the case, girls may have had more experience in considering all individuals points of view in a conflict situation. While Maccoby and Jacklin's (1974) findings do not explain the current results, they highlight the importance of considering socialization and familial factors when discussing the development of ICPS skills.

Creativity

Fluency. The results of the ANCOVA for the cohort and longitudinal samples did reveal a significant main effect for grade for fluency. However, a significant
group main effect found that second graders in the cohort sample were more fluent than second graders in the longitudinal sample. As was concluded at Time 1, it appears that ideational fluency is a skill that is acquired early on (by kindergarten or second grade) and remains fairly stable, at least through tenth grade. Again, this is in accordance with previous findings (Kogan & Pankove, 1972) which discovered that ideational fluency remains stable between fifth and tenth grade.

**Flexibility.** The results of the ANCOVA revealed a main grade effect for both the longitudinal and cohort samples. A group by grade interaction was also significant. Finally, a significant main effect for time and a significant time by grade interaction was found within the longitudinal sample. First, with regards to grade differences in children's flexibility, it appears that older children are more flexible than younger children. Specifically, results from the longitudinal sample found that at Time 1, grades 2, 4, 6, and 8 showed significant increases in flexibility over kindergartners. At Time 2, children in grades 6, 8 and 10 showed significant increases in flexibility over children in grades 2 and 4. Finally, within the cohort sample, children in grades 4, 6 and 8 showed increases in flexibility over second graders. Also of interest was the finding that second graders in the cohort sample had
higher flexibility scores than second graders in the longitudinal sample at Time 1. Furthermore, children's flexibility appears to have increased for all grades over time within the longitudinal sample.

One possible explanation is that flexibility is a skill that is acquired some time between grades 2 and 4, and while there continue to be increases within individuals across grades, the scores remain relatively stable between grades, at least through the tenth grade. Again, the current results are somewhat similar to Torrance's (1961) observations that various indices of creativity increase between grades 1 and 3, decline in fourth grade and then continue to increase again between grades 5 and 6.

**Sex Differences in Creativity**

The results of the ANCOVA revealed no significant main effects for sex for either fluency or flexibility within either the longitudinal or cohort samples. It appears that both boys and girls acquire ideational fluency and flexibility early on and these skills remain relatively stable over time.

**Relationship between ICPS Skills and Creativity**

Results of the partial correlational, multiple regression and stepwise regression analyses revealed a
highly significant relationship between overall problem solving ability and fluency at Time 1 and Time 2, but not within the cohort sample, although the correlation within the cohort sample approached significance ($p<.08$). Furthermore, fluency was found to be significantly correlated with and predictive of problem analysis, alternate thinking and consequential thinking at Time 1 and Time 2. However, fluency was only found to be significantly correlated with and predictive of alternate thinking and consequential thinking within the cohort group. The reason for these discrepancies are most likely attributed to the differences in sample sizes. It is assumed that if the cohort sample had been as large as the longitudinal sample, significant relationships between fluency and total problem solving and problem analysis would have reached statistical significance. These results suggest that ideationally fluid children are better interpersonal problem solvers overall. Specifically, they are more skillful at alternate thinking and consequential thinking, and at least within the longitudinal sample, problem analysis.

Fluency seems to be a particularly salient variable in helping to explain the development of ICPS skills. Fluency alone predicted children's problem analysis, alternate thinking and consequential thinking abilities at Time 1 and Time 2. Furthermore, fluency alone
predicted consequential thinking and alternative thinking (p<.03) within the cohort sample. However, flexibility was not correlated with nor predictive of overall or specific problem solving ability in either the longitudinal or cohort samples.

There are several probable reasons why flexibility was not a significant predictor of children's ICPS skills. For example, a child may generate six alternative solutions to a problem. However, the TIPS scoring system only allows for two categories within alternate thinking: forceful and nonforceful, although many subcategories are subsumed within each of these. Responses are not scored in a sequential manner. For example, response one and two may be scored as forceful, in response three, the subject switches categories and his/her response is scored nonforceful, response four is scored forceful, etc. Finally, the majority of subjects in this sample gave nonforceful responses (i.e., restriction of range), further diminishing the likelihood of finding a relationship between alternate thinking and flexibility. Therefore, while a subject may generate six alternative solutions, he/she could only use two categories. Therefore, while one would expect to find a relationship between alternate thinking and fluency, one would not expect to
find a relationship between alternate thinking and flexibility due to restriction of range.

Finally, as was discussed at Time 1, Kogan and Morgan (1969) found that for fifth graders, test like, compared to game like conditions, generated higher levels of fluency but did not affect flexibility in the Alternate Uses Test. Kogan and Morgan (1969) suggest this finding may be due to the type of strategy chosen by the child. They explain that if a child uses a strategy of "category exhaustion," in which they attempt to exhaust all possibilities in a specific category, that strategy does not encourage the switching of categories. Spontaneous flexibility remains unaffected (Kogan & Morgan, 1969). Therefore, it is possible that the test-like conditions did not promote spontaneous flexibility. Overall, the findings suggest that creativity, especially ideational fluency be added to the list of potential correlates of ICPS skills.

Social Competency and ICPS Skills

Results of the correlational, multiple regression and stepwise analyses indicated that children's ICPS skills are not predictive of teacher's ratings of social competence in the cohort sample. However, children's ICPS skills were predictive of teacher's ratings of social competence, specifically social acceptability,
within the Time 2 sample. The longitudinal sample is larger than the cohort sample, and perhaps is more representative of teacher's ratings of social competence. These results also suggest that had more teacher's returned checklists, a more robust relationship between children's ICPS skills and social competence might have been established.

Similar results linking ICPS skills with social competence have been found by Pettit et al., (1988). Specifically, they found that the relationship between exposure to deviant maternal values and expectations and social competence was mediated by ICPS skills (Pettit et al., 1988). Furthermore, Spivack and Shure (1980) found more socially competent preschoolers to differ from their less socially competent preschoolers with respect to their ability to generate alternative solutions.

The results of the stepwise regression analysis revealed that problem recognition, consequential thinking and problem analysis were the three most important variables in predicting teacher's ratings of social competence. Similar results were discovered by Feldgaier, who found that problem analysis best predicted parent's ratings of social competence (Feldgaier, 1987).

It appears that children who can recognize a problem, analyze it, and critically evaluate proposed solutions to
that problem are more likely to be rated as socially competent by their teachers. It is interesting to note that alternative thinking was not helpful in predicting teacher or parents ratings of adjustment. This suggests that, of the two skills, alternative thinking and consequential thinking, it is not the ability to generate many alternative solutions to a problem that is critical in predicting parents and teachers ratings of competence. Rather, it is the ability to anticipate the consequences of the solutions proposed that is predictive of parents and teachers ratings of adjustment.

Furthermore, although not statistically significant, a negative correlation was found between ICPS skills and behavioral conduct. This implies that as children's scores on ICPS measures increase, teacher's ratings of behavioral problems decrease. This further suggests that ICPS skills directly effect teacher's ratings of behavioral conduct.

Finally, it must also be pointed out that it is currently the trend, with regards to social competence, to regard discrepant results among measures of peer status, social performance in specific situations, and social cognitive skills, as the result of measuring different phenomena (Cavell, 1990). Cavell concludes that a model of social competence needs to be viewed as a model with multiple subconstructs (Cavell, 1990).
Behavioral Adjustment and ICPS Skills

Results of the correlational, multiple regression and stepwise regression analyses found that children's ICPS skills were not predictive of teacher's ratings of behavioral adjustment. These findings are consistent with the Time 1 findings (which used Spivack and Shure's teacher rating scales) and with other past research (Enright & Sutterfield, 1980; Sharp, 1981; Rickel et al., 1983), yet inconsistent with other past findings (Denham & Almeida, 1987; Feldgaier, 1987; Marsh et al., 1981; McKim, 1982; Richard & Dodge, 1982; Rubin & Clark, 1983; Kendall & Fischler, 1984).

In interpreting these results, it is important to point out that the sample used in this developmental study was comprised of "normal" children. Furthermore, the Teachers Report Form (Achenbach & Edelbrock, 1981) is designed to detect "abnormal" behavior. Very few of the children in the Time 2 or cohort sample scored outside of the normal range on the Teacher's Report form, indicating that they were indeed a "normal" sample, based on teacher's ratings. The results of Denham and Almeida's meta-analysis revealed that children's ICPS skills do differentiate between adjusted and nonadjusted children. Because there were only adjusted children in the current study, it is difficult for children's ICPS skills to predict behavioral adjustment based on teacher's ratings.
when there is not a sample of nonadjusted children available for comparison.

Finally, although not statistically significant, negative correlations between ICPS skills and total behavioral adjustment scores, implies as it did with social competence, that as children's ICPS scores increase, teacher's ratings of behavioral maladjustment decreases. This suggests again, that ICPS directly effect teacher's ratings of behavioral adjustment, rather than being mediated by social competence.

Implications of the Study

Theoretical Implications. This study was based on the D'Zurilla and Goldfried model of ICPS skills, which had been previously criticized for having ignored developmental considerations (Kendall & Fischler, 1984). The results of the current study help to place the D'Zurilla & Goldfreid (1971) model into a developmental framework. This in turn, helps researchers begin to think about how and when the various ICPS skills develop. In addition, the design of the this study allows the current findings to be interpreted tentatively as true grade related changes in overall and specific ICPS skills. Furthermore, the results extend the D'Zurilla & Goldfried (1971) model by linking ICPS skills with social competence, specifically social acceptability. This
connection is critical for confirming D'Zurilla & Goldfried's (1971) assumption that children's ICPS skills are predictive of competent social behaviors. Finally, the current results suggest specific correlates (ideational fluency and potentially flexibility) which may influence the development of ICPS skills.

However, work still needs to be done regarding the sequence in which skills develop. Does problem recognition develop first, problem analysis second, etc.? Or, more likely, are all the skills present at ages younger than the current investigation examined. Perhaps more interestingly, from a developmental perspective, in what form do these skills appear? Is a two year-old child's grabbing a toy from another two year-old child the early form of a solution, albeit an inadequate one, to a problem? Studies employing nonverbal measures will be necessary in the future in order that we may evaluate the potential precursors to ICPS skills at an earlier age.

The results of the current study also have implications for those attempting to build an underlying theory guiding ICPS skills research. While in the past, theoretical concerns have been largely ignored, recent investigators (Cavell, 1990) are beginning to build a framework from which a theory of ICPS skills and social competence may be born. Results of this study have
demonstrated that children's consequential thinking abilities appear to emerge at approximately the same time as children's means-ends thinking abilities, and that both of these coincide with the emergence of the transition to formal operational thinking. Clearly, the construct of interpersonal cognitive problem solving is a multifaceted creature. In order to explain this complex "beast," a multi-variable theory is going to be necessary. Cavell's (1990) framework draws from many areas, including information processing, experimental psychology, social psychology, and developmental psychology. Briefly, to review, Cavell's (1990) model expands upon McFall's (1982) model, and builds into McFall's three skills of encoding, decision and enactment, components such as empathy, role taking, goal defining, alternative and consequential thinking, means-ends thinking, self-efficacy and outcome expectancy evaluations, behavioral scripts, delay of gratification, self-instruction and both verbal and nonverbal acts. And while Cavell's model is to date, the most comprehensive suggested thus far, it still fails to include an affective component. Cavell does include an empathy component and a "functional skills" component, which is based on Selman et al.'s (1986) work regarding the evaluation of an action on other's feelings. However, one also has to take into consideration the emotions.
affecting the problem solver, which in turn effect the problem solver's choice of a specific action in the first place. To date, research has failed to investigate the role individual's feelings have on the problem solving process. Furthermore, in light of the current findings, it is suggested that creativity, specifically ideational fluency be considered amongst the list of components contributing to children's social skills. Cavell's proposed model, as well as the role one's own feelings has in the problem solving process, are worthy of further investigation.

**Applied Implications.** The design and results of the current study have implications for both clinicians and researchers who design intervention programs. This study was born out of the scarcity of and necessity for normative developmental data regarding the development of children's ICPS skills and creative abilities. Without normative developmental data, interpretation of developmental studies with maladjusted populations becomes difficult to interpret. In addition, much research has been done on ICPS skills training and intervention with maladjusted populations (Shure et al., 1982). However, these studies have failed to use appropriate, nonclinical control groups, again, making the results difficult to interpret. Because this study examined the development of ICPS skills and creative
abilities within the same children over time, children served as their own controls with regards to individual differences. Finally, the inclusion of a cohort group, allows the interpretation of these data to go one step further. We can determine if the findings within the longitudinal sample are true grade-related changes or cohort effects that are particular to the longitudinal sample. As there were clearly many similar findings, and the trends were very similar, it is doubtful that these findings can be attributed to cohort effects. Rather they should be tentatively interpreted as true grade-related changes. The results of the current study provide a normative base from which researchers can make comparisons between clinical and nonclinical populations of children and adolescents.

Furthermore, the results of the current study may help investigators who have designed intervention programs in choosing critical points in which to intervene. For example, if a child was deficient in his/her ability to analyze a problem, it would be most effective to intervene prior to second grade, and no later than fourth grade, according to the current results. Finally, the results suggest that when training children to be better problem solvers, it is important to focus not only on the quantity of the solutions suggested, but the quality as well.
The results of this study also have implications for parents' child rearing practices. The current results demonstrated that there are grade-related changes in children's ICPS skills. In other words, children are expected to have acquired specific skills within a certain period of time. Furthermore, the current study established a link between children's ICPS skills and teacher's ratings of social acceptability, although it failed to do so for behavioral adjustment, other studies using maladjusted populations have established this link. This implies that children need to have acquired these skills in order to viewed as socially competent. Furthermore, past research (Downey & Walker, 1989; Roopnarine, 1987; Pettit et al., 1988; Putallaz, 1987) has demonstrated a relationship between parental modes of functioning, children's ICPS skills and social competence. The sequence of problem solving skills outlined in the current study, as well as in the literature, can serve to heighten parents awareness of the role they play in their child's socialization, as well as serve as a guide for helping their children become better problem solvers.

Limitations of the Study

One potential limitation of this study is the lack of normal distribution for the main dependent variables.
found in the various samples. Although the analyses used (ANOVA, ANCOVA, MANOVA, MANCOVA) are robust enough to account for these violations, the results should be interpreted cautiously. However, the findings are still very strong, and should not be discounted.

Another potential limitation to this study could be certain demand characteristics. There were three examiners at Time 1 and Time 2. Only the primary investigator participated in data collection at both times. In addition, two different trained undergraduate students were used at Time 1 and Time 2. It is possible that the subjects responded differently to the different examiners. However, this is not likely, as the children in the longitudinal sample served as their own controls, and results suggest that there was no difference in responding based on which examiner tested a child. Furthermore, the examiners were all female and all read a set of standard instructions to each child prior to the testing.

As was discussed at Time 1, one of the TIPS stories is in need of revision as it no longer constitutes a dilemma. As a handful of children pointed out at Time 1, Time 2 and within the cohort group, with reference to story 2 (about a child who wants to go to the circus with all of his friends, but two of his friends want to watch their favorite television show), the protagonist does not
have a problem because they can tape the show on their VCR, all go to the circus and watch the tape later. Although it did not make a difference statistically, and the story could not be changed at Time 2 for the sake of consistency, it is advised that the story be changed appropriately so that the protagonist is faced with a more difficult dilemma.

Another potential limitation in this study was the way in which the alternative and consequential thinking scores were calculated for purposes of finding a relationship with flexibility. In addition to the standard scoring procedure directed by the TIPS, it would also be important to re-score the alternative and consequential thinking responses by the number of different categories used on a sequential basis. This would allow a wider range in which a possible relationship between alternative, consequential thinking and flexibility could be found. Again, for the purpose of consistency, the TIPS had to be scored the same way it had been at Time 1. However, future research should consider scoring the alternative and consequential thinking subscores according to the number of different categories used, as well as the total number of responses generated.

Furthermore, the use of standard versus raw IQ scores may have complicated the data analyses. The
results regarding the relationship between ICPS skills, IQ and behavioral adjustment have been equivocal with some researchers finding IQ to be a mediating variable (McKim et al., 1982; Rubin & Daniels-Beirness, 1983; Kendall & Fischler, 1984), and others finding relationships when IQ effects are held constant (Gesten et al., 1983; Enright & Sutterfield, 1980). Similar results have been found regarding the relationship between creativity and IQ (Guilford & Christensen, 1973; Wallach & Kogan, 1965). Given that there is a potential relationship between IQ and ICPS skills and creativity, the current study statistically adjusted IQ scores in order that problem solving and creativity could be looked at as more pure constructs. There is no literature suggesting that raw scores be used for purposes of statistically controlling for the influences of intelligence. However, it makes intuitive sense that if the other skills, such as problem solving and creativity, have not been standardized, and they are presumed to be developing, that not using raw scores when controlling for IQ may dampen the potential developmental effects on problem solving and creativity. In the future, both raw and standard IQ scores should be utilized in data analysis in order to determine if there are differences when raw IQ scores are covaried. Regardless, the
potential effects of IQ should not be ignored in future research.

Finally, the failure of this study to secure a larger cohort sample, makes interpreting the cohort vs. longitudinal data difficult. Almost every child in grades 2, 4, 6 and 8 within the school district we were assigned participated in the project. With such a large longitudinal sample it was difficult to produce a cohort sample of equal size. While there were still some significant findings within the cohort data, many of the analyses only approached significance. A larger cohort sample would have provided a more representative sampling of children's ICPS skills and creative abilities, and would have allowed us to make more definitive statements with regards to grade-related vs. developmental differences in children's ICPS skills and creative abilities.

**Implications for Future Research**

As was discussed earlier, within the area of children's ICPS skills, there is a need to explore the effects of one's own affective state on the problem solving process. It is logical that the way a person feels (i.e., angry, happy, etc.) could potentially effect the outcome of a problem solving situation. How one's emotions effect the problem solving process is an area
that has been largely ignored, and is in need of future investigation.

More longitudinal studies using cohort of groups of equal size are necessary in order to further substantiate the normal developmental progression of ICPS skills and creative abilities.

Furthermore, it may prove fruitful to rethink the notion that "more is better," with regards to problem solving. It may be that after a certain age, older children with more problem solving experience may not necessarily generate more solutions simply because it is not efficient. Having the benefit of experience, they know which solutions will "work," and simply suggest those. As Rubin and Krasnor (1983) concluded, it is important to examine the quality of children's responses, not just the quantity. It is also important to learn more about what "having a problem" means to children of different ages.

As researchers continue to attempt to promote, predict, and explain social competence, understanding and integrating multiple aspects of social functioning will continue to be an issue (Cavell, 1990). Clearly, interpersonal cognitive problem solving skills are a part of this new model of social competence. But as D'Zurilla and Nezu (1982) point out, problem solving in real life rarely proceeds according to the neatly ordered stages
which characterizes the research literature. The challenge of future researchers interested in the development of children's ICPS skills and its correlates, lies in furthering our understanding of how these skills fit in to this new evolving multi-leveled concept of social competence.

Summary of Study

In sum, this study examined the stability and change of overall and specific ICPS skills and creativity, specifically ideational fluency and flexibility, in the same children over a two year period and in a cohort group. Results found that developmental change was occurring in overall problem solving ability. However, when IQ and creativity are statistically adjusted, the change over time is negated. Results suggest that creative abilities are at least partially responsible for this change. However, the lack of significant time effects for the specific ICPS skills suggests that specific ICPS skills are stable over time. The absence of developmental changes in specific ICPS skills was attributed to the relatively short time span (two years) in which this study occurred.

While there were some specific differences within groups regarding increases in a specific skill, overall, there were many more similarities than differences.
Findings indicated that as children get older, their overall and specific ICPS skills, as well as creative abilities, improve. Specifically, findings suggest that for ICPS skills, children's ability to recognize a problem occurs early on and remains fairly stable throughout development. The other ICPS skills, such as problem analysis, alternate thinking and consequential thinking, seem to develop later on and appear to coincide with the emergence of formal operational thought. Findings regarding creative abilities, specifically ideational fluency and flexibility, suggest that fluency is a skill acquired very early on (by second grade) and it remains fairly stable throughout junior and senior high school. Flexibility appears to develop between second and fourth grade, and then remain fairly stable over time as well.

Because of the design of this study, these results can be tentatively interpreted as true grade changes and not the result of practice or cohort effects. Furthermore, while fluency was found to be related to overall ICPS skills within both the longitudinal and cohort samples, flexibility was not. Furthermore, it was found that fluency was predictive of alternative thinking and consequential thinking within the longitudinal and cohort samples. In addition, fluency was found to be predictive of the ability to analyze a problem within the
longitudinal sample. Overall, it appears that children that are more fluid are better interpersonal problem solvers.

Finally, this study explored the relationship between children's ICPS skills and teacher's ratings of social competence and behavioral adjustment. Findings within the longitudinal (Time 2) sample suggests a relationship between ICPS skills and teacher's ratings of social competence. However, findings did not support a relationship between children's ICPS skills and behavioral adjustment.
References


APPENDIX A
COPY OF ORAL PRESENTATION
TO STUDENTS AND TEACHERS
We are here today to talk about our interest in the way children at different ages go about solving social problems. By social problem, we mean a problem that comes up between two people. For example, a child may have promised to help a friend with his/her homework when another friend calls him up to invite him to go play in the park. Should the child stick to his promise or should he accept the invitation to go to the park which he very much wants to do? Another kind of problem is the kid who "acts tough" and annoys you. Can you think of other social problems?

Yes, those are interesting and challenging problems. Different kids go about solving these problems in different ways. Kids at different ages may also hit upon different solutions. What we want to do is to understand how kids at different ages go about solving these social problems. We also want to learn what other abilities influence children's ability to solve social problems.

You can help us by allowing us to interview you. You will be asked to answer questions about stories or think up things to do with ordinary objects, such as a brick. Children who have gone through these interviews and listen to the stories generally find them interesting and enjoy talking to us about their reactions to these
stories and pictures. You will be free to stop answering questions at any time you want. Also, your answers will be kept confidential, meaning your answers will be like a secret between the examiner and you. No one, including your teacher, will know what your answers were. Do you have any questions?

If you wish to take part in our project, please take a copy of this letter home to your parents. There is a form attached to the letter which your parents must sign in order for you to be able to take part in the project.

Now, after you return the signed forms, we will form groups of children to interview. This is like being in a game where it is important to match the children in each team. This means that some of you who want to take part may not be picked this time but you will have a chance to take part in another project. So if you are interested, be sure to take the letter and the consent form home to your parents, see to it that your parent signs the form agreeing to allow you to participate, then be sure to return the signed form to your teacher. We look forward to having you take part in the project.
Interpersonal Cognitive Problem Solving and Creativity: A Developmental Study

ORAL PRESENTATION TO TEACHERS

We are here today to enlist your help in a research project examining children's interpersonal cognitive problem solving (ICPS) skills. By this we mean, how do children go about solving interpersonal conflict situations. For example, what does a child do when he's promised one friend he'd play with him and another friend asks him to go to a movie which he wants to see very badly. Researchers studying ICPS skills have taken the position that ICPS skills mediate healthy human functioning.

We're interested in examining the relationship between children's interpersonal problem solving skills and other variables such as creativity, vocabulary, social competence and behavioral adjustment. We need your assistance in evaluating individual children's level of social competence and behavioral adjustment.

If you agree to participate in this project you will be asked to fill out two scales. One scale is a ten item questionnaire assessing children's social competence. For example, a statement will read, "This student works really hard at his school work." You then decide if that statement is "Really true," of that person, or, "Sort of true," of that person. The questionnaire takes approximately 5 minutes to fill out. The other scale is a 45 or 60 item checklist, depending on which grade you teach, assessing children's behavioral adjustment. It takes approximately between 5-10 minutes to complete. Do you have any questions?

All data collected will be coded to insure confidentiality of results and to preserve anonymity of the subjects.

Participation in this project is voluntary, and you are free to withdraw from the study at any time. We look forward to having you take part in the project.
APPENDIX B
COPY OF MEASURES
ADMINISTRATION

General Instructions for the TIPS

"I am interested in the way children like you think about different things. What I would like to do is have you listen to some stories and look at some pictures about kids your age who have different things happen to them. Then I'd like you to answer some questions about these stories for me. What we are going to do is not a test. There are no right or wrong answers so feel free to tell me anything that comes into your mind. Also, you need not answer questions you don't want to."

General Instructions for Alternate Uses

"Now, in this game, I am going to name an object—any kind of object, like a light bulb or the floor—and it will be your job to tell me lots of different ways that the object could be used. Any object can be used in a lot of different ways. For example, think about string. What are some of the ways you can think of that you might use string?" (Let the child try.)

"Yes, those are fine. I was thinking that you could also use string to attach a fish hook, to jump rope, to sew with, to hang clothes on, and to pull shades." (Don't duplicate the child's responses.)

"There are lots more too, and yours were very good examples. I can see that you already understand how we play this game. So, let's begin now. And remember, think of all the different ways you could use the object that I name. Here we go."
TEST OF INTERPERSONAL PROBLEM SOLVING

Subject Code No. ______________ Date ______________ Interviewer ______________

A. Jane and her friends are playing a game together and Jane is the captain of the team. Now one thing the captain must do is pick someone to help her as her assistant. Mary is Jane's best friend and they almost always do things together. Sue is not as close a friend but she wants to be the assistant very badly since she hardly ever gets a chance. Sally, however, is the best player on the team and usually wins the game for her friends.

1. Do you think that Jane has a problem? What do you think Jane's problem is?

2. What are all the things you would be thinking about if you had to solve this problem? (What are all the things that are important to solve this problem?)
3. Tell me all the ways you can think of for Jane to solve this problem?

4. What might happen if (read each solution from 3)? (Anything else?)

5. What do you think is the best way to solve the problem? Why?
B. Debbie and her friends are trying to decide what they are going to do when they get home from school. Debbie wants Cathy, Beth and Jenny to go with her to the circus in the park. This is the last day for the circus and Debbie really wants to see it. Cathy would rather go home and watch her favorite television program and she's already asked Beth to come with her. Jenny, though, will do whatever everyone else does since she doesn't have any special plans. Debbie really wants to go to the circus today but she also wants to be with all her friends.

1. Do you think that Debbie has a problem? What do you think Debbie's problem is?

2. What are all the things you would be thinking about if you had to solve this problem? (What are all the things that are important to solve this problem?)
3. Tell me all the ways you can think of for Debbie to solve this problem?

4. What might happen if (read each solution from 3)? (Anything else?)

5. What do you think is the best way to solve this problem? Why?
C. Betty and her friends, Linda and Ellen, are playing with the new video game Betty got for her birthday. Ellen has been playing with it for a long time. Now, Linda would like to play with it also because she really likes video games. Ellen just keeps on playing with it. Betty has also said that she would like to play with the video game since she just got it for her birthday.

1. Do you think that Betty has a problem? What do you think Betty's problem is?

2. What are all the things you would be thinking about if you had to solve this problem? (What are all the things that are important to solve this problem?)
3. Tell me all the ways you can think of for Betty to solve this problem?

4. What might happen if [read each solution from 3]? (Anything else?)

5. What do you think is the best way to solve this problem? Why?
TEST OF INTERPERSONAL PROBLEM SOLVING

E. One day Pam is at home alone when her best friend, Cheryl, calls her and asks her if she would like to go outside and play on her swing set. Pam has nothing else to do so she says "OK" and says that she will come over to Cheryl's house. Pam is very happy about going to Cheryl's house since she has been wanting to play on her swing set. Just before Pam is ready to leave, Amy, one of Pam's other friends stops by to ask her if she would like to see the new "Star Wars" movie. Pam really likes "Star Wars" movies and this is the last day to see the show.

1. Do you think that Pam has a problem? What do you think Pam's problem is?

2. What are all the things you would be thinking about if you had to solve this problem? (What are all the things that are important to solve this problem?)
3. Tell me all the ways you can think of for Pam to solve this problem?

4. What might happen if (read each solution from 3)? (Anything else?)

5. What do you think is the best way to solve the problem? Why?
Alternate Uses

1. Tell me all the different ways you could use a newspaper.

2. Tell me all the different ways you could use a cork.

3. Tell me all the different ways you could use a button—the kind that is used on clothing.

4. Tell me all the different ways you could use a chair.
TEACHER'S RATING SCALE OF CHILD'S ACTUAL COMPETENCE

Child's name ___________________________ Class/grade/group ________ Rater ______________________

For each pupil, please indicate what you feel to be the child's actual competence on each question, in your opinion. First decide what kind of pupil he or she is like, the one described on the left or right, and then indicate whether this is just sort of true or really true for that individual. Thus, for each item, check one of four boxes.

<table>
<thead>
<tr>
<th></th>
<th>Really True</th>
<th>Sort of True</th>
<th></th>
<th>Sort of True</th>
<th>Really True</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil can't do the school work assigned.</td>
<td>□</td>
</tr>
<tr>
<td>2</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>For this pupil it's pretty easy.</td>
<td>□</td>
</tr>
<tr>
<td>3</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil isn't very good when it comes to sports.</td>
<td>□</td>
</tr>
<tr>
<td>4</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil is fine the way s/he is.</td>
<td>□</td>
</tr>
<tr>
<td>5</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil can remember things easily.</td>
<td>□</td>
</tr>
<tr>
<td>6</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil doesn't have many friends.</td>
<td>□</td>
</tr>
<tr>
<td>7</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil can't play as well.</td>
<td>□</td>
</tr>
<tr>
<td>8</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil would be better if s/he acted differently.</td>
<td>□</td>
</tr>
<tr>
<td>9</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil almost always can figure out the answers.</td>
<td>□</td>
</tr>
<tr>
<td>10</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil is not very popular.</td>
<td>□</td>
</tr>
<tr>
<td>11</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>This pupil is good at new games right away.</td>
<td>□</td>
</tr>
<tr>
<td>12</td>
<td>□</td>
<td>□</td>
<td>OR</td>
<td>The way this pupil does things is fine.</td>
<td>□</td>
</tr>
</tbody>
</table>

COMMENTS:

Susan Harter, University of Denver 1980
APPENDIX C

COPY OF LETTER TO PARENTS
October 20, 1986

Dear Parent:

I am writing to request your child's participation in a study of the development of interpersonal problem solving in children. You may recall that your child participated in a similar study two years ago. The purpose of this study is to find out how the same children solve social problems two years later. In addition, the study aims to examine the relationships between interpersonal problem solving abilities and other abilities such as creativity, vocabulary, social competence and behavioral adjustment. These different abilities are assessed by presenting stories to the child, then asking him/her to answer questions about the stories or by asking the child to name all the things he/she can think to do with an ordinary object, such as a brick.

Participation involves the child's being interviewed by a trained OSU graduate or undergraduate student. The child's answers will be written down by the interviewer but the interview will also be audio recorded in case the interviewer misses some of the child's words. The child will be interviewed once, lasting approximately 45 minutes depending upon the age and talkativeness of the child. All interviews will be conducted at the school.

There is no risk involved in this type of study. Also, previous experience has shown that children enjoy being interviewed. The answers of each individual child will be kept strictly confidential and anonymous. Any report based on this study will contain information only about a certain age, for example 7-year-olds' interpersonal problem solving abilities. Also, the child is free to withdraw from participation at any time.

If your child did not participate in this project last time and would like to now, please sign the attached permission slip and have your child return it to his/her teacher.

If you would like to know more about the study, please feel free to call me at 292-0483, or Karen Goldman, the graduate student conducting this study under my supervision at 292-8402. If you are unable to reach either of us, please leave a message at 292-6411 and your call will be returned as soon as possible. Otherwise, please sign the attached consent form and return it to your child's teacher.

I hope that you will allow your child to participate and thereby contribute in our knowledge about child development. Thank you.

Sincerely,

Felicisima C. Serafica, Ph.D.
Associate Professor of Psychology and Pediatrics

College of Social and Behavioral Sciences
I consent to participating in (or my child's participation in) research entitled:

**Interpersonal Cognitive Problem Solving and Creativity: A Developmental Study**

Dr. Felicisima C. Serafica or his/her authorized representative has explained the purpose of the study, the procedures to be followed, and the expected duration of my (my child's) participation. Possible benefits of the study have been described as have alternative procedures, if such procedures are applicable and available.

I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Further, I understand that I am (my child is) free to withdraw consent at any time and to discontinue participation in the study without prejudice to me (my child).

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: September 29, 1988
Signed: (Participant)

Signed: Felicisima C. Serafica
(Principal Investigator or his/her Authorized Representative)
Signed: (Person Authorized to Consent for Participant - If Required)

Witness:
Please fill out the following information as specifically as possible.
Mother: Highest level of education
Father: Highest level of education

Occupation

HS-07 (Rev. 1/87) — (To be used only in connection with social and behavioral research.)