THE EFFECTS OF EXTRINSIC REWARDS AND PERCEIVED COMPETENCE ON CHILDREN'S TASK PERFORMANCE AND INTEREST

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LIST OF SYMBOLS AND ABBREVIATIONS

AT	Number of items attempted
CMP	Number of items completed
CMPTM	Mean time per item completed
COG	Cognitive PCSC competence
CON	Condition (i.e., Reward or Nonreward)
D(x)	Difference Score (for variable x)
DIFAT	Mean difficulty level per item attempted
DIFCMP	Mean difficulty level per item completed
GCP	General competence measure
GEN	General PCSC competence
GIN	General interest measure
M	Mean
N	Nonreward
ON	Time on task interest measure
PCSC	Perceived Competence Scale for Children
PHY	Physical PCSC competence
PIN	Posttask interest measure
PTDF	Posttask perceived difficulty measure
R	Reward
S	Subject identification number
SCP	Specific task competence measure
SD	Standard deviation
SIN	Specific task interest measure

SOC	Social PCSC competence
SS	Standard score Wechsler subscale performance measure
SSTM	Wechsler subscale time-to-task-completion
WAIS	Wechsler Adult Intelligence Scale
WISC-R	Wechsler Intelligence Scale for Children - Revised
WPPSI	Wechsler Preschool and Primary Scale of Intelligence
(x)1	Baseline Session measure (for variable x)
(x)2	Experimental Session measure (for variable x)

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FIGURE

INTRODUCTION

This study was undertaken in an attempt to provide further understanding of the effects of material rewards on performance and intrinsic motivation. This study was designed also to begin exploration of one aspect of individual differences, that of competence, and its role as a possible mediator of the effects of rewards. Specifically, the present study examined the effects of extrinsic rewards and perceived competence on children's performance and interest in a design that included two experimental tasks and two levels of development.

This dissertation differs somewhat from the format called for in the Oklahoma State University Thesis Writing Manual. The body of this dissertation consists of a complete manuscript prepared for publication entitled, "Effects of Rewards and Perceived Competence on Children's Task Performance and Interest," prepared according to the Publication Manual of the American Psychological Association. In order that the dissertation be complete by traditional standards, those materials which are usually presented in the body of the report, such as a review of relevant literature are presented in the appendices (See Appendix A). Also included as appendix materials are all supplemental materials (letters to teachers and parents, rating scales, etc.), raw data, and various statistical analyses.

Effects of Rewards and Perceived Competence on Children's Task Performance and Interest

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Running Head: Reward and Children's Performance and Interest

Effects of Rewards and Perceived Competence on Children's Task Performance and Interest[1]

In recent years, there has been an increasing accumulation of evidence to show that the offer of extrinsic rewards can undermine intrinsic motivation (see Lepper & Greene, 1978a for recent reviews), and have a detrimental effect on immediate performance as well (see McGraw, 1978 for a review). Because most research efforts have focused on the relationship between extrinsic rewards and subsequent intrinsic motivation, theoretical explanations have tended to rely upon cognitive-motivational mechanisms to account for these effects (see de Charms & Muir, 1978). Although these theoretical accounts seem adequate to the task of explaining how extrinsic incentives undermine intrinsic motivation, they appear to be less effective in explaining the detrimental effects of extrinsic incentives on immediate task performance. Some of the difficulties in this latter connection have been noted by Fabes, Moran, and McCullers (in press) and McCullers, Fabes, and Moran (Note 1).

McCullers (1978) has examined traditional theories of learning and motivation for their potential utility in accounting for reward's detrimental effects on immediate performance, and concluded that a satisfactory account may involve processes other than learning and motivation. Studies (Fabes, 1978; Fabes et al., in press; Moran, 1978, McCullers et al., Note 1) have found that rewards appear to affect the developmental level at which a subject functions, raising the possibility that extrinsic rewards may produce some developmental regression in cognitive functioning, perceptual organization, and in the general level of

maturity at which the subject approaches the task.

Although immediate task performance and intrinsic motivation would appear to be integrally related, they do not seem to be governed by precisely the same factors, as Deci (1975), Fabes et al. (in press), and Lepper and Greene (1978b) have noted. Therefore, in line with Lepper and Greene's (1978b) recommendation that "the relationship between these two classes of findings warrants further attention" (p. 124), the primary goal of the present research was to explore further the relationship between performance and interest within the context of the adverse effects of material rewards.

Immediate and Subsequent Measures

The typical paradigm for the study of the detrimental effects of rewards is exemplified in the research of Deci (1971) and Lepper and his colleagues (Greene & Lepper, 1974; Lepper, Greene, & Nisbett, 1973). In this type of research subjects typically perform an interesting task (one that the subjects will engage without reward inducement), under either reward or nonreward conditions. The effects of reward on immediate task performance are assessed during the experimental session and the effects of reward on intrinsic motivation (interest) are assessed during a subsequent free-choice period in which rewards are neither offered nor expected to be forthcoming.

While there has been considerable research on the effects of reward on immediate performance and/or subsequent interest, there has been little attempt to assess the effects of reward on immediate interest or on subsequent performance. To further clarify the relationship between interest and performance, the present study sought to extend the typical investigation of the effects of extrinsic rewards by

including both immediate and subsequent measures of performance and interest in the design.

Subject Differences

Although recent research has repeatedly demonstrated detrimental effects of rewards, these effects have been found for the most part within the context of between-group differences. When one examines individual data however, the sample often contains individual subjects whose measures of interest and/or performance remain unchanged or even improve under extrinsic incentive conditions (McCullers et al., Note 1; Hom & Maxwell, Note 2). Why some subject, indeed the majority, should show a detrimental effect of reward while others under the same conditions remain unaffected or show a beneficial effect is an interesting question. Individual differences, although noted for their potential importance (Condry, 1977), have not received adequate empirical attention. Another purpose of the present study was to begin to explore individual differences in relation to the basic problem of trying to understand the role of rewards in human performance and motivation.

Competence

Although a few studies have identified some significant subject variables related to the effects of reward on performance and motivation, such as sex of subject (Deci, 1972), interest level (Lepper et al., 1973), and initial ability (Moran, 1978), none of these studies systematically explored these individual differences. The present research was designed to include an individual subject characteristic that has been cited as potentially important in mediating the detrimental effects of rewards, namely an individual's feelings of competence and effectance (White, 1959). Several studies (Arkes, 1978; Arnold, 1976; Deci, 1971,

1972; Karinol & Ross, 1977) support the notion that an individual's feelings of competence may be a critical factor in determining whether or not rewards produce adverse effects.

White (1959) conceived of competence as a basic personality and motivational orientation which impelled the organism toward effective interchange with the environment. However, most investigations focusing on the relationship between competence and intrinsic motivation have defined competence rather narrowly as mere success/failure feedback and experience within the experiment (cf. Boggiano & Ruble, 1979; Harackiewicz, 1979). One exception is Harter (1978a, 1978b, 1979) who has extended White's (1959) original formulation and proposed that perceived competence is an important correlate and mediator of intrinsic motivation. Harter (1979) has developed an instrument to measure perceived competence and she hypothesized that the more an individual is intrinsically motivated, the greater his or her sense of competence will be. Conversely, children with an extrinsic orientation are hypothesized to be highly dependant on external sources of motivation and will perceive themselves as less competent. She has found that when children knew they were going to be graded on their performance, low-competence children chose to work easier problems; however, being told that they would be graded had little effect on high-competence children (Harter, Note 3). Thus it seems that feelings of competence may be an important individual difference factor in mediating the detrimental effects of reward. To test this possibility, Harter's (1979) measures of perceived competence were included in the present design. It was expected that children who were high in perceived competence would show less negative effects of reward than children who were low in perceived competence.

Task Differences

The adverse effects of rewards have been demonstrated over a wide range of tasks: Free-style drawing (Greene & Lepper, 1974), embedded figures (Boggiano & Ruble, 1979), mazes (Dollinger & Thelen, 1978), SOMA blocks (Deci, 1971, 1972), anagrams (Harter, 1978a), drum beating (Ross, 1975), and other tasks. However, as some researchers have pointed out (Bates, 1979; Condry, 1977; Condry & Chambers, 1978; de Charms & Muir, 1978), few studies have varied the task within the experiment itself. Condry and Chambers (1978) state that "a careful analysis of how motivational context interacts with the nature of the task is a job that has yet to be done" (p. 65). An ancillary purpose of the present study was to begin work toward this end by employing two tasks within the experimental design. By utilizing separate tasks, the results of the present study may have wider generality in not being bound to a single task.

Experimental Tasks

The choice of the experimental tasks to be used in the present research was based upon several requirements. The tasks had to be attractive, interesting, and appropriate for both third-grade and nursery school subjects. In this context, the Wechsler subscales offered some methodological advantages. The mazes and block design subscales of the Wechsler Intelligence Scale for Children-Revised (WISC-R) (1974) and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) (1967) were chosen for the third-grade and nursery school subjects respectively. These subscales have been found to be interesting to children (Dollinger & Thelen, 1978), and they are well-known, widely-used instruments with readily available normative information and

established estimates of reliability and validity. The subscales provide an objective measure of performance quality as well as performance quantity and contain a wide range of items that differ objectively in their degree of difficulty. Because these instruments are sensitive to developmental differences, they also provide a basis for further examining the theoretical alternative of developmental regression noted earlier.

Developmental Differences

Harter (1978b) has stressed the importance of conducting research within a developmental framework in order to delineate the conditions and processes related to the detrimental effects of rewards. While cognitive-motivational explanations rely upon various theoretical mechanisms, most make use of some type of "discounting principle" (Kelley, 1973). According to this principle, when two causes of behavior are potentially available, one of these tends to become discounted and the other tends to be perceived as the dominant or sole cause. Thus, in the reward paradigm, extrinsic rewards may be perceived by the subject to be the sole or dominant cause of his participation and intrinsic interest in the activity comes to be discounted. Although detrimental effects of extrinsic rewards have been found with very young children (Lepper et al., 1973), several authors (Arkes, 1978; Karinol & Ross, 1977; Smith, 1975) have stressed that young children have limited ability to integrate and process information, and do not seem to use the "discounting principle". The present research proposes to explore the detrimental effects from a developmental perspective by using children at two different stages of cognitive and social development in order to explore the relation between reward effects and developmental processes

in light of available theoretical alternatives.

In summary, the present study was designed to explore the effects of extrinsic rewards on intrinsic motivation and on task performance, taking both immediate and subsequent measures of performance and interest. A second purpose of this study was to explore the relationship between perceived competence and the adverse effects of rewards. The study employed two tasks and children at two levels of development.

Method

Subjects

A total of 80 subjects began the study but for various reasons four children at each age level did not complete the entire experiment and had to be eliminated from the sample. The final sample of 72 subjects consisted of 48 third-grade and 24 nursery school children. The subjects were predominantly white, middle-class children, and there were equal numbers of males and females at each age level. (Letters to parents are presented in Appendix B.)

The nursery school children were selected from the University Laboratory Schools with a restriction that each child be at least four years of age. The mean age of these children was 4.8 years with a range form 4.0 to 5.9 years.

The third-grade children were selected from public school classrooms in Stillwater, Oklahoma. The mean age of these children was 9.1 years with a range from 8.3 to 9.7 years.

Design

At each age level, equal numbers of males and females were randomly assigned to one of four experimental groups that differed in terms of task and whether or not rewards were offered during the

Experimental Session. The research design consisted of a 2 Ages (Third-grade/Nursery School) × 2 Conditions (Reward/Nonreward) × 2 Tasks (Mazes/Block Design) factorial design. (The experimental design is diagrammed in Figure 1 located in Appendix C.) The experiment was conducted in three separate sessions: (a) Competency Pretest Session, (b) Baseline Session, and (c) Experimental Session.

The Competency Pretest Session was used to collect a measure of non-task competence. The Baseline and Experimental Sessions were used to obtain the immediate and subsequent measures of performance and interest. Both the Baseline and the Experimental Sessions consisted of four phases, each immediately following the other in sequence. Phase 1 was used to collect initial interest and perceived task competency data prior to task engagement. Phase 2 consisted of task engagement. Phase 3 was designed to assess task interest and perceived task difficulty following task engagement. Phase 4 was designed to obtain a behavioral measure of the child's interest in the task during a subsequent free-choice period. (See Appendix D for an outline of the research design and variable sequencing.)

Materials and Procedure

All data were collected by the first author, a white, male graduate student experienced in testing and working with children. The Competency Pretest Session measures were taken in the regular classroom in a single session by means of a group-administered instrument developed by Harter (1979) designed to assess an individual's perceptions of competency. The Baseline and Experimental Session measures were taken in a mobile laboratory parked on the school grounds. Each child participated individually.

Competency Pretest Session. The measurement of competency was accomplished by means of the Harter (1979) Perceived Competency Scale for Children (PCSC). Harter and Pike (1980) have recently developed a downward extension of the PCSC suitable for use with nursery school children. However, at the time this research was being conducted, the new scale was not yet available, thus initial non-task competency data could be collected on the third-grade children only.

The PCSC consists of 28 items that comprise four subscales, each reflecting a separate competence domain: (a) Cognitive competence (COG), which reflects primarily academic performance; (b) Social competence (SOC), which measures primarily peer popularity; (c) Physical competence (PHY), which is concerned with ability at sports; and (d) General competence (GEN), which reflects the child's overall feelings of self-worth (Harter, 1979). Each subscale is scored by means of a four-point rating scale, with four indicating the highest degree of perceived competence and one indicating the lowest.

The PCSC was administered to the third-grade subjects only under standard, nonreward conditions and testing took approximately 30 minutes. Instructions to the subjects, data collection, and scoring followed the standard format given in the PCSC manual (Harter, 1979).

Baseline Session: Phase 1. the Baseline Session occurred approximately one week after the Competency Pretest Session. During Phase 1, interest and perceived task competence were assessed by means of four questions. The children responded by pointing to one of five smile/frown faces. These faces constituted a five-point rating scale and differed in the degree to which the mouth on each face had a smile or frown. (The four questions used to assess verbal interest and perceived

task competence, and the smile/frown faces are presented in Appendix E).

Each child was taken individually to the trailer and invited to sit at the table and play some "face" games. The child was then given a brief description and demonstration of the smile/frown face materials and procedure. Following introduction to the smile/frown faces, each child was questioned in an effort to be certain that he/she understood the procedures. The results of this inquiry indicated that all the children readily accepted the smile/frown face format and demonstrated that they had little difficulty following directions. Following the instructions, the child was then asked to respond to four questions. Each question was read aloud and the child was instructed to point to the face that corresponded to his/her response. The first two questions related to general perceptions of game interest ("How much do you like to play games?"), and game competency ("How well do you play games?"). The child was then introduced to the task and asked two further questions regarding specific task interest ("How much do you like to play maze /‾ or block_/‾ games?"), and specific task competency ("How well do you play maze /‾ or block_/‾ games?"). The child responded once again by pointing to one of the five smile/frown faces for each question.

Baseline Session: Phase 2. During Phase 2, two subscales from the Wechsler intelligence test were used as the experimental tasks. These were the mazes and block design subscales of the WISC-R and the WPPSI for the third-grade and nursery school subjects respectively. Immediately following Phase 1, each child was administered either the mazes or the block design of either the WISC-R or the WPPSI as appropriate. All subscales were administered under standard, nonreward conditions

according to the procedures outlined in the Wechsler manuals (1967, 1974). The data were scored according to the standard procedure and the raw scores were converted into the standard scores provided by Wechsler, based on the task and age of the subject.

Baseline Session: Phase 3. Following task engagement (Phase 2), each child was asked to respond to two more questions designed to assess task enjoyment ("How much did you like playing the maze /‾ or block_/ game?") and task difficulty ("How easy was the maze /‾ or block_/ game for you?"). As before, the child responded to both questions by pointing to one of the five smile/frown faces.

Baseline Session: Phase 4. During the free-choice period which occurred immediately following Phase 3, a new set of either seven mazes or six block designs was provided. For the third-grade subjects, five of the mazes were taken from the WISC-R and either inverted or rotated to produce spatially different solutions from those used in Phase 2. Two additional mazes were included that exceeded the most difficult maze in the WISC-R. These two mazes were constructed by expanding the most complex maze in the WISC-R by an additional 2 or 4 peripheral alleys. For the nursery school subjects, four inverted or rotated mazes from the WPPSI were included along with three mazes taken directly from the WISC-R. The mazes were selected in an effort to provide an array of mazes that could be objectively ordered according to the level of difficulty, based upon the order in which they are normally presented in the WISC-R or WPPSI. (The mazes and their difficulty levels are presented in Appendix F for both the third-grade and nursery school children.)

The six block designs selected for the third-grade children were

taken directly from the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1955). The six block designs selected for the nursery school children included two simple designs from the WPPSI, with the red and white blocks reversed, and four new designs taken directly from the WISC-R. As with the mazes, the block design patterns were selected in an effort to provide an array of designs differing in difficulty, such that their difficulty levels could be objectively determined by the order in which they are presented in the Wechsler scales. (The block design patterns and their difficulty levels are presented in Appendix G for both the third-grade and nursery school children.) No materials other than the mazes or block designs were provided to the child during the free-choice period.

Upon completion of Phase 3, the experimenter told the child that he/she was through, but before going back to the classroom, the experimenter had to step into the next room and "figure out whose turn it was next". The experimenter asked the child to sit and wait for him to return and told the child that while he/she was waiting, he/she could play some more maze or block design games if he/she wished to. The experimenter reminded the child that he would be back in just a few minutes, and then questioned the child to be certain the instructions were understood.

The experimenter provided the subject with the new set of mazes or block designs and excused himself from the room. The experimenter then proceeded into the adjoining room and videotaped the subject's free-choice behavior for a period of three minutes through a one-way mirror using a Sony AV-3400 videotape camera and recorder. At the end of the three-minute period, the experimenter wrote the name of the next subject

on a slip of paper and went back into the experimental room. Upon entering the room, he gave the subject the name slip and said, "Good! You waited for me. _____ is next. Let's go and get him/her." Each child was then taken back to the classroom and the next subject brought to the experimental room.

Experimental Session. The Experimental Session occurred approximately one week following the Baseline Session. Upon arrival in the experimental room, each subject was told that he/she would be playing the same games as before. For the reward subjects, they were also told that if they played the maze / or block / game this time, they would get a prize for helping. A tray of rewards was then presented and the child was told that he/she could choose one and would get it when the session was over. To prevent subjects from entering this session with misconceptions as to what they would receive for their participation, all reward subjects were selected from one classroom and nonreward subjects from another classroom.

The rewards were chosen in an effort to conceptually represent a tangible to symbolic reward continuum. Children were allowed to choose one of four rewards: (a) a tangible consumable (bubble gum), (b) a tangible nonconsumable (animal erasers), (c) a direct token of competence (a smile button which the children were instructed to keep for themselves), and (d) an indirect token of competence (a "good player" award which the children were told would be sent home to their parents to show how well they did).

For the nonreward subjects, the Experimental Session was procedurally identical to the Baseline Session. For reward subjects, following reward selection, the Experimental Session was identical to the Baseline

Session except for the inclusion of one additonal question in Phase 3 designed to assess the attractiveness of the reward ("How much do you like the prize you got?"). Subjects responded using the same smile/frown face rating scale utilized in the Baseline Session. Upon returning to the experimental room after the Phase 4 three-minute free-choice period, the experimenter presented the reward to the child in a brown paper bag, and escorted the child back to his/her classroom.

Results

For the most part, the means for the boys and girls were virtually identical. Preliminary analyses of the data failed to reveal any significant main effects of or interactions with Sex. Therefore, the data for boys and girls were combined and Sex of subjects was not included as a factor in subsequent analyses. All data were analyzed via the Statistical Analysis System (SAS) computer program (Helwig & Council, 1979). Raw data for each subject are presented in Appendix H.

The results are presented generally in the same sequence as that of the experimental design. That is, the results of the Pretest Competency Session will be presented first, the Baseline Session results next, followed by the Experimental Session results.

Pretest Competency Session

As a reminder, only the third-grade subjects participated in the Pretest Competency Session. Mean PCSC scores and standard deviations are presented by Condition and Task for each of the four PCSC competency measures in Table 1. Analyses of these variables failed to reveal any

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Insert Table 1 About Here

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significant main effects for Condition or Task or for any interaction involving these variables. For the most part, analyses of the PCSC scores resulted in nonsignificant effects, $F < 1.00$. Therefore, the treatment groups proved to be comparable in terms of initial pretest PCSC scores. A comparison of the PCSC data of the present study with the third-grade normative information provided by Harter (1979) indicated a high degree of similarity both in terms of the mean scores and variance.

Intercorrelations among the four subscales are presented in Table 2.

Insert Table 2 About Here

The highest correlations were those between General self-competence and each of the three other competence variables, and between the Physical and Social subscales. The relationship between the Cognitive subscale and both the Social and Physical subscales tended to be lower. These results are similar to those reported by Harter (1979).

Baseline Session

Baseline Session means and standard deviations are presented in Table 3 by Grade and Condition. Although the groups are designated as

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Insert Table 3 About Here

"Nonreward" and "Reward", it is important to remember that all subjects performed under nonreward conditions during the Baseline Session. Therefore, any initial differences between the Nonreward and Reward groups merely reflect sampling differences.

Analysis of Phase 1 pretask verbal assessment items failed to

reveal any significant main effects for Condition or Task. There were, however, large significant grade differences. The nursery school children scored significantly higher on the general game competency item, $F(1,64) = 30.32$, $p < .001$, the specific task interest item, $F(1,64) = 7.44$, $p < .01$, and the specific task competency item, $F(1,64) = 17.73$, $p < .001$. These results were due to the fact that 80% of the younger children chose the face with the largest smile (rating = 5) on every item, while the third-grade children used the scale in a more discriminating way. Analyses of Phase 2 task performance variables failed to reveal any significant differences by Condition, Grade, or Task, indicating that the groups were initially comparable.

The analyses of the Phase 3 posttask verbal assessment items revealed trends similar to those of Phase 1. There were no significant differences for Condition or Task, and nursery school subjects scored higher than third-grade subjects on both Phase 3 items. Analysis of these differences resulted in a significant main effect for Grade only on the perceived difficulty item, $F(1,64) = 17.13$, $p < .001$. As in Phase 1, these results were again due to the predominance of extreme smile responses on the part of the nursery school children.

For the Phase 4 free-choice period, the measures of interest and performance were taken from the videotaped records for each subject. The measure of interest was time spent on task. The measures of performance were the number of items attempted, number of items completed, mean time per item attempted, mean time per item completed, mean difficulty level per item attempted, and the mean difficulty level per item completed. To determine the reliability of the scoring system, two judges, one of whom was blind to the subject's assigned condition,

scored the videotapes independently. The resulting Pearson rs between the scores of the two judges ranged from .94 ($p < .001$) to .90 ($p < .001$).

Analysis of Phase 4 free-choice interest (time on task) failed to reveal any initial differences for Condition, but did reveal large Grade and Task differences. The third-grade subjects had significantly higher free-choice interest scores than did the nursery school subjects, $F(1,64) = 36.51$, $p < .001$. Maze-task subjects spent significantly more time on task than block-design subjects, $F(1,64) = 12.81$, $p < .001$. There were no significant interactions between the variables.

Analysis of the free-choice performance variables failed to reveal any significant differences between Nonreward and Reward groups for any measure, but did reveal signficant Grade and Task differences. Older children (a) attempted significantly more items, $F(1,64) = 5.86$, $p < .05$; (b) spent significantly more time per item attempted $F(1,64) = 21.29$, $p < .001$; (c) spent significantly more time per item completed, $F(1,64) = 9.56$, $p < .01$; and (d) attempted significantly more difficult items, $F(1,64) = 9.92$, $p < .005$ than did the nursery school children.

Analysis of Task differences also revealed that subjects in the maze task (a) attempted significantly more items, $F(1,64) = 21.25$, $p < .001$; (b) completed significantly more items, $F(1,64) = 39.12$, $p < .001$; (c) attempted significantly more difficult items, $F(1,64) = 10.08$, $p < .005$; and (d) completed significantly more difficult items $F(1,64) = 13.91$, $p < .001$ than did block-design subjects. Interactions between these variables failed to reach significance for any measure.

In summary, analyses of the Baseline Session data revealed large differences between the older and younger children. These differences

were evident in both the verbal assessment items and in the free-choice measure; significant task differences were found also on the free-choice measures. Analyses failed to reveal any initial differences between conditions, suggesting that the groups were comparable in terms of initial Baseline Session scores.

Experimental Session: Reward Effects

The mean results and standard deviations for the Experimental Session, in which rewards were provided to one-half of the subjects, are presented in Table 4 by Grade and Condition. Because of the large

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Insert Table 4 About Here

Grade differences found in the Baseline Session, the results for all subsequent analyses were performed separately for each grade. Analyses of reward effects were performed on difference scores, created by subtracting the subject's score obtained in the Baseline Session from his/her score on that very same measure obtained in the Experimental Session (Difference = Experimental Session score - Baseline Session score). Each subject's own initial level provided a base from which subsequent change could be judged. This allowed the results to be analyzed in terms of the degree and direction of change a subject displayed from the Baseline to the Experimental Session.
A positive difference score would indicate an increase in scores from the Baseline to the Experimental Session, while a negative difference score would indicate a decrease in scores.

Phase 1: Pretask Verbal Assessments. For both the older and younger children, analyses of Phase 1 difference scores failed to reveal any significant main effects of Condition on any of the four

Phase 1 pretask verbal assessment items. For both ages, Baseline and Experimental Session Phase 1 difference scores means were virtually identical for both conditions.

Phase 2: Task Performance. For the older children, reward subjects were found to have significantly lower task performance difference scores than nonreward subjects, $F(1,44) = 12.34$, $p < .001$. This result was due to the fact that the nonreward subjects improved significantly from the Baseline to the Experimental Session, $t(23) = 3.13$, $p < .01$, while reward subjects performed at a significantly lower level in the Experimental Session than they did in the initial Baseline Session, $t(23) = -2.07$, $p < .05$.

For the younger children, the pattern of results was the same as for the older children. Reward subjects had lower Phase 2 task performance difference scores than nonreward subjects, however this difference failed to reach significance. Nonreward nursery school subjects performed significantly better in the Experimental Session than they did in the Baseline Session, $t(11) = 2.60$, $p < .05$, while the nursery school reward subjects performed approximately the same in both sessions.

In order to ascertain whether the Reward/Nonreward performance differences could have been due to differences in the amount of time reward and nonreward subjects spent completing and checking their answers, analyses of completion times were performed. The results from these analyses revealed that reward and nonreward children took comparable amounts of time to complete the items, and there were no significant differences between reward and nonreward subjects for either age group. Thus the Reward/Nonreward Phase 2 task performance differences

were not due to differences in time on task.

Phase 3: Posttask Verbal Assessment. For the third-grade children, analysis of Phase 3 task difficulty difference scores revealed that reward subjects perceived the task to be of significantly greater difficulty than did nonreward subjects, $F(1,44) = 6.53$, $p < .05$. For the nursery school children analyses failed to reveal a significant difference between the reward and nonreward groups on this item. There were no Reward/Nonreward differences in posttask interest for either age. Reward subjects found the rewards very attractive ($M = 4.98$).

Phase 4: Free-choice Behavior. Mean Phase 4 free-choice interest (time on task) difference scores are presented in Table 5 with their standard deviations by Condition, Grade, and Task. Reward subjects at

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Insert Table 5 About Here

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both grade levels had lower and more negative difference scores than did nonreward subjects. Because of high between-subject variation, particularly for the nursery school children, the analyses of the reward and nonreward differences failed to reach significance for either age. However, the results for the older children did approach significance, $F(1,44) = 3.22$, $p < .10$. Further examination of Table 5 reveals that the predominant detrimental effect of reward on free-choice interest occurred in the block design task for the older children and in the maze task for the younger children. Analysis of this Reward/Nonreward × Task interaction only approached significance, $F(1,44) = 2.74$, $p < 10$. The reward subjects on the block design task had significantly lower interest difference scores than nonreward subjects, $t(23) = 2.88$, $p < .05$.

This was also the case with younger children on the maze task where the reward subjects had lower difference scores than the nonreward subjects, but this difference only approached significance, $t(11) = 2.72$, $p < .10$.

In order to determine whether the performance differences found during Phase 2 were related to the interest differences found during Phase 4, Pearson product-moment correlations were computed between the Phase 2 task performance difference scores and the difference scores obtained on the Phase 4 free-choice interest measure. The resulting correlation was found to be extremely low ($r = +.07$) indicating that the changes in performance during Phase 2 was not correlated with the changes in free-choice interest in Phase 4.

Analyses of Phase 4 free-choice performance differences failed to reveal any significant differences due to conditions for any of the identified performance variables. However, examination of the free-choice data indicated that the effects of rewards varied as a function of the difficulty of the items. As a result, the Phase 4 free-choice materials were separated into two groups based upon level of difficulty, as determined by their normal order of presentation in the Wechsler scales. The results for free-choice items 1, 2, and 3 for both the maze and block design task were combined and designated as the low-difficulty group items, and the results for free-choice items 4, 5, 6, for the block design and items 4, 5, 6, and 7 for the maze task were combined and designated as the high-difficulty group items.

Analyses of free-choice interest failed to reveal any significant Reward/Nonreward differences on either the low- or high-difficulty items. Both older and younger and younger children increased the amount of time spent on high-difficulty items from the Baseline to the

Experimental Session, and decreased the amount of time spent on the low-difficulty items. The difference scores on both the low- and high-difficulty items were approximately the same for reward and nonreward subjects at both ages.

For the older children, analyses of Phase 4 free-choice performance difference scores failed to reveal any significant Reward/Nonreward differences on the low-difficulty items, but did reveal significant Reward/Nonreward differences on the high-difficulty items. Nonreward and reward subjects attempted approxmiately the same number of high-difficulty items, however nonreward subjects completed significantly more high-difficulty items in the Experimental Session relative to the Baseline Session than did reward subjects, $F(1,44) = 8.18$, $p < .01$. As a result, nonreward subjects completed a signficantly higher proportion of high-difficulty items attempted than reward subjects, $F(1,44) = 12.60$, $p < .001$. These Reward/Nonreward free-choice performance differences were found to occur even though Reward/Nonreward subjects engaged the task for approximately the same amount of time in relation to their initial Baseline Session interest levels.

For the younger children, rewards again were found to have little effect upon the low-difficulty items, but difference score analyses did reveal significant Reward/Nonreward differences on the high-difficulty items. Reward subjects were found to have significantly lower free-choice interest difference scores on the high-difficulty items than than nonreward subjects, $F(1,23) = 6.67$, $p < .05$. Analyses of performance differences during the Phase 4 free-choice period failed to reveal any significant Reward/Nonreward differences on either the low- or high-difficulty items.

Immediate and Subsequent Measures of Interest and Performance

In order to understand the relationship between immediate and subsequent measures of interest and performance, intercorrelations were computed between all of the Baseline Session measures. Because of the large differences between the younger and older subjects identified previously, the intercorrelations were computed and presented separately for the third-grade and nursery school children in Tables 6 and 7 respectively.

Insert Tables 6 and 7 About Here

For the third-grade children, examination of Table 6 reveals a complex pattern of interrelationships among the variables. Phase 1 verbal measures of pretask interest and competency failed to correlate with Phase 2 task performance variables, but several Phase 1 measures were found to be significantly and positively correlated with each other and with the Phase 3 posttask verbal interest measures. Phase 2 task performance was found to be significantly and positively correlated with the Phase 3 posttask verbal interest measure as well as with the Phase 4 behavioral measure of free-choice interest. Phase 3 posttask verbal assessment of perceived task difficulty was found to be significantly and negatively correlated with the number of items attempted and completed during the Phase 4 free-choice period in that children who rated the task as beging easier also attempted and completed more items during the Phase 4 free-choice period. Phase 4 interest and performance measures were also highly correlated with each other.

For the younger children, because of the extreme clustering of Phase 1 and 3 responses on the face with the largest smile, the resulting correlations are probably spurious. Examination of Table 7 reveals that few of the variables were correlated with one another. Several Phase 1 variables were correlated with each other, but failed to correlate to correlate with any other variable. Phase 2 task performance did not correlate with any other variable. The two Phase 3 posttask variables correlated with each other, but not with any other variable. The Phase 4 free-choice interest variable failed to correlate with any Phase 1, 2, or 3 variable, but did correlate highly with the Phase 4 performance variables.

Correlations between Baseline and Experimental Session measures were also computed. Baseline Session and Experimental Session measures of the same variable correlated highly. Correlations between different variables tended to be fairly low.[2]

Competence and Rewards

Intercorrelations of the four PCSC variables with the Baseline and Experimental Session variables resulted typically in low and nonsignificant correlations. Although no one single PCSC variable predicted actual performance or interest, Cognitive competence (COG) was the best of the four. Subsequent analyses showed COG to be the only PCSC variable to be significantly related to reward effects. Therefore, presentation of PCSC Competence will focus on the COG variable only.

By performaning a median split, each subject was assigned to either a low- or high-COG group based upon his/her Pretest Competency COG score. Analyses of Baseline Session data failed to reveal a

significant difference between the high- and low-COG groups for any of the Phase 1, 2, 3, or 4 variables. Therefore, high- and low-COG groups appeared to be initially comparable with respect to measures of task interest and performance.

Analyses of reward effects during the Experimental Session yielded significant COG differences only on the Phase 4 free-choice measure of interest. This difference was reflected in a significant Reward/Nonreward × High/Low-COG interaction, $F(1,40) = 5.80$, $p < .05$. Mean time-on-task difference scores and their standard deviations, presented in Table 8 by Condition and COG group, reveal the nature

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Insert Table 8 About Here

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of the Reward/Nonreward × High/Low-COG interaction. Specific comparisons revealed that the low-COG reward group differed significantly from the other three groups ($p < .05$). Therefore, the detrimental effect of reward had its primary effect upon subjects in the low-COG reward group.

Inspection of Phase 4 free-choice performance difference scores indicated that the low-COG reward group also had lower and more negative difference scores for the number of items completed, the difficulty level per item attempted, and the difficulty level per item completed. Analyses of these differences failed to reach significance however. There were also no significant High/Low-COG differences when the data were analyzed according to the low- and high-difficulty group items.

Reward Preferences

Analysis of reward preferences was based upon the children's

selections from the array of incentives presented to them during the Experimental Session. For the younger children, all 12 reward subjects chose the tangible, edible incentive (gum), while the older children selected from all four incentives fairly evenly. Analysis of the differences in reward choices (tangible, edible incentive vs. all other incentives) resulted in a significant Age difference for reward preferences, $\chi^2(1) = 5.00$, $p < .05$. (Baseline and Experimental Sessions means and their standard deviations are presented in Appendix I by Condition, Task, and Grade. The results of selected statistical analyses are presented in Appendix J.)

Discussion

Baseline Session

The finding that nursery school children did not make subtle discriminations in their responses on the smile/frown face format used with the verbal assessment items together with recent evidence to indicate that individuals may have some difficulty in reporting subtle differences in internal states (Wilson, Hull, & Johnson, 1981), especially in the case of very young children (Smith, 1975), would seem to make an attributional analysis of intrinisic motivation less plausible in the case of very young children. The data do not lead to the conclusion that young children cannot make these subtle distinctions, only that they did not do so in the present experimental situation using the present measures.

The finding that older children remained on task longer and attempted and solved more items during the free-choice period than younger children, would support Harter's (1975, 1978b) contention that the desire to solve cognitively challenging problems increases

with age and becomes an increasingly important determinant of intrinsic motivation. These results would also be consistent with Zigler's (1963) position that developmentally more advanced children are more responsive to intrinsic types of rewards.

Another finding of the Baseline Session was a significant Task difference. For both ages, the maze task was more attractive during the Phase 4 free-choice period than the block design task. This was especially true for the older children whose time-on-task measures of free-choice interest were close to the ceiling.

There seems to be two possible explanations for the large Task differences. First, the maze task was found to be less difficult, as evidenced by fasted solution times and increased proportion of correctly completed items, than was the block design task. This probably resulted in a higher success rate for maze-task subjects, which may in turn have increased the subject's feelings of competence and effectance.

Second, the maze task is an activity that yields some lasting, tangible evidence of the child's performance. With block designs, the blocks that yield the solution must be taken apart in order to attempt the next design, leaving no evidence of the previous solution. If, as some theorists have pointed out (Boggiano & Ruble, 1979; Harter, 1978b; White, 1959), the feedback of competence is a major determinant of intrinsic motivation, then those tasks which provide more enduring and concrete evidence of competence may be more intrinsically motivating.

Experimental Session

Although there were no measureable effects of rewards upon the

Phase 1 pretask verbal assessments of interest and competence regardless of age, rewards did affect Phase 2 task performance. The Phase 2 Reward/Nonreward task performance data appear to be consistent with McGraw's (1978) prediction model of the selective effects of rewards. According to this model, rewards are predicted to lead to performance decrements on tasks which are initially attractive and require heuristic solutions (i.e., those task requiring insight and perceptual reorganization in order to solve the problem). Rewards are predicted to enhance performance on task that are either aversive or require algorithmic solutions (i.e., those tasks in which the solution to the problem is straightforward and requries rote, mechanical skills).

For the older children, the block design and maze tasks involved more perceptual organization than the same tasks for the younger children. These subscales of the WISC-R and the WPPSI are somewhat different. The tasks for the younger children rely much more upon rote mechanical copying skills than those same tasks for the older children. Therefore, if rewards hamper performance in more heuristic types of tasks, one would expect the performance of the older children to be more adversely affected by rewards than the younger children as was found in the present study. These findings are also in line with those developmental findings of Moran (1978).

Although McGraw's (1978) model provides predictions as to when rewards should be expected to facilitate or hinder performance, it does not provide an adequate explanation of the predictions it makes. The present data would also appear to be consistent with the hypothesis of developmental regression under reward (Fabes et al., in press). Given that any decline in scores on an IQ subtest could be

interpreted as a decline in a subject's level of intellectual maturity and functioning, the results give some further support to the idea that rewards may affect the developmental level at which a subject approaches a task. The present data suggest that the effect of regression may be a function of the initial developmental level of the subject. This result would be consistent with the conclusions of Moran (1978) and those of Danner and Lonky (1981) which suggest that rewards do not have a uniform detrimental effect upon children's task performance and may depend upon the developmental level of the child.

If rewards affect a subject's level of functioning, then those individuals at higher levels logically should be more adversely affected than individuals at lower levels. Because very young children are already responding at a low absolute level, regression may not be possible. There would, hypothetically, be a minimum level from which performance could not regress. For the younger children in the present research, although rewards did not produce a significant detrimental effect on their performance, it is interesting to note that reward subjects did not show the same improvement from the Baseline to the Experimental Session as the nonreward subjects.

Although various theoretical accounts of the adverse effects of rewards focus chiefly on motivational effects, they have recently been expanded to account for performance effects as well. Lepper and Greene (1978b) point out that performance decrements under reward conditions may be viewed as a by-product of an immediate decline in intrinsic motivation. However, this view was not supported in the present data in that immediate interest was not affected by rewards.

Although the results failed to reveal that rewards affected posttask interest, rewards did affect the older children's perceptions of task difficulty. For the older children, reward subjects perceived the task to be of greater difficulty than non-reward subjects. This finding suggests that rewards may have their detrimental effects by affecting subsequent perceptions of the task itself which may in turn affect an individual's subsequent interest and willingness to engage the task. Hom (Note 4), Deci and Ryan (1980), and Danner and Lonky (1981) also provide evidence along these lines.

While there were not apparent effects of rewards on intrinsic interest as assessed by the Phase 1 and 3 verbal assessment measures, there were some effects of rewards on the Phase 4 free-choice behavioral measure of intrinsic motivation. The effects of rewards on free-choice task engagement appeared to be a function of initial interest and perceived task difficulty. This was evidenced as the effects of rewards on subsequent free-choice interest occurred only in those tasks which were found to be of moderate initial levels of intrinsic interest as measured during the Baseline Session. The predominant effects of rewards occurred on the block design task for the older children and the maze task for the younger children. When the task was most intrinsically interesting, as was the case for the maze task for the older children, or least intrinsically interesting, (i.e., the block design task for the younger children), rewards had little effect upon intrinsic interest. These findings are in line with the conclusions of Arnold (1976) and Calder and Staw (1975) that rewards result in a decrease in the level of intrinsic motivation

only when an individual has a moderate intrinsic motivation to perform an activity.

By examining the effects of rewards on the high- and low-difficulty items during the Phase 4 free-choice period, the present research provided some interesting insight into the ways in which rewards undermine intrinsic interest that have not been found in prior research. For the older children, rewards affected free-choice interest on both the low- and high-difficulty items equally. Rewards seemed to simply drive the older children off the task. For younger children, the predominant effect of rewards was primarily to drive them off the high-difficulty items. However, the low-difficulty items for the younger subjects were so simple that they were generally solvable within a few seconds. Therefore, the total time spent on low-difficulty items for the younger children was so low to begin with that rewards were severely limited in their ability to lower time on task.

It was on Phase 4 free-choice performance that the major effects of rewards were found. For the older children, there were no effects of rewards on free-choice performance for the low-difficulty items. Although both groups spent approximately equal amounts of time and attempted approximately the same number of items on the high-difficulty items, nonreward subjects tended to complete a significantly greater proportion of the high-difficulty items they attempted than did the reward subjects. It seems as though reward subjects were just as motivated to attempt and engage high-difficulty items. but failed to perform as well as nonreward subjects in correctly completing those high-difficulty items attempted. These results provide evidence

that the effects of rewards may be more complex than previously reported and may not be limited to or dependent on time-on-task engagement (Harter, 1975). Perhaps the reason that these types of findings have not been previously reported is that the tasks commonly employed in the intrinsic motivation literature have been ones that provided no range of difficulty levels from which to choose. The present findings would seem to argue for the inclusions of a wider range of task difficulty with the research design.

For the younger children, rewards again failed to have any significant effects on free-choice performance on the low-difficulty items. However, on the high-difficulty items, rewards had a detrimental effect upon free-choice time on task but not upon free-choice performance. For the younger children, reward subjects engaged the high-difficulty items for a significantly less amount of time than nonreward subjects, but still were able to attempt and complete approximately as many high-difficulty items as nonreward subjects. This finding would seem to indicate that for the younger children, those few reward subjects who remained on task tended to be only those subjects who solved the high-difficulty items correctly. However, because of the very small numbers of younger children who actually attempted and completed the high-difficulty items, speculation as to the reason why this result would occur would seem to be inappropriate until it can be replicated further with a larger sample.

One further point that should be made about the Experimental Session free-choice period is that the measures of free-choice

interest and performance were taken in the same room that the experiment was conducted. As Lepper and Greene point out, intrinsic motivation "can be inferred from behavior only in situations in which every attempt has been made to eliminate salient extrinsic contingencies which would otherwise be expected to control behavior" (1976, p. 26). Therefore one could argue that the present failure to find strong Reward/Nonreward differences in subsequent free-choice interest may have been due to the fact that reward subjects may have continued to expect further reinforcement by remaining in the setting in which reinforcement had previously been received. However, the behavior of the children did not in any way indicate that they expected further reinforcement nor did it indicate that they had any awareness of the fact that they were being observed. Furthermore, the present procedure was comparable to those use by other researchers who have found the detrimental effects of rewards on intrinsic motivation (Deci, 1971, 1972).

The findings regarding competence indicated that the major effect of rewards on free-choice interest was found in those subjects who were low in PCSC Cognitive Competence. This finding tends to support the idea that those individuals who are low in PCSC Cognitive Competence may be more extrinsically oriented and therefore more susceptible to reward effects (Harter, 1979).

The PCSC competence measures failed to be significantly related to actual performance or interest. This may be due to the fact that Harter developed the PCSC to measure academic competence and the tasks employed within the present research were not traditional academic activities. However, given the overall low predictive power of PCSC

competence in the present study, any explanation or conclusion regarding PCSC competence should be withheld until stronger evidence is obtained.

Immediate vs. Subsequent Measures of Interest and Performance

For the older children in the Baseline Session, pretask initial measures of interest and competence failed to predict actual performance or subsequent free-choice interest. In fact, the only variable to significantly predict subseqeunt free-choice interest was immediate task performance. However, neither immediate performance nor subsequent interest in the Baseline Session predicted reward effects during the Experimental Session. Also, those who dropped in performance from the Baseline to the Experimental Session were not necessarily the same individuals who dropped in free-choice interest from the Baseline to the Experimental Session.

For the younger children, neither measures of immediate task performance nor subsequent free-choice interest were related to each other. This finding would be line with previous research which suggests that preschool-age children may lack the cognitive skills necessary to integrate the relevance of past-performance information in predicting future outcomes and performance (Parsons & Ruble, 1977; Shaklee & Tucker, 1979).

The inclusion of both self-report and behavioral measures of intrinsic interest in the present study allowed for direct comparisons of the two. The generally low correlations would seem to suggest that self-report interest is not equivalent to intrinsically motivated free-choice behavior. This conclusion would be in line with those of Arnold (1976) and McGraw and McCullers (1979) and would argue for

the use of more and varied pre-, immediate-, and posttask measures of performance and interest.

Summary and Conclusion

The inclusion of a nonreward Baseline Session provided a somewhat unique opportunity to explore and assess intrinsic motivation itself and to assess the effects of rewards on intrinsic motivation and performance of children by providing an empirical level from which any subsequent change could be measured. Bandura and Schunk (1981) have also noted that although the effects of rewards on intrinsic motivation have been of great concern recently, there has been considerable neglect of the issue of how intrinsic motivation is developed and in the preexisting conditions that may determine initial interest levels.

The results of the present study concerning intrinsic motivational levels suggest that the task and the developmental level of the child are important in determining the extent to which rewards affect performance and intrinsic motivation. Task performance was found to be the only predictor of free-choice interest and this was again found to be dependent upon the task difficulty and the child's developmental level.

The present results suggest that immediate task performance and subsequent free-choice interest may not be affected by the same mechanism. Within the present experiment alone, there were instances where performance differences were found, but interest differences were not (i.e., the maze task for the older children); where interest differences were found but not performance differences (i.e., the maze

task for the nursery school children); where neither performance nor interest differences were found (i.e., the block design task for the nursery school children); and finally where both performance differences and interest differences were found (i.e., the block design task for the third-grade children). Clearly no one uniform effect existed and this would seem to indicate that neither performance nor interest differences are sufficient in and of themselves to explain the other. Therefore, it seems that although immediate task performance and subsequent interest have been found to be related to each other in certain situations, such as with the third-grade children during the Baseline Session, the introduction of rewards appears to disrupt both performance and interest in manners that may be independent of initial relationship between the two and in ways that may be different for each measure.

One possible limitation within the present experiment the fact that the manipulations of rewards and the subsequent free-choice period occurred in the same setting and followed each other immediately. However, this procedure, as Williams has noted (1980) should increase the likelihood that subjects will engage in the self-perception process necessary to produce the overjustification effect. This process depends on a person's interpretation of the reasons for his or her performance during the contingency period and this in turn depends upon the individual's previous experiences and performance.

However, in situations such as the present research, where the tasks were fairly novel, the subjects had had little previous experience with the tasks and had little baseline information or feedback

with which to compare their contingency period performance. As Williams (1980) concluded, subjects in these situations may "have little basis upon which to judge whether their rewarded performance is intrinsically or extrinsically motivated, and so may not be able to perceive the reward as controlling" (p. 611). This makes a self-attributional explanation of the detrimental effects of rewards in situations such as the present study less plausible. Perhaps the inclusion of additional sessions following the Experimental Session, and the inclusion of a more naturalistic setting, as Lepper and Greene (1978b) have suggested, would further clarify this issue. However, the present findings indicate the necessity for further exploration of the conditions and processes through which rewards affect performance and motivation. The present research also indicates the importance of task difficulty as a factor in the study of rewards and would argue for its further investigation.

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Footnotes

[1]The use of the term "reward" throughout this manuscript refers to extrinsic, material rewards, unless otherwise indicated.

[2]Intercorrelations for the Experimental Session and between the Baseline and Experimental Sessions were also computed, however, due to the fact that reward subjects were combined with nonreward subjects necessitated the splitting of the subjects by condition. This procedure reduced the sample by half and lowered the correlations generally below the level of significance.

Table 1

Mean PCSC Competency Scores

By Condition and Task

	PCSC Scores[a]							
	Cognitive		Social		Physical		General	
Condition	M	SD	M	SD	M	SD	M	SD
Nonreward								
Mazes[b]	2.9	.59	2.6	.49	2.9	.68	2.9	.74
Block Design[b]	3.1	.59	2.8	.60	3.0	.61	3.3	.55
Reward								
Mazes[b]	3.2	.69	3.0	.76	2.9	.51	2.9	.52
Block Design[b]	3.1	.52	3.0	.93	2.8	.80	3.0	.67

[a] Third-grade children only.

[b] $n = 12$

Table 2

Intercorrelations of PCSC Competency Scores

Variable	Cognitive	Social	Physical
Cognitive			
Social	.23		
Physical	.31*	.58**	
General	.53**	.46**	.55**

* $p < .05$

** $p < .001$

Table 3

Mean Baseline Session Measures

By Grade and Condition

	Grade											
	Nursery						Third					
	Nonreward			Reward			Nonreward			Reward		
	n	M	SD	n	M	SD	n	M	SD	n	M	SD
Phase 1: Pretask verbal assessments												
1. General interest	12	4.8	.57	12	4.8	.57	24	4.7	.46	24	4.5	.66
2. General competency	12	5.0	0.0	12	4.8	.57	24	4.1	.50	24	4.2	.68
3. Specific interest	12	4.5	.79	12	5.0	0.0	24	4.5	.65	24	4.3	.92
4. Specific competency	12	4.6	.78	12	4.9	.29	24	4.4	.51	24	4.3	.79
Phase 2: Task Performance												
5. Task performance	12	13.0	1.7	12	12.4	2.4	24	11.1	2.4	24	12.6	2.7
6. Completion time	12	27.4	11.7	12	29.3	12.1	24	40.3	10.4	24	38.9	11.9
Phase 3: Posttask verbal assessments												
7. Specific interest	12	4.6	.79	12	4.9	.29	24	4.7	.48	24	4.3	.96
8. Perceived difficulty	12	4.7	.78	12	4.7	.79	24	3.8	.61	24	3.9	1.0
Phase 4: Free-choice behaviors												
9. Time on-task	12	58.3	71.7	12	46.7	59.1	24	128.1	66.3	24	148.1	50.6
10. Number of items attempted	12	2.3	2.6	12	2.4	2.4	24	3.1	1.9	24	3.8	1.6
11. Number of items completed	12	1.8	2.2	12	1.8	1.8	24	2.0	1.5	24	2.5	1.8
12. Time per item attempted	12	14.3	15.5	12	12.8	10.4	24	43.5	36.4	24	41.7	18.3
13. Time per item completed	7	23.7	12.7	9	15.9	8.1	19	46.8	37.2	19	44.9	32.8
14. Difficulty level per item attempted	12	1.8	1.7	12	2.5	1.8	24	3.0	1.6	24	3.5	1.1
15. Difficulty level per item completed	7	3.1	.81	9	2.9	.98	19	2.7	1.5	19	3.0	1.3

Table 4

Mean Experimental Session Measures

By Grade and Condition

	Grade											
	Nursery						Third					
	Nonreward			Reward			Nonreward			Reward		
	n	M	SD	n	M	SD	n	M	SD	n	M	SD
Phase 1: Pretask verbal assessments												
1. General interest	12	5.0	0.0	12	5.0	0.0	24	4.9	.28	24	4.9	.28
2. General competency	12	5.0	0.0	12	4.8	.57	24	4.4	.58	24	4.3	.61
3. Specific interest	12	5.0	0.0	12	4.8	.57	24	4.7	.48	24	4.4	.50
4. Specific competency	12	5.0	0.0	12	4.7	.78	24	4.4	.50	24	4.1	.65
Phase 2: Task Performance												
5. Task performance	12	14.1	2.0	12	12.8	2.8	24	12.6	2.9	24	11.7	2.7
6. Completion time	12	23.7	8.4	12	26.1	9.5	24	38.2	13.1	24	34.5	10.2
Phase 3: Posttask verbal assessments												
7. Specific interest	12	5.0	0.0	12	4.7	.79	24	4.8	..53	24	4.7	.54
8. Perceived difficulty	12	4.8	.57	12	4.7	.79	24	4.0	.75	24	3.4	.82
Phase 4: Free-choice behaviors												
9. Time on-task	12	64.3	66.1	12	31.2	37.1	24	128.7	64.6	24	123.0	65.1
10. Number of items attempted	12	3.0	2.9	12	1.6	1.7	24	3.2	2.1	24	3.3	1.9
11. Number of items completed	12	2.8	2.7	12	1.4	1.4	24	2.4	2.0	24	2.0	1.8
12. Time per item attempted	12	15.7	10.9	12	13.1	10.4	24	46.6	37.7	24	39.6	25.9
13. Time per item completed	8	20.0	8.0	9	15.3	7.3	19	43.9	31.8	19	38.3	20.5
14. Difficulty level per item attempted	12	2.4	1.6	12	1.9	1.5	24	3.3	1.6	24	3.8	1.6
15. Difficulty level per item completed	8	3.2	.57	9	2.3	1.1	19	3.3	1.3	19	3.3	1.3

Table 5

Mean Time-On-Task Difference Scores

By Condition, Grade, and Task

	Condition			
	Nonreward		Reward	
Grade	M	SD	M	SD
Nursery				
Mazes [a]	25.7	79.6	-4.2	26.0
Block Design [a]	-13.6	42.0	-26.8	50.7
Third				
Mazes [b]	-13.0	56.5	-15.0	32.3
Block Design [b]	14.1	54.4	-35.3	51.5

[a] $n=6$

[b] $n=12$

Table 6

Intercorrelations of Baseline Session Measures

For Third-Grade Subjects

Variable (n=48)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Phase 1: Pretask verbal assessments														
1. General interest														
2. General competency	.07													
3. Specific interest	.34**	.07												
4. Specific competency	.09	.27	.06											
Phase 2: Task engagement														
5. Task performance	.11	-.03	.07	.09										
6. Completion time	-.22	-.03	-.01	-.14	-.34**									
Phase 3: Posttask verbal assessments														
7. Specific interest	.46**	.04	.46**	.31*	.29*	-.17								
8. Perceived difficulty	-.08	-.23	-.05	-.07	.26	.04	.07							
Phase 4: Free-choice behaviors														
9. Time on-task	.15	.02	.03	.12	.31*	-.27	.06	-.19						
10. Number of items attempted	.08	.09	-.01	.00	.23	-.10	.05	-.32*	.71**					
11. Number of items completed	.07	.13	.05	.08	.18	-.19	.16	-.32*	.64**	.84**				
12. Time per item attempted	.11	-.04	.13	.18	.05	-.22	.07	.19	.47**	.17	-.08			
13. Time per item completed[a]	.05	.13	.10	.25	.00	-.33	.05	.30	.23	.52**	-.40*	.86**		
14. Difficulty level per item attempted	.01	.14	.15	.23	.23	-.32	.16	.09	.56**	.29*	.29*	.61**	.64**	
15. Difficulty level per item completed[a]	.10	.13	.18	.16	.12	-.34*	.25	-.04	.62**	.24	.46**	.64**	.77**	.69**

[a] $n = 38$

* $p < .05$

** $p < .01$

Table 7

Intercorrelations of Baseline Session Measures

For Nursery School Subjects

Variable (n=24)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Phase 1: Pretask verbal assessments														
1. General interest														
2. General competency	-.06													
3. Specific interest	.69**	.04												
4. Specific competency	.69**	.04	.04											
Phase 2: Task engagement														
5. Task performance	.11	.18	.18	-.03										
6. Completion time	.28	-.22	.12	.27	.06									
Phase 3: Posttask verbal assessments														
7. Specific interest	.13	-.09	-.09	.26	.01	.13								
8. Perceived difficulty	-.30	.09	.09	-.46*	.17	.06	-.75**							
Phase 4: Free-choice behaviors														
9. Time on-task	.07	.09	.17	-.07	-.02	.37	.17	-.16						
10. Number of items attempted	-.08	.03	.20	-.32	-.01	-.48*	-.15	-.02	.79**					
11. Number of items completed	-.03	.02	.22	-.25	.09	-.50*	-.20	-.01	.75**	.95**				
12. Time per item attempted	.18	.03	.22	.02	-.05	-.12	-.14	-.04	.82**	.57**	.53**			
13. Time per item completed[a]	.17	.18	.00	.17	-.07	.17	.14	-.12	.65**	.01	-.04	.97**		
14. Difficulty level per item attempted	.07	-.17	.26	-.17	.03	-.17	-.16	-.03	.68**	.78**	.75**	.77**	.21	
15. Difficulty level per item completed[a]	.14	-.20	.26	-.07	.06	-.09	-.14	-.06	.62**	.68**	.66**	.80**	.34	.97**

[a] $n = 16$

* $p < .05$

** $p < .01$

Table 8

Mean Time-On-Task Difference Scores By

Condition and High/Low-COG Group

Condition[a]	M	SD
Nonreward		
Low-COG[b]	9.08	45.80
High-COG[b]	-7.92	65.58
Reward		
Low-COG[b]	-53.45	46.75
High-COG[b]	-1.15	20.30

[a] Third-grade children only

[b] $n = 12$

APPENDIX A

LITERATURE REVIEW

Over the past 25 years, there has been an increasing awareness that extrinsic rewards can have detrimental effects on one's intrinsic motivation (Hunt, 1965; Koch, 1956; White, 1959). Recent researchers (Deci, 1975; Lepper & Greene, 1978a) have focused on delineating the conditions necessary to produce these effects and have developed several theoretical accounts of them as well (cf. de Charms, 1968; Deci, 1975; Kruglanski, 1975; Lepper, Greene, & Nisbett, 1973). Basic to these theories is the idea that extrinsic rewards produce negative effects through their capacity to undermine intrinsic motivation in one or more ways (see Bates, 1979; de Charms & Muir, 1978; Lepper & Greene, 1978a, for recent reviews).

The detrimental effects of extrinsic rewards have also been found on immediate task performance (Condry, 1977; McGraw, 1978). The theories that were developed to account for the detrimental effects of extrinsic rewards on intrinsic interest have been extended to account for immediate task performance effects as well (i.e., Lepper & Greene, 1978b). This extension, however, has not been found to be a simple and straightforward one. For example, conditions thought to be critical to the detrimental effects of reward on subsequent interest, such as reward contingency, have not been found to be critical to the detrimental effects of rewards on immediate task performance (Fabes, Moran, & McCullers, in press).

It would seem, in line with suggestions by Deci (1975), Fabes et al. (in press), Feingold and Mahoney (1975), and Lepper and Greene (1978b), that immediate task performance and intrinsic motivation may not be governed by precisely the same factors. Some investigators (Deci, Cascio, & Krusell, 1975; Dollinger & Thelen, 1978; Ross, Karinol, &

Rothstein, 1976) have found that extrinsic rewards can have a detrimental effect on intrinsic interest with no effect upon immediate task performance. On the other hand, there is also evidence (Arnold, 1976; McGraw & McCullers, 1979; McCullers, Fabes, & Moran, Note 1) to indicate that extrinsic rewards can produce a detrimental effect on immediate task performance with no effect upon subsequent intrinsic interest. Clearly, further study of the relationship of rewards to intrinsic motivation and task performance appears to be warranted.

McCullers (1978) reviewed several traditional theories of learning and motivation as theoretical accounts of the detrimental effects of rewards on immediate task performance and concluded that an adequate explanation may involve processes other than learning and motivation. McCullers and his colleagues have found that rewards may affect the developmental level at which a subject approaches the task and have suggested an alternative theoretical explanantion of the processes through which rewards affect human motivation and performance based on the idea of developmental regression. By utilizing tasks that were sensitive to developmental differences, such as inkblots (Fabes, 1978), intelligence tests (Fabes et al., in press; Moran, 1978), and human figure drawings (McCullers et al., Note 1), it was found that subjects under reward conditions performed at levels that might normally have been expected of less mature subjects under nonreward conditions. Thus, performance under reward could be viewed not only as poorer performance, but also as "reward-produced regression" (Fabes et al., in press).

Immediate vs. Subsequent Measures of Performance and Interest

In order to further clarify the relationship between performance and interest, it is necessary to expand the research design typically

employed for the study of the detrimental effects of reward. In the traditional design utilized by Deci (1972) and by Lepper and his colleagues (Greene & Lepper, 1974; Lepper et al., 1973), subjects were induced to perform an initially attractive task for a somewhat superfluous extrinsic reward. Interest (intrinsic motivation) was assessed during a subsequent free-choice period in which the subject neither expected nor received rewards. As a result, the major dependent variables have been measures of immediate task performance and/or measures of subsequent intrinsic interest. In order to clarify the relationship between interest and performance, it is necessary to utilize designs that include on-task measures of interest and post-task measures of performance as well.

Few studies have employed both immediate and subsequent measures of performance and interest. In one such study, McGraw and McCullers (1979) failed to find any linear relationship between on-task and post-task measures of interest and performance. Harackiewicz (1979) found low, but significant correlations between on-task measures of interest and performance. On- and post-task measures of interest were found to be highly correlated with each other. However, she failed to find a significant correlation between on-task performance and posttask interest. Posttask measures of performance failed to correlate with any variable. In these studies it is important to note that on-task and posttask correlations were performed with reward and nonreward subjects combined, Thus, the immediate vs. subsequent measures were confounded with treatment effects. One way to overcome this problem would be to take baseline, nonreward measures of performance and interest first and analyze data from the experimental session separately.

Subject Differences

When all the conditions thought necessary to produce the negative effects of rewards are met, there are often individual subjects whose measures of interest and performance remain unchanged or even improve under extrinsic incentive conditions (i.e., Davidson & Bucher, 1978; Feingold & Mahoney, 1975; McCullers et al., Note 1; Hom, Note 2). Why these differences occur is an interesting question and although individual differences have been noted for their potential importance (Condry, 1977), they have not received adequate empirical attention.

Aside from demonstrating the detrimental effects of reward over a wide age range, e.g. nursery school children (Lepper et al., 1973); elementary school children (Kruglanski, Alon, & Lewis, 1972); high school students (Kruglanski, Friedman, & Zeevi, 1971); college students (Deci, 1972); and adults beyond college age (Kruglanski & Cohen, 1973), few studies have reported any other significant subject differences. Individual differences that have been found to be related to the detrimental effects of reward include: Sex of subject (Deci, 1972); initial interest level (Lepper et al., 1973); and initial ability level (Moran, 1978). However, none of these studies systematically explored individual differences.

Competence

During the last few years, there have been several suggestions that the undermining effects of reward are not an inevitable outcome and that an individual's feelings of competence may be a key factor in mediating the detrimental effects (Arnold, 1976; Boggiano & Ruble, 1979; Deci, Cascio, & Krusell, 1975; Karinol & Ross, 1977; Harackiewicz, 1979). The importance of the concept of competence is also evident in its role

within a wide array of different theoretical approaches (Csikszentmihalyi, 1975; de Charms, 1968; Deci, 1975; Harter, 1978; White, 1959).

White (1959) first utilized the concept of competence in his classic paper "Motivation reconsidered: The concept of competence" (p. 297). In this paper, White took a critical look at the traditional drive theory models of Hull (1943) and Freud's (1924) psychoanalytic instinct theory, and found them to be incomplete and inadequate motivational models of behavior. White (1959) argued that behaviors such as exploration, curiosity, mastery, and play could not be adequately explained by the reduction of organic drives, by secondary reinforcement, or by anxiety reduction. He went on to propose that such behaviors depend upon effective interaction with the environment and reflect an urge towards competence. He viewed competence as a general personality and motivational orientation that impels the organism toward feelings of efficacy. However, while many recent investigations of the relationship between competence and intrinsic motivation have utilized White's (1959) theoretical concept, they have operationally defined competence in a rather narrow manner as mere success/failure feedback and experiences provided by the experimenter within the experiment itself (i.e., Boggiano & Ruble, 1979). From their perspective, it has been argued that intrinsic interest varies directly with information regarding competence or incompetence conveyed by means of rewards, (cf. Deci, 1975; Lepper & Greene, 1978b).

Harter (1978, 1979) felt that White's general notion of competence had great appeal but lacked specificity. She began work to operationalize the competence construct so that it could be put into researchable hypotheses. As a result, Harter (1979) developed a scale designed to

measure a child's perceptions of his/her competence. In developing this scale, Harter isolated four components of competence thought to be relevant to the elementary school child. This differentiated approach reflects her belief that children typically do not view themselves as equally competent in all domains. These components are: (a) Cognitive competence, (b) Social competence, (c) Physical competence, and (d) General competence. Using her scale, Harter (Note 3) found that when children expected to be graded on their work, low-competence children choose easier problems but high-competence children were unaffected. This finding then provided evidence that perceived competence may play an important role in determining whether or not the detrimental effects of rewards occur.

Task Differences

Although the adverse effects of reward have been demonstrated over a wide range of tasks (as noted in the introduction to the journal article portion of this thesis), few studies have varied the task within the experiment. Calder and Staw (1975) varied the attractiveness of the task in their research and found that rewards decreased interest in the interesting task and enhanced interest in the boring and dull task. Arnold (1976) found that when the task was extremely and unambiguously highly interesting (intrinsically motivating), reward had no effect upon subsequent intrinsic motivation. Kruglanski has shown (Kruglanski, Riter, Amitai, Margolin, Shabtai, & Zaksh, 1975; Kruglanski, Riter, Arazi, Agassi, Montegio, Peri, & Peretz, 1975) that when rewards were endogenous to the task, they enhanced intrinsic motivation. When rewards were exogenous to the task, they surpressed intrinsic motivation. These findings give support to the idea that the motivational

context may interact with the task and perhaps even with the alternative materials and activity options that are made available to the subjects during the subsequent free-choice period.

The effects of rewards on immediate task performance have also been found to vary with the type of task utilized. McGraw (1978) reviewed numerous studies and sought to identify the critical features of the tasks in which rewards had been found to produce detrimental effects as well as those in which rewards were found to facilitate performance. As a result of this review, McGraw (1978) developed a two-factor model that predicted when rewards should have either a facilitating or detrimental effect on performance. McGraw predicted a detrimental effect of reward only on tasks that are initially attractive (the Attractive-Unattractive dimension) and require heuristic solutions (the Algorithmic-Heuristic dimension); that is they require insight and discovery to appropriately structure and solve the problem. McGraw labeled these tasks as Attractive-Heuristic. The model predicted that rewards should enhance performance on all other combinations of the two factors. Research (Fabes et al., in press; McGraw & McCullers, 1979) has provided some support for McGraw's (1978) prediction model, thus implicating the role of task differences within the immediate performance context as well.

McCullers and his colleagues (Fabes, 1978; Fabes et al., in press; Moran, 1978; McCullers et al., Note 1) have recently stressed the importance of utilizing tasks that are sensitive to developmental differences within the effects-of-rewards research. By employing such tasks, the developmental level at which subjects perform may be assessed and thus may provide a basis for further assessing the theoretical value of the developmental regression viewpoint noted earlier.

Developmental Differences

It has already been noted that the undermining effects of rewards have been found to occur in preschool-age children even though these young children do not appear to use the "discounting principle" demanded by some theoretical models (Smith, 1975). Thus, the determinants of the adverse effects of rewards may vary with age.

The period from 5 to 7 years of age is one of pronounced developmental changes. Prior to 5 years of age, the pattern of findings obtained with young children resembles those obtained with nonhuman animals. After 5 years of age, the pattern of findings is similar to that found with human adults (see White, 1965). Some of the changes that have been found to occur in this 5-7 years age range include: (a) Changes in the learning process (Kendler & Kendler, 1962); (b) perceptual changes (Bruner, 1964); (c) changes in orientation of locomotion (Piaget, 1959); (d) changes in the stability of intellectual processes (Goodenough, 1954); and (e) changes in the process of internalization (Vygotsky, 1962). The importance of this age range is also evident in a number of theoretical explanations of cognitive development (Freud, 1924; Luria, 1961; Piaget, 1960; Vygotsky, 1962). If the determinants of reward's adverse effects on performance and motivation differ with developmental level, one potentially fruitful place to search for these determinants would be among subjects on either side of the 5-7 year age range.

Harter (1978) has argued for examining the effects of rewards developmentally. Harter hypothesizes that young children are developmentally more dependent upon external reinforcers and that their intrinsic and extrinsic motivational systems are less differentiated than in

older children. As a result, Harter (1978) proposes that extrinsic rewards should "undermine intrinsic motivation less at earlier developmental stages than at later stages" (p. 61). However, Boggiano and Ruble (1979), testing Veroff's (1969) developmental theory of achievement motivation, found no support for Harter's (1978) prediction. Boggiano and Ruble (1979) argued that young children may not be affected by certain types of competency information. These conflicting results perhaps further emphasize the need to explore the detrimental effects of rewards within a developmental framework.

Developmental differences may also be revealed in the reward choices and preferences of children. Based on both theory and empirical data, developmental accounts of reinforcement have been proposed that involve the idea that there is a hierarchy of reinforcers for an individual that changes as the individual develops (Forness, 1973; Zigler, 1963, 1970). Within this hierarchy, maximal reinforcer effectiveness lies along a continuum that proceeds from tangible, extrinsic reinforcers to more intrinsic and symbolic reinforcers with increasing development. Thus, reward preferences may provide further information regarding an individual's motivational level and orientation.

Summary and Conclusions

Although the detrimental effects of rewards have been repeatedly shown on both performance and intrinsic motivation, a clear understanding of the mechanisms and process through which rewards produce their detrimental effects is lacking. This has also been noted by behavior modification researchers, such as Davidson and Bucher (1978) who suggest that the "conditions necessary and sufficient for detrimental effects of extrinsic reinforcement to operate are not

yet known" (p. 223-224). Several theories have been developed to account for the detrimental effects of rewards and these are eloquent and impressive in their many forms. However, one cannot help but wonder along with de Charms and Muir (1978) "where the minitheories are taking us and whether they are based on such similar assumptions that they really are not different" (p. 107). Consequently, the theoretical alternative of developmental regression under reward, discussed here and elsewhere (i.e., Fabes et al., in press), would seem to warrant further attention. By utilizing tasks that are sensitive to developmental differences in functioning, deeper insight into the ways in which rewards affect performance and motivation may be obtained.

In summary, this review of the literature indicates that perhaps the greatest research need at this time is to clarify empirically and theoretically the relationship between performance and intrinsic motivation within the context of the detrimental effects of rewards. To do this would seem to require the inclusion of both immediate and subsequent measures of performance and motivation. Related to this general goal is the need to better undertand the relative roles and contributions of task factors, subject characteristics (individual differences), and the developmental level of the subject. The need to understand instrinsic motivation in and of itself is also apparent. The central aim of this dissertation research project is to generate some data that will help resolve these issues.

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APPENDIX B

LETTERS TO PARENTS

Oklahoma State University

DEPARTMENT OF FAMILY RELATIONS
AND CHILD DEVELOPMENT

STILLWATER, OKLAHOMA 74074
241 HOME ECONOMICS WEST
405 624-5055

March 4, 1981

Dear Parent:

We are presently conducting research into children's problem-solving abilities, and hope to work with your child and other third grade children at Skyline Elementary School. This project has the approval of the Department of Family Relations and Child Development at OSU, and the Stillwater Public Schools, both at the Superintendent's level and at the level of the principal and teachers at Skyline. Current school policy also requires that we obtain parental permission before children are allowed to participate in the study.

The project will be conducted in an attractive laboratory trailer that will be parked on the schoolgrounds. Each child will be asked to work on one of two puzzle-like, problem-solving tasks commonly presented to children at the third grade level. Children find these activities to be interesting and enjoyable, and in no way stressful or harmful. The task takes about 20 minutes of the child's time. Your child's performance will be treated as confidential, and will not be reported or discussed in any way that would allow anyone to identify your child.

If you would like any further information about the project, please feel free to call either of us at the FRCD Department at OSU (624-5061), and we shall be happy to try to answer your questions. In order for your child to be allowed to participate in the study with other children in his/her class, we must have your written permission beforehand. At this time, the study is scheduled to begin Monday, March 16, 1981. Please complete the attached form below and return to the classroom teacher as soon as possible.

We shall be happy to share the outcome of the study with you and other interested parents and teachers at the conclusion of the study. Thank you for you cooperation.

Sincerely,

John C. McCullers - PhD
Professor - FRCD

Richard Fabes
Research Assistant

PARENT CONSENT FORM

My child _____,

_____has my permission to parcipate in the problem-solving study described above

_____may not participate in the study.

Date _____ _____

Signature of parent or guardian

Oklahoma State University

DEPARTMENT OF FAMILY RELATIONS AND CHILD DEVELOPMENT

STILLWATER, OKLAHOMA 74078
(405) 624-5044

April 5, 1981

Dear Parents,

I am writing you this letter to let you know that our research project has been completed and to thank you and your child for your cooperation. All the children seemed to enjoy participating and they were all a pleasure to be around and to work with.

Your role in this research was as important as any other aspect. Without your help and support this research would not have been possible. It was especially nice to have had such a large response and such prompt attention paid to the return of your child's permission slip. The personal interest in the research quite a few of you expressed was also encouraging.

This research was part of my doctoral dissertation and was sponsored by the Department of Family Relations and Child Development at OSU and was part of a five year research project investigating the effects of material rewards on human thought and problem-solving processes and intrinsic interest and motivation. Although it is commonly assumed that rewards normally have only positive effects (such as getting an unattractive chore done by increasing motivation), rewards also appear to have negative effects as well. We now have a considerable amount of data which suggest that when people are offered material rewards, such as money or toys, for engaging in a complex task, they often approach the task at the lowest level necessary to obtain the rewards. Thus when the performance of rewarded people are compared with other people who were not offered material rewards, the rewarded people are usually found to be performing at level lower than those of the nonreward people. Therefore, material rewards can have detrimental effects when compared to standard nonreward conditions. This negative effect of rewards was the focus of our research project which your child participated in.

Each child was given two separate opportunities to perform a series of either maze or block design problems. These tasks are standardized tasks that are attractive to and appropriate for third grade level. In the first session, no child received a reward . This was done in an effort to obtain baseline performance information on each child. During the second session, one-half of the children continued to perform under nonreward conditions, while the other one-half were told that they would receive their choice of prizes for their participation. By comparing the reward children with the nonreward children, the effects of rewards may be investigated.

It is too early to let you know exactly what we found. Hopefully the results should be completed by the end of May and I encourage all of you to contact me at that time at OSU and obtain the results. Also, if any of you would like any further information concerning the research please feel free to contact me and I will be more than happy to chat with you and to answer your questions.

Again I thank you and your child for your help. I look forward to hearing from you.

Sincerely,

Richard Faber

APPENDIX C

THE RESEARCH DESIGN

Grade	Condition	Task	Competence Pretest Session	Baseline Session	Experimental Session
THIRD (n=48)	Nonreward (n=24)	Mazes (n=12)	N	N	N
		Block Design (n=12)	N	N	N
	Reward (n=24)	Mazes (n=12)	N	N	R
		Block Design (n=12)	N	N	R
NURSERY (n=24)	Nonreward (n=12)	Mazes (n=6)	a	N	N
		Block Design (n=6)	a	N	N
	Reward (n=24)	Mazes (n=6)	a	N	R
		Block Design (n=6)	a	N	R

N = Nonreward conditons
R = Reward conditions
a = The nursery school children could not be tested

Figure 1. The Research Design

APPENDIX D

RESEARCH DESIGN AND VARIABLE SEQUENCE OUTLINE

I. Competency Pretest Session
   A. Harter (1979) Perceived Competence Scale for Children administered to third-grade children only.
      1. Cognitive Competence
      2. Social Competence
      3. Physical Competence
      4. General Competence

II. Baseline Session
   A. Phase 1: Pre-task interest and competency assessment
      1. General game interest
      2. General game competency
      3. Specific task interest
      4. Specific task competency
   B. Phase 2: Task performance
      1. Tasks
         a. Mazes
         b. Block Design
      2. Measures
         a. Task performance standard scores
         b. Response time
   C. Phase 3: Post-task interest and difficulty assessment
      1. Specific task interest
      2. Specific task difficulty
   D. Phase 4: Three-minute free-choice period
      1. Behavioral records (videotaped)
         a. Interest variables
            1. Time spent in on-task play
            2. Time spent in off-task play
         b. Performance variables
            1. Number of items attempted
            2. Number of items completed
            3. Mean time per item attempted
            4. Mean time per item completed
            5. Mean difficulty level per item attempted
            6. Mean difficulty level per item completed
            7. Mean number of errors per item completed

III. Experimental Session
   A. Nonrewards subjects: Identical to Baseline Session
   B. Reward subjects: Identical to Baseline Session with the following exceptions:
      1. Rewards offered prior to Phase 1
      2. Attractiveness of rewards assessed during Phase 3
      3. Rewards given to subjects following Phase 4

APPENDIX E

VERBAL ASSESSMENT ITEMS AND SMILE/FROWN FACES

EXPLANATORY NOTE

The verbal assessment items presented in Appendix E are for the mazes. The verbal assessment items for the block designs were identical to those for the mazes except for the substitution of the word "block" for the word "maze". The items are presented in the exact order they were presented to the children during the Baseline and Experimental Sessions: Phases 1 and 3. The last question question was presented to reward subjects only and only during the Experimental Session.

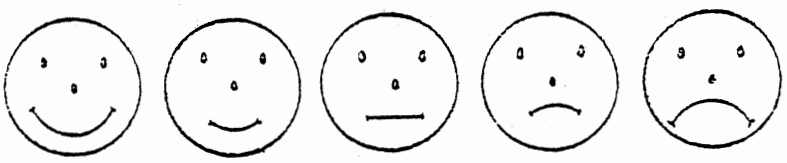
Contents

APPENDIX E-1

VERBAL ASSESSMENT ITEMS FOR PHASE 1

Some kids like to play games BUT Other kids don't like to play games.

Point to the face that shows me how much you like to play games.



Some kids play games very well BUT Other kids don't play games very well.

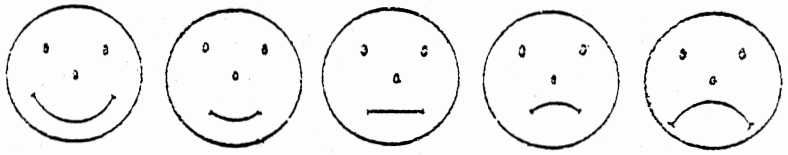
Point to the face that shows me how well you play games.

Some kids like to play maze games BUT Other kids don't like to play maze games.

Point to the face that shows me how much you like to play maze games.

Some kids play maze games very well BUT Other kids don't play maze games very well.

Point to the face that shows me how well you play maze games.



APPENDIX E-2

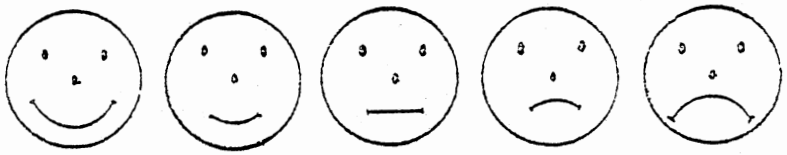
VERBAL ASSESSMENT ITEMS FOR PHASE 3

Some kids really liked playing the maze game BUT Other kids did not really like playing the maze game.

Point to the face that shows me how much you liked playing the maze game.

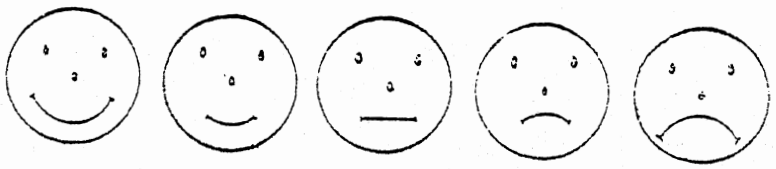
Some kids thought the maze game was easy BUT Other kids thought the maze game was hard.

Point to the face that shows me how easy the maze game was for you.



Some kids really liked the prize they got BUT Other kids did not like their prize.

Point to the face that shows me how much you liked the prize you got.



APPENDIX F

FREE-CHOICE MAZES AND DIFFICULTY LEVELS

EXPLANATORY NOTE

Appendix F contains information on the free-choice mazes for both the third-grade and nursery school subjects that were used during Phase 4 of both the Baseline and Experimental Sessions. Appendix F-1 contains information concerning the source from which each maze was constructed. Appendices F-2 and F-3 contain the actual maze designs used during the Phase 4 free-choice period along with their difficulty levels. The mazes are reduced approximately 40% of their actual size. The mazes are presented in the order of their difficulty and not necessarily the order in which they were left for the children during the free-choice period.

Contents

APPENDIX F-1

FREE-CHOICE MAZE AND DIFFICULTY LEVEL SOURCE

Third-Grade Subjects

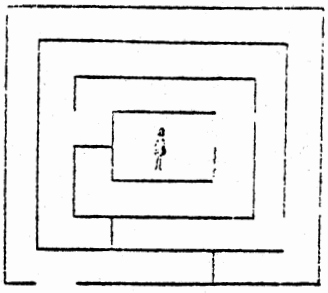
Difficulty level	Maze
1	WISC-R Maze #5 rotated 180°
2	WISC-R Maze #6 rotated 90° right
3	WISC-R Maze #7 rotated 90° left
4	WISC-R Maze #8 rotated 180°
5	WISC-R Maze #9 rotated 90° right
6	NEW
7	NEW

Preschool Subjects

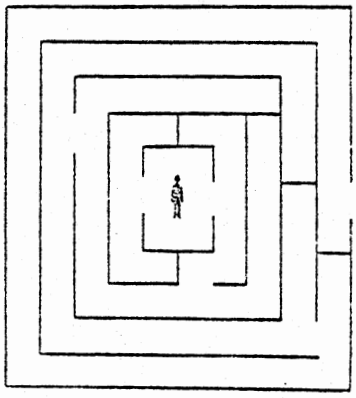
Difficulty level	Maze
1	WPPSI Maze #1 rotated 180°
2	WPPSI Maze #3 rotated 180°
3	WPPSI Sample Maze rotated 90° left
4	WPPSI Maze #4 rotated 180°
5	WISC-R Maze #3 rotated 90° right
6	WISC-R Maze #6 rotated 90° left
7	WISC-R Maze #9 rotated 90° right

APPENDIX F-2

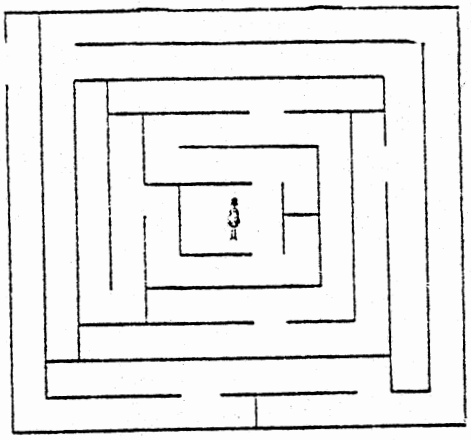
FREE-CHOICE MAZE DESIGNS FOR THIRD-GRADE SUBJECTS



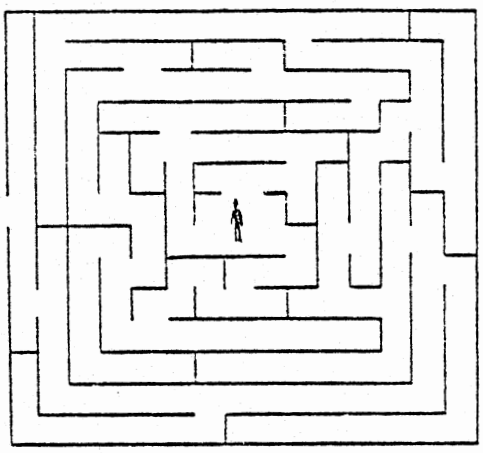
Difficulty 1



Difficulty 2



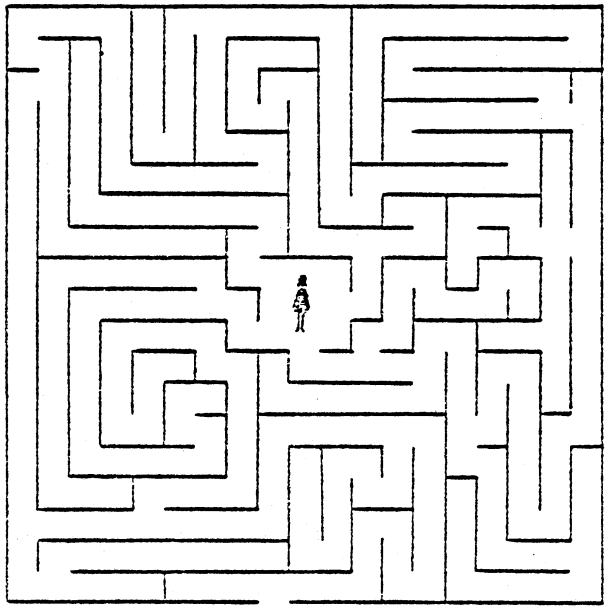
Difficulty 3



Difficulty 4

APPENDIX F-2 - CONTINUED

FREE-CHOICE MAZE DESIGNS FOR THIRD-GRADE SUBJECTS



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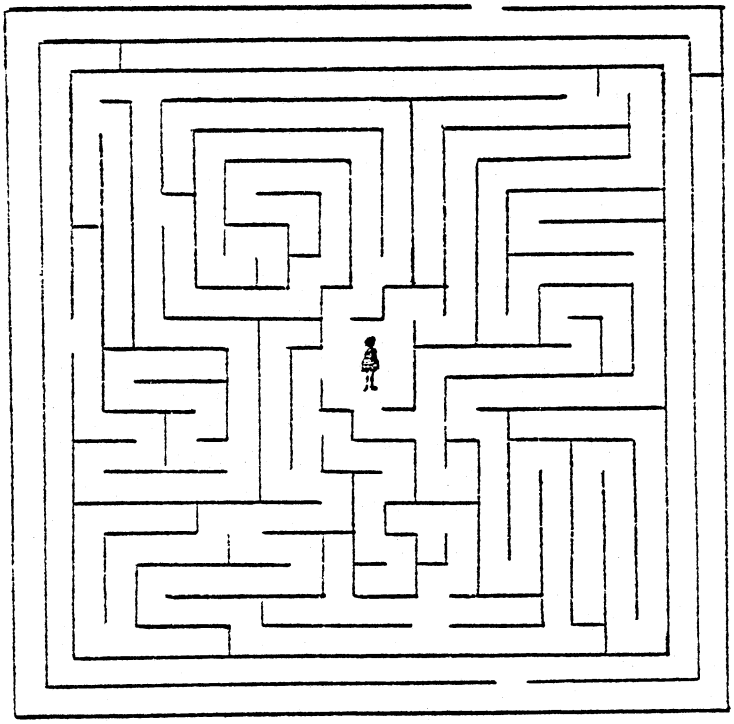
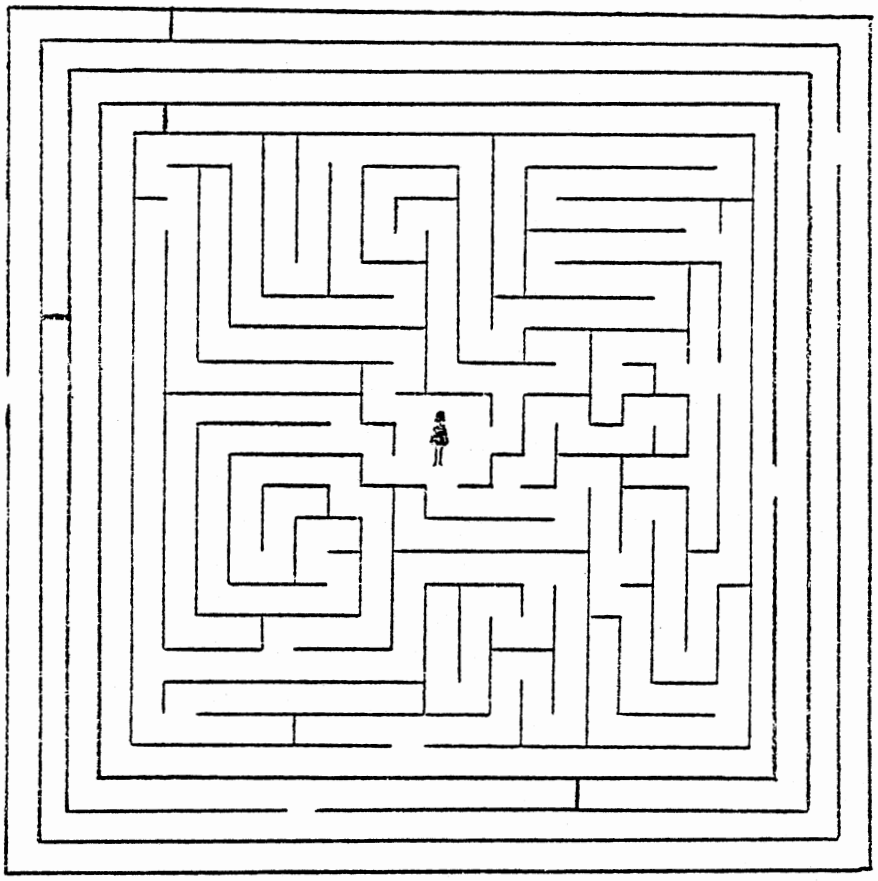


Difficulty 6

APPENDIX F-2 - CONTINUED

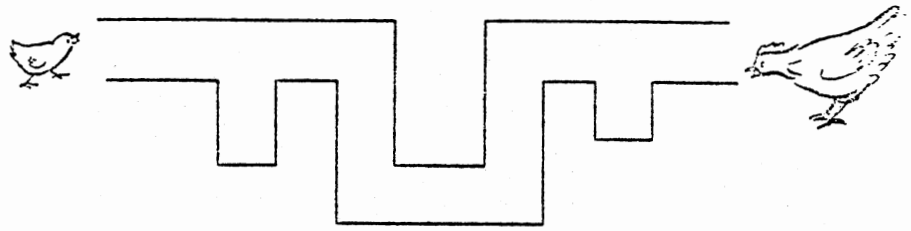
FREE-CHIOCE MAZE DESIGNS FOR THIRD-GRADE SUBJECTS



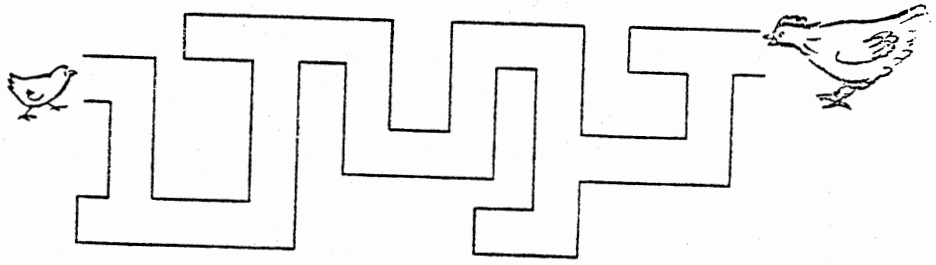
Difficulty 7

APPENDIX F-3

FREE-CHOICE MAZE DESIGNS FOR NURSERY SCHOOL SUBJECTS



Difficulty 1



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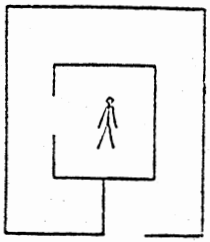

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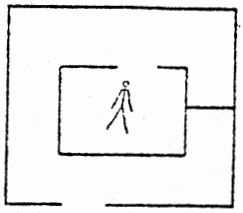
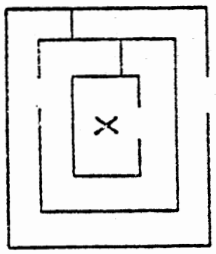


Difficulty 4

APPENDIX F-3 - CONTINUED

FREE-CHOICE MAZE DESIGNS FOR NURSERY SCHOOL SUBJECTS



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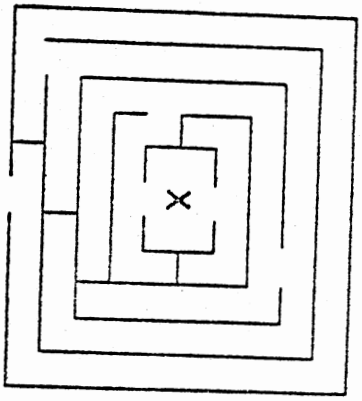

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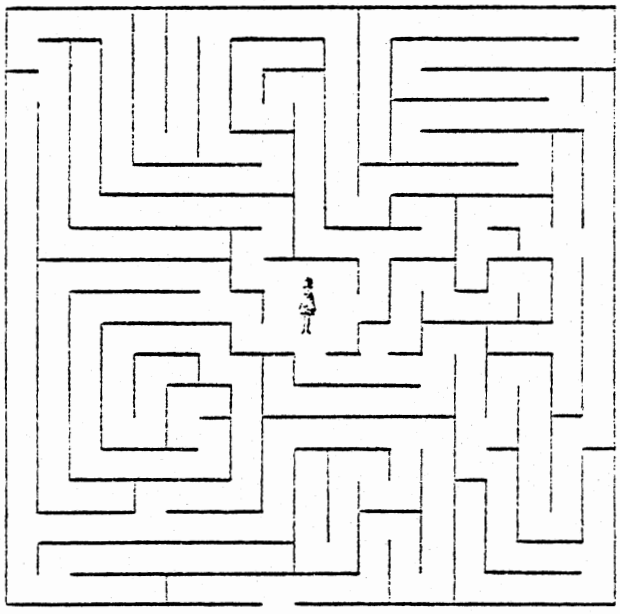


Difficulty 7

APPENDIX G

FREE-CHOICE BLOCK DESIGNS AND DIFFICULTY LEVELS

EXPLANATORY NOTE

Appendix G contains information on the free-choice block designs for the third-grade and nursery school subjects that were used during Phase 4 of both the Baseline and Experimental Sessions. Appendix G-1 contains information concerning the source from which each block design was taken. Appendices F-2 and F-3 contain the actual block designs used during the Phase 4 free-choice period along with their difficulty levels. The block designs are presented in their actual sizes. The block designs are also presented in the order of their difficulty and not necessarily the order in which they were left for the children during the free-choice period. Shaded areas represent red areas.

Contents

APPENDIX G-1

FREE-CHOICE BLOCK DESIGN AND DIFFICULTY LEVEL SOURCE

Third Grade Subjects

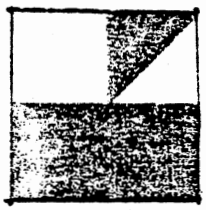
Difficulty level	Block Design
1	WAIS block design card #1
2	WAIS block design card #2
3	WAIS block design card #6
4	WAIS block design card #7
5	WAIS block design card #8
6	WAIS block design card #9

Preschool Subjects

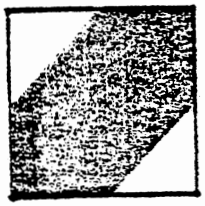
Difficulty Level	Block Design
1	WPPSI block design #1 colors reversed
2	WPPSI block design #2 colors reversed
3	WISC-R block design card #1
4	WISC-R block design card #3
5	WISC-R block design card #6
6	WISC-R block design card #7

APPENDIX G-2

FREE-CHOICE BLOCK DESIGNS FOR THIRD-GRADE SUBJECTS

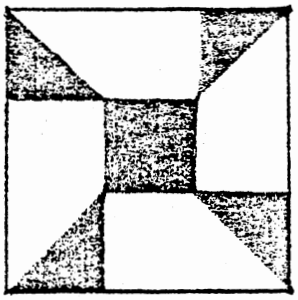


Difficulty 1

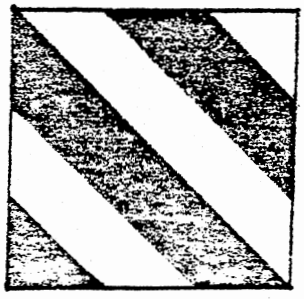


Difficulty 2

Difficulty 3



Difficulty 4



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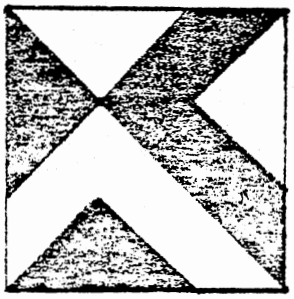
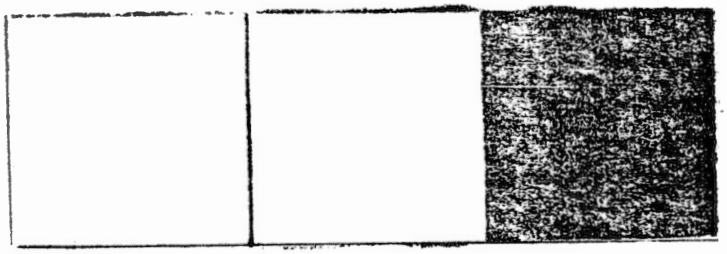


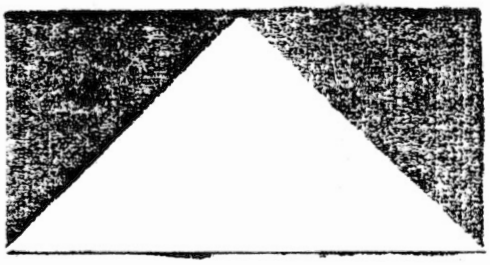
Difficulty 6

APPENDIX G-3

FREE-CHOICE BLOCK DESIGNS FOR NURSERY SCHOOL SUBJECTS



Difficulty 1



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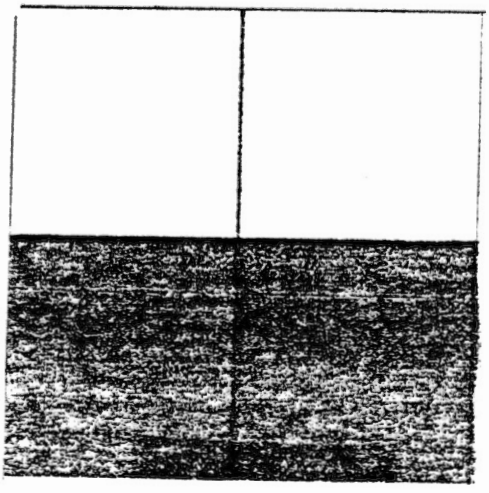
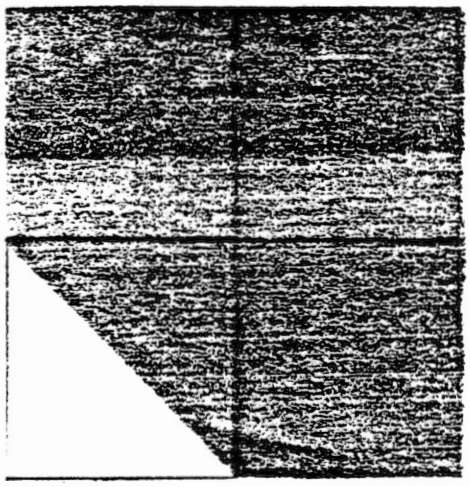


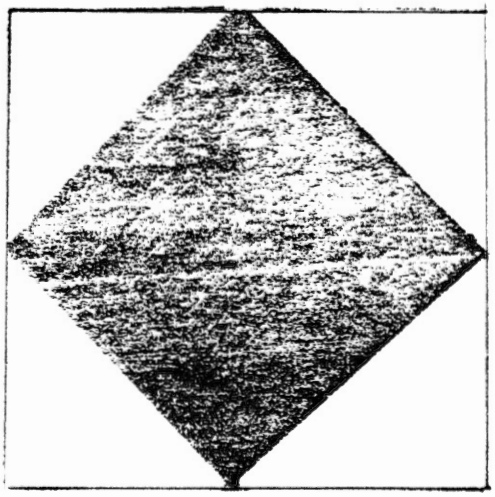
Difficulty 3

APPENDIX G-3 - CONTINUED

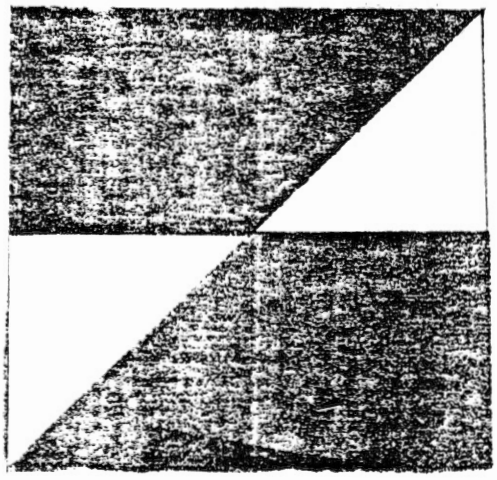
FREE-CHOICE BLOCK DESIGNS FOR NURSERY SCHOOL SUBJECTS



Difficulty 4



Difficulty 5



Difficulty 6

APPENDIX H

RAW DATA

EXPLANATORY NOTE

Appendix H contains the raw data for all subjects for the Pretest Competency Session and the Baseline and Experimental Sessions. Appendix H-1 contains information concerning the key and codes used when interpreting the data. Appendix H-2 contains the Pretest Competency data for the third-grade subjects only. Appendix H-3 and H-4 contain the Baseline and Experimental Session data respectively.

Contents

APPENDIX H-1

VARIABLE CODE AND MEASUREMENT KEY

Subject and Task Identifying Information

Code	Variable Name	Key
S	Subject Number	
SEX	Sex of Subject	1=Male, 2=Female
AGE	Age of Subject	(shown in years)
CON	Experimental Condition	1=Nonreward, 2=Reward
GRA	Grade of Subject	0=Nursery School 3=Third-grade
TASK	Task	1=Mazes 2=Block Design

Competency Pretest Session Data

Code	Variable Name	Range
COG	Cognitive Competence	1-4
SOC	Social Competence	1-4
PHY	Physical Competence	1-4
GEN	General Competence	1-4

Baseline and Experimental Session Data (listed by Phase)

	Code	Variable Name	Range
Phase 1	GIN	General Game Interest	1-5
	GCP	General Game Competency	1-5
	SIN	Specific Task Interest	1-5
	SCP	Specific Task Competency	1-5
Phase 2	SS	Performance Standard Score	1-20
	SSTM	Mean Response Time per item (in seconds)	0-
Phase 3	PTIN	Post-task Interest	1-5
	PTDF	Post-task Perceived Difficulty	1-5
Phase 4	ON	Time-on-task (in seconds)	0-180
	AT	Number of items Attempted	0-7
	CMP	Number of Items Completed	0-7
	ATTM	Mean Response Time per Item Attempted (in seconds)	0-180
	CMPTM	Mean Response Time per Item Completed (in seconds)	0-180
	DIFAT	Mean Difficulty Level per Attempt	0-7
	DIFCMP	Mean Difficulty Level per Completion	0-7
	ERSCMP	Mean Errors per Completion	0-

APPENDIX H-2

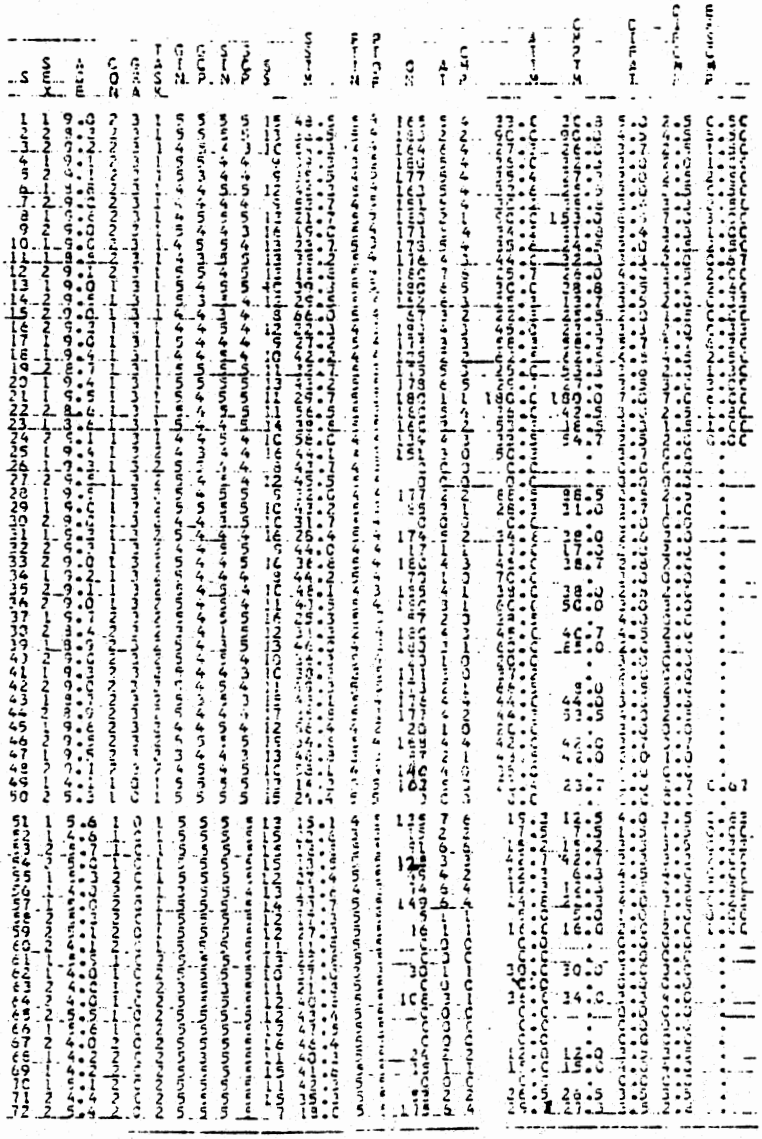
COMPETENCY PRETEST SESSION RAW DATA*

SL	CCN	TASK	CCG	SCC	PPY	CEN
1	2	1	2.1	2.1	2.7	2.6
2	2	1	3.3	2.3	2.4	2.4
3	2	1	2.6	2.6	2.6	2.6
4	2	1	3.4	2.5	2.1	2.1
5	2	1	2.7	2.1	2.4	2.4
6	2	1	3.5	2.6	2.5	2.6
7	2	1	3.5	2.4	2.6	2.7
8	2	1	3.6	2.5	2.5	2.6
9	2	1	3.6	2.6	2.4	2.4
10	2	1	4.0	2.0	4.0	2.9
11	2	1	2.1	1.7	2.0	2.1
12	2	1	3.7	2.5	3.0	2.4
13	1	1	2.0	2.7	1.9	2.0
14	1	1	2.7	2.3	2.1	2.4
15	1	1	2.3	2.4	2.9	2.4
16	1	1	4.0	2.9	2.9	4.0
17	1	1	2.7	1.6	1.8	2.1
18	1	1	3.1	2.7	3.6	4.0
19	1	1	2.5	2.6	2.5	2.6
20	1	1	2.1	2.6	2.9	2.6
21	1	1	2.6	2.0	3.0	4.0
22	1	1	2.3	2.7	2.4	2.6
23	1	1	3.3	2.6	3.1	3.0
24	1	1	3.4	2.6	3.7	3.0
25	1	2	2.4	2.5	2.1	2.1
26	1	2	2.9	2.1	2.2	2.1
27	1	2	2.4	2.1	2.4	2.1
28	1	2	3.6	2.1	2.1	2.6
29	1	2	3.4	2.5	2.1	2.7
30	1	2	2.5	2.5	2.5	2.5
31	1	2	2.5	2.5	2.0	2.0
32	1	2	2.7	2.3	2.6	2.3
33	1	2	2.0	2.0	1.6	2.3
34	1	2	3.4	2.7	3.0	2.4
35	1	2	2.5	2.6	2.7	2.1
36	1	2	2.0	2.0	2.0	2.0
37	1	2	2.5	2.7	2.1	2.3
38	2	2	2.6	1.4	1.7	2.7
39	2	2	3.0	1.7	1.1	2.1
40	2	2	3.6	2.6	3.3	3.0
41	2	2	2.5	2.5	2.4	2.5
42	2	2	4.0	2.7	2.7	4.0
43	2	2	3.5	2.6	2.5	2.6
44	2	2	3.5	2.6	2.5	2.6
45	2	2	3.1	2.6	2.5	2.5
46	2	2	2.5	2.5	2.5	2.6
47	2	2	2.5	2.1	2.4	2.0
48	2	2	2.9	2.2	2.6	2.4

* Third-grade children only

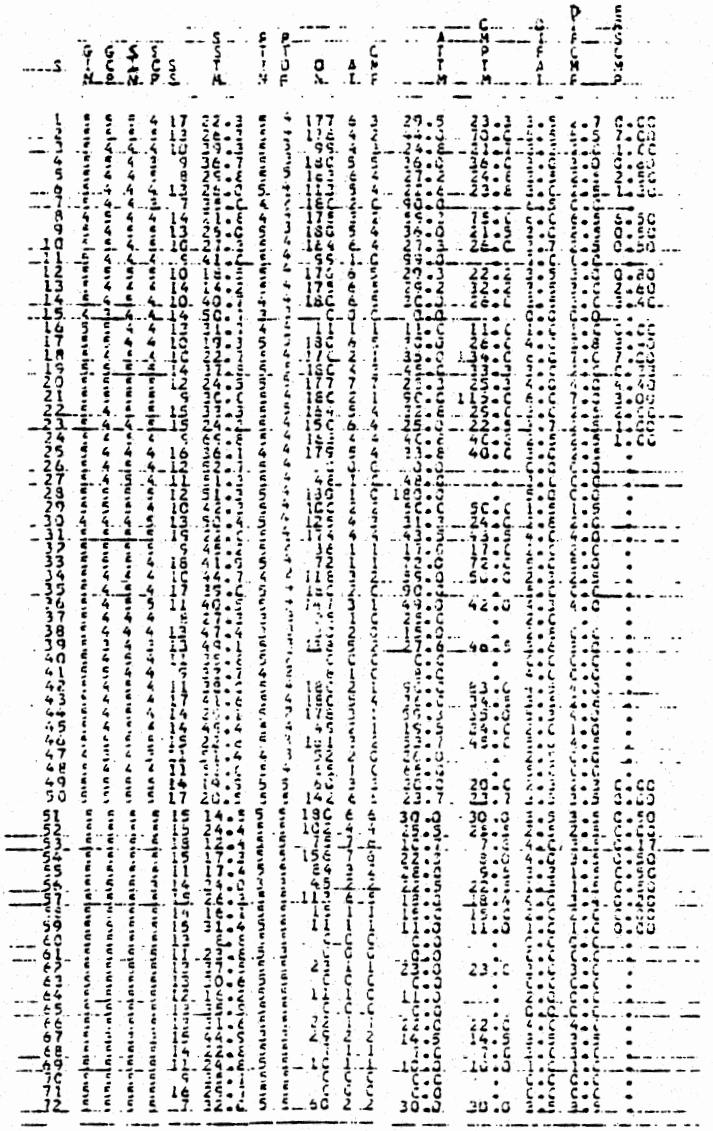
APPENDIX H-3

BASELINE SESSION RAW DATA



APPENDIX H-4

EXPERIMENTAL SESSION RAW DATA



APPENDIX I

BASELINE AND EXPERIMENTAL SESSIONS MEANS AND STANDARD DEVIATIONS BY CONDITION, GRADE, TASK

EXPLANATORY NOTE

Appendix I contains the Baseline and Experimental Sessions means and standard deviations for all variables by condition, grade, and task. Each condition, grade, and task are identified at the top of each page. The reader is referred to Appendix H-1 (p. 99) for variable code information. Baseline Session data are presented in the upper portion of the page with the Experimental Session data in the lower portion of the same page.

CCN=1 GRA=0 TASK=1

Baseline Session

VARIABLE	N	MEAN	STANDARD DEVIATION
AGE	6	5.000000000	0.615629760
GIN	6	5.000000000	0.000000000
GCP	6	5.000000000	0.000000000
SIN	6	5.000000000	0.000000000
SCP	6	5.000000000	0.000000000
SS	6	14.33333333	1.032795560
SSTM	6	18.93333333	4.015802120
PTIN	6	4.500000000	0.836660030
PTDF	6	4.666666667	0.816496580
ON	6	93.50000000	80.25646391
AT	6	3.833333333	2.639444439
CMP	6	3.333333333	2.338090350
ATTM	6	17.51666667	14.54804680
CMPTM	5	20.32000000	13.82034722
DIFAT	6	2.550000000	1.508310310
DIFCMP	6	2.416666667	1.406295370
ERSCMP	5	0.766000000	0.760414360

Experimental Session

VARIABLE	N	MEAN	STANDARD DEVIATION
GIN	6	5.000000000	0.000000000
GCP	6	5.000000000	0.000000000
SIN	6	5.000000000	0.000000000
SCP	6	5.000000000	0.000000000
SS	6	15.66666667	1.505545310
SSTM	6	18.16666667	4.355223634
PTIN	6	5.000000000	0.000000000
PTDF	6	5.000000000	0.000000000
ON	6	119.1666667	47.59166594
AT	6	5.500000000	1.643167670
CMP	6	5.166666667	1.329160140
ATTM	6	22.03333333	6.494818460
CMPTM	6	19.16666667	5.301175611
DIFAT	6	3.300000000	0.734846922
DIFCMP	6	3.133333333	0.751547610
ERSCMP	6	0.195000000	0.245254971

CCN=2 GRA=C TASK=1

Baseline Session

VARIABLE	N	MEAN	STANDARD DEVIATION
AGE	6	4.80000000	0.59329588
GIN	6	4.66666667	0.81649658
GCP	6	5.00000000	0.00000000
SIN	6	5.00000000	0.00000000
SCP	6	4.83333333	0.40824829
SS	6	12.33333333	1.03279556
SSTM	6	21.36666667	8.06465540
PTIN	6	4.83333333	0.40824829
PTDF	6	4.66666667	0.81649658
ON	6	48.83333333	56.65833272
AT	6	3.00000000	2.68323137
CMP	6	2.00000000	1.67332005
ATTM	6	11.73333333	8.69241951
CMPTM	5	12.38000000	7.12299084
DIFAT	6	2.50000000	1.78885438
DIFCMP	6	2.05000000	1.40534693
ERSCMP	5	0.35000000	0.41833001

Experimental Session

VARIABLE	N	MEAN	STANDARD DEVIATION
GIN	6	5.00000000	0.00000000
GCP	6	5.00000000	0.00000000
SIN	6	5.00000000	0.00000000
SCP	6	4.66666667	0.81649658
SS	6	13.66666667	1.50554521
SSTM	6	20.66666667	8.12887866
PTIN	6	4.66666667	0.81649658
PTDF	6	4.66666667	0.81649658
ON	6	44.66666667	45.22241332
AT	6	2.16666667	2.13697606
CMP	6	1.83333333	1.72240142
ATTM	6	15.88333333	9.75713414
CMPTM	5	15.28000000	5.33015980
DIFAT	6	1.96666667	1.47873820
DIFCMP	6	1.56666667	1.12546287
ERSCMP	5	0.24000000	0.25099801

CCN=1 GRA=C TASK=2

Baseline Session

VARIABLE	N	MEAN	STANDARD DEVIATION
AGE	6	4.83333333	C.9223159[illegible]
GIN	6	4.66666667	C.81649658
GCP	6	5.00000000	0.00000000
SIN	6	4.66666667	C.81649658
SCP	6	5.00000000	C.00000000
SSI	6	11.66666667	1.03279556
SSTM	6	35.55000000	10.82326199
PTIN	6	4.66666667	C.81649658
PTDF	6	4.66666667	C.81649658
ON	6	23.00000000	4[illegible].[illegible]
AT	6	0.66666667	1.21106014
CMP	6	0.33333333	C.51639778
ATTM	6	11.00000000	17.14642820
CMPTM	2	32.00000000	2.82842712
DIFAT	6	1.05000000	1.62941107
DIFCMP	6	1.16666667	1.83484786

Experimental Session

VARIABLE	N	MEAN	STANDARD DEVIATION
GIN	6	5.00000000	C.00000000
GCP	6	5.00000000	0.00000000
SIN	6	5.00000000	C.00000000
SCP	6	5.00000000	C.00000000
SS2	6	12.50000000	0.83666002
SSTM	6	29.26666667	7.99541535
PTIN	6	5.00000000	0.00000000
PTDF	6	4.66666667	C.81649658
ON	6	9.33333333	11.[illegible]425586
AT	6	0.50000000	C.54772256
CMP	6	0.33333333	C.51639778
ATTM	6	9.33333333	11.[illegible]425586
CMPTM	2	22.50000000	0.70710678
DIFAT	6	1.50000000	1.76068169
DIFCMP	6	1.16666667	1.83484786

CCN=2 GRP=0 TASK=2

Baseline Session

VARIABLE	N	MEAN	STANDARD DEVIATION
AGE	6	4.55000000	0.56480885
GIN	6	5.00000000	0.00000000
GCP	6	4.66666667	0.81649658
SIN	6	5.00000000	0.00000000
SCP	6	5.00000000	0.00000000
SS	6	12.50000000	3.44963766
SSTM	6	37.31666667	10.11719658
PTIN	6	5.00000000	0.00000000
PTOF	6	4.66666667	0.81649658
ON	6	44.50000000	66.66329241
AT	6	1.83333333	2.22860195
CMP	6	1.50000000	1.51657509
ATTM	6	13.86666667	12.64621158
CMPTM	4	20.20000000	7.83964285
DIFAT	6	2.41666667	1.88193162
DIFCMP	6	2.30000000	1.82208672

Experimental Session

VARIABLE	N	MEAN	STANDARD DEVIATION
GIN	6	5.00000000	0.00000000
GCP	6	4.66666667	0.81649658
SIN	6	4.66666667	0.81649658
SCP	6	4.66666667	0.81649658
SS	6	12.00000000	3.57770876
SSTM	6	31.55000000	7.95707233
PTIN	6	4.66666667	0.81649658
PTOF	6	4.66666667	0.81649658
ON	6	17.66666667	23.31237154
AT	6	1.00000000	0.89442719
CMP	6	1.00000000	0.89442719
ATTM	6	10.25000000	11.21494559
CMPTM	4	15.37500000	10.22558067
DIFAT	6	1.83333333	1.69312335
DIFCMP	6	1.83333333	1.69312335

CON=1 GRA=3 TASK=1

Baseline Session

VARIABLE	N	MEAN	STANDARD DEVIATION
AGE	12	9.09166667	0.28427856
GIN	12	4.66666667	0.49236596
GCP	12	4.08333333	0.51492865
SIN	12	4.66666667	0.65133895
SCP	12	4.50000000	0.52223297
SSI	12	10.91666667	1.67648622
SSTM	12	40.45000000	13.59675763
PTIN	12	4.75000000	0.45226702
PTDF	12	3.75000000	0.75377836
GN	12	157.16666667	34.23404296
AT	12	4.00000000	1.65144965
CMP	12	3.00000000	1.20604539
ATTM	12	50.90833333	42.67621135
CMPTM	12	49.04166667	44.50296220
DIFAT	12	3.80000000	1.31113092
DIFCMP	12	3.05833333	1.76462844
FRSCMP	12	2.09666667	2.15524027

Experimental Session

VARIABLE	N	MEAN	STANDARD DEVIATION
GIN	12	4.91666667	0.28867513
GCP	12	4.33333333	0.65133895
SIN	12	4.58333333	0.51492865
SCP	12	4.41666667	0.51492865
SS	12	12.08333333	2.35326981
SSTM	12	33.24166667	15.24601041
PTIN	12	4.66666667	0.65133895
PTDF	12	4.25000000	0.62158156
GN	12	144.16666667	65.49759673
AT	12	4.08333333	2.31431644
CMP	12	3.33333333	2.14617348
ATTM	12	37.00833333	26.44687499
CMPTM	11	45.00909091	40.20963988
DIFAT	12	3.35000000	1.72600232
DIFCMP	12	3.19166667	2.08782546
FRSCMP	11	2.55727273	2.03501396

CCN=2 GRA=3 TASK=1

Baseline Session

VARIABLE	N	MEAN	STANDARD DEVIATION
AGE	12	8.97500000	0.33063300
GIN	12	4.50000000	0.52223297
GCP	12	4.41666667	0.79296146
SIN	12	4.50000000	0.52223297
SCP	12	4.33333333	0.77849894
SS	12	12.08333333	2.35326981
SSTM	12	35.87500000	13.23007078
PTIN	12	4.58333333	0.66855792
PTOF	12	4.33333333	0.65133895
ON	12	172.08333333	9.38527215
AT	12	4.66666667	1.43548113
CMP	12	3.66666667	1.23091491
ATTM	12	42.83333333	22.51344380
CMPTM	12	44.85833333	38.44884342
DIFAT	12	3.81666667	1.06158629
DIFCMP	12	3.17500000	1.40008117
ERSCMP	12	1.95583333	1.44239358

Experimental Session

VARIABLE	N	MEAN	STANDARD DEVIATION
GIN	12	4.91666667	0.28867513
GCP	12	4.50000000	0.52223297
SIN	12	4.33333333	0.49236596
SCP	12	4.25000000	0.75377836
SS	12	11.08333333	2.90636710
SSTM	12	29.16666667	7.26663277
PTIN	12	4.83333333	0.38924947
PTOF	12	3.66666667	0.77849894
ON	12	157.08333333	32.88950740
AT	12	4.41666667	1.67648622
CMP	12	3.00000000	1.76605573
ATTM	12	43.75000000	25.75007914
CMPTM	10	34.43000000	20.62928644
DIFAT	12	4.29166667	1.50179186
DIFCMP	12	2.72500000	1.85085975
ERSCMP	10	2.09000000	2.54490777

CON=1 GRA=3 TASK=2

Baseline Session

VARIABLE	N	MEAN	STANDARD DEVIATION
AGE	12	9.21666667	0.19462474
SIN	12	4.75000000	0.45226702
SCP	12	4.08333333	0.51492865
SIN	12	4.41666667	0.66855792
SCP	12	4.41666667	0.51432865
SS	12	11.25000000	3.07851794
SSTM	12	40.18333333	6.38020138
PTIN	12	4.58333333	0.51492865
PTDF	12	3.75000000	0.45226702
ON	12	99.08333333	78.52904307
AT	12	2.16666667	1.74945879
CMP	12	0.91666667	0.99620492
ATTM	12	35.99166667	28.74253922
CMPTM	7	43.02357143	22.38948520
DIFAT	12	2.15833333	1.39462882
DIFCMP	12	1.20833333	1.15715822

Experimental Session

VARIABLE	N	MEAN	STANDARD DEVIATION
GIN	12	4.91666667	0.28867513
SCP	12	4.41666667	0.51492865
SIN	12	4.75000000	0.45226702
SCP	12	4.41666667	0.51492865
SS	12	13.16666667	3.42334804
SSTM	12	43.11666667	8.56396605
PTIN	12	4.83333333	0.38924947
PTDF	12	3.66666667	0.71849894
ON	12	113.25000000	52.62331237
AT	12	2.25000000	1.54478995
CMP	12	1.50000000	1.50755672
ATTM	12	56.13333333	45.56904042
CMPTM	8	42.31250000	16.82993898
DIFAT	12	3.15833333	1.57159926
DIFCMP	12	1.95833333	1.75103192

CON=2 GRA=3 TASK=2

Baseline Session

VARIABLE	N	MEAN	STANDARD DEVIATION
AGE	12	9.13333333	C.33399277
GIN	12	4.5CCCCCCC	C.79772404
GCP	12	4.08333333	C.51492665
SIN	12	4.16666667	1.19341628
SCP	12	4.16666667	C.83484711
SS	12	13.16666667	2.99572950
SSTM	12	41.95833333	10.C5950101
PTIN	12	4.08333333	1.16450015
PTDF	12	3.5CCCCCCC	1.16[illegible]
ON	12	124.0833333	6[illegible]
AT	12	2.83333333	1.19341628
CMP	12	1.33333333	1.55699789
ATTM	12	40.5CCCCCCC	13.94821592
CMPTM	7	45.02857143	22.6[illegible]
DIFAT	12	3.12500000	1.01991933
DIFCMP	12	1.5CCCCCCC	1.51897094

Experimental Session

VARIABLE	N	MEAN	STANDARD DEVIATION
GIN	12	4.91666667	C.28867513
GCP	12	4.0CCCCCCC	C.6C3C2269
SIN	12	4.5CCCCCCC	0.52223297
SCP	12	3.91666667	C.51492665
SS	12	12.25CCCCCC	2.56284643
SSTM	12	39.8CCCCCCC	10.17680C71
PTIN	12	4.5CCCCCCC	C.79772404
PTDF	12	3.C8333333	C.79296146
ON	12	88.83333333	72.4C772602
AT	12	2.25CCCCCC	1.54478595
CMP	12	C.91666667	1.24C11241
ATTM	12	35.42500CCC	26.44724[illegible]
CMPTM	6	44.66666667	20.47844395
DIFAT	12	3.35000CCC	1.56582827
DIFCMP	11	1.75454545	1.9C334634

APPENDIX J

SELECTED STATISTICAL ANALYSES

FILE NONAME (CREATION DATE = 81/09/16.)

* * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

GCPL
BY CON
GRA
TASK

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	9.556	3	3.185	10.729	.001
CON	.056	1	.056	.187	.667
GRA	9.000	1	9.000	30.316	.001
TASK	.500	1	.500	1.684	.199
2-WAY INTERACTIONS	.944	3	.315	1.060	.372
CON GRA	.444	1	.444	1.497	.226
CON TASK	.500	1	.500	1.684	.199
GRA TASK	.000	1	.000	.000	.999
3-WAY INTERACTIONS	0	1	0	0	.999
CON GRA TASK	0	1	0	0	.999
EXPLAINED	10.500	7	1.500	5.053	.001
RESIDUAL	19.000	64	.297		
TOTAL	29.500	71	.415		

FILE NONAME (CREATION DATE = 81/09/16.)

* * * * * * * * ANALYSIS OF VARIANCE * * * * * * * *

SIN1
BY CON
GRA
TASK

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	4.924	3	1.641	3.326	.025
CON	.125	1	.125	.253	.616
GRA	3.674	1	3.674	7.444	.008
TASK	1.125	1	1.125	2.280	.136
2-WAY INTERACTIONS	.639	3	.213	.432	.731
CON GRA	.563	1	.563	1.140	.290
CON TASK	.014	1	.014	.028	.867
GRA TASK	.063	1	.063	.127	.723
3-WAY INTERACTIONS	.174	1	.174	.352	.555
CON GRA TASK	.174	1	.174	.352	.555
EXPLAINED	5.736	7	.819	1.661	.135
RESIDUAL	31.583	64	.493		
TOTAL	37.319	71	.526		

FILE NONAME (CREATION DATE = 81/09/16.)

* * * * * * * * ANALYSIS OF VARIANCE * * * * * * * *

SCP1
BY CON
GRA
TASK

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	6.396	3	2.132	6.472	.001
CON	.500	1	.500	1.518	.222
GRA	5.840	1	5.840	17.729	.001
TASK	.056	1	.056	.169	.683
2-WAY INTERACTIONS	.236	3	.079	.239	.869
CON GRA	.063	1	.063	.190	.665
CON TASK	.000	1	.000	.000	.999
GRA TASK	.174	1	.174	.527	.471
3-WAY INTERACTIONS	.063	1	.063	.190	.665
CON GRA TASK	.062	1	.062	.190	.665
EXPLAINED	6.694	7	.956	2.903	.011
RESIDUAL	21.083	64	.329		
TOTAL	27.778	71	.391		

FILE NONAME (CREATION DATE = 81/09/15.)

* * * * * * * * ANALYSIS OF VARIANCE * * * * * * * *

DEPT
BY CON
GRA
TASK

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SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	12.722	3	4.241	6.540	.001
CON	.222	1	.222	.343	.560
GRA	11.111	1	11.111	17.135	.001
TASK	1.389	1	1.389	2.142	.148
2-WAY INTERACTIONS	2.194	3	.731	1.128	.344
CON GRA	.111	1	.111	.171	.680
CON TASK	1.389	1	1.389	2.142	.148
GRA TASK	.694	1	.694	1.071	.305
3-WAY INTERACTIONS	.694	1	.694	1.071	.305
CON GRA TASK	.694	1	.694	1.071	.305
EXPLAINED	15.611	7	2.230	3.439	.003
RESIDUAL	41.500	64	.648		
TOTAL	57.111	71	.804		

FILE NONAME (CREATION DATE = 81/09/16.)

* * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

UNI
BY CON
GRA
TASK

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	160153.396	3	53384.465	16.607	.001
CON	1605.556	1	1605.556	.499	.482
GRA	117363.340	1	117363.340	36.510	.001
TASK	41184.500	1	41184.500	12.812	.001
2-WAY INTERACTIONS	8682.792	3	2894.264	.900	.446
CON GRA	3979.507	1	3979.507	1.238	.270
CON TASK	3726.722	1	3726.722	1.159	.286
GRA TASK	976.563	1	976.563	.304	.583
3-WAY INTERACTIONS	3145.340	1	3145.340	.978	.326
CON GRA TASK	3145.340	1	3145.340	.978	.326
EXPLAINED	171981.528	7	24568.790	7.643	.001
RESIDUAL	205732.250	64	3214.566		
TOTAL	377713.778	71	5319.912		

* * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

ATI
BY CON
GRA
TASK

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	91.333	3	30.444	9.505	.001
CON	4.500	1	4.500	1.405	.240
GRA	18.778	1	18.778	5.862	.018
TASK	68.056	1	68.056	21.247	.001
2-WAY INTERACTIONS	3.444	3	1.148	.358	.783
CON GRA	1.000	1	1.000	.312	.578
CON TASK	2.000	1	2.000	.624	.432
GRA TASK	.444	1	.444	.139	.711
3-WAY INTERACTIONS	4.000	1	4.000	1.249	.268
CON GRA TASK	4.000	1	4.000	1.249	.268
EXPLAINED	98.778	7	14.111	4.405	.001
RESIDUAL	205.000	64	3.203		
TOTAL	303.778	71	4.279		

FILE NONAME (CREATION DATE = 81/09/15.)

* * * * * * * * ANALYSIS OF VARIANCE * * * * * * * *

CMP1
BY CON
GRA
TASK

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SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	81.118	3	27.039	13.909	.001
CON	2.000	1	2.000	1.029	.314
GRA	3.063	1	3.063	1.575	.214
TASK	76.056	1	76.056	39.123	.001
2-WAY INTERACTIONS	4.403	3	1.468	.755	.524
CON GRA	1.562	1	1.562	.804	.373
CON TASK	2.000	1	2.000	1.029	.314
GRA TASK	.840	1	.840	.432	.513
3-WAY INTERACTIONS	7.563	1	7.563	3.890	.053
CON GRA TASK	7.562	1	7.562	3.890	.053
EXPLAINED	93.083	7	13.298	6.840	.001
RESIDUAL	124.417	64	1.944		
TOTAL	217.500	71	3.063		

* * * * * * * * A N A L Y S I S   O F   V A R I A N C E * * * * * * * *

ALIM1
BY CON
GRA
TASK

* *

SOURCE OF VARIATION			SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS			14289.538	3	4763.179	7.520	.001
CON			50.501	1	50.501	.080	.779
GRA			13483.080	1	13483.080	21.287	.001
TASK			755.957	1	755.957	1.194	.279
2-WAY INTERACTIONS			737.757	3	245.919	.388	.762
CON	GRA		.423	1	.423	.001	.979
CON	TASK		571.783	1	571.783	.903	.346
GRA	TASK		165.551	1	165.551	.261	.611
3-WAY INTERACTIONS			15.471	1	15.471	.024	.876
CON	GRA	TASK	15.471	1	15.471	.024	.876
EXPLAINED			15042.767	7	2148.967	3.393	.004
RESIDUAL			40537.260	64	633.395		
TOTAL			55580.027	71	782.817		

* * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * *

DIFCMP1
BY CON
GRA
TASK

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SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	34.671	3	11.557	4.960	.004
CON	1.253	1	1.253	.538	.466
GRA	1.017	1	1.017	.436	.511
TASK	32.401	1	32.401	13.906	.001
2-WAY INTERACTIONS	8.215	3	2.738	1.175	.326
CON GRA	.128	1	.128	.055	.815
CON TASK	1.711	1	1.711	.734	.395
GRA TASK	6.376	1	6.376	2.736	.103
3-WAY INTERACTIONS	1.756	1	1.756	.753	.389
CON GRA TASK	1.756	1	1.756	.753	.389
EXPLAINED	44.642	7	6.377	2.737	.015
RESIDUAL	149.118	64	2.330		
TOTAL	193.760	71	2.729		

DIFATI
BY CON
GRA
TASK

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SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	44.135	3	14.712	7.595	.001
CON	5.390	1	5.390	2.783	.100
GRA	19.214	1	19.214	9.919	.002
TASK	19.531	1	19.531	10.083	.002
2-WAY INTERACTIONS	6.174	3	2.058	1.062	.371
CON GRA	.111	1	.111	.057	.811
CON TASK	5.500	1	5.500	2.840	.097
GRA TASK	.563	1	.563	.290	.592
3-WAY INTERACTIONS	.218	1	.218	.112	.738
CON GRA TASK	.218	1	.218	.112	.738
EXPLAINED	50.527	7	7.218	3.726	.002
RESIDUAL	123.967	64	1.937		
TOTAL	174.493	71	2.458		

DIFON
BY CON
COG
* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	11605.667	2	5802.833	2.627	.084
CON	8373.492	1	8373.492	3.791	.058
COG	3674.646	1	3674.646	1.664	.204
2-WAY INTERACTIONS	14357.560	1	14357.560	6.500	.014
CON COG	14357.560	1	14357.560	6.500	.014
EXPLAINED	25963.226	3	8654.409	3.918	.015
RESIDUAL	97182.253	44	2208.688		
TOTAL	123145.479	47	2620.117		

DEPENDENT VARIABLE: LIFE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	9.1666667	3.0555556
ERROR	44	45.5000000	1.0340909
CORRECTED TOTAL	47	54.6666667	

SOURCE	DF	TYPE I SS	F VALUE	PR > F
CON	1	6.1500000	5.95	0.0192
TASK	1	0.3333333	0.32	0.5731
CON*TASK	1	2.0833333	2.01	0.1623

DEPENDENT VARIABLE: ERD

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	23805.125000	7936.3750000
ERROR	20	42479.833333	2123.7916667
CORRECTED TOTAL	23	66284.958333	

SOURCE	DF	TYPE I SS	F VALUE	PR > F
CON	1	11162.041667	5.67	0.0178
TASK	1	7385.041667	3.48	0.0770
CON*TASK	1	2258.041667	1.07	0.3142

DEPENDENT VARIABLE: DIFON

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	14815.5625CCCC	4939.E541EEE7
ERROR	44	108329.91EEEEE7	2461.55265152
CORRECTED TOTAL	47	123145.47916667	

SOURCE	DF	TYPE I SS	F VALUE	PR > F
CON	1	7931.(2CE3333	3.22	C.C79E
TASK	1	143.12CE3333	C.0C	C.E1CE
CON*TASK	1	6745.(2CE3333	2.74	C.1C5C

FILE NONAME (CREATION DATE = 81/11/09.)

* * * * * * * * ANALYSIS OF VARIANCE * * * * * * * *

DIFSS
BY CON
TASK

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	77.083	2	38.542	6.340	.004
CON	75.000	1	75.000	12.336	.001
TASK	2.083	1	2.083	.343	.561
2-WAY INTERACTIONS	1.333	1	1.333	.219	.642
CON TASK	1.333	1	1.333	.219	.642
EXPLAINED	78.417	3	26.139	4.299	.010
RESIDUAL	267.500	44	6.080		
TOTAL	345.917	47	7.360		

DEPENDENT VARIABLE: DPHT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	2.15830969	0.98610323
ERROR	27	4.88013117	0.17333819
CORRECTED TOTAL	30	7.03844086	

SOURCE	DF	TYPE I SS	F VALUE	PR > F
CON	1	1.62513554	9.38	0.0049
TASK	1	0.44328915	2.56	0.1214
CON*TASK	1	0.88948440	5.13	0.0317

DEPENDENT VARIABLE: DCHT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	3	9.24713282	3.11571087
ERROR	27	26.17222222	0.96563786
CORRECTED TOTAL	30	35.41935484	

SOURCE	DF	TYPE I SS	F VALUE	PR > F
CON	1	8.00338845	8.29	0.0077
TASK	1	0.74929972	0.78	0.3802
CON*TASK	1	0.59444444	0.62	0.4397

VITA

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Candidate for the Degree of

Doctor of Philosophy

Thesis: THE EFFECTS OF EXTRINSIC REWARDS AND PERCEIVED COMPETENCE ON CHILDREN'S TASK PERFORMANCE AND INTEREST

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