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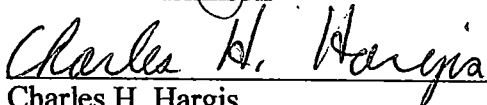


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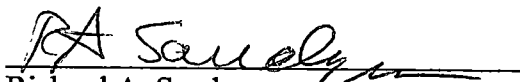
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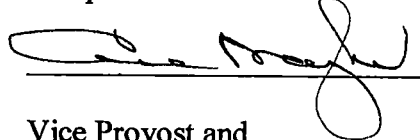


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CAUSING STUDENTS TO CHOOSE MORE LANGUAGE ARTS WORK:
AN EDUCATIONALLY VALID INVESTIGATION OF
THE INTERSPERSAL PROCEDURE

A Dissertation Presented
for the Doctor of Philosophy Degree
The University of Tennessee, Knoxville

Sadonya F. Meadows
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DEDICATION

This dissertation is dedicated to my family. Dad, thank you for giving me the opportunities you never had and for instilling in me the importance of education. You have provided the love and support that enabled me to achieve this accomplishment. Mom, thank you for instilling in me the desire to achieve and confidence to excel. You have taught me that hard work and dedication are truly the means to accomplishing goals and achieving success. To my sister, you set an example that motivated me to set high standards and taught me the importance of academic scholarship.

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ABSTRACT

The current study extended research on assignment choice and the interspersal procedure by exposing seventh-grade students to educationally valid, grade-level English assignments and requiring students to complete assignments with 20% more work. In Experiment 1, students were asked to work on control English assignments containing 20 discrete complex target tasks and experimental assignments containing 24 equivalent target tasks plus eight interspersed briefer/easier items. Students worked on each assignment for 10 minutes and did not complete either assignment. In Experiment 2, assignments were reduced to five target items (i.e., control assignment) and six target items plus two interspersed easy items (i.e., experimental assignment). Students completed both assignments within a class period. Across experiments, after working on the assignments students ranked the assignments for time, effort and ease and chose an assignment for homework.

No significant differences for time, effort, or ease rankings were found. However, significantly more students chose the experimental assignment for homework even though these assignments included 20% more target items plus the eight interspersed items. Experiment 1 showed, significantly greater item completion rates on experimental assignments relative to control assignments but no significant differences in academic performance (i.e., accuracy or item completion rate) on target items. Individual analysis of choice data showed that discrete task-completion rates accurately predict assignment choice across 85% of the cases.

Educators can improve assignment perceptions and the probability of students choosing to engage in assigned tasks by reducing assignment demands (i.e., watering down the curriculum). The current results show that educators can cause students to choose assignments that require more effort to complete by giving them more work (i.e., the interspersed items). Thus, the current study suggests that the interspersal procedure may be effective for increasing student learning rates by increasing opportunities to respond (i.e., thickening up the curricula).

Group and individual student findings support the hypothesis that completion of discrete tasks is a reinforcing event. Therefore, interspersing additional briefer tasks may enhance both tasks-completion rates and rates of reinforcement. Applied and theoretical implications are discussed and directions for future research are provided.

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CHAPTER I

INTRODUCTION

School and educational psychologists are committed to helping students by conducting research designed to enhance the learning process and to contribute to innovative change in educational environments. The resolution of problems in the classroom is dependent on conducting methodical experiments based on fundamental theories, models, principles, and previous empirical research. Attempts to utilize behavior analysis procedures to solve problems in educational settings began in the 1960's (Bijou & Baer, 1966; Birnbrauer, Wolf, Kidder, & Tague, 1965; Patterson, 1966; Zimmerman & Zimmerman, 1962). Most of the experiments contributing to this line of research were initially conducted in special education settings. The success of these experiments led many educators and researchers to believe that applied behavior analysis would "revolutionize" educational procedures throughout the country (Hall, 1991).

A pioneering series of studies in the general public school classrooms (Becker, Madsen, Arnold, & Thomas, 1967; Hall, Panyan, Rabon, & Braden, 1969) and the preschool setting at the University of Washington Child Development Laboratory (Harris, Wolf, & Baer, 1964; Hart, Allen, Buell, Harris, & Wolf, 1964; Wolf, Risley, & Mees, 1964) were launched in response to this movement. Over the years, behavioral researchers have made important contributions to the field of psychology and education. They have developed, implemented, and empirically validated a wide variety of procedures to alter classroom target behaviors, including academic responding (e.g., accuracy, completion rate), disruptive behavior (e.g., aggression, talking out), and on-task

behavior (Lentz, 1988). Despite these advances, the possibilities and promise associated with applying behavioral techniques and theory in the educational setting are, as yet, unrealized (Hall, 1991). Thus, researchers continue to contribute to the evolution and development of behavioral psychology in the schools (Skinner, 2001).

Behavioral researchers have a long history of studying choice behavior. Within educational setting students are often given academic assignments. While educators may assign tasks designed to help students practice skills such as independent seatwork (ISW), (Skinner, Robinson, Johns, Logan, & Belfiore, 1996), students can choose to engage a variety of behaviors including, assigned academic behaviors, passive nonacademic behaviors (e.g., doodling, daydreaming), inappropriate disruptive behaviors, or some combination of these behaviors (Lentz, 1988; McCurdy, Skinner, Grantham, Watson & Hindman, 2001; Shapiro, 1996; Winett & Winkler, 1972).

Active student responding to academic stimuli is often a necessary precursor for skill development (Skinner, Wallace, Neddenriep, in press). Unfortunately, in many instances, students may perceive academic stimuli and related tasks as aversive (Skinner, 1998). Students with skill deficiencies may perceive academic assignments requiring them to utilize underdeveloped skills particularly aversive because these tasks require much time and effort for them to complete (Binder, 1996; Skinner, 1998; Stanovich, 1986). Therefore, these students may be more likely to engage in alternative, competing behavior (e.g., doodling, talking to a peer, leaving the classroom) to escape or avoid these aversive academic tasks (Dunlap & Kern, 1996). As they avoid working on academic assignments, students with academic skill deficits fall farther and farther behind. This

downward spiral can enhance skill gaps and academic deficits while making it more likely that student choose to engage in nonacademic behaviors, as opposed to assigned activities (Skinner, 1998).

Many instructional strategies have been developed to prevent and to remedy academic skill deficits. Still, because learning often requires active responding by the students, none of these procedures are likely to be effective if students choose to engage in nonacademic behaviors (Berliner, 1984; Greenwood, Delquadri, & Hall, 1984). If educators can establish conditions (e.g., antecedents and consequent stimuli) and identify causal variables (e.g., rate of reinforcement, immediacy of reinforcement) that increase the probability of students choosing to engage in assigned academic behaviors, then they may increase appropriate academic behavior (e.g., student learning rates, on-task behavior) and simultaneously decrease inappropriate behaviors (Lentz, 1988; McDowell, 1988; Myerson & Hale, 1984; Skinner, 1998; Skinner, Hurst, Teeple, & Meadows, 2001).

Much research devoted to the resolution of problem behaviors in the classroom has been based on operant models of choice behaviors that allow for the prediction and control of choice behaviors (e.g., Baum, 1974; Davison & Ferguson, 1978; Herrnstein, 1961, 1970). Another line of research, addressing what is commonly referred to as the interspersal procedure, has demonstrated the effectiveness of task variation in improving students' perceptions of academic tasks or assignments and increasing on-task behaviors while reducing incompatible, aberrant behaviors. A more recent series of studies has suggested that combining these two lines of research may allow educators to develop a

more efficient curriculum that will have a positive effect on students' appropriate academic behavior while also enhancing their perceptions of academic assignments.

The focus of this study was to replicate and extend research combining basic choice research and the interspersal procedure to investigate the effectiveness of the interspersal procedure in an educationally valid setting with seventh-grade students in general education language arts classrooms. A secondary objective included investigating the strength of the procedure when students were required to complete interspersal assignments containing 20% more work. Additionally, researchers sought to determine if the interspersal procedure could be generalized to the subject area of language arts using grade-level materials.

CHAPTER II

REVIEW OF THE LITERATURE

The following literature review examines Herrnstein's Matching Law and interspersal research relating to student choice. The history, development, and educational application of these behavioral strategies will be discussed. Additionally, a recent line of research combining these procedures will be reviewed. An overview of previous studies incorporating the interspersal procedure and the Matching Law will be described and theoretical hypotheses and causal variables related to choice behavior will be analyzed.

The Matching Law

History and development. Richard Herrnstein (1961, 1970) pioneered basic behavioral research on choice behavior. He developed a mathematical model that allows for the prediction and control of an organism's choice of two incompatible behaviors, based on the relative rates of reinforcement provided for each behavior. Herrnstein demonstrated that the distribution of behaviors among concurrently available schedules is lawful and is dependent on the schedule and/or rate of reinforcement for each alternative schedule. This mathematical relationship has been termed the Matching Law. The term matching refers to an operant process describing how organisms distribute their behavior between two or more concurrent schedules of reinforcement that are dependent on the ratio of reinforcement provided. The Matching Law posits that when given a choice of two incompatible or competing behaviors, with all other variables held constant, an

organism is more likely to engage in the behavior that yields the higher rate of reinforcement.

Since Herrnstein's classic study, the basic tenets of the Matching Law have been supported in subsequent animal research (e.g., Catania, 1963, 1968; deVilliers, 1977; Findley, 1958). Furthermore, this mathematical law has been validated across species, organisms, behaviors, settings, and experimenters (deVilliers, 1977). Many studies have confirmed and extended principles and procedures originally developed in Herrnstein's animal laboratory to human behavior in applied settings (Binder, 1996; Mace, McCurdy, & Quigley, 1990). In a review of the literature on the Matching Law with human subjects, Pierce and Epling (1983) found that most studies confirmed that humans also distribute their behavior in relation to the rate of reinforcement for response alternatives. Expansive application of the Matching Law has been made in the industrial setting (e.g., Mawhinney & Ford, 1977; Mawhinney & Gowen, 1990) and in the educational setting (e.g., Martens & Houk, 1989; Myerson & Hale, 1984).

Educational application. According to the Matching Law, one way to get students to allocate more of their time to appropriate academic activities would be to provide a thicker schedule of reinforcement for academic versus incompatible, nonacademic behaviors. If rates of reinforcement are increased for engaging in academic behavior, then students are more likely to engage in assigned tasks, such as independent seatwork, that increase skill development and that are less likely to spend their time engaging in competing, alternative, and perhaps disruptive behavior (Horner, Day, Sprague, O'Brien,

& Heatherfield, 1991; Martens & Houk, 1989; Martens, Lochner, & Kelly, 1992; Myerson & Hale, 1984).

Martens and colleagues (1989, 1992) examined how the matching theory could be applied in the classroom setting to help educators increase the probability of students choosing to engage in academic work. For example, Martens and Houk (1989) externally manipulated relative rates of social reinforcement contingent on academic engagement with a retarded adolescent girl. Results indicated that Herrnstein's (1970) mathematical model could account for 83% of the variance of disruptive behavior and 44% of the variance in on-task behavior, after correcting for nonzero intercepts of the mathematical function.

Subsequently, Martens et al. (1992) evaluated the single-alternative form of the Matching Law in an applied educational setting by experimentally altering the rates of social reinforcers with two fourth-grade students in their elementary school classroom. Researchers provided social reinforcement in the form of verbal praise as a response to academic engagement on a variable-interval (VI) schedule. The richness of the variable-interval schedule was increased in four phases (VI 5 min, VI 4 min, VI 3 min, and VI 2 min). As the VI schedule decreased, the percentage of time academically engaged increased, matching Herrnstein's (1970) hyperbolic function. Findings indicated that Herrnstein's equation accounted for a significant proportion of the variance in student engagement. A follow-up study (Martens et al., 1992) incorporating an alternate treatment design upheld these results.

Other researchers have investigated Herrnstein's Matching Law in educational settings and demonstrated that this procedure can be utilized to influence student choice behavior between two distinct academic tasks or assignments (Mace et al., 1990; Mace, Neef, Shade, & Mauro, 1994; Neef, Mace, & Shade, 1993; Neef, Mace, Shea, Shade, 1992). For example, Mace et al. (1994) investigated choice or preference of three adolescent students with special education needs when working on two available sets of math problems. Researchers provided tangible reinforcement in the form of nickels as a response to academic engagement on a variable-interval schedule. The thickness of the reinforcement schedule was increased in three phases with 2:1, 6:1, and 12:1 ratios. Although, findings indicated disproportionate matching due to spillover effects, (i.e., difficulty discriminating change in schedules), results showed a clear linear relationship between reinforcement schedules and time allocation to math problems.

Variables impacting matching. Several studies have shown that when students were given the choice of two academic assignments, they were more likely to choose to engage in the academic assignment that yielded the higher rate of reinforcement (e.g., Mace et al., 1990; Neef et al., 1992; Neef et al., 1993; Neef, Shade, & Miller, 1994). Although, rate of reinforcement has been the primary variable investigated in basic research involving the Matching Law, several additional variables have been shown to impact student choice behavior in the educational setting (Dunlap & Kern, 1996).

For example, researchers have found effort to be a significant variable on choice allocation under concurrent schedules of reinforcement. Horner and Day (1991) examined the role of response efficiency in the application of functional equivalence

training with a group of developmentally delayed subjects. The purpose of this study was to teach socially appropriate alternative behaviors to replace maladaptive behaviors.

Researchers analyzed three causal variables in relation to response allocation: physical effort, schedule of reinforcer delivery, and time delay between discriminate stimulus and reinforcement delivery. Findings indicated that subjects continued to choose competing maladaptive behaviors as long as these behaviors were more response efficient (i.e., required less effort). However, there was some success in the reduction of maladaptive behavior when the replacement behavior required an equivalent amount of effort.

Previous studies have shown that students were more likely to engage in assigned tasks when high-quality reinforcers were provided (e.g. Neef et al., 1993; Neef et al., 1994) and when reinforcers were delivered more immediately (Mace et al., 1990; Neef et al., 1993, 1994). For example, Neef et al. (1994) investigated choices of five students diagnosed as Seriously Emotional Disturbed to determine the effects and interactions of unequal rates of reinforcement, unequal delay to reinforcer, and reinforcer quality. Findings indicated a bias toward immediate access to reinforcers with reinforcer quality overriding the effects of rate and delay to reinforcer access for one student. Neef et al. (1992) examined how three special education students chose to allocate their time between two concurrently available mathematic assignments during unequal rates of reinforcement across equal and unequal qualities of reinforcers. Findings indicated a disruption in predicted matching when quality of reinforcers differed, showing a bias toward the higher quality reinforcer.

Other studies have demonstrated the effect of reinforcer delay (e.g., Mace et al., 1996; Neef et al, 1993, 1994). Neef et al. (1993) showed that, when access to reinforcement was immediate, students' allocation toward concurrently available sets of math problems was sensitive to rate of reinforcement. However, when response alternatives were associated with unequal delays to reinforcers, students exhibited a bias (i.e., impulsivity) toward the more immediate alternative. Students were found to allocate time toward the response providing the most immediate reinforcement even when the schedule of reinforcement was thinner for that response option (i.e., fewer nickels). Horner and Day (1991) also showed delay of reinforcement to be an influential variable on student choice behavior.

These findings are important because they provide an explanation for disrupting matching based solely on rates of reinforcement in the natural environment (Pierce & Epling, 1983). Furthermore, investigation of the relative potency of dimension should suggest how variables could be manipulated and combined to impact choice of students toward the most adaptive behaviors (Neef et al., 1993).

Limitations. There are several limitations to applying Herrnstein's Matching Law in the typical classroom setting. For example, it would be difficult to monitor target behaviors and immediately deliver reinforcement contingent on each student's response (Skinner, Robinson et al., 1996). Additionally, most choice research conducted in educational settings requires an agent to distribute tangible and/or social reinforcement contingent on students' behaviors. Often teachers are not able or not willing to monitor and implement intensive behavioral procedures that may not be time or resource efficient

(Hall, 1991). Due to these limitations, researchers have pursued other behavioral techniques related to curricular revisions and modifications as a means to improve academic engagement and enhance student preference (i.e., choice) of academic tasks.

Altering academic assignments

Task variation: History and development. In school settings, the curricular and instructional expectations largely define a student's school day. Active participation in these activities is vital for appropriate skill acquisition and development. However, a common complaint from classroom teachers involves student work-completion rates. Therefore, curricular alterations have been a topic of interest among researchers in the field of education who are interested in developing efficient procedures for increasing academic responding (Dunlap & Kern, 1993; Dunlap & Kern, 1996; Munk & Repp, 1994). Researchers have shown that direct manipulation of academic materials may be an effective procedure for increasing appropriate academic behavior and enhancing students' perceptions of those tasks. Two of the most effective curricular modifications in relation to improving students' perceptions involve quantitative and/or qualitative reductions (i.e., less time or effort, respectively) of assigned activities (Cates, 2001; Cooke, Guzaukas, Pressley, & Kerr, 1993; Horner & Day, 1991; Kern, Childs, Dunlap, Clarke, & Falk, 1994).

Quantitative alterations. Dunlap and Kern (1996) described examples of enhancing students' perceptions of independent work by reducing academic assignment length. Furthermore, reducing the assignment demands was shown to result in increased rates of appropriate behaviors and decreased rates of inappropriate behaviors. This

quantitative reduction strategy has been shown to be effective with a variety of populations (e.g., Dunlap, Foster-Johnson, Clarke, Kern, & Childs, 1995; Dunlap, Kern-Dunlap, Clarke, & Robbins, 1991) in a number of settings (e.g., Dunlap et al., 1993; Kern et al., 1994; Umbreit, 1995).

Qualitative alterations. Gickling and Armstrong (1978) found task difficulty level to be inversely related to on-task behavior and task-completion rates. Gickling and Thompson (1985) conceptualized that, as ratios of known items to unknown items in a student drill and practice activity drop below the 70th percentile, students' on-task level would decrease. For example, Morales (1977) showed that middle school students with a long history of failure significantly improved their on-task behavior when the curriculum was presented so that students were able to achieve a higher ratio of success (70-80%). Research conducted by Dickinson and Butt (1989) found that changing the ratio of known to unknowns in a curriculum produced mixed result on measures of on-task behavior for low-achieving versus high-achieving students. These findings suggest that increasing known to unknown items (i.e., qualitative substitutive interspersal) in a curriculum may be most influential in influencing on-task behavior of students with deficit skills. Additionally, Hargis (1987) contended that high success ratios improve students' learning rate by allowing students to practice "correct" responses. Weeks and Gaylor-Ross (1981) showed task difficulty to be related to rates of aggression and crying in students with severe disabilities. When experimenters manipulated curriculum to reduce effort or implemented "errorless learning" tasks, students' inappropriate behaviors decreased.

Other research (e.g., Roberts & Shapiro, 1996; Roberts, Turco, & Shapiro, 1991) indicates that reducing academic demands by means of substitutive interspersal with general education students may not be preferred because they have been shown to reduce overall learning rates. For example, Roberts et al. (1991) compared sight-word acquisition rates for known to unknowns across four conditions (10%, 20%, 40%, and 50% unknowns). Findings of this study showed that students' learning rates were best under the 50% known to 50% unknown condition. Subsequently, Roberts and Shapiro (1996) compared acquisition rates of known to unknown sight words across three conditions (20%, 50%, and 90%). Findings demonstrated that word-acquisition rates increased proportionate to presentation of unknowns.

Limitations. Curriculum revisions and modifications that have been proven to be effective in improving student perceptions often involve reducing assignment length and/or effort to complete the task, thus compromising curricula integrity. Techniques that "water down" the curriculum are often unacceptable to educators because they reduce learning rates and create skill gaps for students participating in the lock-step program utilized in most general education classrooms.

Interspersal and choice research

Introduction. Both the substitutive-interspersal procedures and operant reinforcement procedures based on Herrnstein's (1961, 1970) Matching Law have demonstrated greater on-task behavior and more favorable student perception of academic work. However, these procedures are not without significant procedural and resource-efficiency limitations that reduce the likelihood of their implementation in

educational settings. The substitutive-interspersal procedure potentially jeopardizes students' learning rates by reducing their opportunity to respond to target skills. Procedures geared toward increasing reinforcement for appropriate academic behavior can be difficult to implement in educational settings because of the need for an agent (e.g., teacher, computer) to administer immediate tangibles (e.g., nickels, tokens, points) or social reinforcement (e.g., praise) contingent upon student choice behavior (e.g., Skinner et al., 1999; Skinner, Robinson et al., 1996).

A relatively recent line of behavioral research has combined these procedures in an attempt to increase student perception of academic assignments without increasing the rates of educator-delivered reinforcement and without qualitatively and/or quantitatively reducing assignment demands (Cates & Skinner, 2000; Cates et al., 1999; Logan & Skinner, 1998; Skinner, Fletcher, Wildmon, & Belfiore, 1996; Skinner et al., 1999; Skinner, Robinson et al., 1996; Wildmon, Skinner, McCurdy, & Sims, 1999; Wildmon, Skinner, & McDade, 1998). Findings suggest that, in some instances, educators may be able to alter assignments using a variation of the interspersal technique to make assignments, more acceptable to students without reducing assignment demands.

Skinner and colleagues altered academic assignments by adding briefer and easier items to academic tasks instead of substituting target tasks with easier tasks. This additive procedure does not reduce the number of acquisition trials but, instead, adds additional, very brief maintenance trials throughout a specified number of learning trials (e.g., every third target task). Skinner and colleagues have conducted a series of studies that showed students' perceptions (choice) of discrete mathematic assignments could be enhanced by

using this variation of the interspersing procedure (Cates & Skinner, 2000; Cates et al., 1999; Logan & Skinner, 1998; Skinner, Fletcher et al., 1996; Wildmon et al., 1999; Wildmon et al., 1998).

In the initial study of the meshing of the interspersal procedure and matching theory, Skinner, Robinson et al. (1996) administered two mathematical assignments to a group of college students participating in an undergraduate psychology class. Students were asked to complete both a control assignment consisting of 16 three-digit by two-digit (3×2) target problems and an experimental assignment containing 16 three-digit by two-digit (3×2) problems plus an additional 6 one-digit by one-digit (1×1) problem interspersed every third target problem. After working on each assignment for an equivalent amount of time, students were asked to rate the assignments and choose which they preferred for homework. A significant number of students selected a new experimental assignment to complete for homework, even though it contained more problems. Performance rates and accuracy levels on target problems across assignments were not significantly different.

Interspersal effects on student behavior. The interspersal procedure has been found to improved students' perceptions of ISW without quantitatively (i.e., reducing assignment length) or qualitatively (i.e., less effort) reducing assignments, while maintaining accuracy levels of target tasks (Cates & Skinner, 2000; Logan & Skinner, 1998; Wildmon et al., 1999; Wildmon et al., 1998). Research has also demonstrated that the interspersal procedure is an effective curricular modification in increasing student on-task behavior. For example, McCurdy et al. (2001) evaluated the effects of the

interspersal procedure in an elementary school girl experiencing high rates of off-task behavior during ISW. Using an alternating treatments design, the experimenters monitored student on-task behavior while she worked on control and experimental assignments. Findings demonstrated that the interspersal procedure improved on-task behavior during ISW. Skinner et al., (in submission) conducted a subsequent experiment with four emotionally disturbed students participating in a summer program at a self-contained school. Using alternating treatment designs, data for on-task behavior was collected for 14 days. Findings indicated that the procedure was effective in improving on-task behavior during ISW for three of the four students.

Perhaps the most exciting finding of the interspersal technique is that the procedure may not only enhance students' perceptions of academic assignments but also cause students to prefer assignments with more work (Cates & Skinner, 2000; Cates et al., 1999). Cates and Skinner (2000) showed that interspersing brief problems caused students to choose (i.e., prefer) academic assignments containing 20% and 40% more target tasks. This finding is fundamental to the goal of education to increase learning while also creating a desire for knowledge.

Interspersal and choice: Causal mechanisms. Some researchers have attempted to ascertain what variables account for the effectiveness of the interspersal technique. There are several hypotheses as to why this additive interspersal procedure improves students' preference of assigned academic tasks.

The possibility of novelty as an explanation has been ruled out through carefully conducted experiments. For example, Skinner, Robinson et al. (1996, Experiment II)

interspersed different types of tasks (e.g., division problems) within multiplication assignments to investigate this speculative causal variable. Findings suggested that the ease and quickness, not the novelty, of the interspersed tasks accounted for the differences in assignment preference.

Another hypothesis suggests that the interspersal procedure is effective because the interspersal tasks are easy (i.e., less difficult), which boosts students' success level, resulting in enhanced self-concept (Logan & Skinner, 1998; Neef, Iwata, & Page, 1980). Success has long been considered to be a motivator of academic performance (Atkinson & Feather, 1966; Bloom, 1971; White, 1959) especially with low-achieving students (Gickling & Thompson, 1985; Hargis, 1987). One hypothesis is that the briefer and easier tasks increase students' level of success, thereby increasing their perception of the assignment (Dickinson & Butt, 1989).

Skinner, Fletcher et al. (1996) attempted to determine whether the ease or brevity of the additive interspersed tasks accounted for students' assignment preference. Researchers developed control mathematics assignments containing 16 3×2 digit problems and two types of experimental assignments. Each experimental assignment contained 16 equivalent 3×2 problems and six additional interspersed problems. On one type of experimental assignments, additional easy but lengthy 4-digit plus 4-digit problems (e.g. $2133 + 3221$) were interspersed. On the other type of experimental assignments, additional brief but more difficult 2-digit divided by 1-digit problems (e.g. $25/5$) were interspersed. Results showed that students preferred experimental assignments when additive interspersed problems were brief (i.e., division problems) rather than less

difficult (i.e. the addition problems). These results suggest that problem ease may not account for enhanced student perception of assignments when additional tasks are added and interspersed.

Martin, Skinner, & Neddenriep (2001) conducted a study which also suggests that the ease of the interspersal task not accounting for the interspersal procedure in making assignments more acceptable to students. In this study, researchers investigated the effects of the interspersal procedure on perceptions of reading tasks with a group of seventh-grade students. Students read both a control and experimental reading passage. Experimental assignments contained additional brief (i.e., 16 words) and easy (i.e., first-grade level) paragraphs interspersed within an assigned reading passage. Students were asked which assignment they liked most and would like to read again. Results from this study failed to confirm early findings utilizing the interspersal procedure. No differences were found for preference, choice, or effort between passages; however, students selected the control passage as requiring less time. Inconsistent findings between mathematics and reading studies may indicate causal variables responsible for the effectiveness of the interspersal procedure. Researchers theorized that because the reading passages were a continuous task, adding the brief, easy paragraphs just made the passages more time consuming. This finding suggested that the interspersal procedure may improve assignment perception only when interspersing relatively brief, discrete tasks. Furthermore, the fact that the interspersal paragraphs should have allowed students to engage in more successful reading, which has been shown to enhance self-concept and perception of assignments, was not supported as a causal variable.

Other explanations have suggested that students prefer the interspersal procedures because the additional interspersed tasks require relatively less time to complete than target tasks (Skinner & Hall, 1999). Researchers proposed that when given an academic assignment with multiple discrete tasks, completing each task was a conditioned reinforcer (Cates & Skinner, 2000; Cates et al., 1999; Logan, & Skinner, 1998; McCurdy et al., 2001; Skinner, Fletcher et al., 1996; Skinner et al., 1999; Skinner, Robinson, Johns, & Belfiore, 1996; Wildmon et al., 1999; Wildmon et al., 1998). This hypothesis is based on an assumption that most students have a history of being reinforced for assignment completion in which they have experienced reinforcement for task completion.

In many situations, completing an assignment has been linked with students being able to engage in preferred activities (positive reinforcement) or escape and/or avoid aversive consequences (e.g., Iwata, 1987) associated with not completing the assignment (negative reinforcement). Often students receive positive tangible reinforcers (e.g., points, tickets, tokens) or social reinforcers (e.g., attention, praise) for completing academic assignments. Based on the Premack principle (1965) completing tasks may be positively reinforcing because assignment completion has been linked to the opportunity to engage in higher probability behaviors following task completion. For example, students may be allowed to choose a preferred activity (e.g., read a book of choice, play a game, go to recess) after they complete assigned ISW. Likewise, the Premack principle suggested that completing a problem or assigned task may be negatively reinforcing because students avoid negative consequences that may be delivered contingent upon them not completing their assignments. Other research on positive practice

overcorrection (e.g., Fox & Jones, 1978; Ollendick, Matson, Esueltd-Dawson, & Shapiro, 1980) and contingent skipping (e.g., Lovitt & Hanson, 1996) suggested that assignment completion may be negatively reinforcing.

Skinner and colleagues (1999) suggested that prior conditioning (i.e., learning history) may cause completion of assignment demands to be a generalized conditioned reinforcer. Based on classical conditioning, if completing an assignment has been reinforced, then stimuli that consistently precede assignment completion should take on the reinforcing properties of assignment completion and become a conditioned reinforcer through the process of higher-order conditioning (Skinner et al., 1999). This phenomenon is commonly referred to as the delay reduction hypothesis (Fantino, 1969).

If discrete task completion is a reinforcing event, then the interspersal technique may be explained by the relative richness of ratios of the different schedules of reinforcement across two assignments. Researchers have found that the interspersed task that requires less time to complete increases rates of task completion. For example, Skinner, Robinson et al. (1996) found that subjects on average completed 13.51 discrete tasks on the experimental (interspersal) assignment as opposed to an average of 9.94 discrete tasks on the control assignment. Therefore, they suggested that this increase in task completion resulted in an increase of reinforcement, thereby accounting for students' preference for the experimental assignment. They linked this causal hypothesis to the underpinning theory of Herrnstein's Matching Law (1961), suggesting that relative discrete task completion rates predict student choice behavior in a precise manner that is lawful and mathematical in accordance with the Matching Law. If discrete problem completion is a

reinforcing event, the Matching Law would explain why significantly more students chose the experimental assignment over the control assignment.

Alternative Models

Research related to the Premack principle and response deprivation also suggested that within an assignment, item completion may account for these results. The Premack principle and research on response deprivation suggested that the opportunity to complete briefer items is a reinforcing event.

Premack principle. Within the context of the two assignments, previous research suggested that the briefer problems that require less effort to complete would be preferred over the problems that require more time to complete (Horner & Day, 1991). If these problems are preferred they can be considered higher probability responses. Based on the Premack principle (1965), while working on experimental assignments, there is a contingent relationship between completing low-probability target items (i.e., longer, higher effort items) and the opportunity to complete the preferred interspersed items (i.e., briefer, lower effort items). Specifically, students must complete three longer items (low-p behavior) before they have the opportunity to engage in the higher-probability behavior (i.e., work on the brief items). If the opportunity to work on briefer items is a reinforcing event, because these items are never present on the control assignments, the schedule of reinforcement associated with working on the control assignments is thinner than that for working on the experimental assignments.

Response deprivation. Response deprivation is a broader model that incorporates the findings of the Premack principle (Timberlake & Allison, 1974). Based on response

deprivation research, specific responses do not have to be higher probability responses to serve as reinforcers. Instead, reinforcement occurs when baseline schedules of reinforcement are altered and disrupt free-responding baseline levels (Timberlake & Farmer-Dougan, 1991). Put another way, this model states that organisms are reinforced when schedules are altered in a manner that allows them to influence schedules of reinforcement and of responding with their behavior (Konarski, Johnson, Crowell, & Whitman, 1981).

In the interspersal studies, the control assignments only provide students the opportunity to perform one type of response (i.e., complete target tasks). Regardless of their behavior (e.g., completing a 3-digit by 2-digit problem), the next response will again provide only the opportunity to complete another target task (e.g., another 3-digit by 2-digit item). Thus, there is little opportunity (i.e., response deprivation) for students to alter schedules of responding and/or schedules of reinforcement through their academic behavior. However, while working on experimental assignments, students can alter their schedules of responding. Specifically, by completing target tasks (e.g., three 3-digit by 2-digit problems) students alter their responding schedule to allow them to complete a different task (e.g., a 1-digit by 1-digit problem). This opportunity to alter responding schedules and/or schedules of reinforcement should make the experimental assignments more reinforcing to students.

Both the Premack principle and the less popular but more precise and useful response deprivation hypothesis (Konarski et al., 1981) would suggest that students should choose the experimental assignment over the control. However, neither of these

models contradicts the previous model with respect to conditioned reinforcement and the Matching Law as all three models suggest that schedules of reinforcement account for students choosing the experimental assignment.

Purpose of this Study

Purpose 1. The purpose of the current study was to not merely replicate earlier findings but to also extend those findings. A primary purpose of this study was to investigate the interspersal procedure in a more educationally valid setting. The intent of ISW is to give students the opportunity to practice recently acquired skills in order to help them achieve mastery of those skills (Skinner & Schock, 1995). However, much of the research on the interspersal procedure has been conducted with subjects responding to academic tasks that are not part of their general curriculum. In fact, most studies have required subjects to respond to already-mastered target tasks that are well below their instructional level (e.g., college students completing 3×2 multiplication problems as target items). In the current study, academic assignments were composed of instructional-leveled target tasks using grade-appropriate materials that were part of the participants' general language arts curriculum. The experimental procedures were conducted during the students' regularly scheduled language arts class in which they received a classroom participation grade for completing the assignments. Additionally, experimental procedures were conducted following teacher presentation of content material; thus, assignments provided an authentic opportunity to apply and practice recently acquired skills that students had not yet mastered.

Purpose 2. Previous studies (e.g., Cates & Skinner, 2000) have demonstrated the strength of the interspersal procedure by getting students to choose (i.e., prefer) math homework assignments with 20% and 40% more target problems. However, past researchers investigating the strength of the interspersal procedure have required students to work under timed conditions where they did not complete these assignments. Therefore, even though the experimental assignments contained more work, participants did not actually complete significantly more target tasks. A second purpose of this study was to investigate the strength of the interspersal procedure with language arts assignments containing 20% more target tasks (Experiment 1) and to determine if students would prefer and choose language arts assignments containing more target tasks under un-timed procedures where the students were required to complete more work (Experiment 2).

Purpose 3. The third purpose of this study was to examine interspersal choice data at the individual level. According to the mathematical model of the Matching Law (1961), students should always choose the assignment that results in the thicker schedule of reinforcement (i.e., greatest number of completed tasks). Although, many interspersal studies have demonstrated that students prefer the experimental to the control assignment at a statistically significant level, no previous studies have accounted for the undermatching that occurs (Skinner, in press). However, previous studies have analyzed group data and did not match individual task-completion rates of control and experimental assignments to student choice. Even though past studies found that the interspersal procedure did increase problem completion rates for the experimental

assignment at the group level, not all students necessarily completed more tasks on this assignment due to extraneous variables (e.g., motivation, sequence of assignment, classroom distractions). If students did complete more tasks on the control assignment, then the Matching Law would predict that those students would choose that assignment as being their preferred choice, thus accounting for undermatching. This study will specifically analyze each student's task-completion rates across assignments to determine if these data predict choice at the individual level. Thus, the current study incorporates a more comprehensive assessment of individual choice behavior to determine if students do, indeed, choose the assignment in which they complete the greatest number of tasks.

Purpose 4. Past research suggested that the interspersal procedure can be utilized to improve students' perceptions of ISW; however, most research investigating the interspersal procedure has been conducted on mathematic-computation assignments. Since mathematics is a subject that often requires students to perform multiple discrete tasks, it is important for researchers to delineate if the interspersal technique can be generalized to other assignments composed of discrete tasks. Thus, a final purpose of this study was to extend research to the subject of language arts to determine if the interspersal procedure can improve student's perceptions of ISW in this content area.

CHAPTER III

METHODS

This study consisted of two experiments (Experiment 1 and Experiment 2). This chapter describes the participants and setting, materials, procedures, independent variables, dependent variables, experimental design, and data analyses procedures associated with each experiment.

Experiment 1

Participants and setting. The participants in this study included students enrolled at a local public school in the southeastern U.S. The school site selected for the study was a middle school comprised of 1182 students in grades six through eight. There were 388 sixth graders, 383 seventh graders, and 411 eighth grade students attending this school. Four seventh-grade English classes participated in the study. The classes selected for the study were all general education English classes. Each student enrolled in these classes was given the opportunity to participate in the study. Of 99 students enrolled, a total of 72 students participated.

Participation in the study was voluntary. Informed written consent of the parent or guardian and student written assent were required from each participant prior to implementation of the experiment (see Appendix A). All students who returned parental or guardian written consent provided written assent. Participants were informed that they could cease participation in the study at any time without penalty or loss of services to which they were entitled. No students withdrew assent during the course of this project. Data from 14 students was excluded from the analysis due to failure to adhere to

instructions (e.g., skipping items, failure to respond to post-assignment questions). Thus, the final group of participants in the data analysis included 56 students, 33 males and 23 females, who ranged from 12 to 14 years of age. Of this group, 76.8% identified themselves as Caucasian, 8.9% as African America, 8.9% as Other, and 3.6% chose not to respond to the inquiry of race. Confidentiality of all students was maintained, as no identifying information was used in this study. Participants were assigned a number code that was used in computer data files and in the research analysis.

The experiment was conducted during the participants' regularly scheduled Language Arts class with the teacher and other students present. The students sat in their assigned seats with no materials, other than a writing utensil. Students were not allowed to use class materials (e.g., notes, text, etc.) to assist them with the assigned tasks involved in the experiment, nor were students allowed to talk to classmates during the activity. The experimental procedure took approximately 50 minutes of the allotted 75-minute class period. A school psychology student served as the primary researcher for this project. The general education teacher of the classes selected for this study was present during the experimental procedures and assisted the primary experimenter during the actual data collection.

Materials. The materials included in this study consisted of a name sheet, a cover sheet, a control assignment, an assignment sheet separator, an experimental assignment, and a post-assignment questionnaire. All materials were presented to participants in packet form. The sheets included in the packet were on standard 8.5 x 11-inch paper. Assignments were letter coded (i.e., Assignment L or Assignment J). Half of the control

assignments were labeled Assignment L and half were labeled Assignment J. Likewise, half of the experimental assignments were labeled Assignment L and half were labeled Assignment J. In addition, there were two sets of equivalent target items (20 items in each set). These sets of target items were counterbalanced between assignment titles (Assignment J or Assignment L) and between assignment types (experimental or control). Experimental assignments included eight additional interspersed items and four additional target tasks (20% more target items). Each participant was given a packet with two assignments (control and experimental). Hence, there were eight packet variations with counterbalancing used to control for sequence effects (half of the student received and experimental assignment first and half a control assignment), assignment label preference (half of the control assignments were labeled J and half were labeled L) and item set preference or ease (both sets of the initial 20 target items were assigned to the control assignments for 50% of the packets and the experimental assignment for the other 50% of the packets. Assignments were separated by a single white sheet with a stop sign in the middle of the page, informing students to “STOP AND WAIT FOR INSTRUCTION” (see sample packet, Appendix C).

A “NAME SHEET” was included on the top of each packet. The participant’s names were only on this sheet of the packet. Below the students name was a space for an assigned code number that was to be completed at a later date by a researcher not involved in the actual data collection proceedings. All sheets following this name sheet included a space for the student code in the top right-hand corner of the page. The following page, titled “COVER SHEET”, included personal and demographic data of the

participants. Students were asked to complete questions regarding age, grade, gender, and race. Also, they were asked to rate the subject under investigation, language arts, on a 5-point Likert scale (see sample packet, Appendix C). The cover sheet was followed by two language arts assignments. Each participant was given both a control and an experimental assignment to complete.

These assignments were developed by the primary researchers, based on a review of materials utilized in the students' curriculum and a consultation with the classroom teacher regarding activities typically required of students during independent-work time. Assignments were intended to be at an instructional seventh grade-level, involving tasks that had recently taught to students in the sequence of their curriculum (Fundamentals of English). Target tasks were taken from curriculum textbooks and supplementary workbooks (Houghton Mifflin English, 1990). The classroom teacher presented a lesson on the assigned tasks prior to the experimental proceedings. Specifically, the task required students to apply knowledge and skills taught during the last 2-3 weeks. Therefore, all worksheets entailed a review of recently acquired knowledge or skills. The goal of these assignment sheets was to provide extra practice of instructional skills that students could complete independently and accurately, yet still needed some practice in order to achieve mastery.

The control assignment consisted of 20 target items (item set one or two, previously described) that included tasks involving identification of predicate nouns and adjectives, transitive and intransitive verbs, and direct and indirect objects. In addition, some items required students to list nouns or verbs in a passage, add needed end

punctuation, insert apostrophes, or identify correct verb tense. The control items were not numbered; and spacing, font, and formatting were not held constant preventing students from making a surface judgment based on empirical data (e.g. the number of items on the sheet). Nevertheless, items were separated with bullets so students could easily recognize when they had completed an item. Additionally, each item had its own set of instructions to further aid in discriminating one item from the next.

Since each item was composed of several parts researchers felt it necessary to investigate student perception of items included on the assignment sheets. Consequently, during a pilot study of this experiment, 6 seventh-grade students were asked to review assignment sheets and point out what they thought to be an item. The researchers sought to ensure that items were clearly differentiated and perceived to be a single, discrete task. Students participating in the pilot study had no difficulty distinguishing one item from another and confirmed that the type of format used on the language arts assignments was similar to tasks required on typical seventh-grade assignments utilized in their general education classroom.

The experimental assignment consisted 24 target items (20 target items in either item set 1 or 2, plus four additional target items) and 8 interspersed brief and easier items. Thus, the experimental assignment included 20% more target items. The target items on the experimental assignment were carefully designed to be similar in length, level of difficulty, and content. For example, if item one of the control assignment entailed identifying all verbs in the passage and label them transitive or intransitive, then the corresponding item on the experimental assignment would require identification and

labeling of all verbs in a matched passage. All corresponding matched items contained the same number of sentences and were within two words of one another. For example, if the first target item on the control assignment consisted of proofing four sentences containing a total of 34 words, then the corresponding experimental target item would be comprised of four sentences containing 32 -36 words.

The brief and easier items interspersed on experimental assignments were developed to be at a mastery level for students completing the assignment. These tasks involved lower level skills that should be automatic to students functioning at the level of the selected population. Additionally, interspersed items were very short. Specifically, students were required to circle the verb or noun in a two-word sentence. These items were interspersed at a fixed-ratio rate following every third target item. Similar to the control assignment, items on the experimental assignment were not numbered. Spacing, formatting, and font of these items were not held constant, preventing impetuous judgment of the assignment, previously described. Items were differentiated by bullets, with a separate set of instructions for each item.

Two homework assignments were constructed for this study. One homework assignment contained 20 target problems; whereas, a second homework sheet contained 24 target problems and 8 interspersed, easier-brief problems. Homework assignments were modeled after control and experimental assignments previously described (i.e., identical number of tasks, similar length, and similar difficulty levels).

Experimental procedures. The primary researcher visited all selected classes prior to the experiment to inform students of the study and to solicit participation. An informed

written-consent form was given to students to take home to parents. Students presenting written parental consent by the day of the experiment were asked to complete a student-assent form. Information included on this form was read aloud to students by the primary researcher administering the experimental procedures (Appendix A). Students assenting participation signed and returned the assent form prior to distribution of experimental material.

Assignment packets were distributed to all students in the four English classes participating in this research study. The classroom teacher chose to use the assignments as an independent-work assignment and all students received a class-participation grade for the assignment whether or not they participated in the study. Assignment packets of students not participating in the study were returned to the classroom teacher and were not included in the final data analysis. The experiment was conducted in the students' classroom during the regularly scheduled class period. Eight assignment packet variations, previously described, were presented face down in a counterbalanced order as to control for sequencing effects (e.g., practice or fatigue). Students were instructed to leave material face down and to not proceed with activity until further instructed. A standardized set of instructions was used for all four classes participating in the study (see Appendix B). First, students completed the name page followed by a cover sheet including personal and demographic information (e.g., age, grade, gender, and race). Students were also asked to rate their English class on a 5-point Likert-Type scale indicating how well they liked the subject matter.

Next, students were instructed to begin the first assignment in their packet. They were told to complete items in the order in which they were presented and to not skip any problems. An opportunity for questions was given before each administration and students were instructed to raise their hand for assistance if they had questions at anytime during the ISW activities. Students were given 10 minutes to complete each assignment in their packet. Given the lengthiness of the assignments, students were not expected to complete the entire assignment during this allotted time. However, if students finished their first assignment early, they were instructed to put down their pencil, sit quietly, and not proceed to the next assignment. Instructions were repeated between assignments. Start and stop time of each assignment was monitored by the primary researcher and the assisting classroom teacher.

Following administration of the language arts assignments, the participants were asked to complete a post-assignment questionnaire to evaluate the materials. The primary experimenter had the questions and instructions in printed form before her to ensure that questions were posed in the same manner for each class participating in the study. Students were asked which assignment was most difficult, which required the most time to complete start to finish, and which required the most effort to complete from start to finish. Next, they were informed that they would have to complete a third assignment for homework and that they were to choose which type of assignment they would prefer to complete. Each of these questions required a forced-choice response. Students were encouraged to look back over assignments before making their choice. Upon completion of the experiment, the experimenter circulated throughout the room distributing, to each

student, their chosen homework assignment. Students were instructed to complete the homework and return it on the following class period.

The primary researcher collected all packets obtained during the experimental procedures. Packets were coded, and all identifying information was removed from the assignment packets prior to data analysis. All identifying materials (e.g., name sheets, consent forms, assent forms) are maintained in a secure filing cabinet.

Experimental design. A within-subjects design was used to test for differences across experimental and control assignments. The within-subjects design was preferred to a between-subjects design because it requires fewer subjects to reach equivalent levels of power and it reduces the main effect of subject from the error term (Ferguson, 1976).

There are some threats to internal validity associated with within-subjects repeated measures designs, including order and sequencing effects and multiple treatment interference. Order and sequencing effects (e.g., practice effects for problem completion and problem accuracy, fatigue, boredom) were controlled via counterbalancing across subjects. Half of the participants were given the control assignment first and the others were given the experiment assignment. Multiple-treatment interference is more likely to occur when subjects are unable to distinguish between conditions (e.g., control and experimental procedures). This threat to internal validity was abated by clearly defining each experimental condition. Assignments were titled Assignment J or Assignment L and were separated by an assignment sheet separator with a large stop sign instructing students to "STOP AND WAIT FOR INSTRUCTIONS." In addition, separate sets of

instructions were read by the primary instructor before each assignment (Barlow & Hersen, 1984).

Experimental and control materials were meticulously designed to insure internal reliability and validity of the two language arts assignments utilized in this study. Internal reliability consistency of materials was addressed by carefully constructing target items on the control and experimental assignments to match on length, difficulty, and content. In addition, target items were grouped into two item sets so that half of the participants were given item set one (20 target items) on the control and half were given item set one (20 target items) on the experimental assignment. Correspondingly, half the participants were given item set two (20 target items) on the control and half received item set two (20 target items) on the experimental assignment. Thus, each participant completed both item set one and item set two. The interspersed (8 items) and additional target items (4 items) were added to the item set on the experimental assignment.

Content validity and face validity of the assignment were established by incorporating actual items from the seventh-grade curriculum to be target items. In addition, the classroom teacher reviewed assignment materials to ensure that target items were appropriate for the students' level and recent instruction.

Independent variable. The interspersal of brief, easy language arts items with instructional-level language arts items on an assignment worksheet was the independent variable for the study. This interspersal language arts assignment (experimental assignment) was presented in conjunction with a language arts assignment (control assignment) comprised exclusively of instructional-level tasks.

Dependent variable and data analysis procedures. Dependent variables included mathematics performance variables (accuracy and item completion rates). Students were given equal amount of time to work on each assignment. Therefore the total number of items completed (target items on the control measure plus target and interspersed items on the experimental measure) and the number of target items completed (both assignments) were used to measure rates of responding.

Target items contained multiple parts and the English teacher typically gave partial credit for these items. Therefore, accuracy on target items was calculated by recording the percentage of discrete parts correct on target items for control and experimental assignments. Because all interspersed items required only one discrete response, percent correct on these items was used to measure accuracy. Partially completed items were not included in the percentages of items or items parts completed and accuracy totals. Dependent *t*-tests were used to test for differences across mathematics performance dependent variables.

Chi-square goodness-of-fit tests were used to analyze nominal level self-report responses obtained on the post-assignment questionnaire. Data in this analysis included students' perception of time, effort, difficulty, and homework choice. Thus, a comparison of the number of students who selected experimental versus control assignments for each nominal dependent variable was made. An alpha of .05 was used to determine statistical significances for all analyses.

Interscorer agreement and treatment integrity. Assignment sheets were scored and recorded into a computerized data bank by the primary researcher. A second independent

researcher scored assignment sheets and checked data entry for 20% of participants as a measure of interscorer reliability. Standard scoring guidelines were established and reviewed by each researcher before the scoring of any assignment packet. To decrease rater bias, packets were photocopied and given to a second independent researcher prior to any scoring made by the primary researcher. Identifying information (student's name) was removed from the packets prior to photocopying, and only student number codes were included on the packets. Data from any participants who did not follow instructions in completing the assignment was excluded analysis.

For each assignment and each dependent variable interscorer agreement was calculated by dividing the number of agreements by the number of disagreements and multiplying by 100. Interscorer agreement was 100% for number of items completed and 92.66% for number of discrete parts completed correctly. Interscorer agreement was 100%, for time, effort, and difficulty rating and homework choice. The disagreements between researchers were primarily associated with illegible handwriting.

The second independent researcher verified correct computerized data entry for 20% of the participants included in the study. This check consisted of randomly selecting 20% of participant packets and re-entering data in a separate column on the data spreadsheet. Results showed 100% data entry match across researchers.

Treatment integrity was assessed during the administration of the experimental procedure for all four classes participating in the study. The regular classroom teacher served as independent observer of the senior researcher administering the experiment. The teacher completed a checklist indicating whether the administrator followed

standardized steps during the experimental proceedings (Appendix D). These steps included (a) reading assent to students, (b) collecting assent forms prior to distribution of packets, (c) reading standardized administration instructions before each assignment, (d) setting and monitoring time limits of each assignment, (e) reading post-assignment questionnaire, and (f) distributing appropriate homework assignments to each participant. Treatment integrity checklist data showed 100% fidelity.

Experiment 2

Experiment 2 was implemented on day two of the research study (i.e., the following day). During Experiment 1 and previous studies investigating the interspersal procedure students worked under timed conditions and did not complete the assignments. However, no previous studies have examined the effectiveness of the procedure under an un-timed condition where students were required to complete each assignment before rating and choosing their next assignment. For example, Cates and Skinner (2000) found that students preferred experimental assignments containing 20% and even 40% more problems. However, analysis of target problem completion rates indicates that the number of target items completed on experimental and control assignments showed no significant difference. Therefore, even though the experimental assignments contained more work, the participants did not actually have to complete these additional problems before ranking assignments and choose a homework assignment. Experiment 2 was conducted to determine whether previous results supporting the strength of the interspersal procedure in causing students to prefer (i.e., choose) assignments with more work would hold up under this condition.

Experiment 2 involved the same participants, like-content materials, similar experimental design, and utilized the same independent variable. However, procedures differed in that students were required to complete both experimental and control assignments before responding to choice, effort, difficulty, and ease questions.

Participants and setting. The participant pool for this experiment included 70 of 72 students (only two students were absent) who volunteered to participate for this study. Again, no students withdrew assent during the course of this experiment. Data from 10 students was excluded from the analysis due to failure to adhere to instructions involved in the experimental procedures of the assigned tasks (e.g., skipping problems, failure to respond to post-assignment questions). Thus, the final group of participants in the data analysis included 60 students, 34 males and 26 females, who ranged from 11 to 14 years of age. Of this group, 81.7% identified themselves as Caucasian, 6.7% as African-American, 1.7 as Asian, 5.0% as other, and 5.0% chose not to respond to the inquiry regarding ethnicity.

As with Experiment 1, Experiment 2 was conducted during the participants' regularly scheduled English class with the teacher and other students present. The students sat in their assigned seats with no materials, other than a writing utensil, allowed on the desks. The students were not allowed to use any class materials (e.g., notes, text, etc.) to assist them with the assigned tasks involved in the experiment at any time during the procedure. Nor were students allowed to talk to classmates during the activity. Although briefer assignments were used in Experiment 2, the experimental procedures took longer (approximately 60 minutes of the allotted 75-minute class period) because

students were required to complete the assignments, and some students required more than 10 minutes to complete assignments.

Materials. Materials included in this study were similar to those included in Experiment 1. However, the assignments themselves were briefer. The primary experimenter reviewed data obtained in Experiment 1 in order to construct assignments where the majority of students could finish both assignments within approximately a single class period. Initially, experimenters constructed two sets of equivalent target items, with five items in each set. Target items were similar to those used in Experiment 1. These sets of target items were altered between assignment titles (Assignment J or Assignment L) and between assignment types (experimental or control). Experimental assignments including two additional interspersed items (brief items similar to those used in Experiment 1) and one additional target task. Thus, as in Experiment 1, experimental assignments contained 20% more target items, plus the interspersed items (see Appendix F for a sample of assignments used in Experiment 2).

Experimental procedures. The experiment was conducted in the student's classroom during the regularly scheduled class. Students were informed that participation for this experiment was entirely voluntary and that they could withdraw from the study at any time. Assignment packets were distributed to all participants. Eight assignment packet variations (counterbalanced experimental and control item sets, titles, and sequence of presentation) were presented face down. Students were instructed to leave material face down and to not proceed with the activity until further instructed.

A standardized set of instructions was read to the participants (Appendix E). An opportunity for questions was given before administration, and students were asked to raise their hand for assistance if they had questions at any time during the experiment. The primary difference between these procedures was that students were instructed to complete each assignment in its entirety. They were told to complete items in the order in which they were presented and to not skip any items.

After finishing the first assignment, students found a single white sheet indicating that they had completed the first assignment. This sheet also contained instructions to stop and get approval before moving on to the next assignments. They were instructed to raise their hand and have the primary experimenter or assisting school psychology student check and initial their first assignment before beginning the second assignment. This procedure was implemented to provide an interval between the two assignments, thereby reducing the probability of multiple-treatment interference and increasing the probability of students discriminating between the two assignments (Barlow & Hersen, 1984). No formal verbal instructions were given between assignments, as each student was allowed to work at his or her own pace.

After the students completed their second assignment, a sheet instructed them to stop working and raise their hand. An experimenter would check their work to ensure that they had completed all items and then instructed them to put down their pencils and sit quietly until all participants had completed both assignments.

Throughout the experiment, the primary experimenter and assisting graduate student circulated around the room, answering questions and prompting students to not

skip items and to complete them in order. After all participants had completed both assignments, the participants were asked to complete a post-assignment questionnaire to evaluate the materials. Students were asked which required the most time to complete, which required the most effort to complete, and which assignment was easier. Additionally, they were asked to choose an assignment similar to either assignment in their packets for homework. Students were encouraged to look over the two assignments before circling their choice. Each of these questions required a forced-choice response.

Upon completion of Experiment 2, no homework assignment was actually disseminated. Instead, the primary experimenter thanked the students for being so cooperative and debriefed the students on the purpose and goals of the research study. Students were allowed to ask questions pertaining to the study and withdraw inclusion of their data from the study if so desired. No student chose to withdraw from the study.

Dependent variables and analysis procedures. In Experiment 2, students were required to complete all items. Therefore, no data were analyzed with respect to item completion (rates or totals). However, accuracy on target and interspersed items was calculated in the same manner as in Experiment 1. Dependent *t*-tests were used to test for differences across target item accuracy levels (i.e., % correct) on experimental and control assignments. As in Experiment 1, chi-square goodness-of-fit tests were used to analyze nominal level self-report responses obtained on the post-assignment questionnaire. For all analyses, an alpha of .05 was considered statistical significant.

Interscorer agreement and treatment integrity. Interscorer agreement procedures were identical to those used in Experiment 1 except no data was collected on items completed as no students were allowed to stop until their work had been completed. Interscorer agreement was 100% for number of items completed, accuracy on target items and student rankings for time, effort, and difficulty rating and homework choice. Results showed 100% data entry match across researchers.

Treatment integrity was assessed during the administration of the experimental procedure for all 4 classes participating in the study. Using a treatment integrity checklist the assisting school psychology student record treatment integrity data for two classes and for the other two classes the classroom teacher record treatment integrity data (see Appendix G). Direct observation data was taken on the following sequential procedures (a) informing students of their right of withdrawal from participation in the study, (b) review of standardized instructions, (c) monitoring student activity, (d) reading post-assignment questionnaire, (e) recording homework assignment choice of each participant, and (f) debriefing students on goals and purpose of the study. Results showed 100% fidelity.

CHAPTER IV

RESULTS

Experiment 1

Mathematic performance. Table 1 (see Appendix H for all tables in Experiment 1) displays descriptive statistics for item completion rates and accuracy across control and experimental assignments. Table 2 provides a summary of the statistical analyses of mathematics performance data.

The mean total item completion rate was 8.39 ($SD = 3.65$) for the control assignment and 11.53 ($SD = 4.64$) for the experimental assignment. Dependent t -tests showed that this difference was significant, $t(55) = 5.124$, $p < 0.001$. The mean target item completion rates were 8.39 ($SD = 3.65$) and 8.05 ($SD = 3.49$) for control and experimental assignments, respectively. Dependent t -tests showed that this difference was not significant, $t(55) = -0.647$, $p = 0.520$.

Average accuracy levels on target items were 72.99% correct ($SD = 17.51$) on the control assignment and 71.70% correct ($SD = 20.42$) on the experimental assignment. Dependent t -tests showed that this difference was not significant $t(55) = -0.625$, $p = .535$. The average accuracy for interspersed items was 82.53% correct ($SD = 30.58$). This increased the accuracy levels on experimental assignment from 71.70% to 72.73% correct. Dependent t -tests comparing total percent correct across experimental and control assignments was not significant, $t(55) = 0.134$, $p = 0.894$.

Choice and perception data. Summary statistics for rankings of control and experimental assignments and assignment choice data are displayed in Table 3. Results of the chi-square analyses for these data are displayed in Table 4. Homework choice data showed that 36 (64%) students chose the experimental assignment and 20 (36%) chose the control assignment. Chi-square analysis showed that this difference was statistically significant, $\chi^2 (55, 2) = 4.571, p = 0.044$.

When asked to select the assignment that would require the most time to finish, from start to finish, 25 (45%) students select the experimental assignment and 31 (55%) chose the control assignment. Chi-square analysis showed that this difference was not significant, $\chi^2 (55, 2) = 0.643, p = 0.504$. When asked to select the assignment that would require the most effort to finish, from start to finish, 27 (48%) students chose the experimental assignment and 29 (52%) selected the control assignment. Chi-square analysis showed that this difference was not significant, $\chi^2 (55, 2) = 0.071, p = 0.894$. When asked to select the assignment that was easiest, 32 (57%) students selected the experimental assignment and 24 (43%) chose the control assignment. Chi-square analysis showed that this difference was not significant, $\chi^2 (55, 2) = 1.143, p = 0.350$.

Individual student choice and problem completion rates. Table 5 displays exploratory descriptive data that were collected for item completion rates and choice behavior at the individual subject level. Because target items were composed of several discrete tasks (i.e., multiple parts to each item), similar data were collected for total parts completed.

Of the 36 students who chose the experimental assignment for homework, 34 (94%) completed more items on the experimental assignment relative to the control assignment and 2 (6%) completed more items on the control. Of the 20 students who chose the control assignment for homework, 9 (45%) completed more items on the control assignment, 2 (10%) completed the same number of items, and 9 (45%) completed more on the experimental assignment. When these data are combined, individual analysis shows that 41 of 54 students chose for homework the assignment that resulted in the larger problem completion rates and 11 of 54 chose the assignment with the lesser problem completion rates. Thus, within-subject relative item-completion rates accurately predicted homework choice in 76% of the subjects.

Of the 36 students who chose the experimental assignment for homework, 29 (81%) completed more discrete item parts on the experimental assignment relative to the control assignment, 6 (17%) completed more discrete parts on the control assignment, and one (3%) completed the same number of discrete item parts on both assignments. Of the 20 students who chose the control assignment for homework, 18 (90%) completed more discrete tasks on the control assignment relative to the experimental assignment, while only two students (10%) completed more discrete tasks on the experimental assignment. When these data are combined, 47 of 55 students selected the assignment for homework, which result in the larger discrete task completion rates and 8 of 55 chose the assignment with the lesser discrete task-completion rates. Thus, within-subject relative discrete part or task completion rates accurately predicted homework choice in 85% of the students.

Exploratory analysis by groups. Exploratory analysis of data from Experiment 1 was conducted to determine if student performance or ability on target tasks interacted with the effects of the interspersal procedure. Thus, the initial group of 56 students was divided into a three groups (the top 18, the middle 20, and the bottom 18) based on their accuracy on target problems on control assignments. The top 18 students had a mean percent correct on target item parts of 89.96 (range = 84.62 -97.62; SD = 3.98). The middle 20 students had a mean percent correct on target item parts of 76.76 (range = 67.86 -84.62; SD = 5.96). The bottom performing 18 students had a mean percent correct on target item parts of 51.82 (range = 15.00-66.67; SD = 11.81).

For the top 18 students, the mean total item-completion rate was 9.33 (SD = 3.92) for the control assignment and 12.28 (SD = 4.54) for the experimental assignment. Dependent t-tests showed that this difference was significant, $t(17) = 2.442$, $p = 0.026$. For the middle 20 students, the mean total item completion rate was 8.80 (SD = 3.32) for the control assignment and 13.05 (SD = 5.18) for the experimental assignment. Dependent t-tests showed that this difference was significant, $t(19) = 3.885$, $p = 0.001$. For the bottom 18 students, mean total item-completion rate was 7.00 (SD = 3.10) for the control assignment and 9.11 (SD = 3.51) for the experimental assignment. Dependent t-tests showed that this difference was significant, $t(17) = 2.562$, $p = .020$. Thus, across all three groups, the interspersal procedure enhanced problem completion rates.

Table 6 displays the assignment choice and ranking data for the three groups. Table 7 provides a summary of the statistical analyses for these groups. Results show no statistically significant difference across choice, time, effort, and ease for any of the

groups. In these analyses, the small sample size of each group reduces power and the probability of finding significant differences. However, with one exception (i.e., ease ranking for the bottom third group was equivalent), student responses favored (i.e., ranked as easier, less time consuming, less effort, or chose for homework) the experimental assignments.

Summary of Experiment 1 results. Analysis of mathematics performance data showed that interspersing additional brief items resulted in students completing more total items in the 10-minute interval. However, interspersing the briefer items did not impact target item completion rates, target time accuracy levels, or total accuracy levels across the two assignments. The data on choice behavior showed that more students selected for homework (preferred) the experimental assignment, even though it required them to work on 20% more target items, plus the interspersed items. These findings confirm earlier research (e.g., Cates & Skinner, 2000) which showed that the interspersal procedure can increase mathematics problem completion rates and the probability of students selecting assignments that include more discrete target problems, without reducing completion rates or accuracy levels on target problems. However, the data on assignment ranking for time, difficulty, and effort failed to confirm previous experiments which found that students rated mathematics computation assignments with interspersed brief and easier items more favorably across these variables (e.g., Cates & Skinner, 2000).

Analysis of individual data showed that choice could be predicted at the individual levels with high levels of accuracy based on relative item completion rates.

These individual data supported previous research, which supported the hypothesis that relative discrete task completion rates influences choice (e.g., Skinner et al., 1999).

Exploratory analysis of high, middle, and low performance appeared to have little influence on assignment choice or rankings.

Experiment 2

Mathematic performance. Table 8 (see Appendix I for all tables in Experiment 2) displays descriptive statistics for accuracy levels across on the control and experimental assignments. Table 9 provides a summary of the analyses for these mathematics performance data.

Mean accuracy levels for target items were 64.32 (SD = 21.23) on the control assignment and 64.53 (SD = 17.17) on the experimental assignment. Dependent *t*-tests showed that this difference was not significant, $t(59) = -0.147$, $p = 0.883$. The mean accuracy level for interspersed items was 94.17% (SD = 18.62). This increased the accuracy rate on total items completed for the experimental assignment from 64.53% to 66.78% (SD = 15.92) correct. Dependent *t*-tests comparing total percent correct across experimental and control assignments showed that this difference was not significant, $t(59) = -1.644$, $p = 0.106$.

Choice and perception. Summary statistics for rankings of control and experimental assignments and assignment choice data are displayed in Table 10. Results of the chi-square analyses for these data are displayed in Table 11. Homework choice data showed that 39 (65%) students chose the experimental assignment and 21 (35%)

chose the control assignment. Chi-square analysis showed that this difference was statistically significant, $X^2 (59, 2) = 5.400, p = 0.027$.

When asked to select the assignment that required the most time to finish, 28 (47%) students select the experimental assignment, and 32 (53%) selected the control assignment. Chi-square analysis showed that this difference was not significant, $X^2 (59, 2) = 0.267, p = 0.699$. When asked to select the assignment that required the most effort to finish, 24 (40%) students selected the experimental assignment and 36 (60%) selected the control assignment. Chi-square analysis showed that this difference was not significant, $X^2 (59, 2) = 2.400, p = 0.155$. When asked to select the assignment that was easiest, 37 (62%) students selected the experimental assignment, and 23 (38%) selected the control assignment. Chi-square analysis showed that this difference was not significant, $X^2 (59, 2) = 3.267, p = 0.092$.

Exploratory analysis by groups. Exploratory analysis of data from Experiment 2 was conducted to determine if student performance or ability on target tasks interacted with the effects of the interspersal procedure. The initial group of 60 students was divided into three groups (the top 20, the middle 20, and the bottom 20), based on their accuracy levels on control assignments. The top 20 students had a mean percent correct on target-item parts of 88.29 (range = 80.95 -100.00; SD = 4.73). The middle 20 students had a mean percent correct on target item parts of 64.86 (range = 50.00-80.00; SD = 9.16), and the bottom performing 20 students had a mean percent correct on target item parts of 39.83 (range = 23.81-50.00; SD = 7.55).

Table 12 display the assignment choice and ranking data for the three groups. Table 13 provides a summary of the statistical analyses for these groups. Results show no statistically significant differences in either the high performing or low performing groups. However, significantly more students in the middle group selected the experimental assignment for homework and rated the experimental assignment as easier and as requiring less effort to complete. No significant difference was found for time ranking in the middle group.

Summary of Experiment 2 results. Results from Experiment 2 show that after completing two assignments, one that contains 20% more target tasks plus additional brief interspersed tasks, more students chose for homework the assignment that required more work. Analysis of high, middle, and low performing groups suggests that the interspersal procedure impacted choice and assignment perception of effort and ease primarily with the middle-performing group. Although the experimental assignments contained 20% more target items and two additional brief items, significantly more students in the low and high performing did not students select the experimental assignment as requiring more time or effort to complete, nor did they choose the briefer control assignment for homework.

CHAPTER V

DISCUSSION

In this chapter results are interpreted with respect to each purpose of the study. Limitations of the current study are reviewed and directions for future research are presented. The chapter concludes with applied and theoretical implications of the current study and this line of research.

Research Purpose 1

A primary purpose of this study was to investigate the interspersal procedure in a more educationally valid context. Previous researchers investigating the interspersal procedure have required students to work on ISW assignments that had little or no relevance to their current educational curricula (Skinner, Fletcher et al., 1996; Skinner, Robinson et al., 1996). Thus, assignments were composed of tasks that were not associated with recent instructional or educational activities. In the current study, academic assignments were composed of instructional-level target tasks using grade-appropriate materials that were part of the participants' general language arts curriculum. Experimental procedures were conducted following recent instruction of content material (i.e., lessons covering the last 2-3 weeks). Thus, assignments provided an authentic opportunity to apply and practice recently taught skills. Additionally, the experimental procedures were conducted during the students' regularly scheduled English class in which they received a classroom participation grade for completing the assignments.

Results of Experiment 1 confirmed previous research which showed that significantly more high school students chose experimental mathematics assignments

(i.e., interspersal assignments) for homework that include 20%-40% more target problems (Cates & Skinner, 2000). Results from Experiment 1 extended this research by showing that the procedure was effective when students were working on educationally valid tasks (e.g., grade level tasks that they had just received instruction on).

In Experiment 1 no significant differences were found for perceived effort, difficulty, and time. These results failed to confirm findings from the Cates and Skinner (2000) study which showed that secondary students rated experimental mathematics assignments as requiring less effort to complete, less time to complete, and as less difficulty, even when they contain 20-40% more problems.

There are several plausible explanations for these conflicting findings for assignment rankings across studies. First, Cates and Skinner (2000) used mathematics computation problems. It is relatively easy to construct equivalent mathematics computation problems. In the current study, researchers attempted to create equivalent target items for use across assignments. However, item completion rate data show that 11 students actually completed more items on the control assignment. These data suggests that the target items across experimental and control assignments may not have been equivalent for some students. Future researchers should determine if the additional variance caused by difficulties in creating equivalent assignments may account for the failure to replicated previous research with respect to time, difficulty, and effort.

A second variable may be related to time spent working on each assignment across studies. In Experiment 1, students worked on each assignment for 10 minutes. However, in Cates and Skinner (2000) student spent 4 minutes working on each

assignment. Future researchers should determine if longer exposure to each assignment affects students' perceptions of relative time, difficulty, and effort.

Several other variables may account for these disparate findings across studies. For example, students in the Cates and Skinner (2000) study were working on tasks that were not part of their general education curriculum and no grades were given based on performance. In the current study, students work on tasks they had just learned and did receive a grade for their participation. Future researchers should determine if these variables account for different findings with respect to time, difficulty, and effort ranking across studies.

Research Question 2

Previous researchers (e.g., Cates & Skinner, 2000) have demonstrated the strength of the interspersal procedure by showing that students prefer (i.e., choose) mathematics homework assignments with 20% and 40% more target problems when additional briefer and easier problems were interspersed. However, past investigations were conducted under timed conditions where participants were given equivalent amounts of time to work on lengthy assignments. Therefore, even though the experimental assignments contained more work, participants did not complete more target tasks.

Experiment 2 was designed to investigate the strength of the interspersal procedure to determine if students would prefer (i.e., choose) language arts assignments containing 20% more target tasks after they actually complete these additional tasks. Result showed that significantly more students chose the assignment that required them

to complete 20% more target items plus the additional interspersal items, after they completed both assignments.

As in Experiment 1, results from Experiment 2 found no differences in student perceptions of time, difficulty, and effort for the entire subject pool. However, it is reasonable to assume that increasing assignment demands with 20% more target items and requiring students to complete these assignments (Experiment 2) should have caused students to rate the experimental assignments as requiring more time and effort to complete. Thus, the failure to find significant differences in time, effort, and difficulty rankings, coupled with significantly more students choosing the longer experimental assignment for homework has important applied implications. Educators often have problems getting students to choose to engage in assigned academic work. In fact, procedures like contingent skipping reinforce student academic behavior by reducing assignment demands (Lovitt & Hanson, 1996). However, in Experiment 2, there were no significant differences in assignment rankings and significantly more students chose the experimental assignment for homework. From an applied perspective, these results suggest that educators can increase assignment demands by 20% without decreasing students' perceptions of assignment by adding and interspersing additional briefer discrete tasks.

Increasing opportunities to respond, without decreasing assignment perception has important educational implications. Increasing opportunities to respond to target items may enhance learning at the acquisition and fluency stage and providing opportunities to practice previously learned skills (interspersed items), which can

enhance maintenance. Increasing the effort required to complete assignments is typically associated with decreased perceptions of assignments and perhaps increased off-task behavior (see Dunlap & Kern, 1996). However, results from both experiments shows that the interspersal procedure may allow educators to increase assignment demands (effort and time required to complete assignments), while simultaneously increasing both opportunities to practice newly taught skills and previously learner material (e.g., maintenance trials), without reducing assignment perceptions.

Exploratory analysis of results from Experiment 2 may be even more significant. These results suggest the interspersal procedure actually caused the middle performing groups (accuracy levels between 50%-85%) to choose and rank more favorably (effort and ease) the assignment that required 20% more work. Thus, rather than inducing students to choose to do assigned tasks by watering down the curricula (e.g., reducing assignment length or effort required to complete assigned tasks), results from Experiment 2 show how educators can cause students to choose to do more work without having to apply common negative reinforcement procedures (e.g., nag them, threaten them with punishment if they do not complete work) or supplemental positive reinforcement (e.g., token, stickers, praise).

Research Question 3

The third purpose of this study was to examine interspersal choice data at the individual level. According to the mathematical model of the Matching Law, students should choose the assignment that results in the thicker schedule of reinforcement (i.e. greatest number of completed tasks). Even though past studies found that the interspersal

procedure did increase problem completion rates for the experimental assignment at the group level, not all students necessarily completed more tasks on this assignment due to extraneous variables (e.g., fatigue, practice, classroom distractions). If some students did complete more tasks on the control assignment, then the Matching Law would predict that those students would choose that assignment for homework.

Experiment 1 incorporated a more comprehensive assessment of choice behavior to determine if individual students chose the assignment that elicited high item and/or discrete task completion rates. In the current study, target items were composed of several discrete parts. Therefore, analysis of individual choice data was conducted across two variables. With respect to items completed, results showed that 76% of the students chose the homework assignment that elicited greater item completion rates. When target items were broken down to even more discrete tasks (parts), analysis showed that 85% of the student chose the assignment that elicited greater discrete task completion rates.

These results have important theoretical and applied implications. Previous researchers have posited that discrete task completion is a reinforcing event (e.g., Skinner et al., 1999). The current study showed that student choice behavior could be predicted at the individual level with a high degree of accuracy based solely on relative item completion rates; thus providing additional support for the hypothesis that discrete task completion is a reinforcing event. Adding more support to the hypothesis is the increased precision in choice prediction that was found when target items were broken down to more discrete tasks (i.e., parts of items).

Understanding the causal mechanism responsible for the effects of the interspersal procedure is critical to practitioners. For example, Martin et al. (2000) interspersed easier paragraphs and found that this procedure reduced students' perception of the experimental assignment. An understanding of the causal mechanism responsible for the effectiveness of the interspersal procedure may prevent other educators and researchers from inappropriately applying the procedure and unintentionally adversely affecting students' perception of assignments and academic behavior (e.g., accuracy and fluency, on-task behavior). In addition to preventing inappropriate application, a clearer understanding of causal mechanism(s) may allow educators to apply the procedure across other assignments or alter assignments so that this procedure would yield desired effects.

Research Question 4

A fourth purpose of this study was to determine if the effects of the interspersal procedure could be generalized to the subject area of language arts. Past research suggests that the interspersal procedure can be utilized to improve students' perceptions of ISW. However, all previous experiments supporting the effectiveness of the interspersal procedure in enhancing student perceptions of assignments have been conducted with mathematic assignments (e.g., Cates & Skinner, 2000; Skinner, Fletcher, et al., 1996; Skinner, Robinson, et al., 1996). Furthermore, an attempt to extend the interspersal procedure to reading assignments failed to confirm earlier findings (Martin et al., 2001). In this study researchers added brief second-grade reading level paragraphs to passages written at the seventh-grade level. Results show no differences across choice or effort and difficulty ratings; however significantly more students ranked experimental

assignments as more time consuming. Martin et al., (2001) interpreted that this failure to replicate as support for the hypothesis that discrete item completion is reinforcing and accounts for the effectiveness of the interspersal procedure. Specifically, they suggested that adding the easy paragraph merely increased the time and effort required to complete one discrete task (i.e., the reading the passage), and therefore did not increase task completion rate and rates of reinforcement.

Results of the current study suggest that the interspersal procedure can cause student to prefer ISW language arts assignments with 20% more target tasks. Thus, the current findings extend the external validity associated with the interspersal procedures (i.e., generalization across tasks). Future research should determine if this procedure improves students' perceptions of other ISW assignments that are composed of or easily broken down into discrete tasks.

Exploratory Analysis

An exploratory analysis was conducted to determine if student performance or ability on target tasks interacted with the effects of the interspersal procedure. Results showed little difference across groups during Experiment 1. However, in Experiment 2, the middle performing group not only preferred experimental assignments, but significantly more students also rated it as easier and requiring less effort, even though it contained 20% more target tasks plus two additional interspersed items.

Limitations of this exploratory analysis involve small sample sizes in subgroups (i.e., low, middle, and high performers) that impacted the power of statistical procedures utilized to analyze data. Regardless, results suggest that the interspersal procedure may be

most effective when students find assignments moderately difficult, as opposed to extremely easy or hard. Researchers should continue to investigate factors such as student ability level that may interact with and influence the effectiveness of the interspersal procedure. These experiments may allow researchers to identify aptitude-treatment or skill development-treatment interactions, which would allow educators to determine conditions (e.g., groups based on skill development levels) when the interspersal procedure is most likely to be effective.

Limitations and Future Research

The current study and previous research on the interspersal procedures has both theoretical and applied implication. However, before any strong theoretical conclusions or applied recommendations can be made, researchers should address several methodological limitations of the current study and previous experiments.

First, a repeated measures design was used to compare control and experimental assignments. Each participant completed assignments in a counterbalancing order to reduce the effects of extraneous variables (e.g. boredom, fatigue). Nevertheless, presentation of one assignment immediately after another may have impacted task completion rates, accuracy levels, student choice, and/or student preference. Future researchers conducting similar studies should attempt control for sequence effects that may have occurred because assignments were presented so close together in time.

Data from Experiment 1 showed that 11 students completed more tasks on the control assignment, even though the experimental assignment contained tasks that were much briefer. This suggests that students were working at unequal rates across

assignments. This suggests another threat to the internal validity associated with the current study, unequal assignments. In the current study, target items were carefully constructed and matched across control and experimental assignments for length, difficulty, and content. However, since language arts items require several academic skills (e.g. reading, comprehension) that may be influenced by idiosyncratic learning histories, it is unclear as to whether items were equally matched across assignment pairs. Thus, variance caused by failure to construct equivalent assignments may have contaminated the current study. Future researchers attempting to extend research on the interspersal procedure should consider making every effort possible to equate target items on experimental and control assignments.

In the current study, students completed Experiment 1 prior to participating in Experiment 2. Thus, in Experiment 2 students' academic performance (rates and accuracy of responding) and choice and rankings may have been influenced by their exposure to control and experimental conditions and assessment procedures associated with Experiment 1. Future researchers should use across-subject designs or counterbalancing to control for sequence effects.

Homework choice and student rankings of assignment time, effort, and ease required forced choice responses. Future researchers should design perception and choice evaluation procedures that allow for equal rankings across assignments (e.g., "The two took the same amount of effort to complete.") and avoid forcing students to choose one assignment for homework (e.g., "I do not care which assignment I get for homework.").

In the current study, experimental procedures were conducted in a general education classroom setting, which provided the opportunity for peers to influence classmates' academic performance, assignment ranking, and choice. For example, although students were instructed to do their own work, on one occasion a student raised her hand and pointed over to another student's desk to inform the experimenter that her classmate did not have an interspersed item on her assignment. This may be an indication that students were attempting to copy language arts answers from their peers.

If students were attempting to answer items based on peer responses, they may have also based their assignment rankings and homework choice on peer responses. For example, in one class, when the experimenter read the ranking and choice questions to the class, some students verbally called out their assignment preference (i.e. Assignment J or Assignment L). At that point the experimenter instructed the students to be sure to review their own assignment packets before making selections because there were eight variations of packets and Assignment J and Assignment L were not the same for each student. Regardless, these communications across classmates may have influenced student responses with respect to perceptions of assignments and/or homework choice. Future researchers should take extra precautions to reduce the possible confound of peer influence (e.g., running sessions with individual students).

A limitation of the current study and previous interspersal research is that most studies have required students to work on assignments for short periods of time (e.g., 10 minutes for each assignment during Experiment 1). Although students were given the entire class period to finish assignments in Experiment 2, assignments were constructed

to be short enough so that most, if not all students would have the opportunity to complete both assignments within the given class period. Therefore, completing 20% more work on the experimental assignment only resulted in completing one more target tasks. Future research is needed to determine if assignment length and/or assignment intervals (e.g., 30 minutes of ISW) impact the effectiveness of the interspersal procedure

One goal of this study was to construct educationally valid assignments that included tasks that were part of students' general curriculum. However, research indicates that by the time students' progress to the seventh-grade level there is a wide variation in skill development. For example, some students may be performing at an academic level several years below grade level; whereas, other students in the same class may be performing several grade levels above educational placement. In the current study, exploratory analysis indicated that level of skill development may be a salient factor in determining the effectiveness of interspersal procedure. Furthermore, overall group mean accuracy levels on target tasks for both Experiment 1 and 2 indicate that some students were either not motivated to complete tasks carefully and accurately or that tasks were too difficult for students. Although students did receive a participation grade for working on assignments in this study, no grade was awarded for accuracy. To address the issue of motivation, future researcher should consider conducting similar studies in which participants receive an actual grade based on academic performance (e.g., accuracy). Additionally, researchers should investigate accuracy levels of individual students to determine if accuracy rates on target tasks, interspersal tasks, or a

combination of the two impact student perceptions of assignments when the interspersal procedure is used.

The results of the current study show that the interspersal procedure can cause students to choose ISW language arts assignments that require over 20% more work. Future researchers should determine if the interspersal technique is generalizable to other academic content (e.g. science, social studies, spelling). Also, future researchers should determine if this procedure is effective across students. In particular, future researchers should determine if the interspersal procedures enhances perceptions of those who may be most likely to choose not to engage in academic tasks (e.g. low-achieving students, students with ADHD, learning disabilities, and/or behavior disorders).

Previous research on the interspersal procedures has been very brief and students have had few trials (i.e., exposure to assignments and opportunities to choose). Longitudinal studies are needed to establish the educational validity of this procedure. Future researchers should utilize repeated-measures designs that provide students with many choice opportunities to determine if students would continue to prefer or choose assignments that contain more target tasks.

In addition to addressing methodological and external validity limitation associated with the interspersal procedure, future researchers also should attempt to more clearly identify causal mechanisms responsible for interspersal effects. Previous researchers proposed that when presented assignments with multiple discrete tasks, completion of each discrete task is a reinforcing stimuli (Skinner, Fletcher et al., 1996; Skinner, Logan et al., 1998; Skinner, Robinson et al., 1996). Thus, students may be more

likely to choose the interspersal assignment because it results in higher rates of reinforcement.

Results of the current study extend support for this hypothesis. Experiment 1 showed that individuals were more likely to choose for homework the assignments associated with the greater item completion rates, regardless of whether it was a control or experimental assignment. Additionally, when target items were broken down to smaller, more discrete tasks, choice behavior was predicted with even more precision. These findings suggest that discrete task completion rates influence choice behavior in the same manner as relative rates of reinforcement (Herrnstein, 1961). Thus, one way to explain the current findings is to assume that discrete task completion is a reinforcing event.

Although the current data supports the hypothesis that task completion may be a reinforcing event, the current and past studies have failed to directly test this hypothesis. Therefore, a more concerted effort to isolate causal mechanism(s) responsible for the success of the interspersal procedure is needed. A more direct experiment to show that task completion is reinforcing may entail more carefully manipulated studies to control the rate and schedule of task completion. For example, future researchers should directly manipulate the rate and ratio in which interspersal items are presented to determine if altering problem completion rates impacts individual students behavior in the same manner as altering rates of reinforcement. Furthermore, if task completion is a reinforcing event, future researcher should investigate reinforcing properties of completing the brief

interspersal tasks in relation to target tasks to determine the reinforcing quality of each of these tasks.

More basic studies of the causal mechanism responsible for the effectiveness of the interspersal procedure may assist practitioners. For example, the proposed hypothesis behind task completion as a reinforcing event assumes students have experienced a learning history where positive and/or negative reinforcement was delivered or removed contingent upon assignment completion. Future researcher should determine whether students with alternative learning histories respond differently to the interspersal procedure. For example, students who often receive negative feedback after finishing assignments (e.g., low achieving students or students with learning disabilities who receive poor letter grades) may react differently to the interspersal procedure than those who are typically reinforced (e.g., given a high letter grade).

Previous studies suggest that ease of the interspersed task does not account for the impact of the interspersal procedure (e.g., Skinner, Fletcher et al., 1996). However, other researchers have shown that increasing students' success rate may enhance their perceptions of academic assignments (Dickinson & Butt, 1989), especially with low-achieving students (Gickling & Thompson, 1985; Hargis, 1987). When scoring assignments, the primary experimenter came across some unexpected qualitative data that support that students' perceptions of success may influence assignment choice. Specifically, a student drew smiley faces beside several interspersed items and wrote "too easy!!" beside these items. This student chose the experimental assignment for homework. Future researchers should continue to investigate relative item ease to

determine if student success on interspersed items may account, or partially account for enhanced perceptions of experimental assignments.

Research results suggest that discrete task completion is a reinforcing event that can be utilized within classrooms settings to increase appropriate academic behavior (McCurdy et al., 2001). Future researchers should evaluate quality of task completion as a reinforcing stimulus relative to other concurrently available reinforcers in educational setting (e.g., peer attention) as these studies may allow educators to better predict conditions when the interspersal procedure is likely to be effective.

Additionally, more basic research is needed to determine if discrete task completion is a classically conditioned positively reinforcing stimulus and/or negatively reinforcing stimulus. Future researchers also should determine if response deficit models account for the choice behavior. Specifically, researchers should determine if student preference for experimental assignments is caused by the additional reinforcement that only occurs while working on the experimental assignments. This additional reinforcement may be caused by the sequence of events (contingent relationship that requires students to complete three target tasks in order to come into contact with the brief task), as opposed to classical conditioning based on previous learning history.

Conclusions

A strong database is emerging which suggests that interspersal procedures have the potential to enhance students' perceptions of academic tasks (e.g. dreaded ISW) and

cause students to choose to engage in more academic responding. These findings may have an overarching impact on learning and classroom behavior.

The results from the current study have implications with respect to student learning. Other academic assignment alteration procedures that have enhanced students perceptions of assignments and increased the probability of students choosing to engage in assigned work (e.g., on-task behavior) have resorted to quantitative and/or qualitative reductions in assignment demands (e.g. Cooke et al., 1993; Kern et al., 1994). Such procedures threaten the integrity of the curriculum (e.g., water down the curricula), thereby reducing learning rates (Skinner, Robinson et al., 1996). Using the interspersal procedure may enhance rates of reinforcement while students work on academic tasks, while simultaneously increasing academic responding or learning trials. By increasing learning trials during ISW, the interspersal procedure may enhance skill acquisition, fluency, maintenance, and generalization of academic skills. Additionally, enhancing rates of reinforcement for academic behavior may reduce the probability of students choosing to engage in disruptive classroom behavior (e.g., McCurdy, Skinner, et al., in press; Skinner, Hurst et al., 2001).

From an applied perspective the efficiency of the interspersal procedure is particularly exciting. Often behavioral techniques that have been shown to be effective during controlled experimental studies are not easily assimilated into day-to-day general education classroom routines. Frequently these techniques are time consuming and/or expensive and teachers do not have the resources to sustain them for continued periods (Hall, 1991). The current results and previous experiments suggest that the interspersing

procedure may be a teacher-friendly, time and resource efficient procedure that a) enhances rates of reinforcement for engaging in assigned academic work, b) improves students' perceptions of academic assignments, c) decreases students' inappropriate and possibly disruptive classroom behavior, and d) enhances learning rates (e.g., academic skill acquisition, fluency, and maintenance). Thus, the interspersal procedure may be extremely useful in preventing and remedying academic skill deficits and behavior problems across educational settings and students.

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APPENDICES

APPENDIX A: Consent and Assent Forms

Parental Consent Form

Dear Parent,

My name is Chris Skinner. I am professor and coordinator of School Psychology Students at the University of Tennessee. I am currently working with several University of Tennessee students on developing worksheets that are designed to improve student's attitudes toward school work and their classroom behavior. I am seeking your consent for your child to participate in this study.

If you agree to allow your child to participate, your child will be asked to complete two English worksheets. One of these worksheets will be similar to the worksheets regularly given to your child in his/her English class. The other type of worksheet will be altered. Specifically, we are going to add some additional tasks or problems to the worksheets. Following completion of these worksheets your child will be asked to evaluate these assignments and indicate which assignment they preferred.

This study is voluntary which means that you can request that your child stop at any time. All data and information collected will be held confidential. Thus, this identity of the student completing the work or providing information about the assignments will be known only to the researchers and the student's teacher. Although results of our research may be shared with others through professional publications or presentation, your child's name will never be revealed.

If you have any questions about this consent or this study, please feel free to contact Chris Skinner at 974-8403 or Sadonya Meadows (senior students researcher) at (865) 215-4950 ext. 56898. If you agree to allow your child to participate in this research, please check the appropriate box below and sign the form in the space provided for parental signature or legal guardian. Your help is deeply appreciated.

Sincerely,

Christopher H. Skinner, Coordinator of School Psychology Programs
Phone (865) 974-8403

Check one

_____ I DO agree to allow my child to participate in this research.

_____ I DO NOT agree to allow my child to participate in this research.

Child's Name: _____

Signature: _____ Date _____
Parent or Legal Guardian

Student Assent Form

Dear Student,

My name is Chris Skinner. I am professor and coordinator of School Psychology Students at the University of Tennessee. I am currently working with several University of Tennessee students on developing worksheets and assignments that you may like better than typical worksheets and assignments. I am asking if you would be willing to participate in this research.

If you agree to participate, we will ask you to work on some language arts assignment sheets and ask your opinion about the worksheets.

This study is voluntary which means that you do not have to participate and can choose which questions you wish to answer. If at any time you choose to quit, just inform your teacher, Ms. Meadows, or Dr. Skinner at 974-8403. Furthermore, if you have any questions about the research, feel free to ask your teacher or Ms. Meadows. They can also help you get in touch with Dr. Skinner.

If you agree to participate in this research, please check the box below and sign the form in the space provided. Your help is deeply appreciated.

_____ I agree to participate in this research.

Print Name _____

Signature: _____ Date _____
Student

APPENDIX B: Instructions for Experiment 1

Instructions for Group Language Arts Data Collection
Experiment I

“Today we will be working on two separate Language Arts assignments contained in this packet. Please leave your packet turned face down on your desk.” (Begin distributing packets face down on student’s desks)

We will work on one assignment at a time. Please do not start on the assignments until all instructions have been given. (Wait for all packets to be distributed to each student)

Please turn you packets over to where you can see the front sheet entitled “Name Sheet”.

First, I would like you to fill in your name on the blank line. Please do not write your name on any other pages included in your packet and do not work ahead.

Do not write anything beside Student ID number, we will fill that in for you.

Next, turn to the next page in your packet entitled “COVER SHEET”

- 1. First, Fill in the date**
- 2. Next write in your date of birth and age**
- 3. Circle whether you are male or female.**
- 4. Next write in your current grade placement.**
- 5. Circle your identifying ethnic race. W stands for White, B stands for Black, A stands for Asian, and O stands for other. If you choose other please specify in the blank provided.**
- 6. Circle whether or not you are Hispanic.**
- 7. Next, I would like you to rate on a scale of 1 to 5 how well you like the subject area of Language Arts or English.**

After you have finished filling in your cover sheet please stop and put your pencil down.
(Wait for all student to finish)

First Assignment

Please turn the cover page over where you can see the first page of your language arts assignment. Start with the first item at the top of the page (hold up sheet and point to the corresponding page) and work down the page without skipping any items (demonstrate). Remember, start with the first item on the page and do not skip any items. When you finish this page continue to work on the following pages until you come to the page which reads “STOP AND WAIT FOR INSTRUCTIONS. Please work as quickly as you can without making mistakes. If you finish early please just put your pencil down and wait quietly. Do not work ahead. Are there any questions?”

REMEMBER DO NOT WORK AHEAD.

Please begin. (Allow students 10 minutes for first assignment)

Second Assignment

Please turn the assignment sheet separator over where you can see the first page of your next language arts assignment. You are to work only on this assignment. Please do not work ahead and do not go back and work on the previous assignment!

Start with the first item at the top of the page (hold up sheet and point to the corresponding item) and work down the page (demonstrate) without skipping any items. Remember, start with the first item on the page and work from left to right without skipping any problems. Please work as quickly as you can without making mistakes. Work until you come to the page that says "STOP AND WAIT FOR INSTRUCTIONS". If you finish early please just put your pencil down and wait quietly. Are there any questions?

(Allow students 10 minutes to complete assignment)

Instructions for questions

Please turn the page to the last page in your packet.

You have now completed two assignments. Each of you completed one assignment titled Assignment J and one titled Assignment L. Next I would like you to answer some questions about the assignments by circling either J or L for the corresponding assignments.

You may look back through your packet at these assignments. The letter of the assignment it located on the top of each page of the assignment. We will answer each of these questions as a group. Please do not work ahead. Are there any questions?

1. Which assignment required more time to complete, from start to finish?

L J

2. Which assignment required more effort to complete, from start to finish?

L J

3. Which assignment was easier?

L J

4. You will be given a new assignment for homework. Although the problems will not be identical to those on the assignments you worked on today, they will contain the same number and type of problems. Which assignment would you like to work on for homework tonight?

L J

APPENDIX C: Sample Packet for Experiment 1

SAMPLE PACKET

NAME SHEET

Name: _____

Student ID Number: _____



STOP AND WAIT FOR INSTRUCTIONS



**SAMPLE PACKET
COVER SHEET**

Student ID: _____

Date: _____

Birthdate: _____

Age: _____

Circle: Male or Female

Grade: _____

Ethnicity: W B A O (_____)

Hispanic: yes or no

Please rate the subject of Language Arts (circle).

1	2	3	4	5
Favorite	Very Well	Somewhat	Not Well	Least Favorite



STOP AND WAIT FOR INSTRUCTIONS



ASSIGNMENT L
SAMPLE PACKET
(Items reduced to fit page)

Circle the noun.

- Sue won.

Write each verb. Then label it *transitive* (T) or *intransitive* (I).

- Many people depend on wells for their water supply. Scientists locate wells with modern equipment. In earlier times, people found water with a forked branch. The main stem pointed down to a water supply.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

- The Iroquois were Native American tribes in New York. The Mohawks were one tribe in the Iroquois nation. Hiawatha was a powerful chief of the Mohawks who became a peacemaker. Peace was important to him, and soon the Iroquois became famous for their friendship.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Write the underlined object. Label them direct object (DO) or indirect object (IO).

- Jill showed Tom a diagram of a large ant colony. It contained many rooms and passages. Labels on the diagram told them the purpose of each room.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Circle the noun.

- Sam can.

ASSIGNMENT L
SAMPLE PACKET
(Items reduced to fit page)

List all action verbs.

- Sand dollars live on the ocean floor, but sometimes they float onto the beach. They eat tiny plants and crawl through the sand. I collect sand dollars from all over the world, and I search for them every time I go to the beach.

_____	_____
_____	_____
_____	_____

List all plural nouns.

- The students in Ms. Adam's class took a trip. The class visited a farm where potatoes grow. Boxes of potatoes were piled on the porch. Farm workers were loading the boxes onto a truck.

_____	_____
_____	_____
_____	_____

Insert apostrophes in the possessives.

- One of my mothers hobbies is fly-fishing. She learned how to fly fish at her grandfathers cabin on the Clinch River in Tennessee. She had several fishing reels, but her grandfathers old reel was her favorite.

Circle the verb.

- Jill ran.

Circle the correct word in parentheses.

- Violins, violas, cellos, and double basses (is, are) the stringed instruments in the orchestra. We (has, have) five violins in our orchestra. Neither violins nor violas (was, were) used in orchestras before the eighteenth century.

ASSIGNMENT L

SAMPLE PACKET

(Items reduced to fit page)

Write the underlined words. Label them **predicate noun (PN)** or **predicate adjective (PA)**.

- My mother is a painter. She was an art student for several years. She seems happy with her artwork. Her pictures are bright and colorful. Someday she will be famous.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Circle the correct verb in parentheses.

- Here (is, are) my plans for next week. On Tuesday (is, are) a track meet. The runners along with the coach, (is, are) going to Newton School. Pat, one of my best friends, (has, have) won several meets already this year.

Circle the verb.

- Pat sat.

Write each main verb. Label it **transitive (T)** or **intransitive (I)**.

- We will attend my sister's graduation today. My parents bought her an incredible present for graduation. They gave her a brand new Mercedes convertible. The metallic silver paint glistens in the sunlight, and the custom stereo system sounds fabulous.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Add correct end punctuation.

- Have you ever been to visit New York City__ It is one of my favorite places to go during summer vacation__ Last year, I went there with my family, and we visited the Metropolitan Museum of Art__ Have you ever seen a Broadway play__

ASSIGNMENT L

SAMPLE PACKET

(Items reduced to fit page)

Write the underlined object. Label them direct object (DO) or indirect object (IO).

- I showed the class a picture of a monarch butterfly's wings. Its wings have a reddish-brown color with black lines. The monarch's wing pattern serves a special purpose.

_____ → _____

_____ → _____

_____ → _____

_____ → _____

Circle the noun.

- Kim sang.

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

- Jonathan is very bright. He is an honor roll student. His favorite subject is science. His grades are always good. Learning seems enjoyable to him.

_____ → _____

_____ → _____

_____ → _____

_____ → _____

_____ → _____

Add end punctuation.

- The Academy Awards are televised across the globe__ Did you see Julia Roberts during her acceptance speech__ She won the award for best actress for her performance in Erin Brocovich __ Do you think she is a good actress__

Circle the correct word in parentheses.

- Did I (let, leave) my umbrella at your house. My mom will not (let, leave) me go outside in the rain without it. Will you (let, leave) it outside on your doorstep, and I will come by to get it.

ASSIGNMENT L
SAMPLE PACKET
(Items reduced to fit page)

Circle the noun.

- Jan grinned.

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

- Los Angeles is the third largest city in the United States. The current population is well over three million. Los Angeles is also the home of several professional sports teams. The Los Angeles Dodgers, the Los Angeles Lakers, and the Los Angeles Rams are popular.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Insert apostrophes in the possessives.

- My classs field trip was interesting. The monkeys faces made my friend laugh. I took Jills picture by the petting zoo. My teacher took my picture by the lions den.

Add end punctuation.

- I want to travel during the Easter Break__ Have you ever been to Florida__ I want to go somewhere warm with a beach__ Have you ever been to Disney World__ I can not wait to see Universal Studios and Sea World__

Circle the noun.

- Tim drove.

List all action verbs.

- I visited the Eiffel Tower this past fall. My family backpacked across Europe for fourteen days. We stayed in youth hostels and carried all of our luggage on our backs. We traveled to six different countries during our trip and walked over 50 miles.

_____	_____
_____	_____
_____	_____

ASSIGNMENT L
SAMPLE PACKET
(Items reduced to fit page)

Circle the correct verb in parentheses.

- The earliest horns (was, were) long, straight tubes. Today instrument makers (coils, coil) the tubes of metal. They can (handles, handle) these instruments more easily than earlier horns.

Underline all proper nouns.

- Christopher Columbus was a sailor. In 1485 Columbus went to Spain. Soon he began working for King Ferdinand and Queen Isabella. He is best known for the discovery of America.

Circle the verb.

- Jeff looked.

Add commas to the passage

- Christopher Columbus was from Spain and he was one of the greatest seamen to ever live. Columbus' ships on his first voyage to the New World were the Santa Maria the Nina and the Pinta.

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

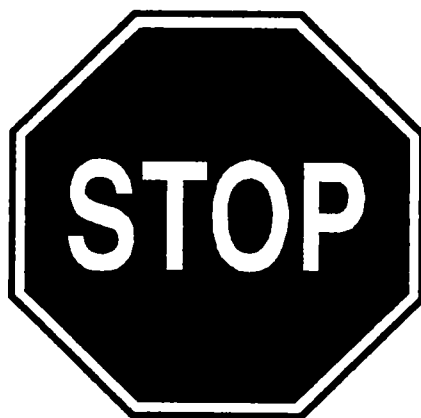
- Marcus is very athletic. He is a great basketball player. His favorite position is guard. His shooting is always good. Basketball seems exciting to him.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Circle the correct verb in parentheses.

- A large orchestra or big band (includes, include) four French horns. The French horn's beautiful shape and rich sound (makes, make) it popular. A French horn or trumpet (is, are) often used for a solo.

SAMPLE PACKET



STOP AND WAIT FOR INSTRUCTIONS



ASSIGNMENT J
SAMPLE PACKET
(Items reduced to fit page)

Write each verb. Then label it *transitive (T)* or *intransitive (I)*.

- Water wells draw water from the ground. Ground water from rain flows into the wells. The water is sometimes hundreds of feet down. In these cases, power-driven pumps draw the water.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

- Martin Luther King was a famous civil rights activist. Mr. King is a very important person in the movement toward equality for Black American citizens. He was influential and moving. Mr. King is highly respected for his great accomplishments in promoting equal rights.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Write the underlined object. Label them direct object (DO) or indirect object (IO).

- Tom lent Jill his book about wasps and bees. These insects perform some useful tasks. Bees make honey from the nectar of flowers and pollinate flowers.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

ASSIGNMENT J
SAMPLE PACKET
(Items reduced to fit page)

List all action verbs.

- Randolph found a sand dollar and ran to show his parents. He washed it off in the ocean and dried it in the sun. Randolph took the sand dollar home with him, and he showed it to his class on show-and-tell day.

_____	_____
_____	_____
_____	_____

List all plural nouns.

- Hiking is one of Michael's hobbies. Every weekend he packs some sandwiches and heads for the mountains. Hiking is not one of my favorite pastimes. I would much rather ride bikes with friends.

_____	_____
_____	_____
_____	_____

Insert apostrophes in the possessives.

- One of my fathers hobbies is scuba diving. He learned how to scuba dive at his grandparents condo off the coast of Mexico. He has been diving in many exotic countries, but Floridas diving sites are his favorite.

Circle the correct word in parentheses.

- Today most stringed instruments (is, are) copied from old Italian instruments. A violin or other stringed instrument (has, have) about seventy parts. Each part of the instrument (is, are) made of wood, except the strings.

ASSIGNMENT J

SAMPLE PACKET

(Items reduced to fit page)

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

- My brother is a basketball player. He has been an incredible athlete for years. His basketball skills are amazing for his age. His shooting is accurate and consistent. One day he will be famous.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Circle the correct verb in parentheses.

- (Have, Has) you ever been to a rodeo? Cowboys from across the country (is, are) participants. The crowd in the bleachers (is, are) noisy and boisterous. At the end there (is, are) a prize for the best cowboy of all.

Write each main verb. Label it *transitive* (T) or *intransitive* (I).

- We will celebrate my father's birthday today. My grandparents bought him a spectacular present. They gave him a Rolex watch with a gold band. The second hand sweeps around the numbers, and the small jewels in the watch gleam brightly.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Add end punctuation.

- Have you ever been to visit Myrtle Beach, South Carolina__ It's one of my favorite places to go during for summer vacation__ Last year, I went there with my family, and we went deep sea fishing__ Would you like to go with us this year__

ASSIGNMENT J
SAMPLE PACKET
(Items reduced to fit page)

Write the underlined object. Label them direct object (DO) or indirect object (IO).

- I gave my classmates a presentation about butterfly wings. Each type of butterfly has a particular wing pattern. Thousands of tiny scales cover a butterfly's wings.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

- Margaret is very smart. She is an honor roll student. Her favorite subject is math. Her grades are always excellent. Learning seems fun for her.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Add end punctuation.

- The Olympic Games are televised across the globe__ Did you see Marion Jones during the final rounds__ She won more metals than any other U.S. contestant __ Do you think she will compete in next Olympic Games__

ASSIGNMENT J
SAMPLE PACKET
(Items reduced to fit page)

Circle the correct word in parentheses.

- Did I (let, leave) my umbrella at your house. My mom will not (let, leave) me go outside in the rain without it. Will you (let, leave) it outside on your doorstep, and I will come by to get it.

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

- New York is the largest city in the United States. The current population is over eight million. New York City is the home of several professional sports teams. The New York Yankees, the New York Mets, and the New York Jets are popular.

_____	→	_____
_____	→	_____
_____	→	_____

Insert apostrophes in the possessives.

- One of the nations space heroes was a chimpanzee. The animals name was Ham. The rockets speed was almost six thousand miles per hour. The chimps fame lasted for years.

ASSIGNMENT J
SAMPLE PACKET
(Items reduced to fit page)

Add end punctuation.

- I want to travel during the summer break__ Have you ever been to Europe__ I think we are going to go to France__ Can you speak French__ I am trying to learn some of the basics before we go__

List all action verbs.

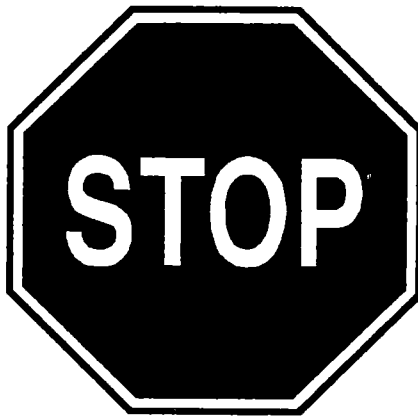
- I visited the Grand Canyon this past fall. My family rented a camper and we drove all the way to the Midwest. We stayed at campgrounds all over the United States. We traveled to six different states and drove over four thousand miles.

_____	_____
_____	_____
_____	_____

Circle the correct verb in parentheses.

- At first neither trumpets nor other horns (was, were) played with valves.
Nowadays the trumpets, the trombone, and the tuba (has, have) three valves.
French horns (has, have) three or more valves.

SAMPLE PACKET



STOP AND WAIT FOR INSTRUCTIONS



SAMPLE PACKET

Student ID Number _____

You have completed two assignments. Next I would like you to answer some questions about the assignments by circling either Assignment L or Assignment J.

5. Which assignment required more time to complete, from start to finish?

Assignment L

Assignment J

6. Which assignment required more effort to complete, from start to finish?

Assignment L

Assignment J

7. Which assignment was easier?

Assignment L

Assignment J

8. You will be given a new assignment for homework. Although the items will not be identical to those on the assignments you worked on today, they will contain the same number and type of items. Which assignment would you like to work on for homework tonight?

Assignment L

Assignment J

For Instructors Use Only

of Items Completed Assignment E _____
of Items Correct Assignment E _____
% of Items Correct Assignment E _____

of Items Completed Assignment C _____
of Items Correct Assignment C _____
% of Items Correct Assignment C _____

APPENDIX D: Treatment Integrity for Experiment 1

Treatment Integrity (Experiment 1)

DATE: _____

OBSERVER: _____

CLASS: _____

Did the instructor read assent to students?	Yes	No
Did the instructor collect assent forms prior to distribution of packets?	Yes	No
Did the instructor follow standardized instructions?	Yes	No
Did the instructor set and monitor time limits of each assignment?	Yes	No
Did the instructor read post-assignment questionnaire?	Yes	No
Did the instructor distribute appropriate homework assignments?	Yes	No

APPENDIX E: Instructions for Experiment 2

Instructions for Group Language Arts Data Collection
Experiment II

“Today we will be working on two separate Language Arts assignments contained in this packet. Please leave your packet turned face down on your desk.” (Begin distributing packets)

Please do not start on the assignments until all instructions have been given. (Wait for all packets to be distributed to each student)

Please turn you packets over to where you can see the front sheet entitled “Name Sheet”.

First, fill in your name on the blank line. Please do not write your name on any other pages included in your packet and do not work ahead.

Do not fill anything in beside Student ID number, we will fill that in for you.

Next, turn to the next page in your packet entitled “COVER SHEET”

- 8. First, Fill in the date**
- 9. Next write in your date of birth and age**
- 10. Circle whether you are male or female.**
- 11. Next write in your current grade placement.**
- 12. Circle your identifying ethnic race. W stands for White, B stands for Black, A stands for Asian, and O stands for other. If you choose other please specify in the blank provided.**
- 13. Circle whether or not you are Hispanic.**
- 14. Next, I would like you to rate on a scale of 1 to 5 how well you like the subject area of Language Arts or English.**

After you have finished filling in your cover sheet please stop and put your pencil down.
(Wait for all student to finish)

Directions for Assignments

Turn the cover sheet over where you can see the first page of your language arts assignment. Start with the first item at the top of the page (hold up sheet and point to the corresponding page) and work down the page without skipping any items (demonstrate). Remember, start with the first item on the page and do not skip any items. When you finish the first assignment raise your hand and my assistant or I will come by and check and intial your assignment. After your first assignment has been approved begin working on the second assignment. Please work as quickly as you can without making mistakes. Keep working until you finish both assignments in your packet. When you finish the second assignment put your pencil down, raise your hand, and someone will come around and check your second assignment. Are there any questions?

(Wait until all students have finished both assignments)

Please turn the page to the last page in your packet. You have now completed two assignments. Each of you completed one assignment titled Assignment L and one titled Assignment J. Next, I would like you to answer some questions about the assignments by circling either ASSIGNMENT J or ASSIGNMENT L for the corresponding assignments.

You may look back through your packet at these assignments. We will answer each of these questions as a group. Please do not work ahead. Are there any questions?

9. Which assignment required more time to complete, from start to finish?

ASSIGNMENT J

ASSIGNMENT L

10. Which assignment required more effort to complete, from start to finish?

ASSIGNMENT J

ASSIGNMENT L

11. Which assignment was easier?

ASSIGNMENT J

ASSIGNMENT L

12. You will be given a new assignment for homework. Although the problems will not be identical to those on the assignments you worked on today, they will contain the same number and type of problems. Which assignment would you like to work on for homework tonight?

ASSIGNMENT J

ASSIGNMENT L

APPENDIX F: Sample Packet for Experiment 2

SAMPLE PACKET

NAME SHEET

Name: _____

Student ID Number: _____



STOP AND WAIT FOR INSTRUCTIONS



SAMPLE PACKET
COVER SHEET

Student ID: _____

Date: _____

Birthdate: _____

Age: _____

Circle: Male or Female

Grade: _____

Ethnicity: W B A O (_____)

Hispanic: yes or no

Please rate the subject of Language Arts (circle).

1	2	3	4	5
Favorite	Very Well	Somewhat	Not Well	Least Favorite



STOP AND WAIT FOR INSTRUCTIONS



ASSIGNMENT L
SAMPLE PACKET
(Items reduced to fit page)

Write each verb. Then label it *transitive* (T) or *intransitive* (I).

- Builders on a construction site work quickly. First, workers dig a foundation for support of the building. They usually raise beams or columns next. The beams or columns form the skeleton of the house.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Circle the correct word in parentheses.

- Mr. Jones (is, are) the teacher for three science classes. He (works, work) very hard. Mr. Jones and Mr. Smith (is, are) the basketball coaches for our school team. Mr. Smith (is, are) a retired NBA player.

Write the underlined object. Label them direct object (DO) or indirect object (IO).

- Ms. Jackson taught my science class interesting facts about insects. I asked her some questions about spiders.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

ASSIGNMENT L
SAMPLE PACKET
(Items reduced to fit page)

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

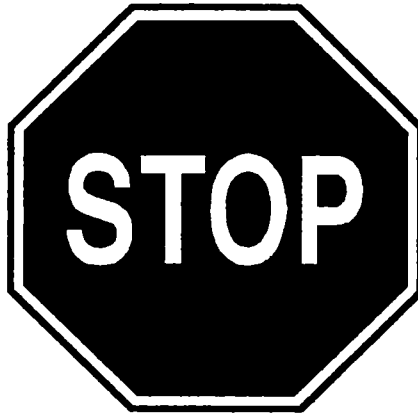
- Football is a wonderful game. The players are usually males. Football is popular at our high school. We won the state championship last year. Jeremiah is the quarterback of our team.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Write the underlined object. Label them direct object (DO) or indirect object (IO).

- Uncle Tom bought my brother a new helmet for Christmas. He got my mother a nice ring from Italy.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____



STOP AND WAIT FOR INSTRUCTIONS



ASSIGNMENT J
SAMPLE PACKET
(Items reduced to fit page)

Circle the noun.

- Pam can.

Write each verb. Then label it *transitive* (T) or *intransitive* (I).

- Early humans lived in caves or in the open air. Later people built houses out of sticks or mud. Today many people construct large houses. People use different kinds of materials for their houses.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Circle the correct word in parentheses.

- Names (is, are) interesting. I (likes, like) the name Emmet. The name Wyatt (means, mean) "a guide". Liz and Libby (is, are) nicknames for Elizabeth. Rhoda or Rose (is, are) a good name for my new sister.

Write the underlined object. Label them direct object (DO) or indirect object (IO).

- Mr. Walker taught my history class interesting facts about presidents. I asked him some questions about Lincoln.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

ASSIGNMENT J
SAMPLE PACKET
(Items reduced to fit page)

Circle the verb.

- Jan swam.

Write the underlined words. Label them predicate noun (PN) or predicate adjective (PA).

- A tomato is a fruit. Some people think a tomato is a vegetable. You can use tomatoes in many cooking recipes. Tomatoes are used as an ingredient in lasagna. Tomatoes are very juicy.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Write the underlined object. Label them direct object (DO) or indirect object (IO).

- Aunt Sue mailed my sister a gift from Holland. She sent my parents a package from Germany.

_____	→	_____
_____	→	_____
_____	→	_____
_____	→	_____

Circle the correct word in parentheses.

- The national news (come, comes) on at 7:00 P.M. The muppets (is, are) rerun after the news. My family (loves, love) this show. Ten years (is, are) a long time for a show to be on TV.



STOP AND WAIT FOR INSTRUCTIONS



SAMPLE PACKET

Student ID Number _____

You have completed two assignments. Next I would like you to answer some questions about the assignments by circling either Assignment L or Assignment J.

13. Which assignment required more time to complete, from start to finish?

Assignment L

Assignment J

14. Which assignment required more effort to complete, from start to finish?

Assignment L

Assignment J

15. Which assignment was easier?

Assignment L

Assignment J

16. You will be given a new assignment for homework. Although the items will not be identical to those on the assignments you worked on today, they will contain the same number and type of items. Which assignment would you like to work on for homework tonight?

Assignment L

Assignment J

For Instructors Use Only

of Items Completed Assignment C _____
of Items Correct Assignment C _____
% of Items Correct Assignment C _____

of Items Completed Assignment E _____
of Items Correct Assignment E _____
% of Items Correct Assignment E _____

APPENDIX G: Treatment Integrity for Experiment 2

**Treatment Integrity
Experiment II**

Date: _____

Observer: _____

- | | |
|--|----------|
| 1. Did the instructor collect assent forms from all students who were absent for Experiment I and did not have a written assent on file? | Yes No |
| 2. Did the instructor collect homework assignments? | Yes No |
| 3. Did the instructor present instructions prior to beginning assignment packets? | Yes No |
| 4. Did the instructor monitor the activity? | |
| 5. Did the instructor read questions aloud after students completed the packet? | Yes No |

APPENDIX H: Tables for Experiment 1

TABLE 1
Problem Completion Rates and Accuracy Levels for Control and Experimental
Assignments for Experiment 1.

Variable	<u>Control Assignment</u>		<u>Experimental Assignment</u>	
	M	SD	M	SD
Total Items Completed	8.39	3.65	11.53*	4.64
Target Items Completed	8.39	3.65	8.05	3.49
% Target Items Correct	72.99	17.51	71.70	20.42
% Interspersed	NA	NA	82.53	30.58
% Correct Total Items	72.98	17.51	72.73	19.79

* Denotes statistical significance

TABLE 2
Dependent t-tests for Experiment 1

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Total Items Completed Experimental - Total Items Completed Control	3.1429	4.5902	.6134	5.124	55	.000
Target Items Completed Experimental - Target Items Completed Control	-.3393	3.9232	.5243	-.647	55	.520
% of Target Items Correct Experimental - % of Target Items Correct Control	-1.2805	15.3384	2.0497	-.625	55	.535
% of Total Items Correct Control - % Total Items Correct on Experimental	.2579	14.4205	1.9270	.134	55	.894

TABLE 3

Rankings for Control (target items) and Experimental Assignments (20% more target plus interspersed briefer items) and Assignment Choice Data for Experiment 1.

	<u>Control Assignment</u>		<u>Experimental Assignment</u>	
	N	%	N	%
Homework Choice	20	36	36	64
Most Time to Finish	31	55	25	45
Most Effort to Finish	29	52	27	48
Easiest	24	43	32	57

TABLE 4
Chi Square Test Statistics - Experiment 1

	Student's Choice	Student's Time Perception	Student's Effort Perception	Student's Ease Perception
Chi-Square ^a	4.571	.643	.071	1.143
df	1	1	1	1
Asymp. Sig.	.033	.423	.789	.285
Exact Sig.	.044*	.504	.894	.350
Point Probability	.022	.155	.205	.121

a. * Denotes statistical significance

TABLE 5**Individual Student Choice and Problem Completion Rates for Experiment 1.**

	<u>Items Completed</u>		<u>Discrete Item Parts</u>	
	Completed More on Exp.	Completed More on Con.	Completed More on Exp.	Completed More on Con.
	N (%)	N (%)	N (%)	N (%)
Chose Exp.	34 (94%)	2 (6%)	29 (81%)	6 (17%)
Chose Control	9 (45%)	9 (45%)	2 (10%)	18 (90%)

TABLE 6**Assignment Choice and Ranking Data for High, Middle, and Low Performers for Experiment 1.**

	<u>High Performers</u>		<u>Middle Performers</u>		<u>Low Performers</u>	
	Control N (%)	Exp. N (%)	Control N (%)	Exp N (%)	Control N (%)	Exp. N (%)
Choice	6 (33%)	12 (67%)	6 (30%)	14 (70%)	8 (44%)	10 (56%)
Most Time	11 (61%)	7 (39%)	12 (60%)	8 (40%)	8 (44%)	10 (56%)
Most Effort	11 (61%)	7 (39%)	12 (60%)	8 (40%)	6 (33%)	12 (67%)
Easiest	7 (39%)	11 (61%)	8 (40%)	12 (60%)	9 (50%)	9 (50%)

TABLE 7**Summary of Statistical Analyses for High, Middle and Low Performers for Experiment 1.**

	<u>High Performers</u>		<u>Middle Performers</u>		<u>Low Performers</u>	
	Chi Square	Exact Sig.	Chi Square	Exact Sig.	Chi Square	Exact Sig.
Choice	2.000	.238	3.200	.115	.222	.815
Most Time	.889	.481	.800	.503	.222	.815
Most Effort	.899	.481	.800	.503	2.000	.235
Easiest	.899	.481	.800	.503	.000	1.000

APPENDIX I: Tables for Experiment 2

TABLE 8**Accuracy Levels for the Control and Experimental Assignments for Experiment 2.**

Variable	<u>Control Assignment</u>		<u>Experimental Assignment</u>	
	M	SD	M	SD
% Target Items Correct	64.32	21.23	64.53	17.17
% Interspersed Items Correct			94.17	18.62
% Total Items Correct	64.32	21.23	66.78	15.92

TABLE 9
Dependent t-test for Experiment 2

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
% of Target Items Correct Control - % of Target Items Correct Experimental	-.2135	11.2186	1.4483	-.147	59	.883
% of Total Items Correct Control - % of Total Items Correct Experimental	-2.4529	11.5596	1.4923	-1.644	59	.106

TABLE 10

**Rankings for Control (target items) and Experimental Assignments (20% more target plus interspersed
briefer items) and Assignment Choice Data for Experiment 2.**

	<u>Control Assignment</u>		<u>Experimental Assignment</u>	
	N	%	N	%
Homework Choice	21	35	39	65
Most Time to Finish	32	53	28	47
Most Effort to Finish	36	60	24	40
Easiest	23	38	37	62

TABLE 11
Chi Square Test Statistics - Experiment 2

	Student's Choice	Student's Time Perception	Student's Effort Perception	Student's Ease Perception
Chi-Square ^a	5.400	.267	2.400	3.267
df	1	1	1	1
Asymp. Sig.	.020	.606	.121	.071
Exact Sig.	.027*	.699	.155	.092
Point Probability	.020	.180	.063	.041

a. * Denotes statistical significance.

TABLE 12**Assignment Choice and Ranking Data for High, Middle and Low Performers for Experiment 2.**

	<u>High Performers</u>		<u>Middle Performers</u>		<u>Low Performers</u>	
	Control N (%)	Exp. N (%)	Control N (%)	Exp N (%)	Control N (%)	Exp. N (%)
Choice	9 (45%)	11 (55%)	4 (20%)	16 (80%)*	10 (50%)	10 (50%)
Most Time	10 (50%)	10 (50%)	12 (60%)	8 (40%)	10 (50%)	10 (50%)
Most Effort	10 (50%)	10 (50%)	15 (75%)	5 (25%)*	9 (45%)	11 (55%)
Easiest	11 (55%)	9 (45%)	4 (20%)	16 (80%)*	8 (40%)	12 (60%)

***Denotes statistical significance**

TABLE 13**Summary of Statistical Analyses for High, Middle, and Low Performers in Experiment 2.**

	<u>High Performers</u>		<u>Middle Performers</u>		<u>Low Performers</u>	
	Chi Square	Exact Sig.	Chi Square	Exact Sig.	Chi Square	Exact Sig.
Choice	.200	.824	7.200	.009*	.800	.503
Most Time	.000	1.000	.800	.503	.000	1.000
Most Effort	.000	1.000	5.000	.041*	.200	.824
Easiest	.200	.824	7.200	.012*	.800	.503

* Denotes statistical significance

VITA

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