To the Graduate Council:

I am submitting herewith a dissertation written by Meredith Leigh Embree entitled "Three Experiments Investigating Partial Assignment Completion and Assignment Choice." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in School Psychology.

Christopher H. Skinner, Major Professor

We have read this dissertation and recommend its acceptance:

Sherry K. Bain, Shawn L. Spurgeon, John Malone

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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THREE EXPERIMENTS INVESTIGATING PARTIAL ASSIGNMENT COMPLETION AND ASSIGNMENT CHOICE

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

Meredith Leigh Embree

August 2012

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Abstract

When students have the prerequisite skills, academic engagement and resulting skill development are often dependent on students' choice behaviors. Although researchers have found that students are more likely to choose to engage in academic tasks when those tasks require less effort (e.g., Billington, Skinner, Hutchins, & Malone, 2004), learning and skill development often require high-effort engagement. Gestalt, social psychology, and behavioral researchers have posited that individuals are motivated to resume and complete tasks which they have begun, but not finished (Rickers-Ovsiankina, 1928; Skinner, 2002). However, no researchers have investigated partial academic assignment completion on students' choice behavior, while controlling for other variables that influence student choice.

The current dissertation included three experiments designed to evaluate the effects of partial assignment completion (PAC), relative effort, and invested effort on students' assignment choice behavior. In Experiment I, mathematics tasks were used to establish existence of a PAC effect on assignment choice. Significantly more seventh-grade students chose to finish their partially completed assignment (n = 52) than chose to complete a new, equivalent assignment (n = 33). In Experiment II, the strength of the PAC effect was investigated. Significantly more seventh-grade students chose to complete a lower-effort mathematics assignment (n = 55) than chose to finish their partially completed mathematics assignment (n = 33). Experiment III provided some evidence that the amount of effort initially invested in the partially completed assignment may influence motivation to complete that assignment. Nevertheless, even when students completed half of an assignment (10 long math computation problems), they were still more likely to choose to complete a new assignment that required less effort.

Together, these experiments suggested that a PAC effect exists, but may not be strong enough to overcome the variable of effort, even when students have invested a meaningful amount of time and effort in the partially completed assignment. As these experiments were the first to study PAC in an applied setting while controlling for assignment effort, difficulty, and interest, they may have heuristic value. Discussion focuses on limitations and directions for future researchers.

Preface

Provided students have the prerequisite skills, academic engagement and resulting skill development are often dependent on students' choice behaviors (Skinner, Pappas, & Davis, 2005). Although researchers have found that students are more likely to choose to engage in academic tasks when those tasks require less effort (e.g., Billington, Skinner, Hutchins, & Malone, 2004), learning and skill development often require high-effort engagement. Gestalt, social psychology, and behavioral researchers have posited that individuals are motivated to resume and complete tasks which they have begun, but not finished (Katz, 1938; Pachauri, 1935, 1936; Rickers-Ovsiankina, 1928; Skinner, 2002). However, no researchers have investigated partial academic assignment completion on students' choice behavior, while controlling for other variables that influence student choice.

The three experiments described in this dissertation were designed to evaluate the effects of partial assignment completion (PAC), relative effort, and invested effort, on students' assignment choice behavior. In Experiment I, mathematics tasks were used to determine whether seventh-grade students (N = 85) would choose to finish an assignment they had already begun or a new assignment. The assignments were constructed so that effort, difficulty, interest, and time required to complete assignments were equivalent. Significantly more students chose to finish the partially completed assignment (n = 52) than chose to complete the new assignment (n = 33). This initial experiment was to first test the PAC effect while holding assignment effort, difficulty, and interest constant.

Results from Experiment I supported the hypothesis that students are motivated to complete assignments that they have started, but not finished. Experiment II was designed to evaluate the strength of the PAC effect by manipulating relative effort. Specifically, we

investigated whether seventh-grade students (N = 88) would choose to finish a partially completed mathematics worksheet or a new matched lower-effort worksheet requiring 10% less effort. Significantly more students chose to complete the lower-effort assignment (n = 55) than chose to complete their partially completed assignment (n = 33). Whereas the first experiment established the PAC effect, Experiment II results suggested that the PAC effect may not be very powerful.

Experiment III was designed to replicate and extend Experiment II by evaluating whether sunken effort influenced the PAC effect. Seventh-grade students (N = 75) were divided into two groups, with different partial-completion assignments. One group was given a 20-problem partial-completion assignment and finished 10 problems before being interrupted. The other group was given a 12-problem partial-completion assignment and finished 2 problems before being interrupted. Thus, both groups had the same 10 problems remaining on the partial-completion assignments.

Next, similar to Experiment II, both groups were given a choice of finishing their partially completed assignment or a new assignment containing 9 matched problems. As with Experiment II, significantly more students chose the lower-effort assignment. Although a larger proportion of the 20-problem group chose the higher-effort partially completed assignment (29%) than the 12-problem group (17%), this difference was not statistically significant. Together, these three experiments suggest that a PAC effect exists, but may not be strong enough to overcome the variable of effort even when students have already invested a meaningful amount of effort in the partially completed assignment.

The current series of experiments represents the first attempt to study PAC in an applied setting while controlling for assignment effort, difficulty, and interest. Consequently, these

studies may have heuristic value with respect to methodology, theory, and practice. Discussion focuses on limitations of the current study and directions for future basic and applied researchers.

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Chapter I

Introduction

In order to enhance their newly-acquired skills, educators provide students with assigned work, such as independent seatwork and homework (Skinner & McCleary, 2010). These assignments are intended to encourage practice of specific skills by providing the students with multiple opportunities to actively and accurately respond, ultimately leading to enhanced fluency and skill maintenance (Ebbinghaus, 1885; Greenwood, Delquadri, & Hall, 1984; Haring & Eaton, 1978; Ivarie, 1986; Skinner, Belfiore, Mace, Williams, & Johns, 1997; Skinner, Fletcher, & Henington, 1996). However, students' skills will not improve unless they actually do the assigned tasks (Skinner, Wallace, & Neddenriep, 2002).

In almost all instances, skill development requires active engagement from the learner. When prerequisite skills are adequate and students have ample ability to do the work, academic engagement is based on student choice (Skinner, Pappas, & Davis, 2005). Students choose whether or not to work on each task assigned to them. This choice behavior may be influenced by several factors, including the amount of effort required to complete the task, the time required to complete the task, and the difficulty level of the assignment (Skinner, 2002). Students may be less likely to misbehave and more likely to choose to engage in assigned tasks when the tasks require less effort (Friman & Poling, 2005). Working with college and elementary students, researchers have shown that when given a choice between two assignments, students were more likely to choose the assignment that required less effort to complete (Billington, Skinner, & Cruchon, 2004; Billington, Skinner, Hutchins, & Malone, 2004; Cates et al., 1999; Cates & Skinner, 2000; Martin, Skinner, & Neddenriep, 2001).

Enhancing the Probability of Students Choosing to Engage

Since skill development almost always requires students to choose to engage, a primary goal of educators is to apply procedures that encourage academic engagement without reducing the quality and quantity of what is learned (Cates et al., 2003; Skinner, 2002). One way to enhance the probability of students choosing to engage in assigned work is to reduce the number of tasks assigned. However, unless the assigned activities are superfluous (i.e., busy work that does not enhance learning or skill development), this procedure will thwart learning because students will have fewer response opportunities (Skinner, Robinson, Johns, Logan, & Belfiore, 1996). Another method for increasing the probability of students choosing to engage in assigned work is to replace high-effort tasks with lower-effort tasks. This procedure, which has been referred to as the substitutive interspersal procedure, may also hinder learning as the curriculum is essentially diluted (Cates et al., 2003; Joseph & Nist, 2006; Nist & Joseph, 2008; Skinner, 2002).

While reducing academic assignment demands by either eliminating tasks (making the assignment brief) or replacing higher-effort tasks (e.g., un-mastered tasks) with lower-effort tasks (e.g., mastered tasks) may delay learning, enhancing reinforcement for academic responding can increase the probability of students choosing to engage without reducing assignment demands (Martens, Lochner, & Kelly, 1992; Neef, Mace, & Shade, 1993; Neef, Shade, & Miller, 1994). However, enhancing reinforcement for students to engage in assigned work can be time consuming, costly, and unacceptable to many educators who believe that such procedures reduce the students' intrinsic motivation to complete assigned tasks (e.g., McCurdy et al., 2001).

Rather than decreasing assignment demands, the additive interspersal procedure enhances assignment demands while still increasing the probability of students choosing to engage in higher-effort academic assignments (Billington, Skinner, & Cruchon, 2004; Billington, Skinner, Hutchins, & Malone, 2004; Cates et al., 2003; Skinner, 2002; Skinner, Robinson, Johns, Logan, & Belfiore, 1996). When applying the substitutive interspersal procedure, researchers replace more difficult items with less difficult items. With the additive interspersal procedure, additional, briefer discrete tasks (e.g., math problems) are interspersed among the assignment. Thus, this procedure does not hinder learning by reducing assignment demands. Furthermore, when given the choice of two assignments, researchers have found that students will choose an interspersal assignment which, relative to the control assignment, contains 20-40% more high-effort target problems plus the additional interspersed brief problems (Cates et al., 1999; Cates & Skinner, 2000).

Skinner (2002) has used the discrete task completion hypothesis to explain these findings. The discrete task completion hypothesis rests on an assumed learning history; specifically, when given assignments, students' assignment completion has been reinforced. Based on the principles of contingency and contiguity, stimuli that reliably precede this reinforcement should become conditioned reinforcers. When an assignment is composed of many discrete tasks, each complete discrete task is a stimulus that reliably precedes reinforcement delivered contingent upon assignment completion. Consequently, each completed discrete task should serve as a reinforcer.

Task Interruption

The (Skinner, 2002) discrete task completion hypothesis suggests that students should be motivated to complete assignments in order to gain access to positive reinforcement or avoid

punishment. Also, Gestalt researchers have suggested that people may have a desire to complete interrupted or incomplete tasks (e.g., Katz, 1938). Lewin and Zeigarnik (as cited in Katz) focused their investigations of interrupted tasks on whether or not individuals recalled the interrupted tasks better than uninterrupted tasks. Rickers-Ovsiankina (1928), examined a different aspect of task interruption. Specifically, Rickers-Ovsiankina was interested in whether or not individuals chose to resume interrupted tasks more often than choosing an alternative task. Each of these Gestalt researchers was interested in what they identified as tension systems that represent a drive to finish something which has been started but not completed (Katz, 1938).

Pachauri (1935) attempted to replicate and extend earlier findings regarding task interruption. Although this author also focused primarily on memory for tasks when they were interrupted versus uninterrupted, Pachauri used tasks which required verbal responses as well as those which required motor responses. Pachauri's research corroborated the earlier work of Zeigarnik. One of Pachauri's discoveries arose from the author's comparison of interruption tendencies between easy and difficult tasks. Pachauri concluded that more difficult tasks did not result in significantly more recall, even when interrupted. Also, Pachauri noted that very brief, incomplete tasks were not remembered any better than comparison tasks which were completed.

Though early research by Zeigarnik (as cited in Katz, 1938) and others [e.g., Lewin (as cited in Katz); Pachauri, 1935] has focused on memory for interrupted tasks, other researchers sought to investigate the tendency for resumption of such tasks. Rickers-Ovsiankina (1928) used both continuous and discrete tasks to examine the task resumption behavior of children and adults. Tasks consisted of activities such as puzzles, brainteasers, bead stringing, and drawing. All activities in this experiment were interrupted before completion, but the manner in which the interruptions occurred varied across tasks. For instance, some tasks were interrupted seemingly

on accident while others were obviously intentionally stopped. Methods for completing each type of interruption varied, including presenting an alternate activity, engaging the participant in conversation, staging a "chance" interruption, and expressly forbidding the participants to continue in the activity. Following interruption, participants were given the opportunity to continue the task on which they were previously working. When given a choice of completing the interrupted task or a finished activity, significantly more participants chose to resume the incomplete task. Additionally, seemingly accidental interruptions were associated with more resumption than intentional interruptions.

Katz (1938) advanced the task interruption research agenda by including novel alternative activities that had not previously been completed by participants. Thus, participants were essentially required to choose between finishing an interrupted task and starting a novel task. The participants in Katz's experiments were all preschool- and kindergarten-aged children. Katz used tasks which were familiar to this age group, including coloring, pasting, and puzzles. In Katz's experiments, interruption was accomplished by redirecting the child's attention to a quick and simple puzzle task. Following interruption, children were allowed to choose what they would like to do. In some instances, the interrupted task was the only activity present and in others there were alternative tasks in the room. Also, children always had the option of quitting the experimental session altogether. Participants most frequently chose to complete the interrupted task. When alternative activities were also present, the participants still chose to resume the interrupted task most frequently, but somewhat less than when no alternatives were available. Individual factors such as intelligence and socioeconomic status did not appear to influence choice behavior. Katz interpreted the findings as support for a theory of tension systems, thought to be activated within an individual when a task is left unfinished.

In a later study by Henle and Aull (1953) participants' resumption of their own versus others' incomplete tasks was investigated. Henle and Aull presented each of 20 children with a cardboard cutout and peg task. Prior to completing the task, experimenters interrupted the children by presenting a partially-stuffed animal and prompting the children to complete its stuffing. Following completion of the interrupting activity, the children were left to resume their cardboard cutout and peg task, finish a cutout and peg task which had already been partially completed by someone else, or return to the stuffed animal. Henle and Aull found that all of the participants resumed their partially completed task rather than an activity left incomplete by someone else. For Gestalt researchers, these findings appeared to support the existence of tension systems created by a task left incomplete. According to this perspective, participants experienced the tension for tasks they were unable to finish but not for those left unfinished by others.

More recently, researchers have investigated a related line of research known as the Interrupted Task Paradigm (ITP). The ITP takes the concept a step further and explains factors related to the choice resumption of interrupted or completed activities in addition to memory for these activities (Butterfield, 1964). One line of ITP research focuses on factors influencing whether or not, when given a choice, participants more often resume incomplete tasks or perform completed tasks again. In 1965, Butterfield extended research on the ITP using fourth- and sixth-grade students as participants and puzzles for tasks. In addition to investigating the effects of interruption on memory and resumption, Butterfield examined whether locus of control and emphasis of task instructions influenced student choice behavior. Results of this experiment suggested that an interaction effect existed between age and the type of instructions provided (skills emphasis versus no specific emphasis on performance). Specifically, the sixth-grade students who were given skills emphasis instructions chose to complete interrupted puzzles

again, from the beginning, more often than younger students who received the same type of instructions.

MacMillan (1969) investigated the ITP with typically-developing children and children with mental retardation. Participants were instructed to re-create pictured designs using colored blocks. The experiment included a total of six block design tasks and two of these were interrupted before completion. Following all of the tasks, the children were prompted to choose one of the tasks to do again. Among the typically developing children, as age increased the likelihood increased that the participant chose to repeat an interrupted task significantly more often than the uninterrupted tasks. Thus, it appears that Butterfield (1964, 1965) and MacMillan both examined restarting of an interrupted task rather than finishing the task from the point of interruption.

In addition to behavioral and Gestalt researchers, social psychology and economics researchers working on the sunk-cost effect have conducted research on task interruption and resumption. Rather than referring to tension systems, the sunk-cost effect purports that humans have a desire to complete a task in which they have previously invested effort, time, or money (Arkes & Blumer, 1985). The sunk-cost effect has been repeatedly demonstrated in economic scenarios (Arkes & Blumer, 1985; Thames, 1996). For example, Arkes and Blumer (1985) investigated the sunk-cost effect with both hypothetical scenarios and an applied situation. In both situations, participants were more likely to participate in events in which they had invested more monetary resources, thereby incurring a sunk cost in the venture. Thames (1996) demonstrated that the higher the initial investment, the more likely individuals are to succumb to a sunk-cost effect. These findings suggest that the more time or effort a student invests in an assignment, the more likely he or she is to return to that assignment for completion. This raises

the question as to how much time or effort must be invested in the task in order for this effect to become powerful enough to overcome other variables influencing student choice (e.g., effort required for the alternate assignment).

More recently, Navarro and Fantino (2009) investigated a related concept which they termed the sunk-time effect. This is a term which the authors use to describe a sunk-cost effect in which the cost invested was time rather than monetary resources. Navarro and Fantino were able to demonstrate that a sunk-time effect may also influence choice behavior related to task completion. Findings from hypothetical scenarios and applied experiments indicated that the more time individuals had invested in a task, the more likely they were to persist with that task than to abandon the task or pursue an alternative task. This research extends the applicability of the sunk-cost effect and is potentially more applicable to academic research because, when working on assignments, students invest time rather than money or other resources.

Summary of Previous Research

Table I provides a summary of task interruption research, which suggests that individuals appear to be motivated to finish incomplete tasks (e.g., Katz, 1938; Rickers-Ovsiankina, 1928) and tasks in which they have already invested money or time (Arkes & Blumer, 1985; Navarro & Fantino, 2009). Consequently, partial assignment completion may be another procedure for influencing students to choose to engage in assigned academic work. The partial-assignment completion (PAC) effect suggests that students are more likely to choose to work on an assignment which they have begun but not finished, than an assignment which they have not started. The PAC effect could have practical and theoretical implications for the classroom. For example, many teachers may not assign work when there is insufficient time to finish that

assignment before class ends. Consequently, the next day when students return to the classroom, they are given an assignment they have not begun. Perhaps students would be more likely to choose to work on the assignment and finish the assignment if they had begun the assignment the previous day.

Purpose

Before recommendations can be proposed for its use in classroom settings, researchers must determine if partial assignment completion influences assignment choice. Additionally, researchers must investigate the strength of the PAC effect and factors that may interact with the PAC effect. The three experiments presented are intended to begin investigating the PAC effect. The first of the three experiments examined whether or not a PAC effect was present when students were given the choice of completing an interrupted assignment or beginning a new one when both assignments would require equal time and effort to complete. Experiment II was designed to begin evaluating the strength of the PAC effect by determining if students would be more likely to choose partially completed assignments or new assignments that would require about 10% less effort to complete. Experiment III was designed to determine if the sunk-effort effect influenced the strength of the PAC effect.

Chapter II

Experiment I: Does Partial Assignment Completion Influence Choice?

Purpose

The purpose of Experiment I was to evaluate the effects of partial assignment completion on assignment choice. Specifically, the researchers tested whether significantly more students would choose to complete an assignment they had already begun or a new equivalent assignment. Although the two choice assignments contained different problems, they were constructed so that they contained the same number of problems and would require the same amount of effort to complete.

Methods

Participants, Setting, and Materials

There were 87 seventh-grade students who consented to participate in the study. Of these, 85 students completed all components of the study. Two students' data were excluded because they did not complete the first worksheet. There were 36 boys and 49 girls who participated. The sample included 81 Caucasian students, 1 African-American student, 1 Hispanic student, 1 Asian/Pacific Islander student, and 1 Native American student. Students' ages ranged from 12 years to 14 years (mean age = 12.37 years). All of the students were in the seventh grade at a rural middle school and were receiving instruction from the same mathematics teacher who taught three general-education math classes, one inclusion class, and one pre-algebra class. Approximately 5 of the participating students were receiving special education services for math within an inclusive setting. Another 5 of the participating students were receiving services for gifted students. Because accuracy was not a primary concern, data of students receiving special services were included in analyses as long as they completed all experimental tasks. Each of

approximately 135 students enrolled in one of these classes was given a chance to participate; however, only those who returned parental consents and gave assent participated.

Procedures were run in the students' math classroom which contained approximately 30 student desks aligned in five rows. The desks faced the front wall of the room with one white dry-erase board and one Smart Technology Board hung on the wall. When standing at the front of the room and facing the students' desks, the teacher's desk was positioned on the right-hand side. The primary researcher stood at the front of the room while implementing procedures and another researcher sat at a table in a back, right-hand corner of the classroom.

Researchers designed two types of mathematics computation worksheets for this study. The partial-completion worksheet contained 25 three-digit by two-digit multiplication problems. Only the first and last digits in the three-digit number were above three, which required carrying only on the first operation. Identical digits (e.g., 22) in the 2-digit factors were not explicitly avoided, but were used sparingly. Researchers also constructed a base, matched worksheet by altering the sequence of digits in one or both of the factors on the partial-completion sheet. Thus, if a problem on the partial-completion worksheet was 417 X 43 = ____, the problem on the matched worksheet may have been 714 X 34 = ____. Previous researchers found that similar procedures allowed them to construct different math sheets that were equivalent with respect to effort (e.g., Billington, Skinner, & Cruchon, 2004). After the base matched worksheet was constructed, the researchers constructed worksheets designed to be used across students who finished various amounts of work on the partial-completion worksheet. Therefore, by eliminating problems from the beginning of the partial-completion worksheet, the researchers constructed versions of this worksheet with 1-24 problems. See appendix A for the two math sheets.

The researchers also created a brief questionnaire (see Appendix B). First, students were asked to write a narrative response to a question that asked them to explain why they chose a particular worksheet. Next, the questionnaire contained five items designed to assess factors that may have influenced each student's assignment choice. Three of the items addressed time, effort, and difficulty; as such variables may influence choice (see Skinner, 2002). The other two items assessed whether already starting the assignment influenced their choice. These five questions were each answered on a five-point Likert scale rating.

Procedure

Data collection took place in the classroom where students typically had their mathematics instruction. The class periods lasted 50 min and study procedures were always conducted immediately following the first bell signaling the beginning of class time (5 min after the hour). Participants for whom parental consent (see Appendix C) had been obtained were provided with a student assent form (see Appendix D) and demographic information form (see Appendix E). The primary researcher read each of these forms aloud with the students and answered any questions. Upon completion, the assent and demographic forms were collected and students not participating were given independent mathematics seatwork by their teacher as their classmates participated in this study.

Each participant was provided with a sharpened pencil with an eraser. Students were asked to place worksheets face down until all instructions were given and they were told to begin work. Participants were reminded to place their name (first and last) in the space provided in the upper left hand corner of the sheet prior to completing problems. Next, the researcher read standardized instructions to the participants. Instructions were as follows:

> When I say begin, you may turn over your paper and begin completing problems as accurately as you can. Please complete problems working from left to right and beginning at the top of your paper. (Researcher demonstrates) Please try to work each problem in order and try not to skip problems. Are there any questions? Begin.

Participants were given 5 min to work on the computations. Students were not permitted to use calculators or multiplication tables. After 5 min had elapsed, the primary researcher said "Stop." in a loud voice. The researcher then instructed the students to complete the problem they had been working on when they were told to stop. Next, the primary researcher collected a worksheet from each participant, thanked the student for participation, and sat with the other researcher at a table in the back corner of the classroom.

Researchers then selected a pre-constructed, matched worksheet for each participant based on the number of problems completed on that student's initial sheet. Each student's second worksheet was constructed to contain the same number of problems left incomplete on her/his partial-completion worksheet. For example, a student who completed 5 problems on the partial-completion assignment would have 20 problems remaining. Thus, that student would receive a matched assignment containing 20 problems.

Approximately 15 min after being told to stop, the primary researcher informed students that she would need them to perform another task. Students were then told that they would be given two worksheets, the one they had begun previously and a new sheet, and would be able to choose which of the sheets to complete. Each participant's matched sheets were distributed and they were instructed to identify the sheet they would prefer to complete. Students were asked to place their names on both sheets and to place a "C" on the one they had chosen. They were

instructed to begin working on the chosen sheet. As students worked, the researchers collected the worksheet not chosen and recorded the choice for each child. Students were given 10 min to work on the sheet they had chosen. After these worksheets were collected, students were asked to complete an open response question and brief questionnaire about their assignment choice. To minimize sequence or prompting effects, the open-response format item was completed prior to and independent of the Likert scale questionnaire.

Design, Dependent Variables, and Data Analysis

The primary research question was whether significantly more students would choose to complete the partially completed assignment or the matched assignment with the same number of problems as those remaining on the partial-completion assignment. Thus, the primary dependent variable was which assignment each student chose to work on after the interrupted experimental session was resumed.

The open-ended item on which students indicated their reason for choosing a particular assignment was scored using operational definitions. The researchers created operational definitions in the following manner. First, they reviewed previous research to identify variables that may influence choice. These variables included assignment effort, difficulty, and time required to complete assignments. Also, the researchers included an item addressing partial-completion and a similar item that was reverse order (chose the assignment because they had not started it). Additionally, they included when students provided irrelevant responses (e.g., “to help you with school”) and when they provided no response.

Procedural Integrity and Inter-scorer Agreement

The primary experimenter developed a protocol describing the experimental procedures in sequence and used this to prompt her behaviors. Procedural integrity data were collected by the second experimenter independently observing the primary experimenter's behaviors and recording whether or not the behaviors were completed consistently in sequence (e.g., read instructions as written). Procedural integrity data showed that the primary experimenter completed all behaviors in the correct sequence across all administrations. Following study completion, the primary researcher recorded student choice data, number of problems correctly completed, students' questionnaire responses, and their responses to open-ended questions. A second researcher independently scored 20% of these responses and inter-scorer agreement was 100% for each measure.

Results

Although 87 students participated, two students' data were excluded from this analysis because they quit the study before the original worksheet was collected. Assignment choice was dichotomous; therefore, Chi square analyses were used to test for significant differences on assignment choice. Results indicated that significantly more students chose to finish the partial-completion assignment (n=52) than chose to begin a new assignment (n=33) requiring equal effort, $x^2(1) = 4.25$, $p < 0.05$.

Table 3 displays the mean responses to each Likert scale question for two groups, students who chose the new assignment (n = 33) and those who chose the partial-completion assignment (n = 52). Multivariate analyses, Wilkes Lambda, revealed a significant overall effect for the Likert scale questions, F (5, 84) = 59.13. Post-hoc Bonferroni corrected pair-wise

comparison revealed significant differences for the question “I chose the sheet because I had already started it”, F (1, 84) = 224.31 and the question “I chose the sheet because I had *not* already started it”, F (1, 84) = 104.91. These significant differences were in the expected direction with students choosing the partial-completion assignment scoring higher on the first item (“I chose it because I had already started it”), and those choosing the new assignment scoring higher on the second item (“I chose it because I had not started it”). No significant differences were found on the items assessing difficulty, effort, and time.

Discussion

Experiment I was designed to examine the effects of partial assignment completion on seventh-grade students’ assignment choice behavior. Specifically, the researchers investigated the role of the PAC effect in influencing student choice when other variables such as time, difficulty, and effort were held constant. The students completed a portion of a mathematics computation assignment and then were provided the opportunity to choose to finish that assignment or a new, matched assignment containing the same type and number of problems as those left to complete on the original worksheet. Significantly more students chose to finish the assignment they had started than chose to complete a new assignment. Student responses to Likert scale items suggest that this difference in choice cannot be accounted for by perceived differences in effort, difficulty, or time required. Thus, it suggests that the significant difference found in students' choice may be best explained by students being motivated to finish what they started.

From a theoretical perspective, the current findings support previous researchers who suggested that students may be more motivated to complete assignments that they already started

(Katz, 1938; MacMillan, 1969; Skinner, 2002). Nevertheless, the current study does not provide any insight to whether this effect is caused by a Gestalt-like innate desire to complete form or a common learning history where consequences often follow assignment completion and failure to complete assignments (Katz, 1938; Skinner, 2002). To begin investigating this issue, researchers may want to develop unique artificial tasks and provide unique learning histories to students for completing different tasks.

To our knowledge, the current study was the first to directly investigate the notion of a PAC effect. As such, there are some potential threats to external validity which limit our ability to generalize the results. The participants in this study are not representative of all seventh-grade students. They were from a rural school district and the majority of students were Caucasian American students. Additionally, the assignments used in research were designed specifically for purposes of the current study and were not derived from the students' current curriculum. Although the type of problems included on the mathematics worksheets required skills the students most likely had already learned and practiced, they did not require specific skills currently being taught in their classroom. Thus, the assignments might have been viewed as somewhat artificial and some students may have had difficulty recalling the appropriate skills for the problems. Still, examination of accuracy suggests that most students were able to adequately perform the mathematical operations required. Another potential limitation arises because the tasks were assigned by the researcher rather than the classroom teacher. Therefore, it is possible that the same findings would not be exactly replicated if the teacher performed the same procedures.

Despite the potential limitations, the findings of the current study may have applied value. For instance, when time is constrained (e.g., only 10 min left in the school day) the teacher

could ask students to start an assignment that they could not finish, or the teacher could assign the work the next day or for homework. The current study suggests getting students to begin the work immediately may enhance the probability of them choosing to work on the assignment later (at home or the next day).

Previous researchers have demonstrated that when given the choice of two assignments students will choose the lower-effort assignment (Billington, Skinner, & Cruchon, 2004; Billington, Skinner, Hutchins, & Malone, 2004; Friman & Poling, 2005). However, researchers have found enhanced rates of reinforcement (Neef, Shade, & Miller, 1994) and interspersing additional problems (e.g., Billington, Skinner, & Cruchon, 2004; Billington, Skinner, Hutchins, & Malone, 2004; Cates et al., 1999; Cates & Skinner, 2000) can be used to cause students to choose to engage in assignments that require more effort. Causing students to engage in academic assignments that require more effort (e.g., longer assignment, assignments with more challenging work) can enhance students' learning (Skinner, 1998; Skinner, 2002). Therefore, future researchers should consider testing the strength of the PAC effect by determining if students are more likely to choose to work on assignments that they have already begun, as opposed to a new assignment, even when the partially completed assignment would require more time and effort to complete.

Chapter III

Experiment II: Can Partial Assignment Completion Cause Students to Choose to Do More Work?

Purpose

If students are more motivated to work on partially completed assignments, then teachers may enhance students' learning and decrease disruptive behaviors by having them start assignments and then interrupting them before they can complete them. Consequently, when students are to begin re-working on the partially completed assignment they may be more motivated to do the work. Although many researchers have investigated reinforcement for working on assignments (e.g., Martens et al., 1992; Neef et al., 1993; Neef et al., 1994) and effort (Billington, Skinner, & Cruchon, 2004; Billington, Skinner, Hutchins, & Malone, 2004; Friman & Poling, 1995), task interruption has been studied less frequently and the focus of this research has not been on motivation or choice (Butterfield, 1964). Experiment I showed that when given equivalent assignments, students were more likely to choose to work on the assignment they had already begun. Experiment II was designed to extend this research by testing the strength of the PAC effect by allowing students to chose to work on a partially completed assignment or an alternative new assignment that contained approximately 10% fewer problems (i.e., required 10% less effort).

Methods

Participants, Setting, and Materials

There were 91 seventh-grade students who consented to participate in the study. Of those, three students' data were eliminated from analyses because they did not complete any problems on their first computation worksheet, leaving a total of 88 participants, 50 girls and 38 boys. The sample included 75 Caucasian students, 2 African-American students, 3 Hispanic students, 1 Asian/Pacific Islander student, 1 Native American student, and 6 students who identified their

ethnicity as “other”. Students’ ages ranged from 12 years to 14 years (mean age = 12.59). All of the students were in the seventh grade at a rural middle school and were receiving instruction from the same math teacher who taught four general-education math classes and one pre-algebra class. None of the participating students were receiving special education or intervention services. Each student enrolled in one of these classes (approximately 104 students) was given a chance to participate; however, only those who returned parental consents and provided assent participated.

Procedures were run in the students’ math classroom, which contained approximately 28 student desks aligned in five rows. The desks faced the front wall of the room with two white dry erase boards hung on the wall. The teacher’s desk was positioned on another wall facing the sides of the student desks. The primary researcher stood at the front of the room while implementing procedures and another researcher sat at a table along the rear wall.

Two types of worksheets were constructed for this study (see Appendix G). The partial-completion worksheet contained 15 three-digit by two-digit multiplication problems. All digits were above 3, which required consistent carrying operations. None of the 2-digit factors contained identical digits (e.g., 66). Researchers also constructed a base, matched lower-effort worksheet by altering the sequence of digits in one or both of the factors on the partial-completion worksheet. Thus, if a problem on the partial-completion worksheet was 579 X 46 = ____, the matched problem on the lower-effort worksheet may have been 957 X 64 = ____, 759 X 46 = ____, etc. Previous researchers have used the same procedures to construct matched mathematics problems (e.g., Billington, et al., 2004). After the base lower-effort worksheet was constructed, researchers constructed lower-effort worksheets designed to be used across students who finished various amounts of work on the partial-completion worksheets. Thus, by

eliminating problems from the beginning of the partially completed worksheet, researchers constructed versions of this worksheet with 1-13 problems.

The researchers also created a brief questionnaire (see Appendix B). The questionnaire was designed specifically for the current study and contained five questions regarding the students' reasons that may have influenced their assignment selection. These items addressed relative difficulty, effort and time to complete, along with choosing it because it was started and choosing it because it was not started. These questions were each answered on a five-point Likert scale rating. In addition, the questionnaire contained an open response format question asking the student to explain his or her choice of assignment.

Procedure

Data collection took place in the classroom where students typically had their mathematics instruction. The class periods lasted 50 min and study procedures were always conducted immediately following the first bell, signaling the beginning of class time (5 min after the hour). Participants for whom parental consent had been obtained were provided with a student assent form and demographic information form. The researcher read each of these forms aloud with the students and answered any questions. Upon completion, the assent and demographic forms were collected and students not participating were given independent mathematics seatwork as their classmates participated in this study.

Each participant was provided with a sharpened pencil with an eraser. Students were asked to place worksheets face down until all instructions were given and they were told to begin work. Participants were reminded to place their name (first and last) in the space provided in the

upper left hand corner of the sheet prior to completing problems. Next, the researcher read standardized instructions to the participants. Instructions were as follows:

> When I say begin, you may turn over your paper and begin completing problems as accurately as you can. Please complete problems working from left to right and beginning at the top of your paper. (Researcher demonstrates) Please try to work each problem in order and try not to skip problems. Are there any questions? Begin.

Participants were given 5 min to work on the computations. Students were not permitted to use calculators or multiplication tables. After 5 min had elapsed, the primary researcher said "stop" in a loud voice. The researcher then instructed the students to complete the problem they had been working on when they were told to stop. Next, the primary researcher collected a worksheet from each participant, thanked the student for participation, and sat with the other researcher at a table in the back corner of the classroom. Meanwhile, students participated in an activity (unrelated to mathematics) provided by their classroom teacher.

Researchers then selected a pre-constructed lower-effort worksheet for each participant based on the number of problems completed on that student's initial sheet. Each student's second worksheet was constructed to contain approximately 10% fewer problems than the number of problems left incomplete on his or her initial worksheet. For example, the 16 students who had completed 5 problems on the partial-completion worksheet had 10 problems left to complete. This particular sheet would have a matched lower-effort worksheet containing 9 problems. Table 3 shows the number of students who received each assignment pair.

Approximately 7 min after being told to stop, the primary researcher informed students that she would need them to perform another task. Students were then told that they would be

given two worksheets, the one they had begun previously and a new sheet, and would be able to choose which of the sheets to complete. Each participant's matched sheets were distributed and they were instructed to identify the sheet they would prefer to complete. Students were asked to place their names on both sheets and to place a "C" on the one they had chosen. They were instructed to begin working upon choosing a sheet. As students worked, the researchers collected the worksheet not chosen and recorded the choice for each child. Students were given 10 min to work on the sheet they had chosen. After these worksheets were collected, students were asked to complete a brief questionnaire about their choice (Appendix B).

Design, Dependent Variables, and Data Analysis

The primary research question was whether students would choose to complete the partial-completion assignment (the worksheet that they started but had not finished) or the matched lower-effort assignment that they had not begun. The primary dependent variable was which assignment each student chose to work on during the second session (the partial-completion worksheet or the lower-effort matched worksheet with approximately 10% fewer problems remaining). Chi square analysis was used to test for significant differences on their choice behaviors. Additionally, exploratory analysis was conducted on the Likert scale items and the open ended questions students completed. The purpose of this analysis was to attempt to identify factors that influenced assignment choice. Therefore, MANOVA was used to test for significant difference across the items for two groups, the students who chose the partially completed assignment and the students who chose the assignment that required less effort to complete. All differences were considered significant at $p < .05$ level.

Researchers developed operational definitions and examples used to score the open-ended question (i.e., why they chose the assignment) responses (see Appendix F). Using these definitions researchers recorded whether students indicated they a) wanted to finish what was started, b) chose the sheet because it appeared to be less work, c) wanted to start something new, d) thought the sheet was less difficult, e) found the sheet more challenging, or f) provided an irrelevant answer for why they chose the sheet.

Inter-scorer Agreement and Procedural Integrity

The primary researcher recorded student choice data, their assignment rankings, and their responses to open-ended questions. A second researcher independently scored 50% of these responses and inter-scorer agreement was 100% for each measure. The primary researcher developed a protocol describing the experimental procedures in sequence and used this to prompt her behaviors. In order to collect procedural integrity data, a second researcher independently observed her behaviors and recorded whether or not she completed the behaviors in sequence (e.g., read instructions as written). Procedural integrity data show that the primary experimenter completed all behaviors in the correct sequence across all administrations.

Results

When asked to choose which assignment they wanted to complete, 55 students chose the lower-effort assignment and 33 chose the partial-completion assignment. Chi square analysis showed that this difference was statistically significant, $x^2(1) = 5.50$, $p < 0.05$. Table 4 summarizes mean responses across the rating items concerning difficulty, time, effort, and desire for assignment completion for the students who chose the lower-effort assignment ($n = 54$) and the students who chose the partial-completion assignment ($n = 33$). One student's data were

excluded from this analysis due to incomplete responses of rating items. MANOVA, Wilk's Lambda, revealed a significant main effect, $F(5, 81) = 54.542$, $p < 0.05$. Across-subjects Bonferroni corrected pair-wise comparisons revealed statistically significant differences ($p < .05$) for the difficulty $F(1, 86) = 8.854$; time $F(1, 86) = 12.639$ and effort items $F(1, 86) = 6.516$. Students who chose the lower-effort assignment rated their chosen assignment as being less difficult and requiring less time to complete than those who chose the partially completed assignment. Corrected pair-wise comparisons revealed a statistically significant difference ($p < .05$) for question 4, (*I chose this assignment because I already started it*) $F(1, 86) = 233.651$, and question 5, (*I chose this assignment because I had not already started it*), $F(1, 86) = 63.127$. Students who chose the assignment that they had already started were more likely to have indicated that they chose that assignment because it was unfinished than those that chose the lower-effort assignment.

Table 4 displays the frequency of student responses to open-ended questions for the students who chose the lower-effort assignment and those who chose the partially completed assignment. Of the 88 students, only 69 students responded to this question; 28 of the 33 who chose the partially completed assignment and 41 of the 55 who chose the lower-effort assignment. Across all response categories, 19 of the 28 respondents who chose the partially completed assignment (57.9%) indicated that they chose that assignment because they wanted to finish the assignment that they had started. Of the 41 respondents who chose the lower- effort assignment, 17 (41.5%) indicated that assignment length (e.g., fewer problems) influenced their choice. In general, these open-ended responses confirmed the students' Likert scale responding.

Discussion

Study 2 was designed to extend PAC research by investigating whether students would be more likely to chose to work on an assignment they had already begun, but not yet finished or on an assignment that contained approximately 10% less work. Significantly more students chose the assignment that required less effort. Likert scale and open-ended questions suggest that these students chose the lower-effort assignment because it was less difficult and required less effort and time to complete. These findings have theoretical and applied implications.

These results support previous researchers who have found that when given two assignments and all else is held constant, students will choose to work on the assignment that requires less effort, and presumably less time to complete (e.g., Billington, et al., 2004). Thus, our study provides additional support for educators and researchers who stressed the need to increase students' basic-skill fluency, as enhancing students' fluency may increase the probability of them choosing to do assigned work that requires them to perform those basic academic skills (e.g., Skinner, 1998).

Previous researchers have suggested and found evidence that students may be motivated to complete partially finished assignments (Hawthorn-Embree et al., 2010; Skinner, 2002). The current results suggest that if students are motivated to complete partially finished assignments, this motivation is not very powerful as significantly more students chose to work on the assignment that required approximately 10% less effort, as opposed to the partial-completion assignment.

This study was the first attempt to evaluate the strength of PAC by manipulating effort. Consequently, there are several external validity limitations which constrain our ability to

generalize findings across tasks, students, and settings. In the current study the mathematics operations were chosen by the teacher because she felt that almost all students could complete these problems. However, these operations were not taught recently, no grades or consequences were delivered contingent upon accuracy or assignment completion, and experimenters ran the procedures. Because it is possible that the students did not complete the assigned math problems with the same dedication or rigor that they would use on classroom assignments, future researchers should conduct similar studies where worksheets are aligned with the students' curricula. Also researchers should extend this research to other assignments containing discrete (e.g., language arts assignments with 20 items) and less discrete (e.g., history or science chapter and questions) tasks.

The participant pool of our study was homogenous; all came from the same rural schools and were in seventh grade, most were Caucasian, and none had disabilities. To determine if these results can be generalized; similar studies should be conducted across students (e.g., students with disabilities, younger and older students, and students from different socio-economic and cultural backgrounds). These studies are particularly important if the PAC effect is influenced by learning histories.

Although the current study suggests that PAC effects are weak, this conclusion would be premature. In the current study, students only worked on the partial-completion assignment for 5 min. Researchers investigating sunk cost and sunk time effects have found evidence that suggest that the amount of time and effort students already spent on the partially completed assignment may influence the strength of the PAC effect (Arkes & Blumer, 1985; Navarro & Fantino, 2009; Thames, 1996). For example, it is possible that if students invested 30 min on an assignment they may be more likely to choose to complete that assignment, relative to an assignment on which

they invested only 5 min. Also, the amount of work left to complete may influence their choice behavior (Friman & Poling, 1995). For example, when there are only a few problems left to complete on the partial-completion sheet students may be more likely to choose the partially completed assignment over the alternative assignment requiring less effort to complete.

Chapter IV

Experiment III: Does Sunk Effort Influence the Partial Assignment Completion Effect?

Purpose

The partial-assignment completion (PAC) effect was established in Experiment I, but evidence from Experiment II suggests that the PAC effect was not powerful enough to overcome a 10% difference in effort. Although, researchers have found evidence that a sunk-time or sunk-cost effect may influence the PAC effect. Specifically, the effect may be stronger when students have invested more time and effort on the partially complete assignments (Arkes & Blumer, 1985; Navarro & Fantino, 2009; Thames, 1996). Therefore, students should be more likely to resume a task in which they have invested 15 min than one in which they have only invested 5 min of their time. Experiment III was designed to investigate a sunk-effort effect by determining if increasing the amount of effort already applied to an assignment would enhance the probability of students choosing that assignment, even though it contained 10% more problems than the alternative assignment.

Methods

Participants, Setting, and Materials

There were 75 seventh-grade students who consented to participate in the study. Of those, one student's data were excluded from analyses because she failed to follow directions. Students' ages ranged from 12 years to 14 years (mean age = 12.09 years). All of the students were in the seventh grade at a rural middle school and were receiving instruction from the same math teacher who taught five general-education math classes and one inclusion math class. Each student enrolled in one of these classes was given a chance to participate; however, only those who returned signed parental consent forms and assent forms participated.

Procedures were run in the students' mathematics classroom, which contained approximately 30 student desks aligned in six rows, facing the front wall of the room. Another set of four desks sat near the teacher's desk and faced the left side of the other student desks. One Promethean board hung on the front wall and a white dry erase board hung on the side wall near the door of the classroom. The teacher's desk was positioned on the opposite wall facing the sides of the student desks.

Four types of worksheets were constructed for this study, two partial-completion worksheets and two matched lower-effort worksheets. The first partial-completion worksheet contained 12 two-digit by two-digit multiplication problems (Appendix I). The second partial-assignment completion worksheet contained 20 two-digit by two-digit multiplication problems (Appendix I). The last 10 problems were the same on both worksheets. Digits above three were used in at least one of the numbers and no ones or zeros were used; thereby, requiring students to consistently complete carrying operations.

Researchers also created matched lower-effort worksheets by altering the sequence of digits in one or both of the factors on each partial-completion worksheet. Thus, if a problem on the partial-completion worksheet was 79 X 46 = ____, the matched problem on the lower-effort worksheet may have been 97 X 64 = ____. Previous researchers have used the same procedures to construct matched mathematics problems (e.g., Billington, Skinner, & Cruchon, 2004). Each lower-effort worksheet contained nine problems, 10% fewer problems than those remaining on the matched partial-completion worksheet. Each student was instructed to complete a number of problems so that 10 problems would remain on each partial-completion worksheet. Specifically, students who received the 12-problem partial-completion assignment were instructed to complete the first 2 problems and those who received the 20-problem partial-completion assignment were

instructed to complete the first 10 problems. Thus, by eliminating problems from the beginning of the partially completed assignments, researchers constructed matched versions of each worksheet containing 9 problems (one less than the 10 problems remaining on each sheet).

Procedure

Data collection took place in the classroom where students typically had their mathematics instruction. The class periods lasted 45 min and study procedures were always conducted immediately following the first bell signaling the beginning of class. Participants for whom parental consent (see Appendix H) had been obtained were provided with a student assent form (see Appendix D) and demographic information form (see Appendix E). The primary researcher read each of these forms aloud with the students and answered any questions. Upon completion, the assent and demographic forms were collected and students not participating were given independent mathematics seatwork assigned by their classroom teacher while their classmates participated in this study.

Each participant was provided with a sharpened pencil with an eraser. Half of the participants received the assignment containing 12 problems and the other half received the assignment containing 20 problems. The assignment each student received was based on random assignment. Students were asked to place worksheets face down until all instructions were given and they were told to begin work. Participants were reminded to place their name (first and last) in the space provided in the upper left hand corner of the sheet prior to completing problems. Next, the researcher read standardized instructions to the participants. Instructions were as follows:

> When I say begin, you may turn over your paper and begin completing problems as accurately as you can. Please complete problems working from left to right and beginning at the top of your paper (researcher demonstrates). Please try to work each problem in order and try not to skip problems. Please continue completing problems until you see the "stop" sign on your paper (researcher demonstrates). Once you have reached the "stop" sign, please raise your hand. Are there any questions? Begin.

Participants were given time to complete the computations up to the designated stopping point on each assignment. Students were not permitted to use calculators or multiplication tables. As each student completed the designated number of problems on their partial-completion assignment and raised his or her hand, the researchers provided the student a new worksheet which contained nine matched problems. Thus, each student had their original assignment which contained 10 incomplete problems and a new one containing 9 problems left to complete. Students were given a choice of which assignment to complete. Students' amount of effort invested (type of partial-completion assignment) and assignment choice was recorded. Students were instructed to complete the assignment they had chosen and to turn the other worksheet face down on their desks. Students were given approximately 10 min to work on the sheet they had chosen. After all worksheets were collected, students were asked to complete an open response questionnaire about their assignment choice. The researcher-constructed questionnaire can be found in Appendix J.

Design, Dependent Variables, and Data Analysis

The primary research question was whether a sunk-effort effect influenced students' choice to complete the partial-completion assignment or a matched lower-effort assignment. Specifically, the researchers were interested in whether more students who had completed 10 problems on the partial-completion assignment would choose to finish what they had started than students who had completed only 2 problems on the partial-completion assignment. Thus, the primary independent variable was the amount of sunken effort (10 problems complete versus 2 problems complete). The primary dependent variable was which assignment each student chose to work on during the second session (the partially completed worksheet or the lower-effort matched worksheet with 10% fewer problems remaining). Chi square analysis was used to test for significant differences on choice. Additional, exploratory analyses were used to test for an effort effect found in Experiment II.

The open-ended item on which students indicated their reason for choosing a particular assignment was scored using operational definitions. The researchers created operational definitions in the following manner: First, they reviewed previous research to identify variables that may have influenced choice. These variables included assignment effort, difficulty, and time required to complete assignments. Also, the researchers included a response category addressing partial assignment completion and a category for students who reported choosing the assignment because they had not already started it. Additionally, they included cases when students provided irrelevant responses (e.g., "because I had to choose one") and when they provided no response.

Procedural Integrity and Inter-scorer Agreement

The primary experimenter developed a protocol describing the experimental procedures in sequence and used this to prompt her behaviors (see Appendix K). Procedural integrity data was collected by having a second experimenter independently observe the primary experimenter's behaviors and record whether or not the behaviors were completed consistently in sequence (e.g., read instructions as written). Procedural integrity data show that the primary experimenter completed all behaviors in the correct sequence across all administrations. Following study completion, the primary researcher recorded student choice data, demographic data, and students' responses to open-ended questions. A second researcher independently scored 20% of these responses and inter-scorer agreement was 100% for demographic and choice data and 88% for the open-response measure.

Results

Chi square analysis was used to test for differences in the number of students who completed 2 of 12 problems and chose the partial-completion assignment and those that completed 2 of 12 problems and chose the lower-effort assignment. Chi square expected frequency counts for each cell were calculated based on the number of students who completed 10 of 20 problems and chose the partial-completion or the lower-effort assignment. Data-based calculations revealed expected frequencies for the 12-problem partial-completion assignment of 11.7 students expected to choose the partially completed assignment and 29.3 students expected to choose the lower-effort assignment. Of the students who received the 12-problem assignment, 7 actually chose the partially completed assignment and 33 chose the lower-effort assignment when asked to choose which assignment they wanted to complete. Chi square analysis showed

that this difference was not statistically significant, $x^2(1) = 2.40$, $p = 0.0605$. Table 6 displays the number of students who received each partial-completion assignment and the number who chose to complete the partial-completion assignment versus the lower-effort assignment.

Exploratory analysis was conducted for the main effect of effort. When chi square was conducted on choice, regardless of group (i.e., 12 problem partial-completion assignment or 20 problem partial-completion assignment) significantly more students (58/75 = 77%) chose the lower-effort assignment, $x^2(1) = 22.41$, $p < 0.001$. When chi square was run with the 12-problem partial-completion assignment significantly more students (33/40 = 83%) chose the lower-effort assignment, $x^2(1) = 16.90$, $p < 0.001$. Finally, when chi square was run with the 20-problem partial-completion assignment significantly more students (25/35 = 71%) chose the lower effort assignment, $x^2(1) = 6.43$, $p = 0.011$.

Table 7 displays the frequency of student responses to open-ended questions for the students who chose the partial-completion assignment and for those who chose the lower-effort assignment. Of the 75 participants, all students responded to the open-ended question; 10 who received the 20-problem assignment and chose the partial-completion assignment, 7 who received the 12-problem assignment and chose the partial-completion assignment, 25 who received the 20-problem assignment and chose the lower-effort assignment, and 33 who received the 12-problem assignment and chose the lower-effort assignment.

Of the 35 participants who received the 20-problem partial-completion assignment, 3 respondents who chose the partial-completion assignment (30%) indicated that they chose that assignment because they wanted to finish the assignment that they had started. Of the same 35 participants, 25 chose the lower-effort assignment. Of those, 16 (64%) indicated that assignment length (e.g., fewer problems) influenced their choice. Of the 40 students who received the 12-

problem partial-completion assignment, none of the respondents who chose to complete the partial-completion assignment indicated that they chose the assignment because they wanted to finish what they had already started. Of the participants who chose to complete the lower-effort assignment, 12 (36%) indicated that they chose this assignment because it contained fewer problems.

Discussion

Experiment III was designed to replicate and extend Experiment II. Exploratory analyses showed that for both groups, significantly more students chose the lower-effort assignment over the partially completed assignment. These findings support findings from Experiment II which suggested that a mere 10% difference in effort has a more powerful influence over assignment choice than the PAC effect.

Experiment III was designed to extend the research on PAC by investigating whether the amount of effort students had invested in a partially completed assignment played a role in their assignment choice. Specifically, researchers examined whether completing 10 of 20 problems on partially completed assignment would result in a more powerful PAC effect than completing 2 of 12 problems on their partially completed assignment. Results indicated that there was no statistically significant difference in assignment choice between students who invested the effort required to complete 10 problems on their partial-completion assignment and those who invested the effort required to complete 2 problems on their partial-completion assignment.

These findings do not support previous researchers who have found that the more cost or time a person sinks into a task the more likely he or she is to resume or continue that task (Arkes & Blumer, 1985; Moon, 2001; Thames, 1996). However, there are several reasons why it would

be premature to conclude that a sunk-effort effect does not exist in relation to PAC. Experiment III was the first to investigate sunken effort, PAC, and assignment choice. Also, although our results were not statistically significant they were approaching statistical significance ($p = .06$) and they were in the correct direction (i.e., a large proportion in the 20-problem group chose the partial-completion assignment). Finally, our methods and analysis procedures were not designed to test for insignificant difference, but to test for difference. Consequently, these data cannot be used to prove the absence of an effect.

Given that results were in the desired direction, future researchers should conduct additional studies before drawing any conclusions regarding sunken effort. Perhaps a sunk-effort effect exists but is not powerful enough to overcome a difference of 10% more problems. To test this hypothesis researchers could examine the sunk-effort effect with effort held constant between the partial-completion and alternate assignments (see Experiment I). Also, replicating current procedures but altering the 20-problem sheet to a 25-problem sheet and requiring students to finish 15 problems before interrupting them may enhance the sunk-effort effect enough to bring about a statistically significant difference in choice behavior. Rather than focusing solely on the number of problems completed, future researchers should also investigate the effects of the number of problems remaining on a partial-completion assignment and/or the proportion of problems completed on assignment choice behaviors.

There are several potential external validity limitations associated with Experiment III. The participants in the current study were from a small, rural middle school and most were Caucasian American. They were all seventh-grade students. Due to the specific demographics of the sample, we cannot assume that the findings of this specific study would generalize to other school settings or students of different ages or ethnic origins.

Similarly, we cannot generalize the current results to different tasks. We used math computation problems, as they allow researchers to construct equivalent assignments (see Billington, Skinner, & Cruchon, 2004. It is possible that the current results would not generalize across tasks (e.g., Language Arts tasks, reading tasks). The math problems used were not aligned with what was currently being taught in the students' math class. Additionally, students were told that they were participating in an experiment, that their performance and/or choice would not affect their grades, and that they could quit at any time. These factors differ from a typical classroom setting where assignments often require students to perform tasks they have recently acquired, students are not given assignment choices, and consequences are delivered contingent upon assignment performance. Consequently, the current findings cannot be generalized to typical classroom settings.

Given these external validity limitations, future researchers should consider conducting similar experiments across populations. In addition to general demographic factors, researchers may want to determine whether personality variables (e.g., conscientiousness) interact with a sunk-effort effect, PAC effect, and relative effort to influence students' choices. Also, before any applied recommendations are made, similar studies are needed in applied settings with less artificial tasks (e.g., assignments that include tasks students just learned) and context (e.g., no assignment options, consequences for work on assignments).

Chapter V

General Discussion

Summary of Research

After students acquire academic skills, educators often attempt to enhance skill development by assigning homework or independent seatwork. Yet, little or no skill development is likely to occur unless students choose to engage in assigned activities (Skinner & McCleary, 2010). Previous researchers have demonstrated that task difficulty level and the amount of time or effort required to complete a task are all factors which may influence students' choice to engage in academic tasks (Billington, Skinner, Hutchins, & Malone, 2004; Cates & Skinner, 2000). When given a choice, organisms tend to choose behaviors that require less effort (Friman & Poling, 2005). While reducing the amount of effort required to complete an assignment may increase the probability of students choosing to work on the assignment (i.e., may enhance engagement), these effort reduction procedures can delay student learning because skill development often requires high-effort engagement (Cates et al., 2003; Joseph & Nist, 2006; Nist & Joseph, 2008; Skinner, 2002, 2008). Therefore, a primary goal of educators is to encourage students to choose to engage in academic tasks without diluting the curriculum (Billington, Skinner, & Cruchon, 2004; Billington, Skinner, Hutchins, & Malone, 2004; Cates & Skinner, 2000; Cates et al., 1999; Skinner, 2002, 2010).

Gestalt and cognitive researchers have suggested that individuals may be more motivated to complete a task that they have already begun (e.g., Butterfield, 1964, 1965; Katz, 1938; Pachauri, 1935; Rickers-Ovsiankina, 1928). However, a majority of those researchers have focused on memory for interrupted tasks, used artificial tasks rather than academic tasks, and given participants the option of completing a task again rather than actually resuming a partially completed task. Also, in these studies no or insufficient efforts were made to control other

factors known to influence choice, including effort required to complete tasks and interest in different tasks.

Much of the Gestalt/cognitive research on motivation to complete interrupted tasks was theoretical in nature and focused on the existence of a tension system within the individual [Butterfield, 1964; Katz, 1938; Rickers-Ovsiankina, 1928; Zeigarnik (as cited in Katz)]. More recently, behavioral researchers have posited that students may be motivated to complete assignments that they have begun because, in their past, their behavior has been reinforced for assignment completion and/or punished when assignments were not completed (Skinner, 2002). Also, social psychologists and behavioral economists have investigated the notion of sunk-cost or sunk-time effects related to individuals' tendency to want to finish something they have already started but not yet finished (Arkes & Blumer, 1985; Navarro & Fantino, 2009; Thames, 1996). According to this phenomenon, individuals are more likely to continue a task in which they have already invested time or money.

The current series of experiments was designed to extend research on partial assignment completion (PAC) to mathematics computation assignments. Specifically, the first experiment was designed to establish the presence of a PAC effect. Experiment II was designed to test the strength of the PAC effect by manipulating effort required to complete assignments. Finally, Experiment III was designed to determine if a sunk-effort effect influenced the strength of the PAC effect.

Results from Experiment I showed that significantly more seventh-grade students chose to complete a partially completed assignment over a new assignment, when the two assignments were matched for effort, difficulty, and length. This experiment established a PAC effect and

suggests that students are more motivated to finish an assignment they have already started rather than beginning a new assignment.

With the PAC effect initially established, the next two experiments focused on the strength of the PAC effect by manipulating effort (Experiment II) and sunk cost (Experiment III). During Experiment II, after seventh-grade students (different sample of participants from those in Experiment I) were interrupted they were given the option of completing their partially completed assignment or a matched, lower-effort assignment containing approximately 10% fewer problems than those remaining on the partial-completion worksheet. Significantly more students chose to complete the lower-effort assignment than chose to finish their partially complete assignment. This finding, which suggests that the PAC effect is not very powerful, led to Experiment III in which researchers investigated sunk effort, a factor that might influence the strength of the PAC effect.

During Experiment III, seventh-grade students were randomly assigned to two groups; a 12-problem partial-completion assignment group and a 20-problem partial-completion assignment group. Participants were instructed to complete 2 of the 12 problems or 10 of the 20 problems so that students from both groups had the same 10 problems remaining on their interrupted assignment. Next, all participants were given a new, matched worksheet containing 9 problems and were asked to choose an assignment to complete (their partial-completion assignment or the lower-effort assignment). Results supported Experiment II in that for both groups significantly more students chose the lower-effort assignment over the partially completed assignment. Also, assignment choice did not differ significantly between participants who had completed 10 problems and those who had completed 2 problems on their partial-completion assignment. This suggests that the sunk-effort effect does not significantly influence

students' tendency to resume a partially completed assignment versus complete a lower-effort assignment. However, because results were in the desired direction (29% of the 20-problem group chose the partially completed assignment compared with only 17% of the 2-problem group) and approached a significant level, it would be premature to draw such a conclusion.

Theoretical Implications

Experiment I supported various theorists who suggested that students may be motivated to complete assignments they had already begun. Evidence from the self-report measure of students' reasons for their choice indicated motivation for finishing what one had already started. From a theoretical standpoint, this information provides no indication whether this tendency is influenced by dynamic tension (Gestalt theory) or learning history (behavioral theory).

As none of our experiments were designed to directly assess various explanations of task interruption or PAC effects, future researchers interested in the causal constructs should continue this line of research while carefully controlling for effort and using artificial tasks and environments to manipulate learning histories. As learning histories are often difficult to manipulate, researchers may want to investigate within-subject variables that could shed light on students' motivation to complete assignments that they have already begun. Learning history surveys or measures of personality constructs (conscientiousness) may prove useful in evaluating various causal mechanisms.

Results from both Experiments II and III support various other studies which have shown that, when given a choice and all else is held constant, organisms (e.g., students) may choose to engage in the behavior that requires less effort (Billington, Skinner, & Cruchon, 2004; Billington, Skinner, Hutchins, & Malone, 2004; Friman & Poling, 1995). Additionally, these

findings suggest that the PAC effect is not very powerful or is less powerful than some other assignment manipulation procedures (see Cates & Skinner, 2000; Cates et al., 1999). Although Experiment III proved inconclusive, the general direction of the results suggests that future researchers should continue to investigate the causal role that sunken effort may play in influencing the strength of the PAC effect.

Limitations and Future Research

External validity. There were several threats to external validity that may limit our ability to generalize findings across students, settings, or tasks. The first potential threat lies within our sample of participants. All participants were seventh-grade students and all of them attended the same rural middle school. All students were in general education, pre-algebra, or inclusion classes taught by the same general education mathematics teacher. Also, the vast majority of participants were Caucasian American. All of these participant factors limit our ability to generalize our findings across students and settings.

In addition to characteristics of the participants, the ability to generalize current findings may have been constrained by attributes of the tasks themselves. For instance, it is possible that participants viewed the mathematics computation assignments as artificial in nature because no grades were assigned contingent upon task performance. Consequently, students may not have performed with the same rigor or felt as committed to each assignment because of the nature of the task.

Across all three experiments, we chose computation tasks because they allowed us to control for effort, difficulty, length, and interest. Additionally, to increase the probability that students could do the task, we used computation tasks most students had learned several years

ago; however, multiplication was not a skill currently being explicitly taught in the students' classroom. Therefore, results cannot be generalized to typical classroom contexts where students are often given independent seatwork assignments immediately after they have acquired a skill.

Another possible limitation of all three studies might have been the length of the interruption. The interval was approximate and not exactly timed in any of the studies. In the first two studies the delay interval between tasks was primarily determined by the length of time it took researchers to match worksheets for each participant. It is possible that a delay interval of approximately 15 min or shorter (as in Experiment III) was too brief. Regardless, it is not possible to generalize current findings to longer interruption intervals (e.g., a 4-hour delay between the end of math class and the opportunity to choose to complete an assignment for homework) or briefer interruption intervals (e.g., a two minute interruption for a school-wide announcement).

In order to draw any generalized conclusions, future research is needed across students, settings, and tasks. Specifically, researchers should consider conducting similar studies where students complete tasks involving recently acquired skills. Future studies should be conducted with typical contingencies associated with task completion and performance. Finally, researchers may want to conduct similar studies in vivo with longer interruption intervals.

Internal validity. There are several uncontrolled threats to internal validity associated with the current experiments. One potential limitation arose from the manipulation of effort in Experiment II. Matched lower-effort assignments in that particular experiment were designed to contain approximately 10% fewer problems than partial-completion assignments. However, the nature of the problems contained on each worksheet and the method for matching did not allow

effort manipulation to be exactly 10% different for all matched sheets. As a result, lower-effort worksheets actually contained between 7% and 14% fewer problems, depending upon the number of problems remaining on each student's partial-completion assignment.

Other potential limitations were associated with the instruments used in all three experiments. The mathematics worksheets, the Likert scale questionnaire, and the open response questions were all specifically designed by the researchers for the current study. All assignments were designed and matched using previously-proven procedures for establishing equivalent assignments (e.g., Billington, Skinner, & Cruchon, 2004; Billington, Skinner, Hutchins, & Malone, 2004); however, no direct demonstration of equivalence for the matched mathematics assignments was provided. Additionally, the researcher-constructed questionnaire and open-response item do not have established reliability or validity for measuring participants' reason(s) for their assignment choice.

The internal validity of all three experiments also may have been limited by the researchers' presence in the room. Because the students were unfamiliar with the researchers prior to the experiments, the researchers' presence in the classroom changed the typical environment. As a result, students may have displayed behaviors different from those which they would typically display with their classroom teacher. Another potential threat to internal validity lies in the manipulation of effort between the assignments. Although open response reports from Experiments II and III suggest that many of the participants counted the problems on each worksheet before choosing, it is possible that some students were not aware that one of the assignments contained fewer problems.

Future researchers might consider numbering the problems on each assignment in order to make the difference in requirements known. Also, future researchers should consider pre-testing assignments to show they are equivalent. Finally, researchers should consider developing and collecting psychometric data designed to support the reliability, validity, and sensitivity of their dependent variables.

Applied Implications and Recommendations

Because of limitations associated with these three experiments, all applied recommendations should be interpreted cautiously. Toward the end of class periods or school days, teachers may be hesitant to ask students to begin independent seatwork/homework assignments because students do not have enough time to finish the assignment. Although the current series of experiments suggest that the PAC effect is not very powerful, results of the first experiment provided evidence for the existence of a PAC effect. Also, getting students started on an assignment does not dilute the curriculum by reducing the amount of work required (see Cates et al., 2003; Nist & Joseph, 1996; Skinner, 2008). Students may be prevented from forgetting what they just learned when educators have the students start practicing skills immediately after they learn them (Greenwood, Delquadri, & Hall, 1984). Finally, having students practice newly acquired skills in the teacher's presence may allow them to ask for additional help and receive feedback that enhances their acquisition of skills and prevents them from practicing errors.

Thus, educators should have students begin independent seatwork/homework assignments, even when there is not enough time to finish these assignments. On the other hand, educators are to be cautioned about expecting large PAC effects, as even a 10% difference in effort appeared to supersede PAC effects as a variable influencing assignment choice behavior.

Thus, partial-assignment completion procedures may not produce effects strong enough to encourage students to choose *more* work or assignments that require very large amounts of effort. Additionally, manipulating the amount of work completed before interrupting students may not override the influence of effort on student choice behavior. Also, educators cannot apply PAC procedure unless students choose to begin assigned work. Therefore, educators should not rely solely on PAC effects to influence students to choose to engage in high-effort academic tasks. Rather, educators should continue to encourage students to engage in high-effort tasks that promote skill development with other procedures (e.g., reinforcement, additive interspersal procedures) that do not hinder learning by reducing assignment demands.

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Table 1

Comparison of Methods and Findings across Studies Investigating Task Interruption.

Author(s)	Participants	Original Task(s)	Method of Interruption	Alternate Task(s)	Duration of interruption	Resumption or Restart of Original Task?	Outcome
Zeigarnik (1927) (as cited in Katz, 1938)	Not specified	Simple tasks	Unclear from the review – the experimenter interrupted	No alternate task – participants were tested on their memory for tasks	N/A	Focus was on Recall for the Task, *not* Resumption	Significantly more incomplete tasks were recalled than completed tasks
Rickers-Ovsiankina (1928)	Total of 124 participants: 108 adults; 16 children (ages 3 – 16) (participants obtained over 2-year course)	Non-continuous and continuous tasks (e.g., puzzles, brain twisters, model assembly, bead stringing, untangling yarn, drawing)	Interrupted by: assigning another task, prohibiting task completion, chance, prompting for self-critique of previous task, engaging in conversation	When an alternate task was present, it was a different non-continuous or continuous task than the original (derived from the same list of task options as the original task)	Variable - ranging from 1-2 minutes to 40+ minutes	Resumption	81.56% of trials resulted in resumption of the original task; More tasks were resumed when interrupted by chance than when interrupted intentionally

Table 1 (continued)

Author(s)	Participants	Original Task(s)	Method of Interruption	Alternate Task(s)	Duration of interruption	Resumption or Restart of Original Task?	Outcome
Pachauri (1935)	20 adults	Naming of 28 different classes of objects (each object was considered a separate task)	Experimenter interrupted some of the tasks by interjecting and did not interrupt others	No alternate task – participants were tested on their memory for tasks	2 minutes elapsed between task completion and opportunity for recall	Focus was on Recall for the Task, *not* Resumption	Incomplete tasks were recalled significantly more often than completed tasks
Katz (1938)	177 preschool- and kindergarten-aged children	A mosaic model construction task; matching game; cardboard Christmas tree decorating task; coloring sheet; sewing card; and construction paper Easter basket	Children were interrupted by presentation of another task (one of 5 puzzles).	Children could choose whether to return to the interrupted task, one of the other tasks present, or quit the study	Time taken to complete puzzle (varying from 30 – 60 seconds)	Resumption	Overall, significantly more children chose to complete the interrupted task than an alternate task or no task

Table 1 (continued)

Author(s)	Participants	Original Task(s)	Method of Interruption	Alternate Task(s)	Duration of interruption	Resumption or Restart of Original Task?	Outcome
Henle & Aull (1953)	20 children	Two types of tasks: one partially completed by the participant and one partially completed by someone else; Tasks were cardboard house cutouts with wooden pegs available to complete house and yard designs	Participants were interrupted by presentation of another task – to complete the stuffing of a stuffed animal	Participants were left to resume any of the tasks after completion of the interruption task	Variable – time taken for each participant to complete the stuffing task	Resumption	All participants resumed their incomplete task instead of the task left incomplete by someone else or the interruption task
Butterfield (1965)	128 4th- and 6th-grade students	3 sets of 2 puzzles constructed from pictures on the PPVT; half of participants were given skills-emphasis instructions and half were not	1 puzzle in each set was interrupted before completion (when participants had placed 4 of 6 pieces)	Participants recalled as many tasks as possible and were asked to choose one puzzle to do again	Interruption period lasted only until the next puzzle was presented	Restart	6th-grade students who were given skills-emphasis instructions completed interrupted puzzles more often than younger students in the same condition

Table 1 (continued)

Author(s)	Participants	Original Task(s)	Method of Interruption	Alternate Task(s)	Duration of interruption	Resumption or Restart of Original Task?	Outcome
MacMillan (1969)	148 Students (classified as EMR and typically-developing)	6 block manipulation tasks, 9 blocks per task; participants were instructed to replicate block designs presented on picture cards	2 of the 6 tasks were interrupted before completion; Interruption occurred when 7 of 9 blocks were placed	Participants chose which of the 6 block tasks to do again	Not Specified	Restart	Participants without MR completed significantly more interrupted tasks, as mental and chronological age increased

Table 2

Comparison of Mean Responses on Likert Scale Items across Students Who Chose the Partial-Completion Assignment (n = 52) and the New Assignment (n = 33)

	Student who Chose (n = 52) Partial-Completion Sheet	Students who Chose (n = 33) New Sheet
Chose Because it was Less Difficult	2.75 (1.30)	2.97 (1.29)
Chose Because it was More Difficult	2.08 (1.10)	1.67 (.89)
Chose Because it Took Less Time to Finish	3.06 (1.21)	2.91 (1.44)
Chose Because I Had Already Started	4.48 (.87)	1.58 (.87)
Chose because I Had *Not* Already Started	1.46 (.85)	3.79 (1.24)

Table 3

Number of Students per Assignment Choice Pairs (Partial-Completion/ Lower-Effort (PC/LE)) and Number/Percent who Chose the Lower-Effort Assignment for each Pair

Assignment Choices: # Problems Remaining on PC/ LE Assignment	Number (% of sample)	Number (%) who Chose LE Assignment
14/ 13	6 (7%)	4 (67%)
13/ 12	9 (10%)	5 (56%)
12/ 11	20 (23%)	10 (50%)
11/ 10	19 (22%)	11 (58%)
10/ 9	16 (18%)	13 (81%)
9/ 8	11 (13%)	8 (73%)
7/ 6	4 (5%)	2 (50%)
6/ 5	1 (1%)	1 (100%)
3/ 2	1 (1%)	0 (0%)
2/ 1	1 (1%)	1 (100%)

Table 4

Comparison of Mean Responses on Likert Scale Items across Students Who Chose the Partial-Completion Assignment (n = 33) and the Lower-Effort Assignment (n = 54)

	Student who Chose (n = 33) Partial-Completion Sheet	Students who Chose (n = 54) Lower Effort Sheet
Chose Because it was Less Difficult	2.33 (.96)	*3.02 (1.08)
Chose Because it was Less Time	2.61 (1.27)	*3.57 (1.21)
Chose Because it was Less Effort	2.09 (1.07)	*2.76 (1.29)
Chose Because I Had Already Started	4.45 (.97)	1.44 (.83)
Chose because I Had *Not* Already Started	1.45 (.94)	3.56 (1.32)

* Significant difference at $p < .05$.

Table 5

Frequency of Open Responses by Choice

	Partial-Completion Sheet	Lower Effort Sheet
Finish what was started	24	0
Less work/ fewer problems	2	29
Something new/ clean sheet	0	11
Easier/ Less Difficult	3	13
More challenging/ More difficult	1	2
Irrelevant Answer	6	12
No Response	2	2

Table 6

Number of Students Who Received Each PAC Assignment and Students' Assignment Choice

		PAC Assignment	
		20-Problem PAC Assignment	12-Problem PAC Assignment
Assignment Choice	PAC Assignment	10	7
	Lower-Effort Assignment	25	33

Table 7

Frequency of Open Responses by Choice

	Partial-Completion Sheet	Lower-Effort Sheet
Finish what was started	3	0
Less work/ fewer problems	1	28
Something new/ clean sheet	0	1
Easier/ Less Difficult	5	12
More challenging/ More difficult	3	3
Irrelevant Answer	5	14

Appendix A

Original Worksheet

Name:_____

417 X 43	845 x 22	524 x 33	503 x 45	645 x 22
416 x 53	708 x 23	728 x 32	916 x 25	324 x 44
527 x 23	417 x 53	719 x 23	315 x 46	607 x 54
718 x 34	415 x 64	826 x 32	608 x 32	204 x 86
926 x 23	803 x 56	318 x 43	819 x 54	906 x 32

Matched Worksheet

Name:_____

714 X 34	548 x 22	425 x 33	305 x 54	546 x 22
614 x 35	807 x 32	827 x 23	619 x 52	423 x 44
725 x 32	714 x 35	917 x 32	513 x 64	706 x 45
817 x 43	514 x 46	628 x 23	806 x 23	402 x 68
629 x 32	308 x 65	813 x 34	918 x 45	609 x 23

Appendix B

Name:_____

Please circle the number which best represents your agreement with each statement.

1 = strongly disagree 2 = disagree 3 = neither agree nor disagree 4 = agree

5 = strongly agree

1. I chose this sheet because it was less difficult.

1	2	3	4	5
strongly disagree		neutral		strongly agree

2. I chose this sheet because it was more difficult.

1	2	3	4	5
strongly disagree		neutral		strongly agree

3. I chose this sheet because it took less time to finish.

1	2	3	4	5
strongly disagree		neutral		strongly agree

4. I chose this sheet because I had already started working on it.

1	2	3	4	5
strongly disagree		neutral		strongly agree

5. I chose this sheet because I had *not* already started working on it.

1	2	3	4	5
strongly disagree		neutral		strongly agree

Name:_____

Please describe the most important reason(s) you chose this sheet. Please be as clear as possible in your explanation.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix C

Parental Permission Form

Date: December 4, 2009

Dear Parent or Guardian,

My name is Meredith Embree and I am currently a graduate student in the School Psychology Ph.D. program at the University of Tennessee. As part of my training, I am working with students and teachers at Madisonville Middle school. I am conducting research on a strategy designed to increase the amount of work students complete. I am requesting permission for your child to participate in this study. I will be supervised by Christopher H. Skinner, a faculty member at the University of Tennessee.

Our project involves having your child complete a series of math problems. Students will be given approximately five to ten minutes to work on the math problems and then the assignment will be collected. Later students will be given the assignment they started and another equal-effort assignment. Students will then be allowed to choose which assignment they will complete. After finishing their chosen assignment students will respond to some questions designed to determine why they chose their particular assignment. The entire process will take between 15 and 30 minutes to complete and will be conducted during your child's daily mathematics instruction time.

The administrative staff and teachers at Madisonville Middle school have been informed about our project and have agreed to allow us to conduct this research. Your child's performance on this task will not affect his or her grades. Your child's name will not be linked with the information collected. Additionally, participation in this project is entirely voluntary. Thus, your child may choose to discontinue participation at any time without penalty.

We hope that the information gained through this project will lead to development of more effective teaching strategies. If so we hope to share this information with others in workshops or with articles. Your child's name will never be included in any of our work to share this information.

If you are willing for your child to participate, please sign and date the form below and have your child return it to their teacher as soon as possible. I appreciate you and your child's willingness to consider helping us with this research and I thank you, in advance. If you have any questions or concerns please feel free to contact me at 865-974-0337 or my faculty advisor (Chris Skinner) at 865-974-8043.

Thank you for your time and consideration.

Sincerely,

Meredith Embree

I have read and understand the above information, and I give permission for my child to participate in this study. I have received a copy of this form.

Signature of parent or legal guardian:_____
Date:_____ Child's Name (please print):_____

Appendix D

Student Assent Form

My name is Meredith Embree and I am a graduate student in the Ph.D. School Psychology Program at the University of Tennessee. I am conducting research on math problems and would greatly appreciate your help. If you decide to participate, you will be asked to work on some math problems and answer some questions.

It is important for you to know that, if you choose to participate, you can quit the study at any time by letting me or your teacher know you wish to quit. You will not be penalized for choosing to quit the study. Your performance on this task will not affect your grades in the classroom and you will be allowed to do work assigned by your teacher.

If you agree to participate please mark the space next to "yes". If you do not want to participate, please mark the space next to "no" and your teacher will give you another math assignment to work on while we conduct this study. Please write your name on the line below.

Thank you for your help.
Sincerely,

Meredith Embree

____ yes

____ no

Name:_____ Date:_____

Appendix E

Name_____

Age_____

Grade_____

Gender: Boy Girl

Ethnicity: African American Caucasian Hispanic Asian/Pacific Islander

Native American

Other_____

Appendix F

Coding and Examples of Student Responses to Open Response Questionnaire Item

Coded Response	Operational Definition	Examples
Finish what was started	The student indicated the primary reason for choice of a particular sheet was because he or she wanted to complete the task which had already been started.	"I had already started the worksheet and when I start something I prefer to finish it."
Less work/ fewer problems	The student indicated the primary reason for choice of a particular sheet was because he or she viewed the particular sheet as requiring less work than the alternate sheet to complete.	"…because I would have to do fewer problems."
Something new/ clean sheet	The student indicated the primary reason for choice of a particular sheet was because he or she wanted to begin work on something different, a "clean slate".	"It was a new paper with nothing written on it."
Easier/ Less difficult	The student indicated the primary reason for choice of a sheet was because he or she felt the particular sheet was less challenging than the alternate sheet.	"It was a little bit easier."
More challenging/ More difficult	The student indicated the primary reason for choice of a sheet was because the work on the particular sheet appeared harder than the alternate sheet.	"I like something challenging and this looked a little bit harder."
Irrelevant answer	The student provided a reason for choosing a particular sheet which did not directly pertain to research questions.	"I had to choose one sheet to work on" "I just chose a sheet" "…so I would have some problems complete on each sheet"
No response	The student did not provide any explanation on the open response item.	

Appendix G

Name:_____

987		976	684
x 64		x 48	x 68
	869	697	649
	x 97	x 98	x 87
674	748	785	479
x 78	x 94	x 89	x 84
	898	957	
	x 76	x 69	
796		486	964
x 96		x 79	x 47

Name:_____

486			
x 86			
968		796	946
x 79		x 89	x 78
476	847	587	974
x 87	x 49	x 98	x 48
988		759	
x 67		x 96	
697		684	469
x 69		x 97	x 74

Appendix H

Parental Permission Form

Date: September 22, 2010

Dear Parent or Guardian,

My name is Meredith Embree and I am currently a graduate student in the School Psychology Ph.D. program at the University of Tennessee. As part of my training, I am working with students and teachers at Madisonville Middle school. I am conducting research on a strategy designed to increase the amount of work students complete. I am requesting permission for your child to participate in this study. I will be supervised by Christopher H. Skinner, a faculty member at the University of Tennessee.

Our project involves having your child complete a series of math problems. Students will be given time to work on the math problems. Later students will be given the assignment they started and another lower-effort assignment. Students will then be allowed to choose which assignment they will complete. After finishing their chosen assignment students will respond to some questions designed to determine why they chose their particular assignment. The entire process will take between 20 and 45 minutes to complete and will be conducted during your child's daily mathematics instruction time.

The administrative staff and teachers at Madisonville Middle school have been informed about our project and have agreed to allow us to conduct this research. Your child's performance on this task will not affect his or her grades. Your child's name will not be linked with the information collected. Additionally, participation in this project is entirely voluntary. Thus, your child may choose to discontinue participation at any time without penalty.

We hope that the information gained through this project will lead to development of more effective teaching strategies. If so we hope to share this information with others in workshops or with articles. Your child's name will never be included in any of our work to share this information.

If you are willing for your child to participate, please sign and date the form below and have your child return it to their teacher as soon as possible. I appreciate your and your child's willingness to consider helping us with this research and I thank you, in advance. If you have any questions or concerns please feel free to contact me at 865-974-0337 or my faculty advisor (Chris Skinner) at 865-974-8043.

Thank you for your time and consideration.

Sincerely,

Meredith Embree

I have read and understand the above information, and I give permission for my child to participate in this study. I have received a copy of this form.

Signature of parent or legal guardian:_____

Date:_____

Child's Name (please print):_____

Appendix I

12-Problem PAC Worksheet

Name:_____

36 x 45	45 x 54		32 x 59	23 x 65
65 x 42	52 x 57		63 x 46	54 x 35
25 x 56	46 x 35		27 x 65	48 x 36

20-Problem PAC Worksheet

Name:_____

45 x 33	24 x 65	49 x 53	32 x 55
58 x 63	57 x 43	38 x 55	48 x 34
36 x 45	45 x 54		32 x 59	23 x 65
65 x 42	52 x 57	63 x 46	54 x 35
25 x 56	46 x 35	27 x 65	48 x 36

Matched Lower-Effort Worksheet

Name:_____

32 x 56	56 x 24	25 x 75	36 x 64
45 x 53	52 x 65	64 x 53	72 x 56
84 x 63			

Appendix J

Name:_____

Which worksheet did you choose to complete? (circle one) 1st sheet 2nd sheet

Please describe the most important reason(s) you chose this sheet. Please be as clear as possible in your explanation.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix K

Procedural Checklist

The following were completed:

___ permission form collected from all participants

___ student assent and demographics given to all participants

___ student assent and demographics collected from all participants

___ math sheet given to each participant

___ standardized instructions read to each participant

___ alternate activity given to non-participating students

___ time given to complete worksheet

___ second worksheet and instructions given when participants raise their hand

___ participants given 10 minutes to complete chosen math sheet

___ math sheets with name collected from each participant

___ open-ended question given to participants

___ time allowed for instructions and completing question

___ questionnaire collected from each participating student

___ participants thanked and dismissed

___ all materials accounted for and filed in designated folders

Appendix L

Standardized Instructions and Procedures

Hi. My name is Meredith. *introduce others. We are here today to ask you to do a math activity. Please clear your desk of everything except a pencil. You will **not** need a calculator for this activity. If you need a pencil, please raise your hand. At this time, I need you to please raise your hand as I call your name. (call names of those with consent forms)

Hand Out Assent and Demographic Forms

I am going to pass out a form for you to sign. Please wait until all forms have been passed out and directions have been provided. This form lets me know that you are willing to participate in the study. Please look at the form and read along as I read it aloud to you. (**read assent form**)

My name is Meredith Embree and I am a graduate student at the University of Tennessee. I am conducting research on math problems and would appreciate your help. If you decide to participate, you will be asked to work on some math problems and answer some questions.

It is important for you to know that, if you choose to participate, you can quit the study at any time by letting me or your teacher know you wish to quit. You will not be penalized for choosing to quit the study. Your performance on this task will not affect your grades and you will be allowed to do work assigned by your teacher.

If you agree to participate please mark the space next to "yes". If you do not want to participate, please mark the space next to "no" and your teacher will give you another math assignment to work on while we conduct this study. Please write your name on the line below.

** Refer to demographic form

This second form will provide me with some general information about you. Please complete each question. When you are finished, stop and look up. Please raise your hand if you have questions. Be sure your first and last names are at the top.

Collect Assent and Demographic Forms

I am now going to pass out worksheets and it is very important that you leave them face down until I tell you to turn them over. All of you will be receiving an assignment. If you did not return a permission slip to participate in the study, Mrs. Conley will hand out and collect your worksheets.

> *When I say begin, you may turn over your paper and begin completing problems as accurately as you can. Please complete problems working from left to right and beginning at the top of your paper. (Researcher demonstrates) Please try to work each problem in order and try not to skip problems. Please stop when you reach the "stop" sign. Are there any questions? Begin.*

Walk around room to monitor students as they work

As students raise their hand, go to them and make sure they have completed designated problems. Provide them with another worksheet (with 9 problems) and prompt them to place their name at the top.

Give instructions to choose one sheet to complete. "You only have to complete one. It is totally up to you and doesn't matter which one you choose. Once you have chosen, please turn the sheet you are not working on face down and you may begin working on the one you've chosen. We will come around to collect the other sheet."

Allow them time to complete the sheet.

As students choose, we can **collect the sheets that have not been chosen (are face down).

5 – 10 minutes before end of class period: announce that all sheets will be collected. After collecting all sheets, hand out open-ended question/ manipulation check. Instruct students to place name at top and complete.

Collect questions and thank students. Teacher will dismiss students.

Vita

Meredith Leigh Hawthorn Embree grew up in Hot Springs, AR. She graduated from Cutter Morning Star High School in 2002 and attended Hendrix College. In 2006, Meredith graduated from Hendrix College with a B.A. in Psychology. Meredith then worked for one year as a case manager and preschool teacher at a therapeutic preschool program within a community mental health center in Hot Springs, AR. Meredith entered the School Psychology Ph.D. program at the University of Tennessee, Knoxville in 2007. She is currently in her fourth year in the Ph.D. program. In the upcoming academic year, Meredith will be completing a year-long predoctoral internship at Cherokee Health Systems, Inc., a member of the Tennessee Internship Consortium. Upon completion of her internship, Meredith will have met all necessary requirements for a Ph.D. in School Psychology.