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I, William C Hunter, hereby submit this original work as part of the requirements for the degree of Doctor of Education in Special Education.

It is entitled: Examining the Effects of NHT on Quiz Results and On-Task Behavior with Students Identified with Emotional Behavioral Disabilities

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Examining the effects of NHT on Quiz Results and On-Task Behavior with Students Identified with Emotional Behavioral Disabilities

A dissertation submitted to the Division of Graduate Studies at the University of Cincinnati in partial fulfillment of requirements for DOCTOR OF EDUCATION in the Special Education Program School of Education, Criminal Justice and Human Services

By

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Abstract
EXAMINING THE EFFECTS OF NHT ON QUIZ RESULTS AND ON-TASK BEHAVIOR WITH STUDENTS IDENTIFIED WITH EMOTIONAL BEHAVIORAL DISABILITIES

By
William C. Hunter

Chair: Dr. Todd Haydon
Major: Special Education

Previous research has demonstrated that Number Heads Together (NHT), a peer-mediated intervention, is more effective than the traditional teacher-led instruction in academic areas such as language arts, social studies, and science. The current study compared the effects of two NHT strategies during a middle school math lesson. Four middle school students with emotional behavioral disorders participated in the study. An alternating treatment design was used to determine the effectiveness of NHT upon the participating students’ on-task behavior, total percentage of quiz scores, correct answer percentage on administrated quizzes, and accurate completion percentage of multiplication algorithms.

The current study extended the previous studies through the incorporation of a preference stimulus assessment to determine the effectiveness of Number Heads Together +Incentives (NHT+I) and included the participating students’ Woodcock Johnson III math (WJ-III) computation scores to determine and develop the pre-test and post-test.

Results of this study suggest that Number Heads Together + Incentives is a more effective intervention than NHT without the Incentives in terms of increasing on-task percentage and academic quiz scores. Results from this study replicates and extend which authors found for similar on-task behavior and academic quiz scores. Social validity assessments for the
participating teacher and students are included with the results. Future research should compare the effects of NHT and NHT+I for students with EBD in a full inclusive environment and in a different academic content area such as social studies. A discussion on study limitations, implications, and future research directions is included.
Dedication

To my wife Flower, and my daughters Amenah and Madison
ACKNOWLEDGEMENTS

I would like to begin my acknowledgements with a biblical verse that I meditated on for the past several years, “Commit thy way unto the Lord, trust also in him, and he should bring it to pass” (Psalms 37:5). I would like to thank the following people for guiding and helping me through the process of obtaining a doctorate in Special Education. I would like to thank my wife, Flower for her overall support and patience during this process, “I am back”. I would like to thank my daughters, Amenah and Madison for their patience and support. I would like to thank my mom, dad, brother, sister, my entire family (Hunter, Walker, and White) and friends for your support, and words of encouragement on the pursuit of my degree.

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CHAPTER 1
INTRODUCTION

The purpose of this chapter is to provide a brief overview of the literature on academic and behavioral characteristics and educational implications of students with Emotional Behavioral Disorders (EBD). The introduction concludes with a focus of the significance of this study and is followed by the study’s research questions.

Statement of Problem

The education of students with EBD is challenging, which is attributed to the complex nature of the disorder (Reid, Gonzalez, Nordness, Trout, & Epstein, 2004). Adolescents with EBD display a range of persistent problems that interfere with the learning process (Kaufman, 2005). Students with behavioral problems have been shown to have fewer opportunities to receive instruction from the teacher compared to same age typical peers (Gunter, Denny, Jack, Shores, & Nelson, 1993). Students with EBD frequently displays low levels of task engagement and task completion, therefore they are prone to lack academic skills (Nelson, Benner, Lane, & Smith, 2004). Managing behaviors displayed in a self-contained classroom for students with emotional and behavioral disorders (EBD) can be challenging even for experienced teachers (Kennedy, & Jolivette, 2008). Unfortunately, teachers of students with EBD tend to be less skilled in general instructional tasks than other special educators (Henderson, Klein, Gonzalez & Bradley, 2005). In the absence of effective interventions implemented by teachers, the behavior patterns of students with behavioral disorders become more firmly established and intervention efforts to increase on-task behavior become diminished (Walker, Ramsey, & Gresham, 2004). Students with EBD in self-contained classrooms demonstrate broad deficits in reading and math skills (Lane, Wehby, Little, & Cooley, 2005). Although tremendous challenges are presented to self-contained teachers of students with EBD in terms of addressing their students’ social and
academic deficiencies, it is imperative that they incorporate empirically based teaching methods to maximize effectiveness (Ryan, Pierce, & Mooney, 2008).

**Significance of the Study**

Number Heads Together (NHT) is an empirically based teaching method that has improved permanent products (daily quizzes) and on-task behavior of students (Maheady et al., 1991; Maheady et al., 2002; Maheady et al., 2006; Haydon et al., 2010). Four NHT studies were included in the review for the current study. The results of the literature review indicated that three of the NHT studies were in general education classrooms (Maheady et al., 1991; Maheady et al., 2002; Maheady et al., 2006) and one study was in a self-contained classroom for students identified with mild to moderate disabilities (Haydon et al., 2010).

The proposed study extends the NHT literature in several ways. First, the effectiveness of increasing on-task behavior and quiz scores of students with EBD are examined. Secondly, a stimulus preference assessment is being utilized to compare the effectiveness of Number Heads Together plus Incentives (NHT+I) versus NHT. Third, the participating students are working in a new content domain, math. Fourth, it will be examined if the students’ on-task behavior and the quiz score percentages were maintained.

**Purpose of the Study**

The purpose of the study was to investigate the following research questions: What are the effects of Number Heads Together (NHT) and Number Heads Together with an incentive package (NHT+I) upon daily quiz scores of students with emotional behavioral disorders during a math activity in a middle school self-contained classroom? What are the effects of Number Heads Together (NHT) and Number Heads Together with an incentive package (NHT+I) upon on-task behavior of students with emotional behavioral disorders during a math activity in a
middle school self-contained classroom? Could the on-task behavior and quiz score percentages be maintained for students in the NHT+I condition?
CHAPTER 2
LITERATURE REVIEW

The purpose of this chapter is to provide an in-depth discussion of the literature on students with emotional behavioral disorders (EBD) academic and behavioral characteristics and will focus on the lack of academic interventions for students with EBD. The literature review section will explore student disruptive behavior and its implications for educators and academic outcomes. The academic strategies of peer-mediated instruction will be reviewed as well as a discussion of cooperative learning. The academic strategy of Number Heads Together, as well as the four experimental studies will also be reviewed. Finally, the purpose for the proposed study based on the review of the literature will be discussed.

Students with Emotional Behavioral Disorders

Students with Emotional Behavioral Disorders (EBD) are characterized as exhibiting an inability to learn which cannot be explained by intellectual, sensory, or health factors (US, Department of Education, 2006) and frequently have co-existing academic and behavioral deficits (Heward, 2006; Smith, 2007). In terms of behavioral deficits, students with EBD tend to have fewer friends than their non-disabled peers and are more likely to be rejected by their peers (Bryan, 2005). Some students with EBD are prone to display seriously aggressive or disruptive behavior, and they exhibit inappropriate feelings under normal circumstances (Mastropieri, & Scruggs, 2010). In terms of academic achievement, students with EBD have the lowest grade point average and experience the highest school dropout rate of any of the 13 disability categories of IDEA (US Department of Education, 1995; Wood & Cronin, 1999). In addition, students with EBD perform 1.2 to 2 grade levels behind their appropriate age level in comparison with typical achieving peers within the elementary school grades and that discrepancy widens for those students while in high school (Ryan, Reid, & Epstein, 2004).
Students with EBD exhibit characteristics such as interpersonal conflict and poor school achievement (Greshem et al., 1999). Researchers have acknowledged the academic discrepancies of students with emotional behavioral disorders in the content areas of reading, writing, spelling, and mathematics (Kaufman, 2001; Reid et al., 2004). Specifically the severe emotional and behavioral problems of students with EBD adversely affect the academic area of reading. Reading deficits are a factor in students with EBD outcomes in terms of high dropout rates, retention rates, and poor academic achievement (Strong et al., 2004). The academic achievement of students with EBD in the content area of math is consistently below average compared to same age peers without disabilities (Reid, Gonzles, Nordness, Trout, & Epstein, 2004). Researchers consider evidenced-based practices as a method to improve the academic achievement of students with EBD in addition to assisting these students in meeting proficiency in the academic areas of reading and math (Mastropieri, & Scruggs, 2010). A significant amount of research concerning students with EBD has focused almost exclusively on decreasing disruptive behaviors while not primarily addressing academic needs (Wehby, Lane, & Falk, 2003).

**Lack of Studies Focusing on Academic Interventions**

Historically, educators and researchers have attempted to provide interventions to students with EBD by addressing inappropriate social behaviors (Vaughn, Levy, Coleman & Bos, 2002). For example, Sutherland, Wehby, and Gunter (2000) conducted a review of the literature on peer-mediated strategies among students with EBD and concluded that there is limited research that demonstrates a positive relationship between cooperative learning strategies and achievement among students with EBD.
In a later meta-analysis conducted by Ryan et al. (2004) the authors addressed the limitations of the Sutherland et al. (2000) and reported that most interventions for students with EBD have focused on social behavior rather than academic outcomes. There has been a challenge to the logic of addressing behavioral outcomes while excluding academic outcomes for students with EBD (Epstein et al., 1989). Past research has established that students with EBD exhibit poor performance in academics that leads to negative outcomes such as academic failure and increased school dropout rates (Epstein et al., 1989). Due to No Child Left Behind (2001), there has been an increased concentration of academic research based interventions for students with EBD (Mooney, Epstein, Reid, & Nelson, 2003).

**Challenging Behavior in Urban Schools**

Specifically, students with EBD in urban schools are particularly at risk for not receiving adequate academic interventions (Kamps, et al. 1999). Due to their challenging behavior, students with EBD in urban schools face the several academic obstacles (Shippen et al., 2006). Challenging behavior of students with EBD includes non-task engagement (off-task), as well as disruptive and aggressive behaviors (Gunter & Jack, 1994). Addressing the increasing levels of off-task behavior in general education classrooms particularly in urban schools has become a critical issue as well as an important national matter (Algozzine, & Algozzine, 2007). Managing students’ challenging behavior can be one of the immense concerns for prospective teachers in urban schools (Lambert et al., 2006). The No Child Left Behind Act (2001) requires teachers to accommodate students with more diverse academic and behavioral needs in the general inclusive setting. Based on the No Child Left Behind Act (2001), there are an increasing number of students with challenging behavior who have access to the general education curriculum and
therefore being included in the general inclusive environment (McKleskey, Henry, & Hodges, 1999).

The Effect of Student Challenging Behavior upon Urban Teachers

Students with EBD display characteristics of frequent off-task behaviors that can be related to failed academic achievement and can be challenging to their teachers (Ruhl, & Berlinghoff, 1992; Meadows, Neel, Scott, & Parker, 1994). Teachers need to have the required skills, knowledge, and strategies to effectively respond to challenging behavior (Gable, McLaughlin, Sindelar, & Kilgore, 1993). However, school personnel often are not prepared with skills in effective management of problem behaviors. Administrators in urban schools continuously report difficulty in obtaining fully credentialed teachers with the desired attributes. Lambert et al. (2006) report that over the past two decades teachers in urban settings, especially those new to the profession, have indicated that behavior problems are one of their greatest school concerns. Teacher shortages are associated with student discipline issues and lack of support from administrators (Tillman, 2005). However, research has identified that fifty percent of urban teachers leave their profession within the first five years of their career because of stress related to the management of student challenging behavior (McKinney, Campbell-Whatley, & Kea, 2005). According to Arroyo and Rhoad (1999) teacher classroom behavior management, expectations, and student off-task behavior contribute to poor reading achievement in urban schools. McMahon et al. (2008) report that primary concerns among teachers and students in urban schools are disciplinary problems and lack of academic achievement. In addition, a significant amount of instructional time is lost because of student non-task engagement behavior which has direct academic implications (Cartledge, Singh, & Gibson, 2008).

Academic Implications of Challenging Student Behavior
Cartledge et al. (2008) indicates that there is a reciprocal relationship between academic and social behaviors. It is important to decrease student non-task engagement behavior due to its adverse affects (loss of instructional time, low grade point averages, school drop out on all student’s academic performance as well as school-wide academic culture, and social climate (Lambert, Cartledge, Heward, & Lo, 2006). Therefore, all students benefit from effective classroom structure and management, but students in urban schools benefit from effective classroom management and instruction (Lannie & McCurdy, 2007). There is a correlation between poor scholastic performance and disruptive behavior (Ascher, 1982). The social–emotional needs of students in urban school are viewed as placing them at risk for educational failure (Utley et al., 2002). Although urban schools experience unfavorable educational circumstances, it is essential for these schools to use effective, research-based practices and interventions to address the academic difficulties experienced by many students, including students with emotional behavioral disabilities (Shippen et al., 2006).

**Theoretical Framework for Academic Interventions**

**Peer-Mediated Learning Strategies**

Peer-mediated interventions are researched based practices in which peers (students) rather than teachers, mediate the instructional process through presenting academic content, offer immediate and positive feedback, and monitor other peer’s performance (Hoff & Robinson, 2002; Maheady, Harper, & Sacca, 1988). The intervention of peer mediated instruction provides an environment that features instructional strategies of individualization, error correction, and reinforcement (Ryan, et al., 2004). Furthermore, peer-mediated instruction refers to an alternative teaching situation in which students participate as instructional agents for their classmates and/or other students (Strain, 1981). Research has shown that peer-mediated
instruction is an effective strategy within both general and special education classrooms (Ryan, et al., 2004). In recent years, cooperative learning, a specific form of peer-mediated instruction, has served as an instructional alternative for professionals who work with students who exhibit consistent disruptive behaviors (Maheady, & Mallette, 1991).

**Cooperative Learning**

According to Slavin (1999), cooperative learning is a set of instructional strategies that involve students working collaboratively with little teacher supervision. Cooperative learning is regarded as the arrangement in which students work in heterogeneous ability groups and are rewarded on the basis of the success of the group (Johnson & Johnson 1994; Woolfolk, 2004). Slavin (1994) indicates that heterogeneous groups should be based on achievement, sex, culture, and disability. Cooperative learning has been used as a teaching strategy that promotes racial and cultural integration, and accommodates learning styles that incorporate multicultural education (Friend, & Bursuck, 2009; Gilles, 2007). Furthermore, when implemented effectively, cooperative learning programs produce increased cooperation among students from diverse backgrounds (Oortwijn, Bockaerts, & Vedder, 2008). Cooperative learning involves students working together to achieve multiparty learning groups (Johnson, Johnson, & Holubec, 1992, 1993). Cooperative learning has produced higher achievement gains for students from various academic backgrounds (Johnson & Johnson, 1994). Hence, as students solve problems in a collaborative fashion, there is an increased possibility of peer acceptance (Slavin, 1995). Therefore, the learning environment must be structured in a way that the essential elements of cooperation are incorporated into the lesson and ultimately become part of the group process (Johnson & Johnson, 1994).

**Five Elements to Cooperative Learning**
According to Johnson and Johnson (1999) there are five elements that define cooperative learning groups. Cooperative-learning skills utilize five basic elements within its structure:

- positive interdependence: participants of the group utilize each other for support, explanations, and guidance.
- face to face interaction: participants of the group are working closely together, not across the classroom.
- individual group accountability: participants are held accountable for their learning through individual assessments and other types of assessments.
- collaborative skills: participants give each other constructive feedback, reach agreements, and involve every member of the group when completing a task.
- group processing: participants monitor the progress of the group, which ensures that all aspects of the group are working effectively.

Researchers has identified that the implementation of cooperative learning has had a positive effect upon participating students academic achievement.

**Cooperative Learning and Students with Disabilities**

It is reported that cooperative learning strategies have increased reading and language achievement for students with disabilities (Fore, Riser, & Boon, 2006; Jenkins et al., 1991). As an added benefit, cooperative learning is often portrayed as a significant inclusion strategy because it allows students with mild to moderate disabilities to receive supplementary attention and assistance from peers while making their own contributions to the group (Johnson & Johnson, 1986). Various forms of small-group instruction, which include cooperative learning models, are being recommended as solutions for the complex problems associated with providing individualized education to students with learning and behavior disabilities particularly
students with EBD in general classroom settings (Malmgren, 1998). In a survey conducted by Jenkins et al. (2003), the authors reported that teachers cited the benefits of cooperative learning among students with disabilities as improving self-esteem, creating a safe and orderly learning, and increasing success in permanent products.

As noted in the review of the literature, there are potential benefits to the incorporation of cooperative learning in the classroom; however, the most common classroom instructional delivery continues to be teacher-led instruction, which involves individual response from the participating students (Hayling, Cook, Gresham, State, & Kern, 2008; Kagan, 1992). A concern with the individual responding classroom structure is that most students become passive observers while higher achieving peers volunteer to answer teacher-directed questions (Maheady, Mallette, Harper, & Sacca, 1991; Maheady, et al., 2002).

**Number Heads Together**

A teaching strategy that has been effective in increasing class participation among all students within a classroom while incorporating teacher-led instruction and peer-mediated instruction is Number Heads Together (NHT). NHT is a cooperative learning teaching strategy that incorporates a unique teacher questioning strategy that actively involves students while increasing their academic scores (Maheady et al., 2006). NHT is regarded as a classroom intervention that combines the components of teacher-directed and peer-mediated instruction while using a distinct teacher questioning strategy that encourages active student participation (Maheady, et al., 1991). The components of NHT include the formation of student teams, student interdependence, and individual student accountability (Kagan, 1989). The structure of NHT involves students being placed into small diverse learning teams that consist of at least one high-achieving, one average-achieving, and one low-achieving student. Teachers then proceed to
assign numbers to individuals in the group (1-4) and students assemble themselves during teacher-directed lessons (Maheady, & Mallette, 1991). Next, the teacher provides a question to the entire class (all groups). The students are coached to "put their heads together," develop the answer as a group, and ensure everyone in the group agrees on a final answer (Kagan, 1989). Teachers recognize and/or reward the students who provide or agree with correct answers (Maheady, & Mallette, 1991).

A Summary of the Literature on the Effects of NHT

Within this section, an analysis and a synthesis of the four NHT studies will be provided. The authors, participants, research design, independent and dependent variables, results of the four NHT experimental studies is included in Table 2-1. Maheady et al. (1991) conducted an experimental study of NHT for 20 third graders in a racially and ethnically integrated school system in which an alternating treatment design (Barlow & Hayes, 1979) was used to evaluate the effects of the NHT intervention compared with a Whole Group Question and Answer technique (WGQ&A) upon the participating students. Maheady et al. (1991) found the NHT intervention increased the dependent variable of 10 item social studies quiz scores. The authors found by using the NHT intervention, the class averages on the weekly social studies quizzes increased approximately two letter grades (i.e., WGQ&A, M=68.5% vs. NHT, M=84.3%). The study also measured student on-task rates, and in comparison with Whole Group Instruction, students were operating on a higher percentage of on-task rates in NHT (WGQ&A, M=39% vs. NHT, M=71%).

In a follow-up investigation, Maheady et al. (2002) conducted a replication of the previous study and compared the effects of NHT and Response Cards (RC) with the WGQ&A condition. The authors implemented a simpler version of NHT (Maheady et al., 1991) to increase
the possibility of teachers using NHT. The authors did not use the components of public posting of quiz scores, competing teams nor contingent awards. The results indicated that the sixth grade science quiz scores improved one letter grade under the second NHT and RC experimental conditions compared to the WGQ&A conditions (i.e., WGQ&A, M=73.2 vs. NHT/RC, M=86%). The study also measured the on-task rates of participating students, and in comparison with Whole Group Instruction, students were operating on a higher percentage of on-task rates in the NHT and RC conditions (WGQ&A, M=80% vs. RC, M=90%, vs. NHT, M=98%).

In the third related study, Maheady et al. (2006) examined the effects of Number Heads Together (NHT) and Number Heads Together plus Incentives (NHT+I) for 23 6th grade students in an urban school district. The authors used an A-B-BC-BC (Barlow & Hayes 1979) to evaluate the effects of the intervention upon the participating students. NHT was introduced in the B phase and NHT+I was introduced in the BC phase. The authors examined the effects of WGQ&A, NHT, and NHT+I on student’s performances on daily formative chemistry quizzes and summative academic measures. The authors also implemented a behavioral incentive package within the study. The results indicate that the student performance on the chemistry quiz scores improved in the NHT condition and NHT+ incentive condition compared to the WGQA condition (i.e., WGQ&A, M=72.4 vs. NHT, M=80.3, vs. NHT+I, M=89.2), and the students indicated a preference for the NHT+I condition.

Haydon, Maheady, and Hunter (2010) extended the Maheady et al. (2006) study by: (a) using a different setting, a 7th grade self-contained classroom; (b) working with students identified with various disabilities; (c) further investigating the use of incentives with and without NHT, and (d) working in a new content domain, language arts. The authors examined the effects of NHT and NHT+I upon three students with various disabilities in an urban middle
school. One of the student participants was an African American male with EBD, another participant was an African American male with Attention Deficit Hyperactivity Disorder (Other Health Impairment), and one participant was an African American female with a Mild Mental Disability. The authors used an alternating treatment design (Barlow & Hayes, 1979) to evaluate the effects of the intervention upon the participating students. The authors examined the effects of student individual response (IR) condition (baseline), NHT, and NHT+I on student’s performances on daily formative language arts quizzes and student on-task behavior. According to Bloom’s taxonomy, the objective of the language arts formative quizzes focused on the comprehension of material for the participating students (Gronlund & Bookhart, 2009). Comprehension is a lower-level objective that assesses the student’s ability to understand material presented (Woolfolk, 2010). The results indicated that the student performance in the area of daily language arts quizzes improved in the NHT and NHT+I conditions in comparison with the baseline condition (i.e., IR, M=42% vs. NHT, M=61.4%, vs. NHT+I, M=61.9%). Student on-task behavior was measured in the IR, NHT, and NHT+I conditions. Students were operating on a higher percentage of on task rates in the NHT and NHT+I conditions compared to the IR condition (IR, M=66% vs. NHT, M=97%, vs. NHT+I, M=96.6%). However, there was a lack of clear differential effects for one NHT strategy over the other.

In the four NHT studies, the dependent variable of on-task behavior was investigated. The results showed that for NHT, the average on-task behavior was 89%, and for NHT+I the average on-task behavior was 96.6%. The Haydon et al. study (2010) compared the on-task percentage of NHT and NHT+I, and the difference is less than one percentage point. The results show that there is a lack of clear effects between NHT and NHT+I in terms of student on-task percentage. In the four NHT studies, the dependent variable of student quiz scores was
investigated. The results showed for NHT the average student quiz scores was 78% and for the NHT+I the average quiz scores were 76%. There is a lack of clear effects on quiz scores between NHT and NHT+I conditions. The lack of clear effects on student on-task behavior and quiz scores creates a gap within the literature.

**Stimulus Preference Assessment**

To address the lack of clear effects on student on-task behavior and quiz scores between the NHT and NHT+I condition, a stimulus preference assessment can be used to determine the effectiveness of the incentives in the NHT+I condition. A stimulus preference assessment refers to a variety of procedures used to determine the stimuli a person prefers and the preference values of those stimuli (Cooper et al., 2007). Typically, a stimulus preference assessment is conducted to identify one or two highly ranked items, and these items are then used consistently to increase the effectiveness of reinforcers used to improve student behavior (Deleon et al., 2009)

Various stimulus preference assessment methods have been examined with children with behavior disorders (Paramore & Higbee, 2005). Daly III, et al. (2009) conducted an investigation on the effects of a Multiple Stimuli without Replacement procedure (a form of a preference stimulus assessment) with students with behavioral disorders. In the Multiple Stimuli without Replacement Procedure (MWSO), the chosen item is removed from an array of items, and the process continues until there are no remaining items (Cooper et al., 2007). One characteristic of students with behavioral disorders is that they tend to have the ability to communicate their ideas, which may have benefits for stimulus preference assessments such as the MWSO (Daly III, et al., 2009). The findings in the Daly III, et al. (2009) study indicated that the activities chosen during the MWSO served as effective reinforcers for the students in terms of correctly completing math problems.
Purpose of the Study

The author addressed the gaps of the literature through investigating the differential effects of NHT and NHT+I through using a stimulus preference assessment for the participating students of a conducted study. The investigation extended the Haydon et al. (2010) study by: (a) working only with students identified with EBD (b) further investigate the use of incentives with and without NHT, through using a stimulus preference assessment (c) examining if the students on-task percentage and quiz scores maintained and (d) working in a new content domain, math.

Research Questions

The specific research questions the author will address in the proposed study are:

1. What are the effects of Number Heads Together (NHT) and Number Heads Together with an incentive package (NHT+I) upon daily quiz scores of students with emotional behavioral disorders during a math activity in a middle school self-contained classroom?

2. What are the effects of Number Heads Together (NHT) and Number Heads Together with an incentive package (NHT+I) upon on-task behavior of students with emotional behavioral disorders during a math activity in a middle school self-contained classroom?

3. Could the on-task behavior and quiz score percentages be maintained for students in the NHT+I condition?
CHAPTER 3
METHODS

The purpose of this chapter is to explain the methods followed to conduct the current study. This chapter describes: (a) the criteria for participant selection; (b) the setting in which the study will be conducted, and the materials needed to perform the study; (c) measurement procedures (d) experimental procedures, and study design. In conclusion, the data analysis procedure of the study will be summarized. The study was conducted to answer the following research questions: What are the effects of Number Heads Together (NHT) and Number Heads Together with an incentive package (NHT+I) upon daily quiz scores of students with emotional behavioral disorders during a math activity in a middle school self-contained classroom? What are the effects of Number Heads Together (NHT) and Number Heads Together with an incentive package (NHT+I) upon on-task behavior of students with emotional behavioral disorders during a math activity in a middle school self-contained classroom? The results from this study compare the effects of NHT and NHT +I upon students with emotional behavioral disorders math quiz scores and on-task behavior.

Participants

The purpose of this study involved examining the effects of Number Heads Together (NHT) and Number Heads Together with an incentive package (NHT+I) on the on-task behavior, daily quiz scores, percentage of correct answers on daily quizzes, and percentage of accurate completion of multiplication algorithm of students with emotional behavior disorders (EBD) during a math activity in a middle school self-contained classroom. In accordance with the policies set forth by the University of Cincinnati Institutional Review Board, the experimenter obtained consent from the teacher and the parents of participating students within the study.
Teacher

One teacher served as a participant in the conducted study. The classroom teacher was a Caucasian female, age 40 with 11 years of teaching experience. The teacher participant: (a) worked with the student participants on a daily basis, (b) had teacher certification in the area of learning and behavioral disorders in the state of Kentucky, and (c) consented to participate in the study. The teacher participant was also selected based on: interest in receiving individualized training in implementing Number Heads Together (NHT) and Number Heads Together plus incentives (NHT+I). During the study there was a Caucasian female paraeducator, age 53, who assisted the classroom teacher during academic activities.

Students

Four target students (names are pseudonyms) participated in the study. Informed consent was sought for all eight students in the class, and the first five students to return signed forms were included in the study. One student did not participate in the study, although consent was obtained, due to being placed in an alternative to suspension program and in-school suspension for extended time periods throughout the duration of the study. All of the participants for the study were middle school aged students with emotional behavior disorders (EBD). All of the students’ disabilities were identified by school personnel using state-define criteria (Kentucky Department of Education, 2008). Due to the age of the student participants, assent and parental consent were obtained (see Appendix B). Criterion sampling was used for identifying the participants for this study. The student participants were selected based on the criteria of disrupting class through noise making, talking out, and not being focused on task provided by the teacher.
The participants in the study were three male students (one African American and two Caucasian) and one female student (African American). During the time of the study, the student participants’ ages ranged from 12 years 5 months to 13 years 11 months. Table 3-1 provides demographical information about the student participants. A total of 18 observations, (6 observations in each condition) took place during the study. Donnie and Jack were present for the 18 observations. Barry was not present during two observations due to being assigned in-school suspension for an event that transpired in another classroom with a different teacher (not the participating teacher). Jessica was not present during three observations due to being placed in an alternative to suspension program for physically assaulting the participating teacher prior to the implantation of the study. Three additional observations took place after the initial 18 observations in order to gather data for maintenance.

**Settings and Materials**

**Setting**

The middle school in the study is located within an urban environment within a mid-western city. The middle school ranges from grades 6th to 8th. Approximately 92% of the students in the school receive free and reduced lunches. The racial/ethnic make-up of the students is approximately 60% Caucasian, 32% African American, 2% American Indian, and 6% unspecified. The participants for the study were observed in one EBD self-contained classroom within the middle school. There were a total of eight students in the classroom.

The classroom was arranged with three rows of five individual seats and included a large dry erase board in the front of the room along with a standard sized dry erase board on the side of the room. The teacher placed her classroom rules that focused on each activity (group work, independent work) in the front of the room. The teacher’s desk was located in the left corner of
the room and paraprofessional’s desk was located in the right and corners of the classroom.
There was also a student computer station (three computers) in the back of the classroom and
both the teacher and paraprofessional were in the classroom during the study. The room was
large enough to allow students to work in peer-mediated groups and be observed by the primary
investigator with an additional observer (graduate student, professor etc.).

The study took place during teacher-led whole group math instruction at the same time
each afternoon. The planning and lesson structure for all sessions was consistent throughout the
study. The teacher used part of a 55-min planning period to develop questions focusing on math
facts and to develop10-item quizzes focusing on double digit multiplication math facts.

Three conditions of the study were conducted (a) Baseline (BL), (b) Number Heads
Together (NHT), and (c) Number Heads Together plus Incentives (NHT+I). Prior to the baseline
condition, a pre-test of math double digit multiplication facts was administered to the
participants. At the end of the study, a post-test of math double digit facts was administered to
the participants.

**Materials**

Prior to the implementation of the study, paper and pencil interviews were completed to
collect information on the student participants’ stimulus preference assessments (See Appendix
D), and classroom social behaviors. For the stimulus preference assessment, a paired item choice
inventory was administered to the student participants by the participating teacher prior to the
study (DeLeon, Frank, Gregory, & Allman, 2009).

The primary investigator and the participating teacher used the participating students’
most recent Woodcock-Johnson III (WJ-III) math assessment scores to assist with developing the
pre-test and the post test (Woodcock et al., 2001). A Sony recording device with a visible digital
clock counter was used to collect direct observational data during the study. A recorded sound indicated the lapse of a 20-second interval within the total 10-minute span of the observation. The observers used a split y-cord to listen to the recording device simultaneously.

The primary investigator used parallel index cards (12.7 cm by 7.5 cm) for a stimulus preference assessment. Response Cards (RC) in the form of small dry erase boards with dry erase markers were used in the study to allow the participating students in the NHT and NHT+I groups to answer questions delivered by the participating teacher (Maheady et al., 2002). The teacher selected the material to deliver math fact instruction to the student participants during the baseline, NHT, and NHT+I conditions. A dry erase board was used for the teacher to deliver the math fact instruction.

The teacher selected math problems from the books Working with Numbers (Shea, 1990) and Multiplication II (Hudson, 1999) and ensured that lesson standards were aligned with the state of Kentucky Middle School Core Content Standards (i.e. students will add, subtract, multiply, and divide whole numbers, etc.) The objective of the lessons was to complete multiplication problems through the application of the math algorithms and to find the correct answer. The lead math teacher in the middle school evaluated the materials to verify that the topic, lesson plans, and objectives were appropriate for the middle school level. The double digit multiplication problems were deemed appropriate with the incorporation of unknown variables to compute a correct final answer. The students primarily worked on double digit multiplication problems initially, and the teacher incorporated double-digit math problems with unknown variables within the lesson. In order to ensure that the quiz difficulty was equivalent across conditions, all quizzes consisted of 10 double-digit multiplication problems with spaces that allowed for students to work out the complete math algorithms.
Measurement Procedures

Dependent Measures

On-Task Behavior. On-task behavior is defined in a similar manner to Nelson, Johnson, and Marchand-Martella (1996) and includes student engagement in an academic task (individually or shared with a peer): looking at required material, verbalizing about an academic subject or material, teacher instructions, verbalizing to provide an answer to the teacher’s or peer’s academic questions, and asking the teacher or peer about directions. On-task behavior includes the student attending to academic task and asking for help. Data on student on-task behavior was collected using a 20-s momentary time sampling recording system during 10-minute observation sessions.

Quiz Scores. The percentage of correct responses on daily 10-item quizzes administered at the end of each math fact activity was measured. The quiz scores included the number of correct answers of a given problem and the accurate completion of the multiplication algorithm. The participating students’ overall quiz scores were measured in all three conditions (BL, NHT, and NHT+I).

Correct Answers. The percentage of the student’s correct answers on the daily 10-item quizzes administered at the end of each math activity was measured. The correct answer required two lines to be added correctly after the completion of the multiplication algorithm. The participating students’ correct answers were measured in all three conditions.

Accurate Completion of Multiplication Algorithm. The percentage of the participating students’ accurate completion of the multiplication algorithms for a given problem was measured. The accurate completion of the multiplication algorithm for double-digit multiplication involved the students to having two lines correct (no errors) when multiplying
numbers prior to adding to determine the final answer. The accurate completion of the multiplication algorithm was measured in all three conditions.

**Data Collection and Reliability**

During the study, a University of Cincinnati, College of Education, Criminal Justice, and Human Services (CECH), graduate student, and university professor participated in the study as classroom observers. To provide evidence that the measures of on-task behavior were accurate, observers were be trained by the primary investigator in using procedures outlined by Kennedy (2005). Adapted from the Haydon, et al. (2010) study, the following procedures to train observers were followed: (a) observers were provided with a four-page document that includes operationalized definitions and examples and non-examples of the dependent variable of student on-task behavior (see Appendix F); (b) after reading the manual, observers participated in a one-hour training session; (c), observers practiced coding all behaviors while watching video clips of teachers implementing NHT during large group instruction; (d) data collection began as soon as interobserver reliability levels of at least 90% was achieved for three consecutive trials. Data collectors followed a coding manual to be aware of which condition was being observed (i.e., baseline, NHT, or NHT+I).

**Recording Procedures**

Student on-task behavior was measured by using momentary time sampling. Momentary time sampling is an observational recording system in which an observation period is separated into equivalent intervals, and a target behavior such as student on-task behavior is observed at the end of an interval (Alberto & Troutman, 2009). An advantage of using momentary time sampling includes the observer not underestimating the target behavior (Hintze & Matthews, 2004). The process of determining percentages of student on-task behavior included adding the
intervals coded as on-task and dividing by the total number of intervals. All observations of the student’s on-task behavior lasted a total of 10 minutes. Student on-task behavior was recorded during the time period in which students were participating in whole group instruction (BL), NHT activity, and the NHT+I activity. The primary observer and the secondary observer(s) collected real time data of the participating students’ on-task behavior. Student on-task behavior data was collected by using a paper/pencil data system (see Appendix C for a sample data sheet). Within the data collection sheet, a section included a component in which a plus (+) was used to indicate on-task behavior and a minus (-) was used to indicate that the student was not exhibiting on-task behavior. During the 10-minute observation period, the primary and the secondary observer(s) continuously observed the target student’s on-task behavior.

The primary observer and the secondary observer(s) were prompted every 20 seconds (by a recorded sound) to look at the targeted student and code if the student was on-task at that moment (Sutherland, Wehby, & Copeland, 2000). The length of each observational session for student on-task behavior was 10 minutes; there were a total of 18 observations for student on-task behavior. Prior to the beginning of data collection, the primary observer spent four 30-minute periods in the classroom to help control for the potential of reactivity effects (Haydon, Mancil, & Van Loan, 2009).

Interobserver Agreement

Interobserver agreement (IOA) refers to monitoring the consistency of the dependent variables that are being measured for a study (Kennedy, 2005). IOA is used to minimize observer bias that may develop during the study (Kazdin, 1982). The primary investigator served as the primary data collector during all conditions. The trained graduate student and university professor assisted with IOA during the, BL, NHT and NHT+I conditions. To ensure reliability,
data was collected on the IOA associated with each dependent variable, and IOA levels met the minimum standard of 80% agreement among observers within the initial study (Horner et al., 2005). IOA for student on-task behavior was calculated using the interval agreement; dividing the total number of agreements by the total number of agreements and disagreements and multiplying by 100%. Quiz scores were calculated using the total agreement formula and the unit of measurement was percentage correct. Interobserver agreement was calculated during 44% of observations during the initial study phase. Mean inter-observer agreement for on-task behavior across all study conditions was 98%, 90.5%, and 93.7 % (range 87- 100.0%) for Jessica, Barry, Donnie, and Jack, respectively. The primary investigator and the participating teacher independently scored all pre-test, post-test and 10-item quizzes. Average interobserver agreement for the pre-test, post-test, and 10-item quiz scores was 100%.

**Study Design and Experimental Procedures**

The study design section describes the advantages of utilizing an alternating treatment design to evaluate the treatment effect of each condition. The experimental procedures section summarizes the steps that were followed to conduct the various conditions of the study. Within the experimental procedures section, a description of the assessments administered within the study is included.

**Study Design**

An alternating treatment design (Barlow & Hayes, 1979) was used to compare the effectiveness of the three instructional strategies (BL, NHT, NHT+I). An Alternating Treatment Design (ATD) is a single-subject experimental design that allows for the effectiveness of two or more treatment conditions (Alberto & Troutman, 2009). ATD allows for the evaluation of two treatments or conditions “in the same subject within the same time period produces one of the
most elegant controls for most threats to internal validity” (Barlow & Hayes, 1979 pg. 203). For this study, the treatment condition (NHT) is compared to another treatment condition (NHT+I), and both treatments are compared to a no treatment condition (handraising) in an alternating random method. The ATD provides the potential advantage of a quicker demonstration of treatment effects in comparison to a reversal design because the two treatments are alternated within the same time period (Kennedy, 2005). The lesson structure for all study conditions included: (a) initial review of classroom rules and previous content, (b) explicit statements of lesson goals, (c) teacher directed instruction (i.e., writing double digit multiplication problems on white board, explaining how correct answer was determined), and (d) teacher questioning to assess pupil understanding. According to the teacher’s instructional routine, quizzes were distributed after the presentation of the lesson. An entire class session typically lasted 40 min.; however, the NHT interventions were used only during the last 15 min of each intervention session. The study was conducted over a period of 18 days. Based on a randomized schedule, the teacher was instructed to implement either (a) baseline instruction (BL), (b) NHT, or (c) NHT+I.

### Experimental Procedures

**Teacher Training.** The teacher-training phase of the study consisted of two informational sharing sessions. In the first informational session, the primary investigator reviewed the following with the participating teacher: operational definitions, several video clips of teachers implementing NHT, establishment of a hand signal to ensure treatment integrity, the rationale of the preference assessment, and the rules and procedures of the NHT/NHT+I activity (Haydon, Mancil, & Van Loan, 2009). In the second information session, the primary investigator and the participating teacher met to design the double digit multiplication pre-test and post-test
(Maheady et al, 2006). The components of the pre-test and post-test was derived from the student scores on the math calculation segment of the WJIII.

**Pre-Test/Post-Test.** The primary investigator and the participating teacher used the results of the WJ-III (student’s most recent assessment) to assist with designing the participating students’ individual program (Lane, Barton-Arwood, Nelson, & Wehby, 2007). The primary investigator and the participating teacher used results from the WJ-III, which extends the Maheady, et al. (2006) study in developing the pre-test and the post test. The Kentucky Core Content Standards were used by the primary investigator and the participating teacher to compose a 20 item math multiplication double-digit facts pre-test and post-test. All evaluation materials were reviewed independently by the lead math teacher with expertise in math instruction within the school and assessed for accuracy, educational importance, clarity, and consistency with Kentucky Core Content Standards.

**Stimulus Preference Assessment.** The purpose of the multiple-stimulus without replacement (MWSO) preference assessment is to validate the tangible items/school events preferred by the participating students during the NHT+I condition. Adapted from the work of Daly III et al. (2009), the specific procedures for conducting the MWSO (stimulus preference assessment) are (a) the primary investigator interviewed (see Appendix D) the participating teacher to generate a list of 10 possible activities/items (5 activities, 5 tangible items) based on perceived teacher acceptability and feasibility for use in the school setting; (b) from the list of original list of 10 items, 8 items were selected for the stimulus assessment based on teacher preference and feasibility during the NHT+I condition; and (c) once items were determined (i.e. drawing time, going to the gym, tangible items) the eight activity cards (12.7 cm by 7.5 cm) contained the written name of one item (activity, tangible item) and were presented to each
participating student individually by the participating teacher prior to the implementation of the study (baseline, NHT, and NHT+I conditions). During the NHT+I condition the teacher prompted the students through showing each individual the card they selected prior to the start of the NHT+I intervention. Prompting is a listed accommodation on each participating student’s Individual Education Program (IEP).

**Baseline (Hand-raising).** Baseline conditions are described by using guidelines provided by Lane, Wolery, Reichow, and Rogers (2007). First, the teacher restated the classroom rules and asked questions to assess prior knowledge on the math facts that would be presented for the upcoming lesson. Next, the students had an opportunity to answer questions individually at their desk/tables. The teacher posed approximately 10 questions focusing on math facts to the entire class, and the students had an opportunity to volunteer responses by raising their hands to respond to the question. The teacher called upon volunteers at random.

The teacher administered one 10 item multiple choice math fact (double digit multiplication) quiz to the students after instruction. The quiz format for each condition was reviewed independently by the lead math teacher with expertise in math instruction within the school. Each quiz was assessed for problem difficulty that is consistent across conditions (BL, NHT, and NHT+I). The math quizzes evaluated the procedural knowledge of the participating students through including a section in which students would solve problems through completing multiplication algorithms. The math quizzes included a section in which the participating students selected the correct answers through the completion of the math multiplication algorithm. The combined elements of the multiplication quizzes will provide a source for determining the error patterns of the participating students (Riccomini, 2005). The participating
teacher accommodated the quizzes in consistency with pupils’ individualized education program (IEP).

**Numbered Heads Together (NHT).** During the standard NHT condition, the teacher participant read a script (i.e., provided by the primary investigator) to students that covered expected behaviors during NHT (see Appendix E). The primary investigator consulted with the participating teachers in regard to the classroom rules and procedures. The primary investigator consulted with the participating teacher in regard to accessing the participating student’s attitude toward math prior to the implementation of NHT and the NHT+I condition. A social validity survey was issued at the end of the study for the participating teacher and students. During consultation with the participating teacher, the primary investigator established a hand signal to indicate to the teacher on the event when a particular step in protocol was not followed. The participating teacher prompted the students to chorally respond and repeat the condition (NHT) that was in effect at the time of instruction. The teacher delivered math fact instruction (double digit multiplication) through using a dry erase board in front of the class. After the delivery of the math fact instruction, the teacher implemented the NHT condition within the classroom. The primary investigator consulted with the participating teacher in terms of NHT implementation procedures, which was be similar to Maheady et al. (2006). The NHT procedure consisted of (a) students being first assigned to small, heterogeneous groups according to their current academic ranks in class (Slavin, 1995); (b) heterogeneous teams being formed by assigning high, average, and low performers to each team (c) students within teams were then assigned numbers 1 to 4 to designate who would respond to questions on each team.

Adapted from the Haydon, et al. (2010) study, the participating teacher directed 10 math fact questions (double-digit multiplication) to the entire class and directed the class with the
following statement “Put your heads together, come up with the best answer you can, and make sure that everyone on your team knows the answer.” The teacher waited approximately 30-s for team members to discuss questions and have one team member write their answers on a RC. The teacher randomly selected a number from 1 to 4 and asked students (one in each group) to raise their boards and show their answers. The teacher asked students “if everyone in each group agrees with answers” and then provided positive and corrective feedback as needed. At the end of each session, students independently completed a 10-item quiz following the baseline procedures. In order to meet individual student accommodations, students received extended time to complete the quizzes. Quizzes were scored and returned the next day.

**Numbered Heads Together Plus Incentives (NHT+I).** During the NHT + I condition, the teacher followed the same procedures outlined in NHT condition (read from a script, respond to handsignal from investigator in the event of not following a step, prompt students to chorally respond to condition, directed pupils to write responses on white board, and checked others for agreement) with one exception. The teacher provided contingent rewards based on a stimulus preference assessment administered to the students individually, which extends the Haydon, et al. (2010) study, after the NHT+I condition. The participating pupils were notified by the teacher in regard to the requirements to obtain the reinforcer after the implementation of the NHT+I condition. The teacher prompted the students during the NHT+I through showing each student the incentive (picture and word on the index card) they selected. The participating teacher based the requirements for the students to obtain the reinforcers in accordance to their scores on progress monitoring data.

**Maintenance.** To determine whether the effects of the NHT+I condition upon student’s quiz scores and on-task behavior maintained over time, the primary investigator collected data
for an additional three weeks after the completion of the study (Haydon, & Hunter, 2011). The primary investigator served as the primary data collector during the maintenance condition. The trained graduate student and university professor assisted with IOA during 2 out of 3 observations; thus, interobserver agreement was calculated during 66% of observations during the maintenance phase. Mean inter-observer agreement for on-task behavior in the maintenance condition was 93.2% (range 91.5 to 94.9). The primary investigator and the participating teacher independently scored the 10-item quizzes during the maintenance condition.

Three data points were collected for Jack, Barry, and Donnie. Two data points were collected for Jessica due to her being placed in an alternative to suspension program due to vandalism of school property. Treatment integrity data indicated that the participating teacher implemented all procedural steps for NHT+I with 100% adherence during the maintenance phase. The data collection procedures during the maintenance phase were consistent with the BL, NHT, and NHT+I phase. As with the BL, NHT, and NHT+I conditions, student on-task behavior was measured by momentary time sampling. During the NHT+I maintenance condition, the participating teacher did not prompt the students with the index cards containing pictures of tangible items and physical activities and modified the overview of NHT+I rules explanation. During the maintenance condition, the participating students had to participate and complete the NHT+I activity to earn incentives. Progress monitoring sheets were not used to access if the student earned the incentives after the NHT+I activity.

**Treatment Integrity**

Adapted from the Haydon, et al. (2010) study, four different treatment procedural checklists were developed for each condition (BL, NHT, NHT+I, and NHT+I maintenance condition) to ensure treatment integrity (see Appendix G). Aspects of the procedural checklist
included (a) the participating teacher stating the classroom rules and procedures, (b) the participating teacher checking for prior knowledge, and (c) the participating teacher administering the quiz to the students. The three procedural checklists were developed after the primary investigator had an initial consultation with the participating teacher. Procedural checks for the BL condition consisted of six items. In contrast to the BL condition, the NHT procedural checklist consisted of 10 steps (e.g. prompting students to chorally respond which treatment is in effect, assigning students into small heterogeneous groups, directing 10 questions and asking students “to put their heads together,” asking if everyone agrees, etc.) The NHT+I procedural checklist consisted of the identical 10 steps as the NHT condition with two additional steps (prior to the activity, the teacher discussed with the incentives with the students, and informed students if they received incentives at the end of the activity). Treatment integrity was calculated by dividing the number of steps present by the total number of steps and then multiplied by 100. Treatment integrity data indicated that the participating teacher implemented all procedural steps for NHT and NHT+I with 100% adherence on all occasions. Mean inter-observer agreement for treatment integrity was 100%.

Social Validity

Adapted from the Haydon et al. (2010) study, the teachers and the students were asked to complete social validity surveys (see Appendix H) at the completion of the study in order to gain perspective on the NHT and NHT+I (condition) strategies. The student surveys were completed independently and anonymously. The four administered surveys included 9 Likert-scale type questions.

Student Perception of Math
Prior to the study, a likert-like scale was administered to the student participants to gain perspective of their views on the content area of math (see Appendix H). A post-study likert-like scale was administered to the student participants to gain a perspective on their views on the content area of math after the implementation of NHT/NHT+I (See Appendix H).

**Data Analysis**

The primary investigator used the Microsoft Excel software program to graph the collected data (Lo, & Konrad, 2007). Line graphs were drawn for the intervals of the students on task behavior, overall quiz score percentage, correct answer percentage, and accurate completion of math algorithm percentage. Visual inspection was used to evaluate quantitative information through analyzing specific patterns in the graphed data (Kennedy, 2005). Visual analysis for the investigation will be used for the interpretation of the level, trend, and variability of performance occurring during baseline and intervention conditions (Horner, et al., 2005). The ending of each condition was determined by visually examining the last three data points for stability (Kazdin, 1982).
CHAPTER 4
RESULTS

The purpose of this study was to examine the effects of NHT and NHT+I upon the on-task behavior, daily quiz scores, percentage of correct answers on daily quizzes and percentage of accurate completion of multiplication algorithm on daily quizzes of students with EBD. These effects were concluded by collecting academic and behavioral observation on the participating students’ behavior in a self-contained classroom using an alternating treatments design. Data from the participating students’ scores on the Woodcock Johnson III (WJ-III), multiplication fact pre-test, and multiplication post-test are included within this section. Results from the stimulus preference assessment administered prior to the study for the participating students will be reviewed. Data for the dependent variables were recorded and displayed on graphs for visual analysis (Figures 4-1, 4-2). Treatment Integrity data were collected to ensure the implementation of the study’s procedures occurred and social validity data were collected to assess the teacher’s and the participating students’ perceptions on the overall study. Social validity data were also collected to assess the participating students’ perception of the academic content area of math prior and after the intervention was administered. This chapter reports the results of the assessments administered, the outcomes for each participant during the three conditions of the study, outcomes for each participant during the maintenance condition, treatment integrity, and social validity surveys administered.

Assessment Results

WJ-III results

The most recent Woodcock-Johnson III (WJ-III) report was reviewed for the four participating students prior to the implementation of the study (Woodcock et al., 2001). Results of the math calculation area of the WJ-III indicate that all of the participating students scored
below average in comparison to same age peers. According to the average standard score descriptor on the WJ-III; in the area of math calculation, Donnie, Jack, and Barry scored below average in comparison to same age peers, while Jessica scored significantly below average to same age peers (Table 4-1). The participating teacher and the primary investigator reviewed the participating student’s scores on the WJ-III before developing the math program consisting of double digit multiplication facts. The math program was developed by the participating teacher and the primary investigator after reviewing the WJ-III results for the participating students.

**Stimulus Preference Assessment**

The participating students were administered a stimulus preference assessment by the participating teacher prior to the study. Table 4-2 summarizes the top four incentives selected by each of the four participating students during the NHT+I condition. The results indicate that Jessica had a high preference for the basketball activity (selected 4 events) compared to the computer game activity (selected 2 events), healthy snack (selected 1 event), and a drawing activity (not selected during the condition). For Barry, he had a high preference for receiving a healthy juice (selected 5 events), compared to healthy snacks (selected 2 events), computer game activity (selected 1 event) and a drawing activity (not selected during the condition). For Donnie, he had a high preference for the basketball activity (selected 6 events) compared to a computer game activity (selected 2 events), a drawing activity (selected 1 event) and extra walking time (not selected during the condition). For Jack, he had a high preference for the basketball activity (selected 7 events) compared to a computer game activity (selected 2 events), extra walking time (not selected during the condition) and a drawing activity (not selected during the condition).

**Pre-test/Post-Test**

Student performance on the 20-item math pre-test/post-test was examined (Table 4-1). The results indicate that each student made significant improvement from the pre-test.
administered prior to the study to the post-test administered after the completion of the study. The class average at pretest was 16.5% correct (range = 10-25%). At post-test, the class average had increased to 76% correct (range = 60% -87%). Barry scored 25% correct on the pre-test while improving to 87% correct on the post-test. Jack scored 17% correct on the pre-test while improving to 85% correct on the post-test. Jessica scored 14% correct on the pre-test while improving to 60% correct on the post-test. Donnie scored 10% correct on the pre-test while improving to 72% correct on the post-test.

**Intervention Results**

A summary of the means and ranges for the percentage intervals of the on-task behavior, daily quiz scores, percentage of correct answers on daily quizzes and percentage of accurate completion of multiplication algorithm across conditions is presented for each participant (Tables 4-3-4-5). Visual data analysis was used to assess changes in trend, level, and variability (Figures 4-1, 4-2). Trend lines were determined by using a visual analysis for lines with six or fewer data points, and by using regression trend lines in Microsoft Excel. The data provides information on the effectiveness of NHT and NHT+ I upon each dependent variable.

**Percentage of On-Task Behavior**

The percentage of target student on-task behavior was based on a momentary time sampling with 20-second intervals, collected during 10-minute instructional sessions. The process of determining the percentages of student on-task behavior included adding the intervals coded as on-task and dividing by the total number of intervals. Table 4-3 summarizes means and ranges for the percentage of intervals on-task behavior across students and experimental conditions. Table 4-5 summarizes the means and ranges for the four dependent variables in the maintenance (NHT+I) condition. All four students demonstrated lower mean percentages of on-
task behavior during baseline as compared to NHT and NHT+I conditions. All four students demonstrated lower mean percentages of on-task behavior during NHT compared to the NHT+I condition. All four students maintained high on-task percentage scores in the maintenance condition. Results for the four participants are presented (Figure 4-1).

**Participant 1: Barry.** The mean percentage of on-task behavior for Barry during the BL condition was 69.6% (range = 47%-78.5%), during the NHT condition was 88.2% (range = 80%-94%), during the NHT+I condition was 96.2% (range = 93%-100%) and during the maintenance condition (NHT+I) was 100%. Barry demonstrated his highest levels of on-task behavior in the NHT+I condition. Visual analysis revealed that for Barry, all five NHT and NHT+I data points (100%) exceeded the highest BL data point, while three out of five NHT+I data points (60%) exceeded the highest NHT data point. There was no overlapping between the NHT/NHT+I conditions with the BL condition. There was little variability within the NHT and NHT+I conditions. Barry maintained high on-task percentage scores in the maintenance condition.

**Participant 2: Donnie.** The mean percentage of on-task behavior for Donnie during the BL condition was 49.3% (range = 28.5%-63%), during the NHT condition was 74.2% (range = 53%-100%), during the NHT+I condition was 90.8% (range = 88%-100%), and during the maintenance condition (NHT+I) was 97.7% (range = 93%-100%). Donnie demonstrated his highest levels of on-task behavior in the NHT+I condition. Visual analysis revealed that for Donnie, all six NHT+I data points (100%) exceeded the highest BL data point. Two (33%) out of six NHT+I data points overlapped with NHT data points. Further visual analysis reveals that there was little variability within the NHT+I condition and moderate variability in the NHT condition. Donnie maintained high on-task percentage scores in the maintenance condition.
Participant 3: Jack. The mean percentage of on-task behavior for Jack during the BL condition was 57.6% (range = 37.5%-75%), during the NHT condition was 81.7% (range = 75%-88%), during the NHT+I condition was 96% (range = 94%-100%), and during the maintenance condition (NHT+I) was 96.7% (range = 93%-100%). Jack demonstrated his highest levels of on-task behavior in the NHT+I condition. Visual analysis revealed that for Jack, all six NHT+I data points (100%) exceeded the highest NHT and BL data point, while five out of six NHT data points (83%) exceeded the highest BL data point. The three (NHT +I) maintenance condition data points (100%) exceeded the highest NHT data point. There was no overlapping between the NHT+I conditions with the NHT and BL conditions. There was little variability within the NHT and NHT +I conditions. Jack maintained high on-task percentage scores in the maintenance condition.

Participant 4: Jessica. The mean percentage of on-task behavior for Jessica during the BL condition was 24.1% (range = 13%-33%), during the NHT condition was 68.2% (range = 53%-88%), during the NHT+I condition was 86.8% (range = 73%-100%), and during the maintenance condition (NHT+I) was 89.5% (range = 86%-93%). Jessica demonstrated her highest levels of on-task behavior in the NHT+I and the NHT+I maintenance conditions. Visual analysis revealed that for Jessica all five NHT and NHT+I data points (100%) exceeded the highest BL data point, while two out of five NHT+I data points (40%) exceeded the highest NHT data point. There was a moderate upward trend for the NHT+I condition while there was no overlapping between the NHT/NHT+I conditions with the BL condition. There was little variability within the NHT +I condition. Jessica maintained high on-task percentage scores in the maintenance condition.

Overall Quiz Score Percentage
The process of determining the overall quiz score percentage of the participating students included reviewing how the students performed in determining the correct answer of the multiplication problem and the accuracy of completing the multiplication algorithm on daily quizzes. Each problem was worth 3 points (2 points for the accurate completion of the algorithm, 1 point for the correct answer). There were 10 problems on each quiz totaling 30 points in the BL, NHT, NHT+I, and the maintenance (NHT+I) conditions. Table 4-3 summarizes means and ranges for the percentage of overall quiz scores across students and experimental conditions. Table 4-5 summarizes the means and ranges for the four dependent variables in the maintenance (NHT+I) condition. All four students demonstrated lower mean percentages on the overall quiz scores during baseline as compared to NHT and NHT+I conditions. Donnie, Jack, and Jessica earned higher overall quiz score percentages in the NHT+I condition compared to the NHT condition. All students maintained high overall quiz scores in the maintenance condition. Results for the four participants are presented (Figure 4-1).

**Participant 1: Barry.** The mean percentage of the overall quiz scores for Barry during the BL condition was 78.8% (range = 0-100%), during the NHT condition was 98.6% (range = 93%-100%), during the NHT+I condition was 96.8% (range = 87%-100%) and during the maintenance condition (NHT+I) was 100%. Visual analysis revealed that there was little variability within the NHT and NHT +I conditions for Barry. For Barry, four data points in the NHT condition overlapped with four data points in the BL condition. In addition, three data points in the NHT+I condition overlapped with three data points in the BL condition. Barry scored a 100% for his overall quiz score percentage in four events within the BL condition, four events within the NHT condition, and three events within the NHT+I condition. Barry maintained high overall quiz scores in the maintenance condition.
Participant 2: Donnie. The mean percentage of the overall quiz scores for Donnie during the BL condition was 22.8% (range = 0-67%), during the NHT condition was 66.5% (range = 33%-93%), during the NHT+I condition was 74.5% (range = 37%-100%), and during the maintenance condition (NHT+I) was 94.3% (range = 90%-100%). Donnie demonstrated his highest overall quiz score average in the NHT+I condition. Visual analysis revealed that for Donnie, three out of six NHT+I data points (50%) exceeded the highest BL data point, while three out of six NHT data points (50%) exceeded the highest BL data point. Donnie maintained high overall quiz scores in the maintenance condition.

Participant 3: Jack. The mean percentage of the overall quiz scores for Jack during the BL condition was 48.7% (range = 6%-93%), during the NHT condition was 81.7% (range = 30%-100%), during the NHT+I condition was 90.5% (range = 73%-100%), and during the maintenance condition (NHT+I) was 100%. Jack demonstrated his highest overall quiz score average in the NHT+I condition while scoring the lowest overall quiz score average in the BL condition compared to the other conditions. Visual analysis revealed that for Jack, two out of six NHT+I data points (33%) exceeded the highest BL data point, while three out of six NHT data points (50%) exceeded the highest BL data point. Jack maintained high overall quiz scores in the maintenance condition.

Participant 4: Jessica. The mean percentage of the overall quiz scores for Jessica during the BL condition was 3.8% (range = 0-13%), during the NHT condition was 17.4% (range = 10%-30%), during the NHT+I condition was 41.8% (range = 6%-67%), and during the maintenance condition (NHT+I) was 76.5% (range = 60%-93%). Jessica demonstrated her highest overall quiz score average in the NHT+I condition while scoring the lowest overall quiz score average in the BL condition compared to the other conditions. Visual analysis revealed that
for Jessica, four out of five NHT+I data points (80%) exceeded the highest BL data point while there was little variability for the NHT condition. Jessica maintained high overall quiz scores in the maintenance condition.

**Correct Answer Percentage**

The process of determining the participating students correct answer percentage included reviewing how the students performed in determining the correct answer of the multiplication problem. The correct answer required two lines to be added correctly after the completion of the multiplication algorithm. The correct answer component of the quizzes was worth 1 point. There were 10 problems on each quiz totaling a possible 10 points for the correct answer component. The correct answer percentage was measured in the BL, NHT, NHT+I, and the maintenance (NHT+I) condition. Table 4-4 summarizes means and ranges for the percentage of correct answers across students and experimental conditions. Table 4-5 summarizes the means and ranges for the four dependent variables in the maintenance (NHT+I) condition. All four students demonstrated lower mean percentages on the correct answer scores during baseline as compared to NHT and NHT+I conditions. Donnie, Jack, and Jessica earned higher correct answer score percentages in the NHT+I condition compared to the NHT condition. All students maintained high percentages of correct answer scores in the maintenance condition. Results for the four participants are presented (Figure 4-2).

**Participant 1: Barry.** The mean percentage of correct answers for Barry during the BL condition was 80% (range = 0-100%), during the NHT condition was 98% (range = 90%-100%), during the NHT+I condition was 94% (range = 80%-100%) and during the maintenance condition (NHT+I) was 100%. Barry demonstrated his highest correct answers score average in the NHT condition compared to the other conditions. Visual analysis revealed that there was
little variability for the dependent variable of correct answers within the NHT and NHT +I conditions for Barry. For the dependent variable of correct answer on quiz score percentage, for Barry, there was four data points in the NHT condition that overlapped with four data points in the BL condition. In addition, three data points in the NHT+I condition overlapped with three data points in the BL condition. Barry scored a 100% for his correct answer score percentage in four events within the BL condition, four events within the NHT condition, and three events within the NHT+I condition. Barry maintained high correct answer scores in the maintenance condition.

**Participant 2: Donnie.** The mean percentages of correct answers for Donnie during the BL condition was 15% (range = 0-60%), during the NHT condition was 55% (range = 20%-90%), during the NHT+I condition was 63.3% (range = 30%-100%), and during the maintenance condition (NHT+I) was 93.3% (range = 90%-100%). Donnie demonstrated his highest correct answer score average in the NHT+I condition while scoring the lowest correct answers score average in the BL condition compared to the other conditions. Visual analysis revealed that the dependent variable of percentage of correct answers for Donnie, three out of six NHT+I data points (50%) exceeded the highest BL data point, while three out of six NHT data points (50%) exceeded the highest BL data point. Donnie maintained high correct answer scores in the maintenance condition.

**Participant 3: Jack.** The mean percentage of correct answers for Jack during the BL condition was 50% (range = 0-90%), during the NHT condition was 78.3% (range = 20%-100%), during the NHT+I condition was 86.7% (range = 60%-100%), and during the maintenance condition (NHT+I) was 100%. Jack demonstrated his highest correct answers scores in the NHT+I condition while scoring the lowest correct answers score average in the BL
condition compared to the other conditions. Visual analysis revealed that the dependent variable of percentage of correct answers for Jack, two out of six NHT+I data points (33%) exceeded the highest BL data point, while three out of six NHT data points (50%) exceeded the highest BL data point. Jack maintained high correct answer scores in the maintenance condition.

**Participant 4: Jessica.** The mean percentage of correct answers for Jessica during the BL condition was 2% (range = 0-10%), during the NHT condition was 10% (range = 0-20%), during the NHT+I condition was 33.4% (range = 0%-67%), and during the maintenance condition (NHT+I) was 75% (range = 60%-90%). Jessica demonstrated her highest correct answers score percentage in the NHT+I condition while scoring the lowest correct answers percentage average in the BL condition compared to the other conditions. Visual analysis revealed that the dependent variable of percentage of correct answers for Jessica, four out of five NHT+I data points (80%) exceeded the highest BL data point while there was little variability for the NHT condition. Jessica maintained high correct answer scores in the maintenance condition.

**Accurate Completion of Multiplication Algorithm Percentage**

The process of determining the participating students’ accurate completion of multiplication algorithm percentage included reviewing how the students accurately completed a double digit multiplication algorithm. The accurate completion of the multiplication algorithm for double digit multiplication involved the students to have two lines correct (no errors) when multiplying numbers prior to adding to determine the final answer. The multiplication algorithm component of the quizzes was worth 2 points. There were 10 problems on each quiz totaling a possible 20 points for the math algorithm component. The accurate completion of multiplication algorithm percentage was measured in the BL, NHT, NHT+I, and the maintenance (NHT+I)
condition. Table 4-4 summarizes means and ranges for the accurate completion of multiplication algorithm percentage across students and experimental conditions. Table 4-5 summarizes the means and ranges for the four dependent variables in the maintenance (NHT+I) condition. All four students demonstrated lower mean percentages on accurate completion of multiplication algorithm scores during baseline as compared to NHT and NHT+I conditions. Jack and Jessica earned higher accurate completion of multiplication algorithm score percentages in the NHT+I condition compared to the NHT condition. All students maintained high percentages of accurate completion of multiplication algorithm scores in the follow-up condition. Results for the four participants are presented (Figure 4-2).

**Participant 1: Barry.** The mean percentage of accurate completion of multiplication algorithm for Barry during the BL condition was 78.3% (range = 0-100%), during the NHT condition was 99% (range = 95%-100%), during the NHT+I condition was 98% (range = 90%-100%) and during the maintenance condition (NHT+I) was 100%. Barry demonstrated his highest accurate completion percentage of multiplication algorithm average scores in the NHT condition. Visual analysis revealed that there was little variability for the dependent variable of accurate completion percentage of multiplication algorithm within the NHT and NHT+I conditions for Barry. For the dependent variable of accurate completion of multiplication algorithm score percentage, for Barry, there was four data points in the NHT condition that overlapped with four data points in the BL condition. In addition, four data points in the NHT+I condition overlapped with four data points in the BL condition. Barry scored a 100% for his overall quiz score percentage in four events within the BL condition, four events within the NHT condition, and four events within the NHT+I condition. Barry maintained high accurate completion of multiplication algorithm scores in the maintenance condition.
Participant 2: Donnie. The mean percentage of accurate completion of multiplication algorithm for Donnie during the BL condition was 26.7% (range = 0-75%), during the NHT condition was 77.5% (range = 55%-100%), during the NHT+I condition was 77.5% (range = 30%-100%), and during the maintenance condition (NHT+I) was 96.7% (range = 95%-100%). Donnie scored a 77.5% in the NHT+I condition and 77.5% in the NHT condition for the dependent variable of accurate completion of multiplication algorithm. Visual analysis revealed that the dependent variable of accurate completion percentage of multiplication algorithm for Donnie, four out of six NHT+I data points (67%) exceeded the highest BL data point, while three out of six NHT data points (50%) exceeded the highest BL data point. Donnie maintained high accurate completion of multiplication algorithm scores in the maintenance condition.

Participant 3: Jack. The mean percentage of accurate completion of multiplication algorithm for Jack during the BL condition was 49.1% (range = 0-95%), during the NHT condition was 80.8% (range = 30%-100%), during the NHT+I condition was 91.7% (range = 70%-100%), and during the maintenance condition (NHT+I) was 100%. Jack demonstrated his highest accurate completion percentage of multiplication algorithm average scores in the NHT+I condition while scoring the lowest percentage of accurate completion of multiplication algorithm in the BL condition compared to the other conditions. Visual analysis revealed that the dependent variable of accurate completion percentage of multiplication algorithm for Jack, two out of six NHT+I data points (33%) exceeded the highest BL data point, while three out of six NHT data points (50%) exceeded the highest BL data point. Jack maintained high accurate completion of multiplication algorithm scores in the maintenance condition.

Participant 4: Jessica. The mean percentage of accurate completion of multiplication algorithm for Jessica during the BL condition was 3% (range = 0-10%), during the NHT
condition was 20% (range = 10%-30%), during the NHT+I condition was 45.5% (range = 5%-67%), and during the maintenance condition (NHT+I) was 77.5% (range = 60%-95%). Jessica demonstrated her highest accurate completion percentage of multiplication algorithm scores in the NHT+I condition while scoring the lowest overall accurate completion of multiplication average in the BL condition compared to the other conditions. Visual analysis revealed that the dependent variable of accurate completion percentage of multiplication algorithm for Jessica, four out of five NHT+I data points (80%) exceeded the highest BL data point while there was little variability for the NHT condition. Jessica maintained high accurate completion of multiplication algorithm scores in the maintenance condition.

**Treatment Integrity**

Treatment integrity data are reported for the three conditions (BL, NHT, and NHT+I). Items of the treatment integrity checklist for the NHT and NHT+I conditions included (a) the participating teacher stating the classroom rules and procedures, (b) the participating teacher checking for prior knowledge, (c) prompting students to chorally respond which treatment is in effect, (d) assigning students into small heterogeneous groups, and (e) directing 10 questions and asking students “to put their heads together”. For each step in the procedure, the observer noted the treatment integrity sheet (Appendix F) if the teacher implemented the step correctly. Treatment integrity data indicated that the participating teacher implemented all procedural steps for BL, NHT, NHT+I, and NHT+I maintenance conditions with 100% adherence on all occasions.

**Social Validity**

At the end of the study, the teacher and the students completed a 9-question social validity questionnaire (see Appendix H). Each NHT (teacher and student) questionnaire used
Likert-type rating scales to determine the social validity of the instructional process and outcomes.

**Teacher NHT Questionnaire**

At the end of the study, the teacher completed a 9-question social validity questionnaire. The questionnaire consisted of 4-point Likert scale responses ranging from 1 (*not at all*) to 4 (*very*). The teacher indicated that NHT and NHT+I were both equally easy to implement but NHT+I was more time consuming of the two. A high score (4.0) suggested that the teacher found the NHT strategies as very helpful to her instruction, helpful to her student’s math computation, that she would be very likely to use the intervention in the future, and that she thought other teachers in the building would like NHT and NHT+I. Midrange scores (3.0) suggested that the teacher felt the intervention was fairly helpful for increasing student on-task behavior and during the NHT activities she indicated that the student got along fairly well.

**Student NHT Questionnaire**

At the end of the study, the four participating students completed a 9-question social validity questionnaire. The questionnaire consisted of 4-point Likert scale responses ranging from 1 (*not at all*) to 4 (*very*). All four students indicated that they were not at all treated differently during observations. Three students (Jessica, Donnie, and Barry) indicated that they liked being on a team during NHT very much and that they participated more than usual during NHT (4.0), while Jack indicated that he liked being on a team fairly and participated more than usual during NHT (3.0). Midrange scores 3.5 (range = 3-4) indicated that the students would be willing to participate in a study again, 2.75 (range = 2-4) indicated that NHT helped them with their math computation, and 2.5 (range = 2-3) indicated that during intervention the students thought they were on-task more.
Pre-Study/Post Study Math Content Questionnaire

The pre-study and the post-study math content questionnaire used Likert-type rating scales to determine the student’s perception of math (see Appendix H). Likert values ranged from 1, indicating the student did not complete an action, the teacher did not complete an action, or the student did not like the content area (not at all), 2 indicating the student inconsistently completed an action, the teacher inconsistently completed an action, or the student was unsure if they liked the content area (somewhat), 3 indicating the student fairly completed an action, teacher fairly completed an action, or the student fairly liked the content area (fairly), and 4, indicating the student completed an action, the teacher completed an action, or the student liked the content area (very much).

**Question 1.** In response to the question, “How do you like the subject of math?” for the pre-study content questionnaire, the average response was 3.25 (range = 1-4). For the post-study content questionnaire, the score was identical to the pre-study questionnaire, the average response was 3.25 (range = 1-4).

**Question 2.** In response to the question, “How often do you use a calculator to work out multiplication problems?” for the pre-study content questionnaire, the average response was 2.5 (range = 2-3). For the post-study content questionnaire, the average response was 3 (range = 2-4).

**Question 3.** In response to the question, “How often do you work out multiplication problems without a calculator?” for pre-study content questionnaire, the average response was 2.75 (range 1-4). For the post-study content questionnaire, the average response was 3.25 (range = 2-4).
Question 4. In response to the question, “How often do you work with a partner to work out multiplication problems?” for the pre-study content questionnaire, the average response was 2.5 (range = 2-3). For the post-study content questionnaire, the average response was 3.25 (range = 2-4).

Question 5. In response to the question, “How often does your teacher help you work out multiplication problems?” for the pre-study content questionnaire, the average response was 3.25 (range = 3-4). For the post-study content questionnaire, the average response was 3.75 (range = 3-4).

Question 6. In response to the question, “Do you find the subject of math to be difficult?” for the pre-study content questionnaire, three participants indicated “no” while one indicated “yes”. For the post-study content questionnaire, the responses were identical to the pre-study questionnaire for question 6.

Question 7. In response to the question, “Do you find the subject of math to be easy?” for the pre-study content questionnaire, two participants indicated “no” while two indicated “yes”. For the post-study content questionnaire, the responses were identical to the pre-study questionnaire for question 7.

Question 8. In response to the question, “How often do you work in groups (more than two people) to work out multiplication problems?” for the pre-study content questionnaire, the average response was 2.75 (range = 2-4). For the post-study content questionnaire, the average response was 2.25 (range = 1-3).

Question 9. In response to the question, “Do you find the subject of multiplication to be easy?” for the pre-study content questionnaire, three participants indicated “no” while one
indicated “yes”. For the post-study content questionnaire, three participants indicated “yes” while one indicated “no”.

Summary

Based on the reported results of the individual participant’s data, conclusions can be drawn across the four participants. Based on previous evaluations, all four students scored below average in comparison to same age peers on the WJ-III in the area of math calculation. After the completion of the study all four students increased their overall scores on their post-math fact assessment compared to the pre-test math fact assessment taken prior to the implementation of the study. The stimulus preference assessments indicated that the participating students selected their top rated incentive a minimum of four events during the NHT+I activity. All four students demonstrated a higher rate of on-task behavior in the NHT and NHT+I conditions compared to the baseline conditions supporting earlier findings (Haydon et al., 2010; Maheady et al., 2006). In addition, all four students demonstrated a higher rate of on-task behavior in the NHT+I condition compared to the NHT condition. All four students had higher overall quiz scores in the NHT and NHT+I compared to the baseline conditions supporting earlier findings (Haydon et al., 2010; Maheady et al., 2006). With the exception of Barry, all students had higher overall quiz scores in the NHT+I condition compared to the NHT condition, however, Barry maintained high overall quiz scores in the NHT+I maintenance condition. All four students had a higher correct answer on the quiz percentage in the NHT and NHT+I conditions compared to the baseline condition. With the exception of Barry, all students had a higher correct answer on the quiz percentage in the NHT+I condition compared to the NHT condition, however, Barry maintained a high correct answer on the quiz percentage in the NHT+I maintenance condition. All four students had a higher accurate completion percentage of math algorithm scores in the NHT and
NHT+I conditions compared to the baseline condition. Two (Jack and Jessica) had a higher accurate completion percentage of math algorithm scores in the NHT+I condition compared to the NHT condition, however, all participants maintained high accurate completion percentage of math algorithm scores in the NHT+I maintenance condition.

Treatment integrity data revealed that the participating teacher was able to implement NHT and NHT+I with 100% adherence. Social validity data demonstrated that the participating teacher perceived the NHT activity to be very helpful to her instruction while the participating students liked being on NHT teams. For the post-study math content student perception questionnaires, three out of four students (Jessica, Jack, and Donnie) found multiplication to be easy.
CHAPTER 5
DISCUSSION

The purpose of this chapter is to interpret and explain the results of the current study, which was designed to investigate the differential effects of traditional handraising (HR) and two instructional NHT strategies on students with emotional behavioral disorders (EBD) on-task behavior, overall scores on daily quizzes, correct answer percentage on daily quizzes and percentage of accurate multiplication algorithm completion on daily quiz scores. It will also be explained if the students’ on-task behavior and the quiz score percentages were maintained.

The findings of the study and its contribution to theory and practice will be discussed within this chapter. A discussion of limitations and suggestions for future research is also included within this chapter.

The following research questions were addressed:

What are the effects of Number Heads Together (NHT) and Number Heads Together with an incentive package (NHT+I) upon daily quiz scores of students with emotional behavioral disorders during a math activity in a middle school self-contained classroom? What are the effects of Number Heads Together (NHT) and Number Heads Together with an incentive package (NHT+I) upon on-task behavior of students with emotional behavioral disorders during a math activity in a middle school self-contained classroom? Could the on-task behavior and quiz score percentages be maintained for students in the NHT+I condition?

Four middle school students with EBD and one middle school special education teacher participated in the study. The students ranged in age from 12 years 5 months to 13 years 11 months and were nominated by their teacher due to exhibiting disruptive and off-task behaviors in the classroom. The students’ disabilities were identified by school personnel using state-defined criteria to determine eligibility for special education services.
An alternating treatment design was used to assess the effectiveness of the instructional strategies of BL (handraising), NHT, and NHT+I on student on-task behavior, overall daily quiz scores, correct answer percentage on daily quizzes, and percentage of accurate multiplication algorithm completion on daily quizzes. There were multiple phases to this study: teacher training, assessment, implementation of NHT and NHT+I, and a maintenance phase. The teaching training phase consisted of two informational sessions. The assessment phase consisted of the students being administered a pre-test on double digit multiplication facts prior to the study and a post-test on double digit multiplication facts after the completion of the study. The assessment phase also consisted of the students being administered a stimulus preference assessment prior to the study in which the students selected their preferred incentive during the NHT+I and NHT+I maintenance conditions. After teacher training, a comparison of BL (handraising) NHT, and NHT+I began. Based on a randomized schedule, the teacher was instructed to implement BL, NHT, or NHT+I.

**Overview Findings**

Several key findings are identified within this study. In terms of assessments, the participating students’ performance is consistent with the findings of Nelson, Benner, Lane, and Smith (2004) in which students with EBD scored lower in math calculation on the Woodcock Johnson III (WJ-III) compared to same age peers without disabilities. The participants’ average on the multiplication fact pretest was 16.5% correct with a range of 10-25% correct. The class average of the multiplication fact post-test had increased to 76% correct with a range of 60% to 87% correct similar to the findings of previous research (Maheady et al., 2006). It appears that students gained knowledge about completing double-digit multiplication facts accurately. All four students selected their top activity/tangible item on their stimulus preference assessments.
during the NHT+I and NHT+I maintenance condition over 57% of the time compared to secondary activities/tangible items. The top activity/item preferred by the students was chosen the majority of the time compared to their secondary activities/items. Daly, III, et al. (2009) recommends that offering choices among potentially reinforcing activities increases the effectiveness of those reinforcers when incorporated within educational programs. The stimulus preference assessment was used exclusively in the NHT+I condition and the group mean average in the NHT+I condition in all dependent variables was higher than the NHT and baseline conditions. The findings from this study support the concept of offering choices among potentially reinforcing activities in order to increase the effectiveness in an educational program.

The results of this investigation indicate that NHT and NHT+I are the more effective teaching strategies compared to BL in terms of improving on-task behavior and academic quiz scores. In this study, findings are similar to previous research of cooperative learning groups improving permanent products (quiz scores) of students with mild to moderate disabilities (Jenkins et al., 2003). All four participants had noticeable increases of on-task behavior and overall academic quiz scores under both NHT conditions over baseline performance which is similar to the findings of previous research (Haydon et al., 2010; Maheady et al., 2006). In terms of improving student on-task behavior specifically, NHT+I appeared to be a more effective instructional strategy than NHT and the baseline condition. In terms of overall quiz scores, three out of four students scored a higher mean percentage on overall daily quizzes within the NHT+I condition, compared to the NHT condition. For the dependent variable of correct answer percentage on daily quizzes, three out of four students scored a higher mean percentage within the NHT+I condition, compared to the NHT condition. For the dependent variable of accurate completion percentage of multiplication algorithm on daily quizzes, the results were mixed on
which NHT intervention was more effective. For the four dependent variables across conditions, the four students combined mean scores were higher within the NHT+I condition compared to the NHT and BL conditions.

**Stimulus Preference Assessment**

The stimulus preference assessment was used primarily in the NHT+I condition. The combined mean scores for the participants indicated that NHT+I was the most effective condition. All of the participating students selected their top incentive during the majority of the time during the NHT+I condition. In the event a person has the opportunity to select and engage in preferred activities/tangible items, those activities/tangible items serve as effective reinforcers if the contingency is to engage in low-probability behavior (Cooper et al., 2007). The findings support the claim that the use of stimulus preference assessments assist practitioners in identifying a variety of stimuli that can be used as potential reinforcers in behavior reduction programs (DeLeon & Iwata; Fisher et al., 1992).

**Percentage of On-Task Behavior**

Several conclusions can be determined from this study. First, all the participants demonstrated higher rates of on-task behavior in the two NHT conditions compared to the BL condition. All participants demonstrated higher rates of on-task behavior in the NHT+I and the NHT+I maintenance conditions compared to the other conditions. This finding extends the research of (Haydon et al., 2010; Maheady et al., 2006). The high rate of student on-task behavior is noteworthy because previous research has indicated that off-task behavior for students with EBD prevents their social and academic development in content areas (Webhy, Symons, & Shores, 1995). Jessica in particular showed a 62.7% increase in her on-task behavior under the NHT+I condition over the BL condition. Considering the measures of the on-task
percentage in the NHT+I condition, on-task percentages did increase by 26.6%, 41.5%, and 38.4% for Barry, Donnie, and Jack, respectively during the study.

**Overall Quiz Score Percentage**

Another notable finding from this study is that three out of four participants had higher mean overall quiz scores in the NHT+I condition compared to the NHT, and BL conditions. All the participants scored higher overall quiz scores in the two NHT conditions compared to the BL condition. One participant, Jessica scored 41.8% as her highest mean scores across the three conditions; the score is not a passing percentage according to the grading scale in her classroom. Jessica also scored significantly below average in comparison to her same age peers on her WJ-III assessment which possibly explains her difficulty in achieving passing percentages in the BL, NHT, and NHT+I condition. However, Jessica showed a 38% increase in her overall quiz scores in the NHT+I condition over the BL condition. Considering the measures of overall quiz score percentages in the NHT+I condition over the BL condition, overall quiz score percentages did increase by 27.2%, 25.2%, 32.9% for Barry, Donnie and Jack, respectively during the study.

**Correct Answer Percentage**

Findings from this study indicates that three out of the four students had a higher mean overall in correct answer percentage on the daily quizzes in the NHT+I condition compared to the NHT, and BL condition. All the participants scored a higher correct answer on quiz percentage in the two NHT conditions compared to the BL condition. Donnie in particular showed a 48.5% increase in his correct answer on quiz percentage in the NHT+I condition over the BL condition. Considering the measures of correct answer percentages in the NHT+I condition over the BL condition, correct answer percentages did increase by 14%, 36.7%, and 31.4% for Barry, Jack and Jessica respectively during the study.
Accurate Completion of Multiplication Algorithm Percentage

Findings from this study indicates that results were mixed on which NHT intervention was more effective for the dependent variable of accurate completion of multiplication algorithm percentage. The lack of differential effects within the variable of accurate completion of multiplication algorithm percentage are consistent with results from the previous NHT studies where NHT+I was not the effective for all students (Haydon et al., 2010; Maheady et al., 2006).

Maintenance Condition

Recently, recommendations have been made for investigations to include maintenance data for students with EBD to increase the likelihood of research-based interventions being used for this population (Gage et al., 2010; Maggin et al., 2010). To extend the previous NHT study (Haydon et al., 2010), that investigated the effectiveness of the intervention upon students with mild to moderate disabilities, a maintenance phase (NHT+I strategy) was implemented after the completion of the intervention. The number of days between the end of treatment and the start of follow up was 10 days. The number of days between the end of maintenance and the start of maintenance was 21 days. During the NHT+I maintenance condition, the participating teacher did not prompt the students with the index cards containing pictures of tangible items and physical activities. The participating teacher provided a brief overview of the NHT activity prior to implementation. During the maintenance condition, the teacher did not utilize progress monitoring sheets in order for the students to earn their incentives; they simply had to participate in the NHT+I activity and receive the incentive after the activity.

A powerful testimony for student success within the NHT+I intervention, is that all four participants maintained high mean scores for the dependent variables of on-task behavior, overall quiz score percentage, correct answer percentage and accurate completion of multiplication...
algorithm percentage. There was little to no variability for all four participants in the maintenance condition. Jessica maintained a passing mean score of 76% for the dependent variables of overall quiz score percentage, correct answer percentage and accurate completion of multiplication algorithm percentage in the condition. Jack, Barry, and Donnie maintained mean scores over 93% for the dependent variables of overall quiz score percentage, correct answer percentage and accurate completion of multiplication algorithm percentage in the condition. The student’s high percentages in the maintenance condition indicate that the intervention sustained over time, which is an indicator of how powerful the intervention was and the level of acceptability by the teacher (Kennedy, 2002).

**Social Validity**

At the end of the study, the teacher and the students completed a 9-question social validity questionnaire. Each teacher and student questionnaire used Likert-type rating scales to determine the social validity of the instructional process and outcomes. The teacher and the students felt the NHT intervention help improve the students’ interpersonal relationships. The teacher and the students felt the NHT intervention help improve the student’s math computation.

**Teacher NHT Questionnaire**

Social validity data revealed that the participating teacher found the NHT strategies very helpful to her instruction which is consistent with Haydon et al. (2010), Maheady et al., (2006), Maheady et al., (2002), and Maheady et al. (1991) findings. A powerful testimony for the effectiveness of the NHT+I intervention, is that the teacher indicated that other teachers in the building would utilize the intervention. Interestingly, the teacher reported that the intervention was fairly helpful for increasing student on-task behavior. However the mean score percentages indicate otherwise; the student’s on-task behavior was at 92.5 % during the NHT+I condition and 96% during the NHT+I maintenance condition. Anecdotal data indicated that the students were
off-task during the baseline condition and displayed behaviors that disrupted the learning process (peers shouting at each other, throwing objects). According to Lee, Sugai, and Horner (1995), the delivery of an effective instructional intervention reduces off-task behaviors for students with EBD.

**Student NHT Questionnaire**

An analysis of the students responses on the NHT questionnaire was quite interesting overall. First, Jack, Donnie and Barry indicated that they were on task “somewhat” during the NHT interventions yet observational data did not confirm these perceptions. The implications that the students’ perceptions did not match the data calls for a social validity scale to use a normative comparison. By using a normative comparison scale, the participants’ behavior is compared to typical peers that exhibit high rates of on-task behavior (Kennedy, 2005). This is particularly important because a majority of students with EBD have not been associated with appropriate behavior in peer group situations (Hallenbeck & Kauffman, 1995). The students indicated that they liked being on a team during NHT interventions very much and that they participated more than usual during NHT interventions. This finding is consistent with the Ryan et al. (2004) observation that peer- mediated interventions for students with EBD is beneficial in terms of being used as effective instructional method. The findings of Ryan et al. (2004) also indicate that peer-mediated interventions provide academic gains in across subject areas such as math.

**Student Perception of Math Prior to and After the Intervention**

Information was also collected on the participating students’ perception of the content of math prior to and after the intervention. Although Jessica made significant improvement from the BL condition, to the NHT+I condition, her highest mean score average was 41.8% in the NHT+I
condition and 76.5% in the NHT+I maintenance condition. Prior to the intervention, Jessica indicated that she did not like the content area of math before and after the intervention. Barry, Donnie, and Jack indicated that they like the content area of math before and after the intervention. Prior to the intervention, three participants (Barry, Donnie, and Jessica) found multiplication not to be easy while after the intervention, three students (Jessica, Donnie, and Jack) found multiplication to be easy which indicates that NHT is as a powerful instructional strategy. After the intervention, the mean decreased in terms of students working in groups, indicating that more students worked on math independently.

**Interpretation of Findings**

One of the study’s findings, on-task behavior within the NHT+I and NHT conditions, has several implications. There was little variability within the NHT+I condition for all of the participants for the variable of on-task behavior. There was a slight upward trend within the NHT+I condition for Barry and Donnie for the dependent variable of on-task behavior which indicates the effectiveness of the intervention. For the variable of on-task behavior, there was a moderate upward trend within the NHT+I condition for Jack and Jessica. For the variable of overall quiz scores, there was little variability within the NHT+I condition for all of the participants. There was moderate variability of in the NHT condition for Donnie for the dependent variable of overall quiz scores. There was a slight upward trend within the NHT+I condition for Barry and Donnie for overall quiz scores. There was a moderate upward trend within the NHT+I condition for Jack and Jessica for overall quiz scores. For the variable of correct answers on the quiz, there was little variability within the NHT+I condition for all of the participants. There was moderate variability in the NHT condition for Donnie and Jack for the dependent variable of correct answer on quiz percentage. There was a moderate upward trend within the NHT+I condition for Jack, Jessica and Donnie for correct answer on the quiz.
percentage. For the variable of accurate completion of multiplication algorithm, there was little variability within the NHT+I condition for Jack and Jessica.

For Barry, there were mixed results between the NHT conditions for the dependent variables of overall quiz score percentage, correct answer percentage and accurate completion of multiplication algorithm percentage. There were several overlapping data points for Barry between the BL, NHT and NHT+I conditions. A possible explanation is that Barry’s lower percentages of on-task behavior were masking his skill level in multiplying double digit multiplication (Cooper, Heron, & Heward, 2007). For the dependent variable of accurate completion of multiplication algorithm percentage, Donnie had several overlapping data points, this lack of differential effects in the NHT and NHT+I are consistent from previous studies (Haydon et al., 2010; Maheady, et al., 2006).

Implications for Practice

The current study has practical implications for students with EBD; first it provides evidence of the importance of using a peer-mediated intervention to improve behavioral and academic outcomes. These findings demonstrated that cooperative learning strategies such as NHT are powerful instructional strategies that allow teachers to educate students with wide-ranging abilities in various settings such as self-contained classrooms (Ryan, Pierce, & Mooney, 2008).

Furthermore, for students that exhibit off-task behavior, NHT+I and NHT is an intervention self-contained EBD teachers can use to actively engage these students. Students are less likely to exhibit off-task behavior (that leads to being sent out the classroom) to avoid assignments when they are actively engaged in a classroom activity (Mace & Belfiore, 1990). Anecdotal data from this study gives some support of this claim. For example, Jessica was the
only student sent out during a NHT (without the incentives) intervention for a brief time-out for displaying off-task behavior. As the results from the overall quiz scores and the post-test indicates, NHT+I or NHT is an instructional strategy that classroom teachers can use to assist students with disabilities in an academic area of math. Based on observations within the study, a strong suggestion for teachers is to review rules and use pre-correction strategies before implementing each NHT session.

Although the results of this study indicate that NHT+I is an intervention that improves student on-task behavior and quiz scores, some teachers may opt against incorporating extrinsic rewards into their classroom (Chapman & Cope, 2004). Maag (2001) hypothesizes some teachers believe that providing positive reinforcement involves a large amount of effort and is not cost effective. Therefore, a potential limitation to the stimulus preference assessment is that continuous access to preferred stimuli during an intervention may take up instructional time and teacher planning time. Furthermore there is concern of satiation effects of the reinforcers provided during the stimulus preference assessment (Vollmer & Iwata, 1992). Satiation decreases the effectiveness of a reinforcer and occurs as a result of prior exposure or access to that reinforcer (Hagopian et al., 2000).

Research conducted by Paramore and Higbee (2005) indicated that stimulus preference assessments that included the incentives of edible items improved classroom on-task behavior of adolescent students with behavior disorders. However, teachers may object to some items identified as reinforcers such as edible items as being unnatural or potentially unhealthy for use in classrooms (Cooper et al., 2007).

Tangible items (including edible items) and school activities were offered in the stimulus preference assessment in order to establish incentives for the NH+I condition.
Therefore, one possible solution is that teachers may be less likely to object to reinforcement programs in which students receive contingent access to more non-edible items such as access to the gym or the computer for educational games (Daly III, et al., 2009). Teachers may consider an alternate educational activity if a facility for an activity such as basketball is not available such as a classroom team building exercise. Providing students with the opportunity to select items during a stimulus preference assessment can strengthen the intervention (Deleon et al., 2009). The use of stimulus preference assessments assists the teacher with implementing an effective teaching intervention in a self-contained classroom for students with EBD. NHT+I and NHT is an intervention EBD self-contained teachers can use for improving students active participation, while reducing off-task behavior.

**Limitations**

Although NHT+I appeared to be more effective in improving on-task behavior and academic outcomes than NHT and traditional teacher led instruction (handraising), a few limitations may temper the power of the statements that can be made as a result of this study. First, the small sample size limits the overall generalizability of the findings. The intervention took place in one urban middle self-contained school classroom with four students; hence, there are limitations to generalizing these findings to other classrooms and student populations. Generalization to other settings, student characteristics, academic interventions, requires systematic replication (Kazdin, 1982). Second, Barry’s data show overlap between the BL, NHT and NHT+I conditions for the dependent variables of overall quiz score percentage, correct answer on quiz percentage, and accurate completion of multiplication algorithm percentage. A possible explanation is that Barry’s lower percentages of on-task behavior were masking his skill level in multiplying double digit multiplication (Cooper, et al., 2007). A further possible explanation is that the salience of the stimuli that controls Barry’s behavior may have caused him
not to attend to the teacher’s directions because of focusing on other objects or materials that was not required during the academic task. The salience is the importance of the stimulus in a person’s environment (Cooper et al., 2007). According to Dinsmoor (1995b), masking is a phenomenon to decrease the salience of stimuli. Once the intervention was introduced, Barry’s off-task behavior did not continue to block his ability to attend to the curriculum material. Donnie also had overlapping data points for the variable of accurate completion of multiplication algorithm percentage in the NHT and the NHT+I conditions. Third, there was a failure to directly address verbal and non-verbal interaction of the participating students; hence we cannot determine if the conversation of the participating students involved academics entirely. Fourth, Jessica scored 41.8% as her highest mean score which was not a passing percentage according to the grading scale in her classroom.

**Implications for Future Research**

The findings from this study demonstrate that NHT+I was more effective than NHT and BL conditions in terms of improving student on-task behavior percentage and overall daily multiplication quizzes scores. As a logical next step, researchers should analyze and code pupils’ verbal and non-verbal behavior during NHT considering students with EBD documented histories of interpersonal conflict. Also future research can examine any possible gender differences that appear during NHT. Lockheed, Abigail, Harris, & Nemceff (1983) suggested that males in mixed gender groups tend to perceive their female group-mates as less competent. Researchers could also review the performance of females compared to males in the content area of math. Future researchers could extend the study with different content areas, different settings, and a different population (students with specific learning disabilities). Finally, future researchers should investigate the use of praise statements within the NHT intervention as a replacement for the incentive package.
Summary

Previous research has compared Number Heads Together (NHT) and Number Heads Together plus Incentives (NHT+I) with traditional (handraising) teacher led instruction (Haydon et al., 2010; Maheady et al., 2006; Maheady et al., 2002; & Maheady et al. 1991). The present study extends the outcomes of this research by comparing (NHT+I), a condition in which stimulus preference assessments were used and NHT, a condition that did not incorporate incentives on the academic and social behavior of students with EBD during a peer-mediated intervention. The study’s findings indicated the NHT+I was more effective than NHT. The stimulus preference assessment increased the effectiveness of the intervention. The students learned in order to receive incentives from the stimulus preference assessment, they must be on-task during the NHT+I intervention. The incentives acted as powerful reinforcers for the NHT+I intervention. Progress monitoring sheets provided the participating students an example to follow in order to be considered on-task.

As with previous studies, results showed a positive impact of the NHT conditions compared to the handraising condition. All four students had a higher on-task percentage in the NHT+I condition compared to the NHT and BL (handraising) conditions. However, three out of four participants had higher overall quiz score percentages and correct answer on quiz percentage in the NHT+I condition compared to the NHT and BL conditions.

Although positive results were found for all participants for academic and social outcomes, for one student there was a lack of clear results on overall quiz score percentage, correct answer percentage, and accurate completion of the multiplication algorithm percentage within the NHT and NHT+I conditions. Future research could focus on the impact NHT and NHT+I on students with EBD in full inclusive environments. The current study adds to the NHT literature by adding a preference assessment to increase the effectiveness of the NHT+I condition.
and as a result improved the on-task behavior and academic performance for students with EBD.
References


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Kentucky Department of Education (2008). Kentucky administrative regulations: Special education programs. Frankfort, Kentucky: Author


## APPENDIX A

### Table 2-1.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Sample Description</th>
<th>Single subject design</th>
<th>Independent variable(s)</th>
<th>Dependent variable(s)</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haydon, Maheady, &amp; Hunter, (2010)</td>
<td>One 7th grade male student with EBD, one 7th grade male student with OHI, one 7th grade female student with MMD</td>
<td>Alternating Treatment</td>
<td>BL, NHT, NHT+I</td>
<td>Student</td>
<td>Increased quiz scores and on-task percentage in the NHT and NHT+I conditions compared to the BL conditions</td>
</tr>
<tr>
<td>Maheady, Michielli-Pendl, Mallette, &amp; Harper (2002)</td>
<td>21/6th grade Students</td>
<td>Alternating Treatment</td>
<td>WGQ&amp;A, RC, NHT</td>
<td>Student Science Quiz Scores, Student on-task percentage</td>
<td>Increased quiz scores and student on-task percentage in the NHT and RC conditions compared to the WGQ&amp;A Condition</td>
</tr>
</tbody>
</table>

Note. NHT=Number Heads Together, NHT+I=Number Heads Together plus incentives, BL=Baseline, RC=Response Cards, WGQ&A=Whole Group Question and Answer
| Maheady, Mallette, Harper, & Sacca (1991) | 20/3rd Grade | Alternating Treatment | NHT, WGQ&A | Student Social Studies Quiz Scores, Student on-task percentage | Increased quiz scores and on-task percentage in the NHT condition compared to the WGQ&A condition |

Note: NHT=Number Heads Together, NHT+I=Number Heads Together plus Incentives, BL=Baseline, RC=Response Cards, WGQ&A=Whole Group Question and Answer
### 3.1 Participant Characteristics

<table>
<thead>
<tr>
<th>Name</th>
<th>Gender/Age</th>
<th>Ethnicity</th>
<th>Disability</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jessica</td>
<td>Female 12 years 5 m</td>
<td>AA</td>
<td>EBD</td>
<td>7th</td>
</tr>
<tr>
<td>Barry</td>
<td>Male 13 years 11 m</td>
<td>W</td>
<td>EBD</td>
<td>7th</td>
</tr>
<tr>
<td>Demry</td>
<td>Male 13 years 11 m</td>
<td>AA</td>
<td>EBD</td>
<td>8th</td>
</tr>
<tr>
<td>Jack</td>
<td>Male 12 years 4 m</td>
<td>W</td>
<td>EBD</td>
<td>7th</td>
</tr>
</tbody>
</table>

*Note. AA = African American, W = White, EBD = Emotional/Behavioral Disorder*
Table 4-1

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Woodcock Johnson III (WJIII) Basic Math Calculation Skills Assessment Score Outcome</th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barry</td>
<td>*Below average</td>
<td>35%</td>
<td>87%</td>
</tr>
<tr>
<td>Jack</td>
<td>*Below average</td>
<td>17%</td>
<td>85%</td>
</tr>
<tr>
<td>Jessica</td>
<td>*Significantly below average</td>
<td>14%</td>
<td>60%</td>
</tr>
<tr>
<td>Donnie</td>
<td>*Below average</td>
<td>10%</td>
<td>72%</td>
</tr>
</tbody>
</table>

Note. *Indicates comparison to same age peer
Table 4-2

*Stimulus Preference Assessment Selection: Includes the Primary 4 Activities the Participating Students Pre-selected Prior to the Implementation of NHT+1.*

<table>
<thead>
<tr>
<th>Name</th>
<th>Incentive *1 (T)</th>
<th>Incentive *2 (T)</th>
<th>Incentive *3 (T)</th>
<th>Incentive *4 (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jessica</td>
<td>Basketball Activity (4)</td>
<td>Computer Game Activity (2)</td>
<td>Healthy Snack (1)</td>
<td>Drawing Activity (0)</td>
</tr>
<tr>
<td>Barry</td>
<td>Healthy Juice (5)</td>
<td>Healthy Snack (2)</td>
<td>Computer Activity (1)</td>
<td>Drawing Activity (0)</td>
</tr>
<tr>
<td>Donnie</td>
<td>Basketball Activity (6)</td>
<td>Computer Game Activity (2)</td>
<td>Drawing Activity (1)</td>
<td>Extra Walking Time (0)</td>
</tr>
<tr>
<td>Jack</td>
<td>Basketball Activity (7)</td>
<td>Computer Game Activity (2)</td>
<td>Extra Walking Time (0)</td>
<td>Drawing Activity (0)</td>
</tr>
</tbody>
</table>

*Note. *number of times the incentive was selected after the completion of a NHT+1 Activity. *number order of incentives selected.*
Table 4.3

*Means and Ranges, for On-task Behavior and Overall Quiz Scores in Each Condition*

<table>
<thead>
<tr>
<th>Student</th>
<th>Baseline</th>
<th></th>
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<th></th>
<th></th>
<th>NHT</th>
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<th></th>
<th></th>
<th></th>
<th>NHT+I</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On-task M (Range)</td>
<td>Quiz M (Range)</td>
<td>On-task M (Range)</td>
<td>Quiz M (Range)</td>
<td>On-task M (Range)</td>
<td>Quiz M (Range)</td>
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</tr>
<tr>
<td>Barry</td>
<td>69.6 (47-78.5)</td>
<td>78.8 (0-100)</td>
<td>88.2 (80-94)</td>
<td>98.6 (93-100)</td>
<td>96.2 (87-100)</td>
<td>96.8 (87-100)</td>
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<tr>
<td>Donnie</td>
<td>49.3 (28.3-63)</td>
<td>22.8 (0-67)</td>
<td>74.2 (33-100)</td>
<td>66.5 (33-93)</td>
<td>90.8 (88-100)</td>
<td>74.5 (37-100)</td>
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</tr>
<tr>
<td>Jack</td>
<td>57.6 (37.5-75)</td>
<td>48.7 (6-93)</td>
<td>81.7 (73-88)</td>
<td>81.7 (30-100)</td>
<td>96 (94-100)</td>
<td>90.5 (73-100)</td>
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<tr>
<td>Jessica</td>
<td>24.1 (13-33)</td>
<td>3.8 (0-13)</td>
<td>68.2 (33-88)</td>
<td>17.4 (10-30)</td>
<td>86.8 (73-100)</td>
<td>41.8 (6-67)</td>
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<tr>
<td>Total mean score</td>
<td>50.15</td>
<td>38.52</td>
<td>78.1</td>
<td>66.1</td>
<td>92.5</td>
<td>75.9</td>
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</tbody>
</table>

*Note.* M = Mean
Table 4-4
Means and Ranges, for Correct Answer on Quiz Percentage (CAQP) and Accurate Completion
Percentage of Multiplication Algorithm (ACPMA) in Each Condition

<table>
<thead>
<tr>
<th>Student</th>
<th>Baseline CAQP (Range)</th>
<th>Baseline ACPMA (Range)</th>
<th>NHT CAQP (Range)</th>
<th>NHT ACPMA (Range)</th>
<th>NHT+1 CAQP (Range)</th>
<th>NHT+1 ACPMA (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barry</td>
<td>80 (0-100)</td>
<td>78.3 (0-100)</td>
<td>98 (90-100)</td>
<td>99 (95-100)</td>
<td>94 (80-100)</td>
<td>98 (90-100)</td>
</tr>
<tr>
<td>Donnie</td>
<td>15 (0.60)</td>
<td>26.7 (0.75)</td>
<td>55 (20-90)</td>
<td>77.5 (55-100)</td>
<td>63.3 (30-100)</td>
<td>77.5 (30-100)</td>
</tr>
<tr>
<td>Jack</td>
<td>50 (0.90)</td>
<td>49.1 (0.95)</td>
<td>78.3 (20-100)</td>
<td>80.8 (30-100)</td>
<td>86.7 (60-100)</td>
<td>91.7 (70-100)</td>
</tr>
<tr>
<td>Jessica</td>
<td>2 (0-10)</td>
<td>3 (0-10)</td>
<td>10 (0-20)</td>
<td>20 (10-30)</td>
<td>33.4 (0-67)</td>
<td>45.5 (5-67)</td>
</tr>
<tr>
<td>Total mean score</td>
<td>36.8</td>
<td>39.3</td>
<td>60.3</td>
<td>69.3</td>
<td>69.4</td>
<td>78.2</td>
</tr>
</tbody>
</table>

Note. M = Mean; CAQP = Correct Answer on Quiz Percentage; ACPMA = Accurate Completion Percentage of Math Algorithm.
Table 4-5

*Means and Ranges for On-Task Behavior, Overall Quiz Score, Correct Answer on Quiz Percentage (CAQP) and Accurate Completion Percentage of Multiplication Algorithm (ACPMA) in Maintenance Condition*

<table>
<thead>
<tr>
<th></th>
<th>On-Task</th>
<th>Quiz Score</th>
<th>CAQP</th>
<th>ACPMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>M (Range)</td>
<td>M (Range)</td>
<td>M (Range)</td>
<td>M (Range)</td>
</tr>
<tr>
<td>Barry</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Donnie</td>
<td>97.7</td>
<td>94.3</td>
<td>93.3</td>
<td>96.7</td>
</tr>
<tr>
<td></td>
<td>(93-100)</td>
<td>(90-100)</td>
<td>(90-100)</td>
<td>(95-100)</td>
</tr>
<tr>
<td>Jack</td>
<td>96.7</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>(93-100)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jessica</td>
<td>89.5</td>
<td>76.5</td>
<td>75</td>
<td>77.5</td>
</tr>
<tr>
<td></td>
<td>(86-93)</td>
<td>(60-93)</td>
<td>(60-90)</td>
<td>(60-95)</td>
</tr>
<tr>
<td>Total Mean Score</td>
<td>96.0</td>
<td>92.7</td>
<td>92.1</td>
<td>93.6</td>
</tr>
</tbody>
</table>

*Note. M = Mean; CAQP = Correct Answer on Quiz Percentage; ACPMA = Accurate Completion Percentage of Math Algorithm*
Table 4-6

**Pre-Study/Post Study Math Concept Student Questionnaire**

Scale: Not at all (1), Somewhat (2), Fairly (3), and Very Much (4)

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre-Study Response (N=4)</th>
<th>Post-Study Response (N=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1 How do you like the subject of math?</td>
<td>3.25 (range 1-4)</td>
<td>3.25 (range 1-4)</td>
</tr>
<tr>
<td>Question 2 How often do you use a calculator to work out multiplication problems?</td>
<td>2.5 (range 2-3)</td>
<td>3 (range 2-4)</td>
</tr>
<tr>
<td>Question 3 How often do you work out multiplication problems without a calculator?</td>
<td>2.75 (range 1-4)</td>
<td>3.25 (range 2-4)</td>
</tr>
<tr>
<td>Question 4 How often do you work with a partner to work out multiplication problems?</td>
<td>2.5 (range 2-3)</td>
<td>3.25 (range 2-4)</td>
</tr>
<tr>
<td>Question 5 How often does your teacher help you work out multiplication problems?</td>
<td>3.25 (range 3-4)</td>
<td>3.75 (range 3-4)</td>
</tr>
<tr>
<td>Question 6 Do you find the subject of math to be difficult?</td>
<td>“No” (N=3)</td>
<td>“No” (N=3)</td>
</tr>
<tr>
<td></td>
<td>“Yes” (N=1)</td>
<td>“Yes” (N=1)</td>
</tr>
<tr>
<td>Question 7 Do you find the subject of math to be easy?</td>
<td>“No” (N=2)</td>
<td>“No” (N=2)</td>
</tr>
<tr>
<td></td>
<td>“Yes” (N=2)</td>
<td>“Yes” (N=2)</td>
</tr>
</tbody>
</table>
Table 4-6 Contd.

*Pre-Study/Post Study Math Content Student Questionnaire*

Scale: Not at all (1), Somewhat (2), Fairly (3), and Very Much (4)

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre-Study Response (N=4)</th>
<th>Post-Study Response (N=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 8 How often do you work in groups (more than two people) to work out multiplication problems?</td>
<td>2.75 (range 2-4)</td>
<td>2.25 (range 1-3)</td>
</tr>
<tr>
<td>Question 9 Do you find the subject of multiplication to be easy?</td>
<td>“No” (N=3)</td>
<td>“No” (N=1)</td>
</tr>
<tr>
<td></td>
<td>“Yes” (N=1)</td>
<td>“Yes” (N=3)</td>
</tr>
</tbody>
</table>
Figure 4-1

[Graphs showing data trends for different conditions labeled as 'Maintainance', 'Berry', and 'Jack', with axes labeled 'SESSIONS' and values ranging from 0 to 100.]
APPENDIX B
INFORMED CONSENT FORMS

Adult Consent Form for Research
University of Cincinnati
Department: Special Education
Principal Investigator: William Hunter
Faculty Advisor: Dr. Todd Haydon

Title of Study: EXAMINING THE EFFECTS OF NHT ON QUIZ RESULTS AND ON-TASK BEHAVIOR WITH STUDENTS IDENTIFIED WITH EMOTIONAL BEHAVIORAL DISABILITIES

Introduction:
You are being asked to take part in a research study. Please read this paper carefully and ask questions about anything that you do not understand.

Who is doing this research study?
The person in charge of this research study is William Hunter of the University of Cincinnati (UC) Department of Special Education. He is being guided in this research by Dr. Todd Haydon. There may be other people on the research team helping at different times during the study.

What is the purpose of this research study?
The purpose of the study is to examine the effects of Number Heads Together (NHT), a cooperative learning strategy, on various academic content (language arts, math, science, social studies) results of students identified with emotional behavioral disorders. The study will replicate an earlier NHT study Haydon et al. (in press) and extend the investigation by: (a) using a different setting, a self-contained classroom; (b) working with students identified with emotional behavioral disabilities; (c) further investigating the use of incentives with and without NHT, (d) working in various content areas.

Who will be in this research study?
About ten people will take part in this study. You may be in this study if you are certified to teach in the state of Kentucky. You may be in this study if you work with students on a daily basis.

What if you are an employee where the research study is done?
Taking part in this research study is not part of your job. Refusing to be in the study will not affect your job. You will not be offered any special work-related benefits if you take part in this study.
What will you be asked to do in this research study, and how long will it take?

You will be asked to participate in a research study that will take place in your classroom at Holmes Middle School. During the study, you will be asked to conduct a peer-mediated academic activity for the participating students in the study which the duration will be approximately forty minutes on a daily basis. Your participation will involve conducting an experimental peer-mediated academic activity in two treatment (interventions) conditions and a baseline condition. There will be approximately 27 study visits approximately 50 minutes are less. This study will take place approximately until February 2011. A 10 minute survey will be administered to you prior to and at the end of the study within the Holmes Middle School campus. Data will be collected on the academic quiz scores of the student participants, and on-task percentage of the participating students.

Are there any risks to being in this research study?

It is not expected that you will be exposed to any risk by being in this research study. It is not expected that you will be exposed to any risk by allowing student’s grades, class work, student on task information to be used in this research study. The risk is not expected to be more than you would have in daily life.

Are there any benefits from being in this research study?

The direct benefit associated with this study includes getting extra information on implementing an academic activity to benefit the overall classroom environment.

Will you have to pay anything to be in this research study?

You will not have to pay anything to take part in this study.

What will you get because of being in this research study?

You will not be paid (or given anything) to take part in this study.

Do you have choices about taking part in this research study?

If you do not want to take part in this research study you may simply not participate.

How will your research information be kept confidential?

Information about you will be kept private by using a study ID number instead of the participant's name on the research forms. Information will also be kept private by keeping the master list of names and study ID numbers in a separate location from the research forms.

Research data will be limited to the research team. Research data will be kept on a password protected computer.

Your research information will be kept in a locked file cabinet in the William Hunter’s office. Only the researchers in this study will look at your information. Research information will be stored in a locked file cabinet for three years. At the end of that time it will shredded. The
information from the study may be published; however, you will not be identified by name. Agents of the University of Cincinnati may inspect study records for audit or quality assurance purposes. The researcher cannot promise that information sent by the internet or email will be private.

What are your legal rights in this research study?

Nothing in this consent form waives any legal rights you may have. This consent form also does not release the investigator, the institution, or its agents from liability for negligence.

What if you have questions about this research study?

If you have any questions or concerns about this research study, you should contact William Hunter at 859-392-1100

The UC Institutional Review Board – Social and Behavioral Sciences (IRB-S) reviews all non-medical research projects that involve human participants to be sure the rights and welfare of participants are protected.

If you have questions about your rights as a participant or complaints about the study, you may contact the Chairperson of the UC IRB-S at (513) 558-5784. Or, you may call the UC Research Compliance Hotline at (800) 889-1547, or write to the IRB-S, 300 University Hall, ML 0567, 51 Goodman Drive, Cincinnati, OH 45221-0567, or email the IRB office at irb@ucmail.uc.edu.

Do you HAVE to take part in this research study?

The participant can withdraw from the study at any time and that there are no negative consequences if the student chooses not to participate or to withdraw from the study at any time.

You may start and then change your mind and stop at any time. To stop being in the study, you should tell William Hunter at 859-392-1100.

Agreement:

I have read this information and have received answers to any questions I asked. I give my consent to participate in this research study. I will receive a copy of this signed and dated consent form to keep.

Participant Name (please print) ________________________________________________

Participant Signature ________________________________________________________ Date ______

Signature of Person Obtaining Consent ________________________________ Date ______
Title of Study: EXAMINING THE EFFECTS OF NHT ON QUIZ RESULTS AND ON-TASK BEHAVIOR WITH STUDENTS IDENTIFIED WITH EMOTIONAL BEHAVIORAL DISABILITIES

Introduction:
You are being asked to allow your child to take part in a research study. Please read this paper carefully and ask questions about anything that you do not understand.

Who is doing this research study?
The person in charge of this research study is William Hunter of the University of Cincinnati (UC) Department of Special Education. He is being guided in this research by Dr. Todd Haydon. There may be other people on the research team helping at different times during the study.

What is the purpose of this research study?
The purpose of the study is to find out if Number Heads Together (NHT), a student group learning activity, helps students in all academic content areas (language arts, math, science, social studies) by improving their quiz scores and classroom behavior.

Who will be in this research study?
About ten people will take part in this study. Your child may be in this study if he or she is a student in the participating teacher’s classroom.

What will your child be asked to do in this research study, and how long will it take?
Your child will be asked to participate in a research study that will take place in their classroom at Holmes Middle School. Your child’s participation in the study will involve being in a student group learning activity, (Your child will work with other students in the classroom on academic activities). There will be approximately 27 study visits approximately 50 minutes are less. This study will take place approximately until February 2011. A 10 minute survey will be administered to your child by the primary investigator prior to and at the end of the study within the Holmes Middle School Campus. Data will be collected on the academic quiz scores of the student participants, and on-task percentage of the participating students.

Are there any risks to being in this research study?
There is minimal risk to being in the study. Your child will have their grades and overall work reviewed by the primary investigator, William Hunter. The risk is not expected to be more than your child would have in daily life.

Are there any benefits from being in this research study?

Direct benefit includes your student participating in an academic activity that would possibly improve their overall academic performance which includes academic activity quiz scores.

Will your child have to pay anything to be in this research study?

Your child will not have to pay anything to take part in this study.

What will your child get because of being in this research study?

Your child will not be paid (or given anything) to take part in this study

Does your child have choices about taking part in this research study?

If your child does not want to take part in this research study you may simply not participate.

How will your child’s research information be kept confidential?

Information about your child will be kept private by using a study ID number instead of the participant's name on the research forms and keeping the master list of names and study ID numbers in a separate location from the research forms. Research data will be limited to the research team. Research data will be kept on a password protected computer.

Your child’s research information will be kept in a locked file cabinet in the William Hunter’s office. Only the researchers in this study will look at your information. Research information will be stored in a locked file cabinet for three years. At the end of that time it will shredded. The information from the study may be published; however, you will not be identified by name.

Agents of the University of Cincinnati may inspect study records for audit or quality assurance purposes.

The researcher cannot promise that information sent by the internet or email be private.

What are your and your child’s legal rights in this research study?

Nothing in this consent form waives any legal rights you or your child may have. This consent form also does not release the investigator, the institution, or its agents from liability for negligence.

What if you or your child has questions about this research study?

If you or your child has any questions or concerns about this research study, you should contact William Hunter at 859-392-1100.

The UC Institutional Review Board – Social and Behavioral Sciences (IRB-S) reviews all non-medical research projects that involve human participants to be sure the rights and welfare of
participants are protected.

If you have questions about your child's rights as a participant or complaints about the study, you may contact the Chairperson of the UC IRB-S at (513) 558-5784. Or, you may call the UC Research Compliance Hotline at (800) 889-1547, or write to the IRB-S, 300 University Hall, ML 0567, 51 Goodman Drive, Cincinnati, OH 45221-0567, or email the IRB office at irb@ucmail.uc.edu.

**Does your child HAVE to take part in this research study?**

The participant can withdraw from the study at any time and that there are no negative consequences if the student chooses not to participate or to withdraw from the study at any time.

Your child may skip any questions that he or she doesn’t want to answer.

You may give your permission and then change your mind and take your child out of this study at any time. To take your child out of the study, you should tell William Hunter at 859-392-1100. Your child will be asked if he or she wants to take part in this research study. Even if you say yes, your child may still say no.

**Agreement:**

I have read this information and have received answers to any questions I asked. I give my permission for my child to participate in this research study. I will receive a copy of this signed and dated Parent Permission form to keep.

You Child's Name (please print) __________________________________________

Your Child's Date of Birth _______________ (Month / Day / Year)

Parent/Legal Guardian's Signature ____________________________ Date _______

Signature of Person Obtaining Permission ____________________________ Date _______
Title of Study: EXAMINING THE EFFECTS OF NHT ON QUIZ RESULTS AND ON-TASK BEHAVIOR WITH STUDENTS IDENTIFIED WITH EMOTIONAL BEHAVIORAL DISABILITIES

Introduction:

You are being asked to be in a research study. Please ask questions about anything you do not understand.

Who is doing this research study?

The people in charge of this research study are William Hunter and Dr. Todd Haydon. There may be other people helping as well.

What is the purpose of this research study?

The purpose of the study is to find out if Number Heads Together (NHT), a student group learning activity, helps students in all academic content areas (language arts, math, science, social studies) by improving their quiz scores and classroom behavior.

Who will be in this research study?

About ten people will take part in this study. You may be in this study if you are a student in the participating teacher’s classroom.

What will you be asked to do in this research study, and how long will it take?

You will be asked to participate in a research study that will take place in your classroom at Holmes Middle School. By participating in the study, you will work with other students in a group learning activity. There will be approximately 27 study visits approximately; each visit will be 50 minutes or less. This study will take place approximately until February 2011. A 10 minute survey will be given to you prior to and at the end of the study within the Holmes Middle School Campus. The primary investigator, William Hunter will be observing you during the group activities in your classroom. The primary investigator, along with several research observers, and your teacher will review your quiz scores and your overall classroom behavior.
Are there any risks to being in this research study?

There is minimal risk to being in the study. You will have your grades and overall work reviewed by the primary investigator, William Hunter. The risk is not expected to be more than you would have in daily life.

Are there any benefits from being in this research study?

By participating in the study, a direct benefit includes being a part of an academic activity that would possibly improve your academic quiz scores and classroom behavior.

Will you have to pay anything to be in this research study?

You will not have to pay anything to take part in this study.

What will you get because of being in this research study?

You will not be paid (or given anything) to take part in this study.

Do you have choices about taking part in this research study?

If you do not want to take part in this research study you may simply not participate. You can opt out of certain aspects of the study, and still participate in other aspects of the study.

How will your research information be kept confidential?

Information about you will be kept private by using a study ID number instead of the participant’s name on the research forms and keeping the master list of names and study ID numbers in a separate location from the research forms. Research information will be only for the research team. Research information will be kept on a password protected computer.

Your research information will be kept in a locked file cabinet in the William Hunter’s office. Only the researchers in this study will look at your information. Research information will be stored in a locked file cabinet for three years. At the end of that time it will shredded. The information from the study may be published; however, you will not be identified by name.

What are your legal rights in this research study?

Nothing in this assent form takes away your rights.

What if you have questions about this research study?

If you have any questions or concerns about this research study, you should contact William Hunter at 859-392-1100.

Do you HAVE to take part in this research study?

No one has to be in this research study. You will not get in any trouble if you say no. You can withdraw from the study at any time and that there are no negative consequences you choose not to participate or to withdraw from the study at any time. You can either participate or not
participate in the group activity; if you choose not to participate in the activity, your teacher will assign you an individual assignment during the group activity time.

You may start and then change your mind and stop at any time. To stop being in the study, you should tell William Hunter at 859-392-1100.

**Agreement:** I have read this information. I want to be in this research study.

Your Name (please print) ____________________________________________

Your Date of Birth ________________ (Month / Day / Year)

Your Signature ______________________________________ Date ___________

Signature of Person Obtaining Assent _____________________________ Date __________
I am conducting a research study on effective classroom management practices. I am inquiring if you would be interested in participating. The procedures of the study should not interfere with your regular classroom activities. We will be in your classroom for approximately 50 minutes or less per day and collect data from the back of the classroom so we will be as unobtrusive as possible. The classroom management training session will last for about an hour and will take place after school and scheduled at your convenience. Your name will be kept anonymous if the data is used for publication. It is suggested that you select at least two students to participate in the study and involves sending home permission forms to get signed consent. Most importantly at any time you can withdraw from the study. I anticipate that there will be little risks involved for you and your students, throughout this study.”

“Thank you for your consideration in participating in this study.”
<table>
<thead>
<tr>
<th>Teacher</th>
<th>Data point</th>
<th>Date <em>/ /</em></th>
<th>Day __</th>
<th>10 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(+)=on task</td>
</tr>
<tr>
<td></td>
<td>S1 (+) (-)</td>
<td></td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S2 (+) (-)</td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td>S1 (+) (-)</td>
<td></td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S2 (+) (-)</td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td>S1 (+) (-)</td>
<td></td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S2 (+) (-)</td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td>S1 (+) (-)</td>
<td></td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S2 (+) (-)</td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td>S1 (+) (-)</td>
<td></td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S2 (+) (-)</td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td>S1 (+) (-)</td>
<td></td>
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<td>20 sec</td>
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<tr>
<td></td>
<td></td>
<td>S2 (+) (-)</td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td>S1 (+) (-)</td>
<td></td>
<td></td>
<td>20 sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S2 (+) (-)</td>
<td></td>
<td>20 sec</td>
</tr>
</tbody>
</table>
1. List 5 activities within the school/classroom setting that students in your classroom are able to do that can be viewed as a potential incentive (ex. going to and playing in the gym for a specific amount of time). List the most preferred activity that the participating students would most likely work for as an incentive.

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________

2. List 5 tangible items within the school/classroom setting, that students in your classroom are able to do or eat that can be view as potential incentive (healthy snacks). List the most preferred tangible item that the participating students would most likely work for as an incentive.

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________
Script for Numbered Heads Together

“Students today we are going to use a game to help us come up with answers to the quiz. The game is called Numbered Heads Together. I will assign a number (one through four) for each of you in each group. You will as a group come up with the answer but, I will pull a number and call on one of you based on that number.”

“What is the name of the game?” (Acceptable answers depending on condition is Number Heads Together or Number Heads Together plus Incentives)

1. Go over rules for the group
   a) One person talks at a time.
   b) Respect everyone’s answers.
   c) Use “indoor voices” when talking
   d) Remain quiet when the teacher speaks.
   e) Quietly return to your seats

2. Go over Math Fact Instruction

3. Form NHT Groups

4. Direct 10 Questions to students in NHT Group
   a. Tell students: For NHT, the teacher randomly choose a student from the 4 numbers
   b. Tell Students: For NHT, Put the number back and choose again-but the same student repeat again.

5. After 10 Questions are administered to group, have students return to their seat.

6. Pass out individual quizzes

7. Collect Individual Quizzes
Teacher Script for NHT+I

Script for Numbered Heads Together+Incentives

“Students today we are going to use a game to help us come up with answers to the quiz. The game is called Numbered Heads Together plus Incentives. I will assign a number (one through four) for each of you in each group. You will as a group will come up with the answer but, I will pull a number and call on one of you based on that number.”

“What is the name of the game?” (Number Heads Together plus Incentives)

1. Go over rules for the group
   a) One person talks at a time.
   b) Respect everyone’s answers.
   c) Use “indoor voices” when talking
   d) Remain quiet when the teacher speaks.
   e) Quietly return to your seats

2. Go over Math Fact Instruction

3. Form NHT Groups

4. Direct 10 Questions to students in NHT Group
   a. The teacher will state to the students “Rewards will be provided immediately after the individual quizzes are collected”.
   b. Tell students: For NHT, the teacher randomly choose a student from the 4 numbers
   c. Tell Students: For NHT, Put the number back and choose again—but the same student repeat again.
   d. The teacher will hand out tokens every five minutes for students that are on task (These tokens will be redeemed during class time as part of the teachers’ token economy or general classroom incentives).

5. After 10 Questions are administered to group, have students return to their seat.

6. Pass out individual quizzes

7. Collect Individual Quizzes
**APPENDIX F**  
**CODING MANUAL**

**Baseline.** The condition of baseline is described as “typical” teacher instruction, students having opportunity to respond to questions through raising their hand to be called on and the teacher calls on the students randomly.

**NHT.** The condition of NHT is a peer mediated intervention which allows students to work in heterogeneous groups and respond to academic questions administered by the teacher through response cards.

**NHT+I.** The condition of NHT+I is a peer mediated intervention which allows students to work in heterogeneous groups and respond to academic questions administered by the teacher through response cards. Based on progress monitoring data, the student participants will receive incentives based on the results of a stimulus preference assessment.

**Pre-Test/Post Test-** The participating teacher(s) and the primary investigator will develop math skill pre-test prior to the study and post-test after the final data point within the study.

**Stimulus Preference Assessment-** The purpose of the stimulus preference assessment is to validate the tangible item/event identified during the Multiple Stimulus without Replacement (MWSO) for the NHT+I condition. Adapted from the work of Daly III et al. (2009), the specific procedures for conducting the (MSWO) stimulus assessments are (a) the primary investigator will interview the participating teacher(s) to generate a list of 10 possible activities/items (5 activities, 5 tangible items) based on perceived teacher acceptability and feasibility for use in the
school setting (b) from the list of original list of 10 items, 8 will be selected for the stimulus assessment based on teacher preference and feasibility during the NHT+I condition (c) once items are determined (i.e. playing with gameboy, going to the library, tangible items) eight parallel index activity cards (12.7cm by 20.3 cm) will contain the written name of one item (activity, tangible item) and will be presented to each participating student individually by the participating teacher(s) prior to the implementation of the study (baseline, NHT, and NHT+I conditions).

**NHT and NHT + I Conditions.** The conditions of Number Heads Together (NHT) or Number Heads Together plus Incentives (NHT+I) will be recorded when the participating teacher prompts the entire class to chorally respond and repeat the condition (NHT) that was in effect at the time of instruction.

1. **Examples:**
   - The teacher asks “what activity will we be doing today?”
   - The teacher asks “Today, we will be working on what class?”

2. **Non-examples:**
   - The teacher does not allow class to chorally respond activity (condition)

**On-task behavior.** Adapted from the Nelson, Johnson, and Marchand-Martella (1996) study, on task behavior will be coded when a target student is engaged in an academic task individually or shared with a peer; looking at required material, verbalize about an academic subject or material, teacher instructions, verbalizes to provide an answer to the teacher’s or peer’s academic questions, and ask the teacher or peer about directions. On-task behavior includes the student attending to academic task and asking for help. Data on student on-task behavior will be
collected using a 20-s momentary time sampling recording system during 15-min observation sessions. If the target student being observed during the 20-s second momentary time sample does not meet the criteria for on-task behavior, the observer will record “off-task” (−) for that interval. The non-examples for on-task behavior are examples of off-task behavior.

1. Examples:

1. The student is holding and/or marking academic task materials (e.g., paper, response cards)
2. The student is engaged in an academic task individually or shared with a peer;
3. The student verbalizes about an academic subject or material, teacher instructions, or other appropriate topics;
4. The student verbalizes to provide an answer to the teacher's or peer's academic question.

2. Non-examples:

1. The student is looking directly at the observer
2. The student has their head down, eyes not focused on teacher, peer, or material.
3. Teacher talking, the student looking at and/or talking to a peer
4. The student is looking at material that is not related to the lesson.
5. Student is drawing while teacher talks.

**Quiz scores.** The percentage of correct responses on daily 10-item quizzes administered at the end of each math fact activity will be measured. The quiz scores will include the number of correct answers of a given problem and the accurate completion of the multiplication algorithm. The primary investigator and the participating teacher will collect quiz score data.

**Correct Answers.** The percentage of the student’s correct answers on the daily 10-item quizzes administered at the end of each math activity will be measured. The primary investigator and the participating teacher will collect correct answer data.
Accurate Completion of Multiplication Algorithm. The percentage of the participating students’ accurate completion of the multiplication algorithms for a given problem will be measured. The accurate completion of the multiplication algorithm for double digit multiplication involves the students to have two lines correct (no errors) when multiplying numbers prior to adding to determine the final answer. The primary investigator and the participating teacher will collect accurate completion of multiplication algorithm data.
<table>
<thead>
<tr>
<th>Teacher/Student Action</th>
<th>The action occurred.</th>
<th>The action did not occur.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher states classroom rules and procedures to students prior to the lesson.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Teacher checks for prior knowledge through asking students questions focusing on math facts.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Students have an opportunity to answer questions at their desk.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The teacher delivers math fact instruction to the entire class which includes approximately 10 questions.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Teacher calls upon students (randomly) to answer questions.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Teacher administers quiz to students.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Teacher/Student Action</td>
<td>The action occurred.</td>
<td>The action did not occur.</td>
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<tr>
<td>---------------------------------------------------------------------------------------</td>
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<td>--------------------------</td>
</tr>
<tr>
<td>Teacher asks students to chorally respond to the present activity (condition). The</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>students will respond “Number Heads Together”.</td>
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</tr>
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<tr>
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<td>The teacher delivers math fact instruction to the entire class which includes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>approximately 3-5 questions.</td>
<td></td>
<td></td>
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<tr>
<td>Teacher assigns students into small heterogeneous groups.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Teacher assigns numbers (ex.1-4) to individual students to designate which student</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>will answer a question when called upon.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher directs 10 questions to class and ask students to “put their heads together/</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>number heads together” to come up with an answer to each question.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher asks each group “if everyone agrees” to the answer provided on the response</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>card before accepting final answer.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Teacher asks students to chorally respond to the present activity (condition). The students will respond “Number Heads Together plus Incentives”.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Teacher reminds students of incentives that would be possibly received at the end of the activity based on progress monitoring sheets.</td>
<td>Yes</td>
<td>No</td>
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<td>Teacher states classroom rules and procedures to students prior to the lesson.</td>
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<td>Teacher directs 10 questions to class and ask students to “put their heads together/number heads together plus incentives” to come up with an answer to each question.</td>
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<td>No</td>
</tr>
<tr>
<td>Teacher asks each group “if everyone agrees” to the answer provided on the response card before accepting final answer.</td>
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</tr>
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<td>Teacher administers quiz to students.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Teacher informs students if they earned their incentives immediately after the quiz.</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Teacher/Student Action</td>
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<td>Yes</td>
<td>No</td>
</tr>
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<td>Teacher states classroom rules and procedures (modified) to students prior to the lesson.</td>
<td>Yes</td>
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<tr>
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</table>
Please complete the items below by circling the number under the question that best fits how you feel about the intervention.

1. Which intervention, if at all, was easiest to implement? (NHT or NHT+I)

2. How difficult was it to implement the intervention (you chose in Q1)?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Somewhat</th>
<th>Fairly</th>
<th>Very</th>
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<tr>
<td>1</td>
<td>2</td>
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</table>

3. How time-consuming was the preparation of the implementation of the intervention (NHT or NHT+I)?

<table>
<thead>
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</table>

4. How helpful was (the most effective intervention) to your students’ math computation?

<table>
<thead>
<tr>
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<th>Fairly</th>
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<td>4</td>
</tr>
</tbody>
</table>
5. How helpful to your teaching instruction was the intervention?

Not at all  Somewhat  Fairly  Very
1  2  3  4

6. After implementing (the most effective intervention), did you see an increase in the student’s on-task behavior than what you normally observe?

Not at all  Somewhat  Fairly  Very
1  2  3  4

7. While implementing (the most effective intervention), how well did you think the students got along with each other?

Not at all  Somewhat  Fairly  Very
1  2  3  4

8. How much do you think other teachers in your building would like NHT and NHT+I?

Not at all  Somewhat  Fairly  Very
1  2  3  4

9. How likely is it that you will use NHT in the future?

Not at all  Somewhat  Fairly  Very
1  2  3  4

STOP HERE
Pre-Study-Student Survey

Please complete the items below by circling the number under the question that best fits how you feel about the intervention(s).

1. **How much do you like the subject of math?**

<table>
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<tr>
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</table>

2. **How often do you use a calculator to work out multiplication problems?**

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Sometimes</th>
<th>Fairly</th>
<th>Very Much</th>
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3. **How often do you work out multiplication problems without a calculator?**

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4. **How often do you work with a partner to work out multiplication problems?**

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5. **How often does your teacher help you work out multiplication problems?**

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</table>
6. Do you find the subject of math to be difficult?

7. Do you find the subject of math to be easy?

8. How often do you work in groups (more than two people) to work out multiplication problems?

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9. Do you find multiplication to be easy?

STOP HERE
Post-Study-Student Survey

Please complete the items below by circling the number under the question that best fits how you feel about the intervention(s).

1. **How much do you like the subject of math?**

<table>
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2. **How often do you use a calculator to work out multiplication problems?**

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3. **How often do you work out multiplication problems without a calculator?**

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4. **How often do you work with a partner to work out multiplication problems?**

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5. How often does your teacher help you work out multiplication problems?

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6. Do you find the subject of math to be difficult?

7. Do you find the subject of math to be easy?

8. How often do you work in groups (more than two people) to work out multiplication problems?

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9. Do you find multiplication to be easy?

STOP HERE
NHT Student Survey

Please complete the items below by circling the number under the question that best fits how you feel about the intervention(s).

1. I was treated differently during observations?

<table>
<thead>
<tr>
<th>Not at all</th>
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<tr>
<td>1</td>
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<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

2. During NHT, I think I was on-task more than usual?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Somewhat</th>
<th>Fairly</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</tbody>
</table>

3. I would be willing to participate in a study again?

<table>
<thead>
<tr>
<th>Not at all</th>
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<th>Very Much</th>
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</table>

4. How much did you like being on a team during NHT?

<table>
<thead>
<tr>
<th>Not at all</th>
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</table>

5. How much did you like sharing answers with your teammates?

<table>
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</tbody>
</table>
6. I think I participated more than usual during NHT?

<table>
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<tr>
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</tr>
</tbody>
</table>

7. Do you prefer answering your own questions or using NHT?

<table>
<thead>
<tr>
<th>Own questions</th>
<th>Use Heads Together</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

8. After implementing NHT, I got along with my peers better than usual during the day.

<table>
<thead>
<tr>
<th>Not at all</th>
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<th>Fairly</th>
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9. How much did NHT help with your math computation?

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STOP HERE