Examining the Effectiveness of Numbered Heads Together for Students With Emotional and Behavioral Disorders

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Numbered Heads Together and Don, a Case Study

Don, one of the four student participants in the study, is a 13-year-old boy with emotional behavioral disorders (EBD). He recently transferred to Ms. Jackson's class from a partial hospitalization day treatment program. Don struggles in several content areas, including math computation and math reasoning, compared with same-age peers without disabilities. As one may imagine, Don initially experienced difficulty in displaying on-task behavior during instructional time. During baseline, Don was noticeably frustrated when asked by his teacher to complete double-digit multiplication facts. After the first few Numbered Heads Together (NHT) interventions, Don began to work with his teammates, he completed his math facts, he was enthusiastic, and he enjoyed that his team provided the right answer. At the end of the Numbered Heads Together plus Incentive intervention, Don was on task more than 80% of the time and scored greater than 80% on his math quiz scores.

Students with EBD are more likely to be placed in self-contained classrooms and special schools in comparison with other students with mild to moderate disabilities. Challenging behaviors displayed in both general education classrooms and self-contained classrooms by students with EBD can be a difficult challenge for novice and experienced teachers (Kennedy & Jolivette, 2008; Turnbull, Turnbull, & Wehmeyer, 2010). Furthermore, students with EBD demonstrate broad deficits in academic areas such as reading and math (Lane, Wehby, Little, & Cooley, 2005). Therefore, it is imperative that teachers of students with EBD incorporate teaching strategies to address their students' social and academic deficiencies in order to maximize the effectiveness of classroom instruction (Ryan, Pierce, & Mooney, 2008).

Numbered Heads Together

An instructional strategy that has been found to maximize the effectiveness of classroom instruction by increasing student participation and academic outcomes is Numbered Heads Together (Maheady, Michielli-Pendl, Harper, & Mallette, 2006; Haydon, Maheady, & Hunter, 2010). NHT requires little preparation time while ensuring active student participation and positive academic and behavioral outcomes.

Procedures for Implementation of NHT

Prior to the implementation of the NHT activity, the teacher explains the rules and expectations to the students to proactively decrease potential off-task behavior and interruptions to the learning environment (Maheady et al., 2006; Simonsen, Fairbanks, Briesch, Myers, & Sugai, 2008). Examples of expected behaviors include (a) respect everyone's answers, (b) use "indoor voices" when talking, and (c) return to desk quietly after the activity. During the NHT activity, the teacher assigns students to small heterogeneous groups. Heterogeneous teams are formed by assigning high, average, and low academic performers to each team. Next, students are then assigned numbers 1 to 4 to designate who will respond to questions on each team. Once students are assigned the numbers, the teacher poses an academic question and says, "OK, put your heads together." Next, all group members discuss the question, making certain that everyone can answer the question. The teacher waits approximately 20 s for team members to discuss possible answers and selects one team member to write the answer on a small handheld dry-erase board. The teacher restates the question and announces a number (1, 2, 3, or 4); students with the announced number in each group provide an answer to the teacher's question. Next, the teacher asks students in the group if they agree with the answer and provides feedback to the entire class on whether the answer is correct. Then, the teacher asks another question and repeats the process.

Previous NHT Studies

To date, there have been four NHT studies conducted (Haydon et al., 2010; Maheady et al., 2006; Maheady, Mallette, Harper, & Sacca, 1991; Maheady, Michielli-Pendl, Mallette, & Harper, 2002). In the Haydon et al. (2010) study, an individual reward system was used in the incentive condition. The authors investigated the use of providing the Numbered Heads Together + Incentives (NHT+I) condition as an alternative to NHT without rewards. Results of the study indicated improvement in social and academic behavior in favor of the NHT+I strategy. The present study

Table 1 Student Demographics

Student	Gender/Age	Ethnicity	Grade
Barry	M/13 years 11 months	W	7th
Jack	M/13 years 4 months	W	7th
Jessica	F/12 years 5 months	AA	7th
Don	M/13 years 11 months	AA	8th

AA = African American; W = White.

systematically replicates and extends the Haydon et al. (2010) study by (a) working with students identified with EBD in a self-contained classroom, (b) investigating the use of a preference assessment in the NHT+I condition, and (c) working in a new content domain (math).

Method

Participants and Settings

The classroom teacher requested assistance from the first author, a former self-contained teacher of students with EBD, in implementing an instructional strategy to improve the academic and behavioral outcomes of her students. The classroom teacher was a Caucasian female, age 44 years, with 11 years of teaching experience. She held state certification in mild/moderate learning disabilities (K–12). During the study, a 55-year-old Caucasian female paraeducator was also in the room.

As soon as 4 of 8 students returned parent permission consent forms, the study began. All 8 students received the NHT interventions; however, only the students who returned their signed consent forms have data reported. Based on the size of the class, one group of students had 2 members instead of 3 in their NHT groups. The amount of data collected was limited by student attendance. *Table 1* provides demographic information about the student participants (names are pseudonyms).

This study took place over a 2-month period during math instruction in a self-contained classroom for students with EBD, which was located within an urban middle school (Grades 6–8) in a Midwestern city. Approximately 92% of the students in the school received free and reduced lunches, and more than 25% of the student population was transient.

The seating arrangement in the classroom was organized in a traditional row format during general instruction. During the NHT interventions, student desks were arranged in clusters of three in a manner that allowed the students to view the teacher instructing from a large white board in front of the classroom. The teacher posted the classroom rules for each strategy of the study in the front of the room. She then wrote double-digit multiplication math problems on a large dry-erase board from the front of the room. Math instructional sessions typically lasted 50 min and took place after the students' lunch period in the afternoon.

Dependent Measures

On-task behavior. On-task behavior was defined in a similar manner to Nelson, Johnson, and Marchand-Martella (1996) and was defined as the student looking at required material; verbalizing about an academic subject or material; using a marker on the response card; having eyes on peers discussing academic material or eyes on the teacher when instructions, directions, and feedback were given; and asking a teacher or peer about directions. Examples included the student writing material associated with the academic subject and requesting help from the teacher.

Quiz scores. A 10-item quiz covering similar material from the current day's lesson was given at the end of the instructional portion of each class session. The double-digit multiplication problems on the quizzes were different from the math problems used during the instructional period. The daily quiz was administered to the students by the teacher. The students were assessed based on the total correct response percentage on daily 10-item quizzes.

Teacher Training

The first author used procedures adapted from Daly et al. (2009) for the implementation of the preference assessment in order to determine the rewards that each student found reinforcing. The first author helped the teacher generate a list of five activities and five tangible items (see *Table 2*). The teacher then presented the activities and tangible items on index cards to each student prior to each NHT+I session. Then each student selected his or her top preferred incentive as indicated on the index card.

Study Design

An alternating treatment design (Alberto & Troutman, 2009) was used to compare the effectiveness of the two NHT conditions and the baseline condition. We wanted to determine the relative effectiveness of the NHT interventions on student quiz scores and on-task behavior. The use of the alternating treatment design was justified because students were able to discriminate the NHT condition from the NHT+I condition.

Conditions

Baseline condition (BL). During baseline, the teacher instructed the class in her usual manner, which involved (a) asking the class questions to assess prior knowledge on the math facts, (b) providing an

Table 2 Types of Reinforcers

Types of Reinforcers in NHT+I	
Tangible/edible	**Activity**
Healthy snacks	Basketball in gym
Healthy juice	Educational computer game
Plastic bracelet	Walking time on the track
Pen/pencils	Lunch with the teacher
Drawing paper	Drawing time

opportunity for the students to answer questions individually at their desks, (c) using the large dry-erase board to demonstrate the process of completing approximately 10 double-digit multiplication problems, (d) calling upon students randomly to voluntarily provide their answers to the multiplication facts placed on the large dry-erase board, and (e) using the remaining time of approximately 10 min to administer one 10-item math fact quiz to the students after instruction.

Numbered Heads Together (NHT). During the NHT condition, the teacher read a script (provided by first author) to ensure the specific procedures of the activity were being implemented. Using the large dry-erase board, the teacher directed 10 double-digit multiplication problems to the entire class and then asked the class to "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 randomly selected a number from 1 to 3 and asked students (one in each group) to raise their small handheld dry-erase boards in order to show their answers. In the group with two members, one student had the numbers 1 and 3. The teacher asked the students whether everyone in each group was in agreement with the answer 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.

Numbered Heads Together Plus Incentives (NHT+I). During the NHT+I condition, the teacher followed the same procedures as the NHT condition with the exception that each student selected an incentive before instruction and then a reward was provided if the student earned at least three out of five tally marks for on-task behavior. The students received their incentives immediately after the activity. All 4 students met the criteria to receive their rewards every day of the NHT+I condition.

Treatment Integrity

The primary investigator collected the treatment integrity data on a daily basis for each condition. Two different treatment procedural checklists were developed for each condition (NHT and NHT+I) to ensure treatment integrity (Haydon et al., 2010). Treatment integrity data indicated that the teacher implemented all procedural steps for NHT and NHT+I with 100% adherence on all occasions.

Social Validity

Similar to Haydon et al. (2010) study, the teacher and the students were asked to complete social validity surveys at the end of the study to evaluate their perceptions regarding the value of NHT interventions. A separate social validity survey focusing on the instructional component of NHT was provided to the teacher, and a separate social validity survey focusing on the participation component of the NHT interventions was provided to the students. The student surveys were completed independently.

Results

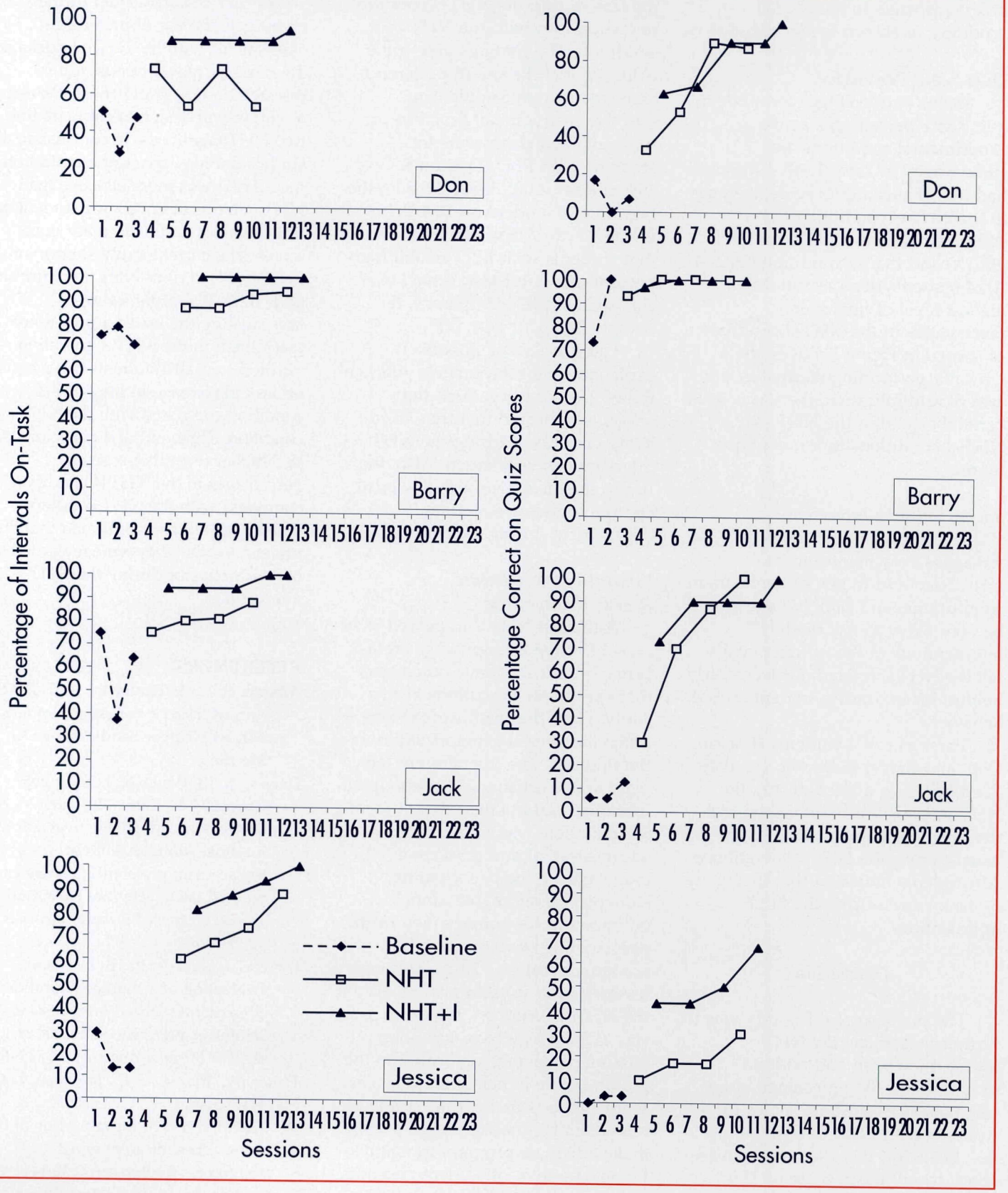
On-Task Behavior

Means and averages for student on-task behavior percentages across experimental conditions are summarized in *Table 3*. The NHT+I condition had the highest on-task percentage (93.9%) compared with the NHT condition (76.5%) and the

Table 3 Means and Ranges for On-Task Behavior and Quiz Scores in Each Condition

	Baseline		NHT		NHT+I	
Student	**On-Task *M* (Range)**	**Quiz *M* (Range)**	**On-Task *M* (Range)**	**Quiz *M* (Range)**	**On-Task *M* (Range)**	**Quiz *M* (Range)**
Don	41.8 (28.5–50)	8 (0–17)	63 (53–73)	65.7 (33–90)	89 (88–93)	82 (63–100)
Jack	58.8 (37.5–75)	8.3 (6–13)	81 (75–88)	71.7 (30–100)	96.4 (94–100)	88.6 (73–100)
Jessica	18.1 (13–28.5)	2 (0–3)	72 (60–88)	18.5 (10–30)	90.25 (81–100)	50.75 (43–67)
Barry	74.8 (71–78.5)	86.5 (73–100)	90.25 (87–94)	98.25 (93–100)	100 (100)	99.25 (97–100)
Total mean	48.3	26.2	76.5	63.5	93.9	80.1

Figure 1 On-Task Behavior and Quiz Score Percentages in Each Condition



BL condition (48.3%). All four students demonstrated their highest level of on-task percentages in the NHT+I condition, as shown in *Figure 1*.

Quiz Score Percentage

Means and averages for student quiz score percentages across experimental conditions are summarized in *Table 3*. All 4 students had higher mean quiz score averages in the NHT+I condition (93.9%) compared with the NHT condition (63.5%) and the BL condition (26.2%). All 4 students demonstrated their highest level of quiz score percentages in the NHT+I condition, as shown in *Figure 1*. For Barry, a typically performing student in the area of multiplication, there was little variability within the NHT and NHT+I conditions in terms of quiz scores.

Social Validity Interview

The teacher found the NHT strategies very helpful to her instruction and to her student's math computation and said that she would be very likely to use the NHT interventions in the future. She also felt the NHT interventions were fairly helpful for increasing student on-task behavior.

Three out of 4 students (Jessica, Don, and Barry) indicated that they liked being on a team during the NHT interventions very much and that they participated more than usual during the NHT interventions. All students indicated that they were on task more during the NHT interventions.

Discussion

The purpose of this study was to further investigate the NHT intervention with and without incentives on the percentage of on-task behavior and quiz scores for 4 students with EBD. In terms of on-task behavior, there was an increase of an overall mean score of 17.4% during the NHT+I condition over the NHT condition. In terms of overall quiz scores, all 4 students scored a higher mean percentage on daily quizzes during the NHT+I condition in comparison with the NHT condition. The findings give some evidence that the use of preference assessments may supplement effective instructional practices in self-contained classrooms for students with EBD (DeLeon & Iwata, 1996; Fisher et al., 1992). Finally, the high rate of student on-task behavior is noteworthy, as research indicates that students with EBD exhibit high percentages of off-task behavior in classrooms (Wehby, Symons, & Shores, 1995).

There are a few possible explanations for the positive effects of the NHT+I strategy. First, the students indicated that they liked being on a team during the NHT interventions very much. Also, the use of the incentives was powerful enough to increase student engagement during the math activity.

Limitations and Future Research Directions

Although NHT+I appeared to be most effective in improving on-task behavior and academic outcomes, there are a few limitations of this study. First, the small sample size limits the overall generalizability of the findings. The intervention took place in one urban middle school self-contained classroom with 4 students. Second, there was a failure to directly address verbal and nonverbal interaction of the participating students; therefore, we cannot determine if the conversation of the participating students involved academics entirely. Third, although Jessica's quiz score improved during the NHT+I condition, her mean score was at 50.75%, which was not a passing percentage according to the grading scale in her classroom. The score suggests that further academic remediation is necessary for her to make adequate progress in math. Finally, because of student absences, holidays, and teacher scheduling, additional data are needed to establish stability in the NHT conditions.

Future research could further investigate the use of preference assessments with the NHT+1 package. To avoid carryover effects, future research designs could consist of using a withdrawal design to compare the two NHT conditions. In conclusion, the study's findings give some indication the NHT+I was more effective than NHT in terms of improving student on-task behavior and daily math quiz scores. The current study supports the findings of pervious NHT literature and adds to the literature through investigating the use of a preference assessment in the NHT+I condition. Furthermore, all 4 students had a higher on-task percentage in the NHT+I condition compared with the NHT condition. Three out of 4 participants had higher overall quiz score percentages in the NHT+I condition compared with the NHT condition. Finally, the students indicated that they understood that they were rewarded for on-task behavior during the NHT+I intervention.

REFERENCES

Alberto, P. A., & Troutman, A. C. (2009). *Applied behavior analysis for teachers* (8th ed.). Upper Saddle River, NJ: Merrill.

Daly, E. J., III, Wells, N. J., Swanger-Gagne, M. S., Carr, J. E., Kunz, G. M., & Taylor, A. M. (2009). Evaluation of multiple-stimulus without replacement preference assessment method using activities as stimuli. *Journal of Applied Behavior Analysis, 42*, 563–574.

DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis, 29*, 519–532.

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25*, 491–498.

Haydon, T., Maheady, L., & Hunter, W. (2010). Effects of numbered heads together on the daily quiz scores and on-task behavior of students with disabilities. *Journal of Behavioral Education, 19*, 222–238.

Kennedy, C., & Jolivette, K. (2008). The effects of positive verbal reinforcement on the time spent outside the classroom for students with emotional and behavioral disorders in a residential setting. *Behavioral Disorders, 33*, 211–221.

Lane, K. L., Wehby, J. H., Little, M. A., & Cooley, C. (2005). Academic, social, and behavioral profiles of students with emotional and behavioral disorders educated in self-contained classrooms and self-contained schools: Part I—are they more alike than different? *Behavior Disorders, 30*, 349–361.

Maheady, L., Mallette, B., Harper, G., & Sacca, K. (1991). Heads Together: A peer-mediated option for improving the academic achievement of heterogeneous learning groups. *Remedial and Special Education, 12*, 25–33.

Maheady, L., Michielli-Pendl, J., Harper, G., & Mallette, B. (2006). The effects of numbered heads together with and without an incentive package on the science test performance of a diverse group of sixth graders. *Journal of Behavioral Education, 15*, 25–39.

Maheady, L., Michielli-Pendl, J., Mallette, B., & Harper, G. F. (2002). A collaborative research project to improve the academic performance of a diverse sixth grade science class. *Teacher Education and Special Education, 25*, 55–70.

Nelson, J. R., Johnson, A., & Marchand-Martella, M. (1996). Effects of direct instruction, cooperative learning, and independent learning practices on the classroom behavior of students with behavioral disorders: A comparative analysis. *Journal of Emotional and Behavioral Disorders, 4*, 53–62.

Ryan, J. B., Pierce, C. D., & Mooney, P. (2008, spring). Evidence-based teaching strategies for students with EBD. *Beyond Behavior*, 22–29.

Simonsen, B., Fairbanks, S., Briesch, A., Myers, D., & Sugai, G. (2008). Evidence-based practices in classroom management: Considerations for research to practice. *Education & Treatment Of Children, 31*, 351–380.

Turnbull, A. P., Turnbull, H. R., & Wehmeyer, M. (2010). Exceptional lives: Special education in today's schools (6_{th} ed.). Upper Saddle, NJ: Pearson Learning Solutions.

Wehby, J. H., Symons, F. J., & Shores, R. E. (1995). A descriptive analysis of aggressive behavior in classrooms for children with emotional and behavioral disorders. *Behavioral Disorders, 20*, 87–105.