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Stack the Deck: An Intervention for Regulating Verbal Participation in Students with Autism Spectrum Disorder

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Stack the Deck: An Intervention for Regulating Verbal Participation
in Students with Autism Spectrum Disorder

Katherine Ensign Montgomery

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of
Master of Science

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ABSTRACT

Stack the Deck: An Intervention for Regulating Verbal Participation in Students with Autism Spectrum Disorder

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Master of Science

Some students with autism spectrum disorder (ASD) struggle with social reciprocity, or the ability to engage in chains of back-and-forth conversation, interfering with other students' ability to respond to a question that is posed by the teacher in classrooms. The participants were 11 fifth grade students with autism spectrum disorder. We used a simple differential reinforcement intervention within a token system in direct instruction sessions for math to help balance the participation in a class of children with ASD as well as lower the number of talk-outs made by all students. Using a single-subject design, data were analyzed for changes in level, trend, and variability. Secondary analysis consisted of descriptive data and effect size calculations, including analysis of three subgroupings of students according to participation levels at baseline. Results show that students who previously had excessively high rates of participation were able to better balance their participation to allow other students the opportunity to participate. The intervention also increased participation from students who previously showed minimal rates of participation. Students whose participation levels were already within one standard deviation of the class mean maintained their balanced participation levels, on average, throughout the intervention. Lastly, the intervention was very effective in lowering the number of talk-outs made overall during the direct instruction period. This is a simple intervention that showed good results in a classroom setting to help students with autism regulate their participation during instruction.

Keywords: autism, participation, intervention, talk outs, classroom

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DESCRIPTION OF THESIS STRUCTURE

This thesis, *Stack the Deck: An Intervention for Regulating Verbal Participation in Students with Autism Spectrum Disorder*, is presented in a hybrid format. In this format, both journal publication and traditional formatting requirements are met.

The initial pages of the thesis follow the university requirements for thesis formatting and submission. The first section of the document is presented in the journal-ready format and adheres to the style requirements for future publication in a peer-reviewed journal. The full literature review is included in Appendix A. Two references lists are included in this format. The first list includes only the references found in the journal-ready article. The second reference list includes all citations from the full literature review found in Appendix A. Appendix B contains the data recording sheet that was used by video coders. Appendix C includes assent and consent documents.

Introduction

Autism spectrum disorder is a developmental disability characterized by communication impairments and restricted, repetitive interests (American Psychiatric Association [APA], 2013). In a classroom setting, students with autism who have age-appropriate cognitive and language function might not have the social skills necessary to independently and appropriately interact with peers their age.

The Centers for Disease Control and Prevention publishes a series of studies in conjunction with The Autism and Developmental Disabilities Monitoring (ADDM) Network to find the prevalence of children age 8 years old with ASD, the most recent of which was based on data collected in 2014 (Baio et al., 2018). They found that the combined estimated prevalence of ASD in the 2014 sample was 16.8 per 1,000. The estimated prevalence of boys with autism, 26.6 per 1,000, was considerably higher than the estimated prevalence of girls with autism, found to be about 6.6 per 1,000. According to the ADDM network, the estimated prevalence of children with autism has continually increased from 6.7 children per 1,000 in 2000 to the current levels in slightly less than one generation.

People who have delays in social reciprocity often have trouble maintaining long chains of back-and-forth conversation with others because they do not have the skills to interpret social cues in an interaction (Leach & LaRocque, 2011). For example, children with ASD who have troubles with “turn-taking” in conversations might become agitated when other people begin to speak and they do not have a chance to say everything they would like. When children cannot communicate they may become very frustrated. When this happens, they sometimes do not have the ability to regulate their emotions as well as their peers and are not as able to control impulses (Sofronoff, Attwood, Hinton, & Levin, 2006). This reduced ability to regulate emotions can

cause outbursts that are “colloquially referred to as ‘meltdowns’” (Mazefsky et al., 2013). When a child with ASD exhibits a meltdown in a classroom setting, it becomes very difficult for the teacher to continue with instruction. Students who have trouble with turn-taking may participate excessively during class instruction, including “talking out” instead of raising their hand and waiting until called on to speak. The end result is that a small number of students are participating, while the rest of the class does not have a chance to participate.

While some people with ASD may “talk out” excessively, other individuals with ASD exhibit the opposite behavior. When they become anxious due to communication deficits, they may instead “shut down” and not participate during class. Multiple studies have found that student participation in a classroom setting is vital for success and leads to deeper understanding of material (Roscoe & Chi, 2008; Veenman, Denessen, van den Akker, & van der Rijt, 2005; Warner, 2008). Students who question and contribute, especially during mathematics discussion and discourse, achieve higher academic success (Ing et al., 2015). Therefore, it is necessary that all students learn the social reciprocity skills needed to participate appropriately in a classroom so that everyone has the opportunity to learn and experience academic success.

Interventions using differential reinforcement are effective in changing behavior in children (Dietz & Repp, 1973; Thompson, McLaughlin & Derby, 2011). To date, there are multiple studies to *increase* verbal behaviors in children with autism, but none were found to use behavioral interventions to help regulate (*decrease*) excessive verbal participation in students with autism in classroom settings.

Statement of the Problem

Because of the increasing prevalence of students with ASD in classrooms, social reciprocity intervention strategies are needed for classrooms so that all students learn how to

participate in class instruction. Students who exhibit hyper-verbal behaviors and participate excessively need to learn to regulate their participation to allow other students the opportunity to learn through verbal participation in class discussions. Students who become anxious and do not participate need to learn coping skills so they feel comfortable participating, as participation leads to greater academic success.

Statement of Purpose

Our first aim was to use differential reinforcement and a self-monitoring intervention within a token system to limit the number of talk-outs and participation for students with excessive participation rates (using differential reinforcement of low rates of behavior, or DRL). Using the same system, but with a different ratio of available incentive tokens, our second aim was to increase the participation of students with very low participation rates (differential reinforcement of high rates of behavior, or DRH).

Research Questions

To accomplish these aims, we asked three research questions, as follows:

1. Will differential reinforcement of low rates of behavior (DRL) using a token system reduce the number of talk-outs from students with excessive verbal participation rates in an autism specialty classroom, resulting in more balanced participation?
2. Will differential reinforcement of high rates of behavior (DRH) using a token system increase the number of attempted comments from students with low verbal participation rates in an autism specialty classroom, resulting in more balanced participation?
3. Will the self-monitoring DRH/DRL intervention result in fewer talk-outs during direct instruction sessions?

Method

The Institutional Review Board of the university approved all methods, and informed, written consent was obtained from all parents. Signed, written assent was obtained from all participants. Student participation in the class-wide intervention was not affected by research participation decisions.

Participants

Participants for the study were drawn from a pool of 15 students in a fifth grade classroom at an autism-specialty charter school. Participants ranged in age from 10-12 years, including males and females. All participants had a full scale IQ score above 70, which was verified by standardized cognitive assessment. All participants were able to communicate with minimal language barriers, also verified through standardized assessment of verbal abilities. Twelve of the students in the classroom had an autism diagnosis and/or educational classification, and three of the students in the class were neurotypical. All students were in the top 34% of their grade based on their math ability level, determined by multiple sources of curriculum-based measurement.

The intervention was administered on a class-wide basis to encourage average levels of participation across the class. While all 15 students participated in the intervention during class instruction, 4 students were not included in the analysis (see Table 1). Two students were not included because they were absent for over 50% of the baseline collection sessions. Another student was not included because he did not stay in the class for the duration of the research project. Lastly, one student was not included because he missed the beginning portion of math class every day due to implementation of a pre-existing behavior intervention plan.

Table 1

Participant Demographic Information

Participant	Age	Sex	Educational Classification	Full Scale IQ Score	Race/Ethnicity
Student 1	11	Male	Autism	135	White
Student 2	12	Female	Autism	94	White
Student 3	11	Female	None	95	White
Student 4	10	Male	Autism	85	White
Student 5	11	Male	Autism	80	White
Student 6	11	Male	Autism	85	White
Student 7	10	Male	Autism	88	White
Student 8	11	Female	Autism	90	White
Student 9	11	Male	None	n/a	Hispanic
Student 10	11	Male	Autism	88	White
Student 11	11	Male	None	n/a	White

By classroom teacher report, Student 1 was the most vocal of the students. When he became frustrated, he shouted out disrespectful statements to the teacher and classmates if he was not allowed to answer every question. This caused the other students to become upset and begin melting down because of the loud noise. Other students became aggressive because of his disrespectful statements. Student 1 did not recognize that other people wanted to participate. During the baseline phase, Student 1 received four office disciplinary referrals in the five class sessions for disrespectful comments to the teacher or other students.

Student 2 was very distractible. She often had difficulty keeping up with the lesson and consistently began drawing instead of participating in class. Student 2 became distracted within the first couple minutes of the lesson and did not re-engage by the end of the lesson. Often, she did not complete her work during class and typically had multiple pages for homework each night.

Student 3 did not have an autism diagnosis and was one of the three neurotypical students in the class. Student 3 was very respectful and did not have a problem participating. Student 3 did not want other people to become frustrated, so over the course of the school year, she refrained from answering questions so Student 1 would not get mad. Student 3 did not struggle in class and performance showed that she understood the material.

Student 4 often sat quietly during math but did not participate. After the teacher posed a question, he very rarely raised his hand to answer. When he was called on to answer a question, he was able to get the question right, but would never raise his hand spontaneously. Because of his lack of participation, it was hard for the teacher to know whether he was engaged and understanding the task or if he needed more individualized instruction.

While Student 5 participated excessively in class, he was never disrespectful if he was not called on. He enjoyed talking and answering questions and constantly shouted out answers to questions instead of raising his hand before speaking.

Student 6 was very similar to Student 1. Student 6 often became very frustrated and yelled if he could not answer questions. He often told other students they were “stupid” or “dumb” if they could not figure out the answer to a math question as quickly as he could. Student 6 received 3 office disciplinary referrals during the baseline phase because of his

disrespectful comments. He also typically said the answers to questions out loud as soon as he figured them out instead of waiting for the teacher to call on him for a response.

Student 7 loved math and was very eager to come to class every day. If Student 7 did not raise his hand, he was working on problems in his notebook. He allowed other students the chance to participate but was typically the first one to raise his hand if he saw that nobody else knew the answer.

Before beginning the intervention, Student 8 required one-on-one instruction after the teacher finished giving group instruction in order to complete her assignments. She frequently did not understand how to solve any of the problems, and all of the math concepts seemed brand new to her after each direct instruction session. While she sometimes raised her hand to participate during group instruction, when she was called on, her response was typically a random fact instead of answering the question.

Student 9 was another neurotypical student. He participated frequently in class but was never upset if he was not called on.

Student 10 had a persistent difficulty with talk-outs. He frequently told other students what to do. Student 10 understood the math concepts that were taught and participated during class instruction. Many students became frustrated with Student 10 very quickly because of his constant talk-outs with movie quotes, song lyrics, or reprimands of other students.

Student 11 was very similar to Student 9. Student 11 was very shy but still participated in class because he knew it was an expectation. Most times Student 11 participated, he would get the correct answer and did not seem to struggle in math. He was always eager to get to independent work and received good grades on his independent work assignments.

Setting

The study was conducted in a charter school specializing in teaching children with autism spectrum disorder, kindergarten through eleventh grade. A classroom teacher and paraeducator work in each classroom to provide a smaller teacher-to-student ratio. According to the 2017 Demographic Report provided by the Utah State Board of Education (2017), there were 551 total students enrolled in the school and 84% of all students had disabilities. The study took place in a fifth grade classroom during the math instruction period.

The first author, who is also the classroom teacher, implemented the intervention. The classroom teacher taught math instruction to the students for six months prior to the study period. The teacher had 3 years of classroom teaching experience and a bachelor's degree in special education, mild-to-moderate disabilities. The classroom also had the same paraeducator in the class every day to provide support in the classroom. The paraeducator worked in the classroom for three months prior to the study period. On the days that the classroom teacher was not in attendance during math instruction, the paraeducator was in charge of the intervention while a substitute teacher provided direct instruction in math. The creator of the intervention, the second author, trained the classroom teacher who then trained the paraeducator how to implement the intervention with fidelity.

Dependent Variables

Three indications of student participation were collected for analysis: talk-outs, attempted participation (hand raises), comments. A fourth variable, opportunities to respond, was collected from the teacher's observed behavior to allow for analysis of participation rates.

Talk-outs. Talk-outs are defined as any vocalizations (e.g., questions, answers, other thoughts) that are loud enough to be heard on video recordings of class sessions that are made

during direct instruction sessions and that were made without first being called on by the teacher. Talk-outs may occur with or without the students raising their hands. The defining characteristic of a talk-out is that the teacher has not called on (given permission for) the student to speak.

Attempted participation. Attempted participation is defined as any time a student raises his or her hand and waits to be called on before speaking. Hands raised and maintained beyond the level of the table were counted as a single attempt. If the hand was dropped to table level before being called on, and raised again, a new attempt was recorded.

Comments. A comment is defined as any vocalization a student made after being called on (given permission to speak) by the teacher. A comment might include an answer to a question asked by the teacher, a question posed by the student, or any other vocalization that a student makes once he or she has been called on by the teacher.

Opportunities to respond. Opportunities to respond are defined as any question, statement, or gesture given by the teacher that requires a response from a student. For the purpose of this study, opportunities to respond did not include any question that required a choral response.

Research Design

A multiple single subject A-B-A-B reversal design was used. Baseline data (phase “A”) were collected for six sessions before the intervention began. The first day of baseline data collection was not analyzed to allow all students to become accustomed to the presence of video recorders in the classroom, which resulted in five sessions of baseline data. The teacher then implemented the intervention (phase “B”) for seven sessions. After intervention participation levels were established for seven sessions, the intervention was withdrawn for two sessions. After only two sessions of generalization, the teacher noticed significant increases in problem

behaviors (i.e., talk-outs and excessive or reduced participation rates) and re-introduced the intervention. Data were collected for three more class sessions where we again implemented the intervention before the end of the school year.

Data Collection

Baseline data were measured during direct instruction sessions in math for a minimum of seven sessions, with data analyzed for the last six. Two video cameras were used to record class sessions. Each camera filmed from a different angle, allowing for all students to be visible during instruction. Both video recordings were coded to allow for accurate and reliable data collection across all participants. Cameras were placed at the back and side of the classroom to reduce intrusion and to minimize reactivity to the cameras. Some participants ($n = 6$) were previously exposed to the use of cameras in the classroom during data collection of pilot videos for reliability coding purposes. Videos produced were subsequently viewed and coded by graduate and undergraduate research assistants who had reached reliability (3 consistent sessions with $\geq 80\%$ group consensus scores) on videos of classroom behavior during direct instruction of a different topic.

Group level data. A frequency count of the number of opportunities for students to respond was calculated on the overall opportunities given by the teacher in each session. Opportunities delivered to the group as well as to individuals were recorded. A frequency count was also calculated on the total number of talk-outs made by any student during each session. Because talk-outs could be heard, but no visual signals (hand raises) were given, it was not possible for coders to reliably assign talk-outs to individuals.

Individual level data. Data were collected on the number of hand raises (attempts to participate) and comments (talking after receiving permission from the teacher) made by each

student. After data were collected, a hand raise percentage was calculated according to the following formula:

$$\frac{\text{number of hand raises made by student during the session}}{\text{total number of opportunities to respond during the session.}} = \text{attempt rate}$$

Although collected, the rate of comments was not analyzed here. Because comments could only be recorded if the teacher called on the student to answer a question, the confound of teacher behavior was deemed to be significant.

Baseline Phases

A token economy using classroom points for classroom dollars was in place prior to and throughout the intervention. During the baseline phase, the class session was conducted in the same manner as it had been for the previous six months. Students entered the classroom and completed a few review problems before whole group instruction began. Once group instruction began, the students had many different opportunities to respond. The teacher held a clipboard with each student's name on a piece of paper. Every time a student participated, a point was given to that student by the teacher marking a tally on that sheet. At the end of class, all points were redeemed for class dollars. Class dollars were subsequently redeemed for prizes once a week, at a time previously determined by the teacher.

Intervention Phases

After baseline levels were established, the teacher introduced and began the intervention. Each student received a stack of cards (slips of colored paper) on their desk at the beginning of the math class period. Each student received 10 cards in total, but the stack of cards included two different colors. One color was designated as the "KEEP" cards while the other color was designated as the "USE" cards. The color of the cards changed every day, but students were

informed which color was for KEEP or USE. The colors changed frequently to promote generalization and reduce behavioral association of value with any particular color (some students had strong color preferences and aversions). Students wrote their names on each of their cards at the beginning of the session to facilitate recording of points as part of the intervention.

The teacher and classroom paraeducator met to discuss the ratio of cards that each student was to receive. The target participation rate range that was considered to be “balanced” participation was defined as the average class participation rate during the baseline phase plus or minus one standard deviation. Students whose baseline attempted participation average *exceeded* this range received 6 KEEP cards and 4 USE cards (incentive to reduce participation attempts to a more balanced level). Students whose baseline attempted participation average was *below* the targeted range received 4 KEEP cards and 6 USE cards (incentive to increase participation attempts to a more balanced level). Students whose attempted participation percentage average was within the target range received 5 KEEP cards and 5 USE cards (balanced participation attempts). Students were instructed to write their name on each card and leave them at their desk during direct instruction.

All information about the intervention was explained to students prior to the beginning of intervention. Students were told that USE cards would be worth bonus points in the token system if they waited to be called on before talking during direct instruction. These points were in addition to the regular participation point system already in place. Talk-outs would result in a USE card being taken without a bonus point or participation point, however, and the only consequence of talk-out behavior was this opportunity cost. KEEP cards could earn bonus points if kept until the end of the direct instruction session. For each comment or talk-out made after all

of a student's USE cards were gone, a KEEP card was forfeited as an opportunity cost. All KEEP cards kept until the end of the instruction session were redeemed for bonus points. Participation points were tallied as usual for all comments sanctioned by the teacher (by calling on the student).

When the direct instruction session began, any student who raised his or her hand and waited quietly until they were called on by the teacher before making a comment had a USE card removed from their desk by the paraeducator. That student also received a participation tally on a chart held by the teacher (as usual). If the teacher asked a question for the entire class to answer together (i.e., a choral response), nobody had a card collected from their desk and no points were given on the chart. If a student talked out during direct instruction, the paraeducator took a USE card from their desk and threw it away. The student did not receive a tally on the participation chart held by the teacher because participation was not sanctioned by the teacher. When a student had used or forfeited all of their USE cards, the student had to choose if he or she would like to continue making comments and/or talking out or sit quietly for the remainder of the class session. If students chose to continue to comment or talk out, a KEEP card was taken from their desk for each occurrence, but a tally for participation with permission was still recorded on the chart as the usual reinforcement for participation. The bonus points for the KEEP card were forfeited, however.

If a student used all USE cards in a session, he or she had to continue to pay attention to the teacher for the duration of the class period. A student who was paying attention was defined as having their eyes on the teacher and not participating in other activities. If a student stopped paying attention (e.g., began to draw, played with a toy at their desk, laid their head down, slept)

they were called on by the teacher to respond and a KEEP card was taken from their desk, even if they did not provide a verbal response.

At the end of the class period, any KEEP cards that remained on the student's desk were turned in and redeemed for 2 bonus points or class dollars (vs. earning only 1 point for participation as usual for making comments with permission). This meant that any student who continued to make comments or talk out when their USE cards were gone were forfeiting 2 bonus points at the end of the class period for each occurrence until their KEEP cards were gone. Any extra USE cards remaining on students' desks after direct instruction were thrown away and not redeemable for any points or dollars. The students redeemed all points on the clipboard for dollars as well as any bonus points they earned from leftover KEEP cards at the end of each class period. The dollars were redeemed for prizes weekly during a time that had been previously been set aside by the teacher. The intervention was repeated the next day in the same manner.

Intervention Data Collection

Intervention data were collected and analyzed in the same manner as baseline data. The same attempted participation percentages and comment percentages were calculated for each student each day. Along with individual student data, the total number of opportunities to respond given by the teacher were recorded. The total number of talk-outs made by all students was recorded for each class session.

Interobserver Agreement

All data were coded on the data recording sheets previously referred to before being entered onto electronic data spreadsheets. All data were double entered to ensure accuracy. All class sessions were coded by at least two coders. The data were considered reliable and analyzed if the number of total data fields minus discrepancies (agreements) divided by the total number

of data fields (agreements + disagreements) was more than 80%. Once all data were considered reliable, random selection was used to decide which data set (of the two raters) was included in the analysis for each participant.

Social Validity

Parents could not be interviewed to determine social validity because they were not in the classroom during instruction. Students were also not formally interviewed regarding social validity because of possible confounds related to the condition of autism. Children with autism have difficulties with seriation that may make responses on a standard Likert-type scale unreliable (Yirmiya & Shulman, 1996). Instead, any comments about the intervention made by the students while videos were being recorded were used to determine social validity. The following comments were all made while videos were being recorded: Student 1 said he loved the intervention because “it was so easy to know when to talk and when to let somebody else talk;” Student 5 often asked when he first arrived to school in the morning if we were going to play the “card game” that day; on the first withdrawal day, students were told (once the videos began recording) that they would not be playing the “card game” today, and many students complained saying that they missed the game.

Other anecdotal data were collected by the classroom teacher to determine social validity. Along with the student comments in the math class, participants began asking to use the intervention in other classes. At the school, students moved among classrooms for different subjects and asked in their language and science classes if they could also play the “card game” they had been playing during math instruction. Teachers from other classes in other grades began asking the math teacher if they could learn how the “card game” worked because they kept hearing students ask about it.

Results

Interpretation of results is organized according to three groups of students as follows: (a) those who displayed rates of participation during baseline that were more than one standard deviation above the class average (High); (b) those who displayed minimal rates of participation during baseline, at least one standard deviation below the class average (Low); and (c) those who displayed levels of attempted participation within one standard deviation of the classroom average participation rate during the baseline phase (Balanced). The intervention also aimed to lower the number of talk-outs made by the students during math instruction. These results are also shown.

Students with High Rates of Participation

This study lowered the percentage of attempted comments by students with excessive participation rates to be more consistently within the target range of “average” verbal participation. Students with excessive participation rates were defined as anybody who attempted (raised their hand) more than one standard deviation above the class average (above 55%). When the intervention phase began, all three students with excessive participation rates were given a KEEP:USE card ratio of 6:4 to encourage a lower percentage of attempted comments. Results for these participants are shown in Figures 1-3.

Student 1. Student 1 displayed very high percentages of attempted comments during baseline data collection sessions. Figure 1 shows the graph of the percentage of opportunities to respond that were attempted by Student 1 during all data collection sessions.

Student 1 showed a downward trend during the baseline phase, including two days of maximum (100%) attempted participation. When the intervention phase began, Student 1 had a dramatic change in level but maintained more than 18% attempted participation. Student 1 was

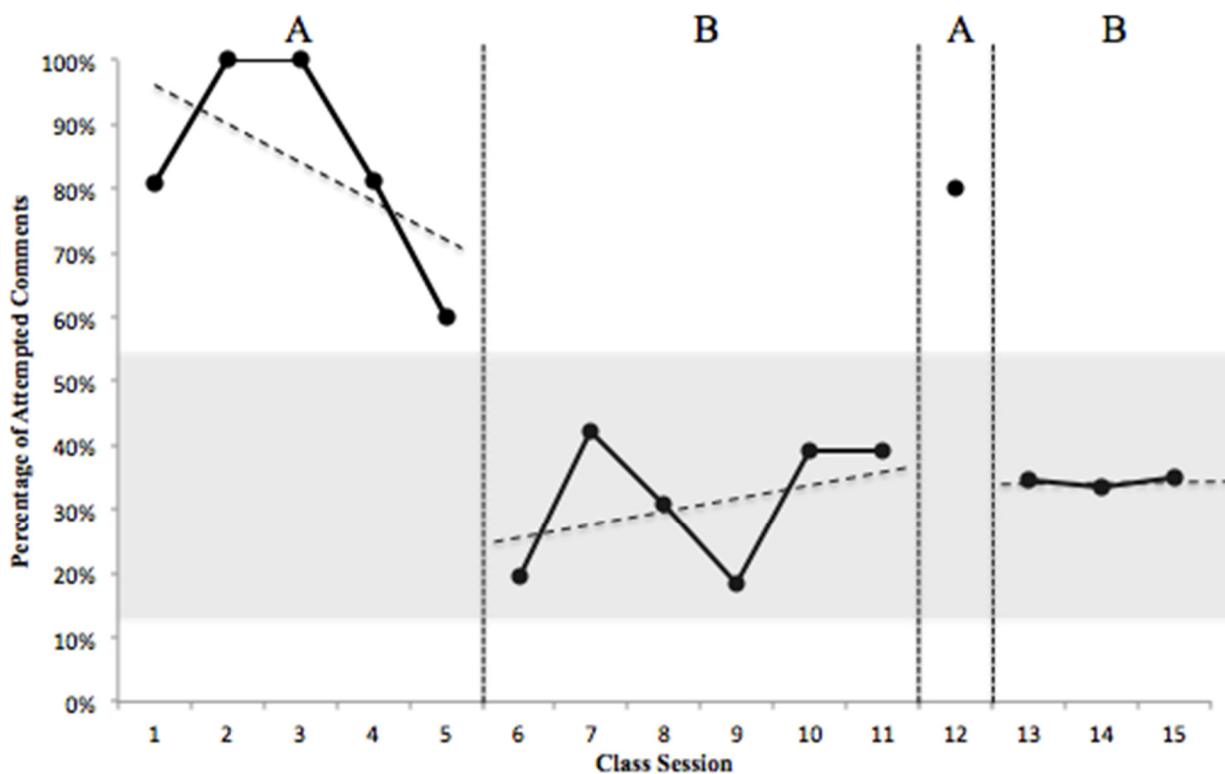


Figure 1. Student 1 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

absent on the first day of withdrawal, but on the second day he attempted 80% of all opportunities given by the teacher without intervention. When the intervention returned, Student 1 had a very stable trend with minimal variability. All of the data points during intervention phases for Student 1 fell within the target range.

Quantitative analysis is consistent with visual inspection of the data. Student 1 attempted to comment an average of 84% of opportunities to respond with a standard deviation of 16% during baseline. Once the intervention phase began, Student 1 lowered his average of attempted comments to 32% with a standard deviation of 10%. During the six intervention data collection sessions, the highest percentage of attempted comments by opportunities to respond was 42%. During the intervention phase, Student 1 did not receive any office referrals for disrespectful behavior.

On the one day he was present during the return to baseline (withdrawal phase), Student 1 again struggled with shouting out and often shouted out the answer to the question posed by the teacher before another student could answer. When the intervention phase returned, Student 1's attempts to comment averaged 35% of all opportunities to respond across the data collection sessions with a standard deviation of only 1%. After the intervention was restarted, the shouting-out behaviors once again decreased. On multiple occasions, Student 1 was observed to silently mime to other students to raise their hands so they could also participate and get rid of their USE cards.

Student 5. Student 5 had a highly variable baseline phase with a downward trend that continued to trend down during the intervention phase (see Figure 2). On the first day of intervention, Student 5 attempted over 90% of all opportunities given by the teacher. However, during the other 6 sessions of the first intervention phase, Student 5 attempted between 20% and 55% of all comments, which was the target range. Student 5 immediately increased his attempted participation on the first day the intervention was withdrawn. Student 5 showed consistently high participation on the first session of each phase, then more balanced or average participation rates subsequently.

Quantitative analysis is consistent with visual inspection of the data. Student 5 had an average baseline attempted participation rate of 67% with a standard deviation of 19%. Student 5 had one session of 100% attempted participation with two sessions of 50% attempted participation. Once intervention started, Student 5 began the first session of the intervention phase with 90% attempted participation. On the first day of intervention, Student 5 quickly went through all of his USE cards before realizing he needed to pace himself. The second session in the intervention phase, Student 5 lowered his attempted participation percentage to only 39%.

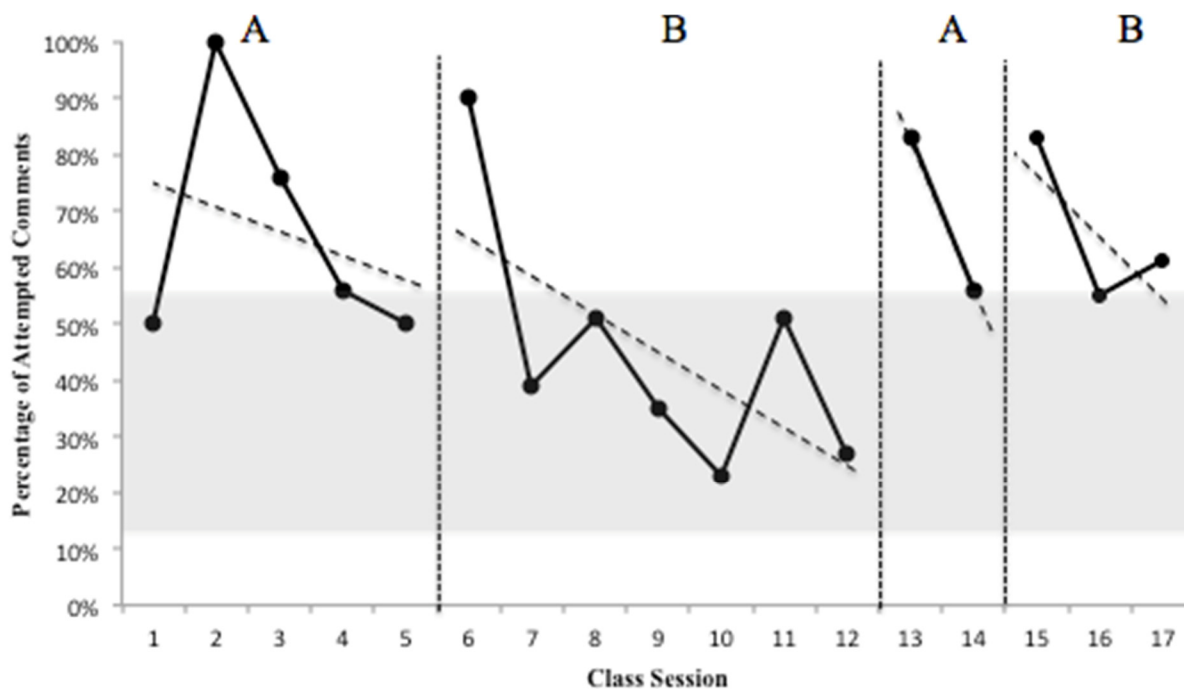


Figure 2. Student 5 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

Including the first session of intervention, Student 5 averaged 45% attempted participation with a standard deviation of 23%. However, excluding the first day of intervention, Student 5 averaged 38% attempted participation with 12% standard deviation. On the return to baseline, Student 5 went back up to 83% attempted participation. Finally, when the class returned to the intervention condition, Student 5 averaged 66% attempted participation with 15% standard deviation.

On the first day of the intervention, Student 5 had to give up two of his KEEP cards as he continued to make comments after his USE cards were gone. When it was time to add up all bonus points at the end of the class, he was frustrated that he didn't have more bonus points. After that, he learned to "budget" his USE cards throughout the lesson instead of using them all at the beginning of the lesson. The intervention also helped him learn to wait until he was called

on to speak instead of talking out. He only had to give up a KEEP card one other time during the intervention phases.

Student 6. Student 6's participation behavior was very similar to Student 1. Student 6 had high percentages of attempted participation during the baseline phase and had one session with 100% attempted participation as he re-adjusted to intervention again. Figure 3 shows all attempted participation percentages for Student 6.

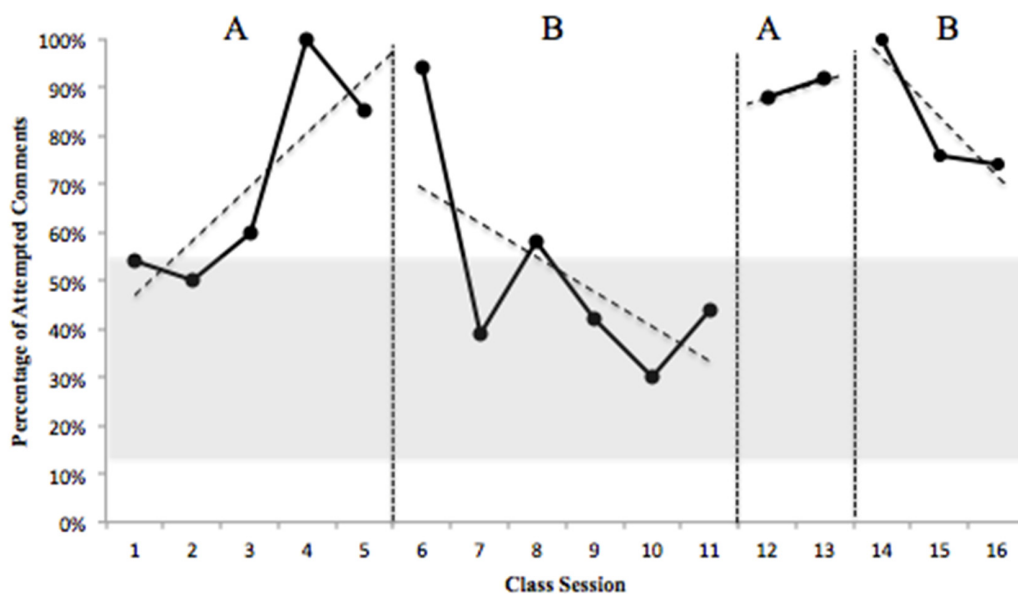


Figure 3. Student 6 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

Student 6 had a very steep increasing trend during the baseline phase. Once the intervention started, we observed a steep downward trend of his attempted participation. Except for the first class session of the intervention phase, Student 6 did not have a lot of variability and stayed within the target range until the withdrawal phase, then had continued difficulty re-adjusting to the intervention following withdrawal, but participating was trending downward toward the target range after 3 sessions.

Quantitative analysis is consistent with visual inspection of the data. Student 6 showed a steadily increasing trend of attempted participation during the baseline phase. He averaged 70%

attempted participation with a standard deviation of 22%. Once the intervention phase began, Student 6 rapidly started lowering his attempted participation but still never attempted fewer than 30% of all opportunities to respond. Although Student 6 was absent after the fifth session during the intervention phase, he was present for six other class sessions. His mean attempted participation percentage during the intervention phase was 51% with 21% standard deviation. Besides the first day of intervention when Student 6 attempted 94% of all opportunities to respond, his highest attempted participation percentage during the intervention phase was 58%.

After the intervention began, Student 6 no longer called other students “dumb” and “stupid” when they could not answer a question quickly. During the intervention phase, Student 6 did not receive any office discipline referrals for disrespectful comments. When the class returned to baseline, Student 6 soared back up to 88% and 92% attempted participation in consecutive class sessions. When the intervention was brought back, Student 6 exhibited another high day of attempted participation, raising his hand for 100% of the opportunities to respond. After the first session back to the “B” or intervention condition, Student 6 lowered his attempted participation to 76% and 74% consecutively.

Students with Low Rates of Participation

The study also aimed to identify whether the intervention would increase the number of attempted comments made by students with low verbal participation rates. Students with low verbal participation rates were defined as any student who attempted less than 16% of opportunities to respond across all baseline data sessions (defined as more than one standard deviation below the class average participation rate at baseline). When the intervention phase began, all students with low verbal participation rates were given a KEEP:USE card ratio of 4:6 to encourage more participation.

Student 2. Student 2 initially displayed low verbal participation rates until the intervention began. Figure 4 shows the graph of the percentage of opportunities to respond that were attempted by Student 2.

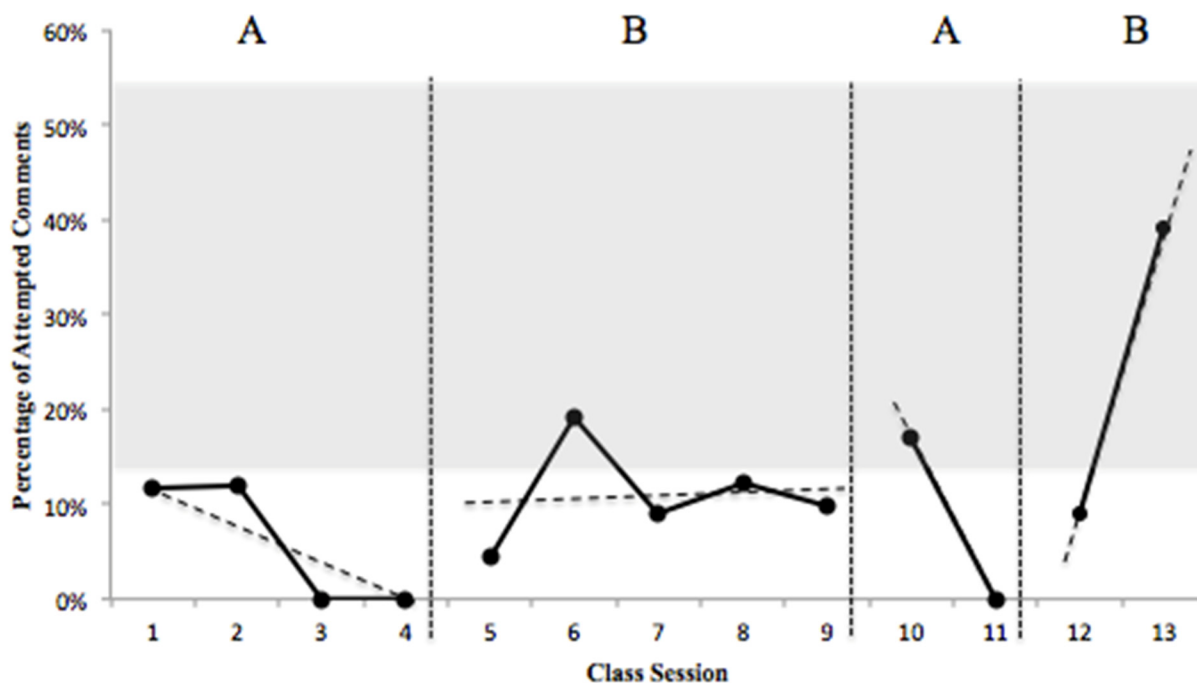


Figure 4. Student 2 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

During baseline phase, Student 2 had a downward trend that included two class sessions with 0% attempted participation. Once the intervention began she had a very stable trend with small amounts of variability. While she did not rise to the level of the target range, she did increase the level of her trend line to just below the target range. During the withdrawal condition, Student 2 again lowered her attempted participation. When the intervention returned, she showed her highest participation rate, with a steep upward trend.

Quantitative analysis is consistent with visual inspection of the data. Student 2 attempted only 5.8% of opportunities to respond during baseline data collection. It is important to note that Student 2 was absent one of the five baseline data collection sessions. On two of the four

baseline data collection sessions that Student 2 was present for, Student 2 attempted 0% of all opportunities to respond, meaning she never raised her hand to participate during the math instruction period. Once the intervention phase began, Student 2 attempted an average of 10.9% of all opportunities to respond. During the five intervention sessions for which Student 2 was present, she attempted to participate at least once in each session and did not have any days of 0% attempted participation. When the class returned to baseline, Student 2 experienced another day with 0% attempted participation during class. After the class returned to the intervention, Student 2 again participated at least during every class session and attempted an average of 24.1% of all opportunities to respond, with a 40% participation rate on the last day of intervention. When the intervention began, Student 2 held on to the cards and would not let go of them. She used them as a sort of fidget for her hands and folded and rolled the paper cards. Teacher observation indicated that this small movement was enough to keep her busy and she appeared to be able to stay focused on the teacher's instruction.

Student 4. Student 4 was another student who averaged fewer than 16% attempted participation across all baseline sessions. Figure 5 shows the attempted participation percentage for all class sessions for Student 4.

Student 4 had a very stable trend during the baseline phase with limited variability. Once the intervention phase started, he had a minimal increase in level, though the trend was still sloping down. Student 4 had three class sessions where his attempts to participate were within the target range before dropping back down to lower levels. Some participation near the average range was observed during withdrawal phase, and participation dropped to the lowest levels with the return to intervention.

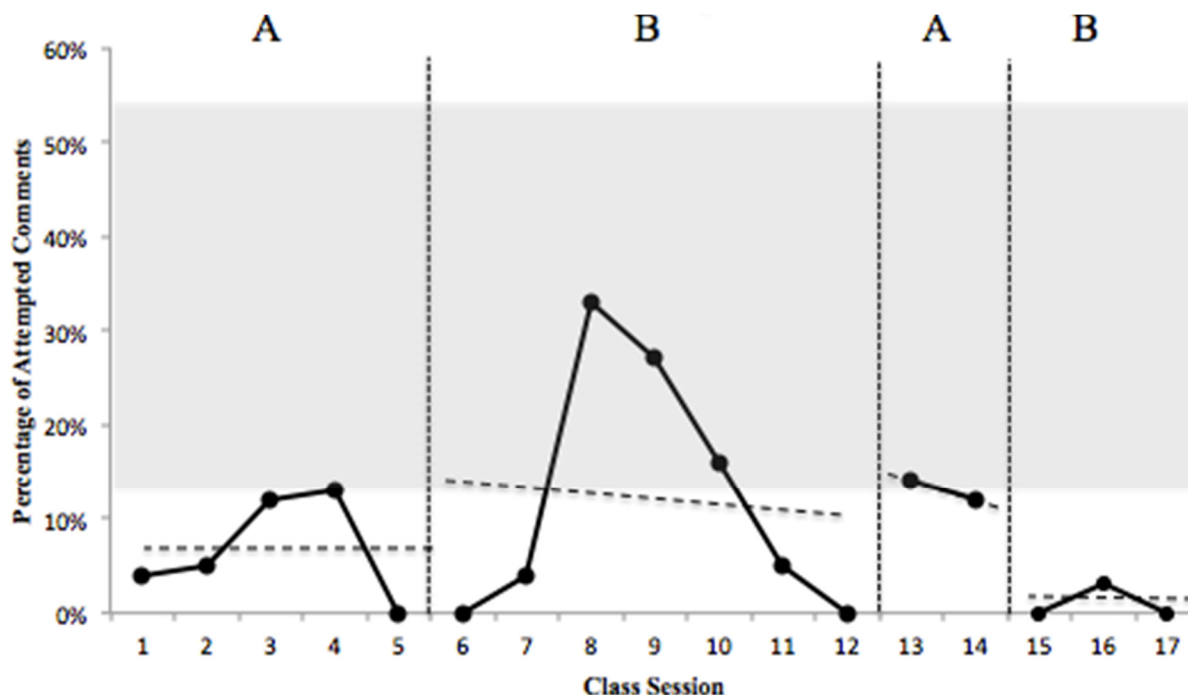


Figure 5. Student 4 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

Quantitative analysis is consistent with visual inspection of the data. During the baseline phase, Student 4 averaged only 7% of all opportunities to respond with a standard deviation of 6%. The last day of the baseline phase, Student 4 attempted 0% of all opportunities to respond. On the first day of the intervention, Student 4 did not attempt to participate at all. He did not raise his hand once during the lesson. However, the next day he attempted 4% of the opportunities to respond and the third day of intervention he raised his hand for 33% of all opportunities given by the teacher. By the end of the third session of the intervention phase, Student 4 appeared to be more comfortable with raising his hand in class and volunteering to answer questions. However, after only three class sessions, Student 4 stopped raising his hand as frequently and his attempted comment percentage dropped again. On the final intervention session, Student 4 attempted 0% of all opportunities to respond. His mean percentage of attempted participation during the intervention phase was only 12% with a standard deviation of

13%. Student 4 attempted 14% and 12% consecutively during the withdraw phase. When we returned to intervention, he had two more class sessions with 0% attempted participation.

Student 8. Student 8 also had 20% or lower attempted participation during all baseline class sessions. Figure 6 shows her attempted participation for all class sessions.

Student 8 showed an increasing trend during the baseline phase that continued to increase during the intervention phase. However, when the intervention phase began, the slope of the trend increased. During the intervention phase, all of the data points for Student 8 fell within the target range.

Quantitative analysis is consistent with visual inspection of the data. Student 8 averaged 14% attempted participation across the baseline phase with 6% standard deviation. She had one session where she raised her hand for only 5% of all opportunities to respond. Before the intervention began, the teacher reported that Student 8 often had homework to do because she did not pay attention during whole group instruction and needed a lot of individualized instruction after the group instruction ended. This would not leave her with enough time to complete her assignments in class. During the intervention, Student 8 doubled her mean percentage of attempted participation and was averaging 28% with a standard deviation of 9%. She had one class session where she raised her hand for 41% of all opportunities to respond. Once the teacher withdrew the intervention, her attempted comment percentage lowered to only 2% and 4% consecutively.

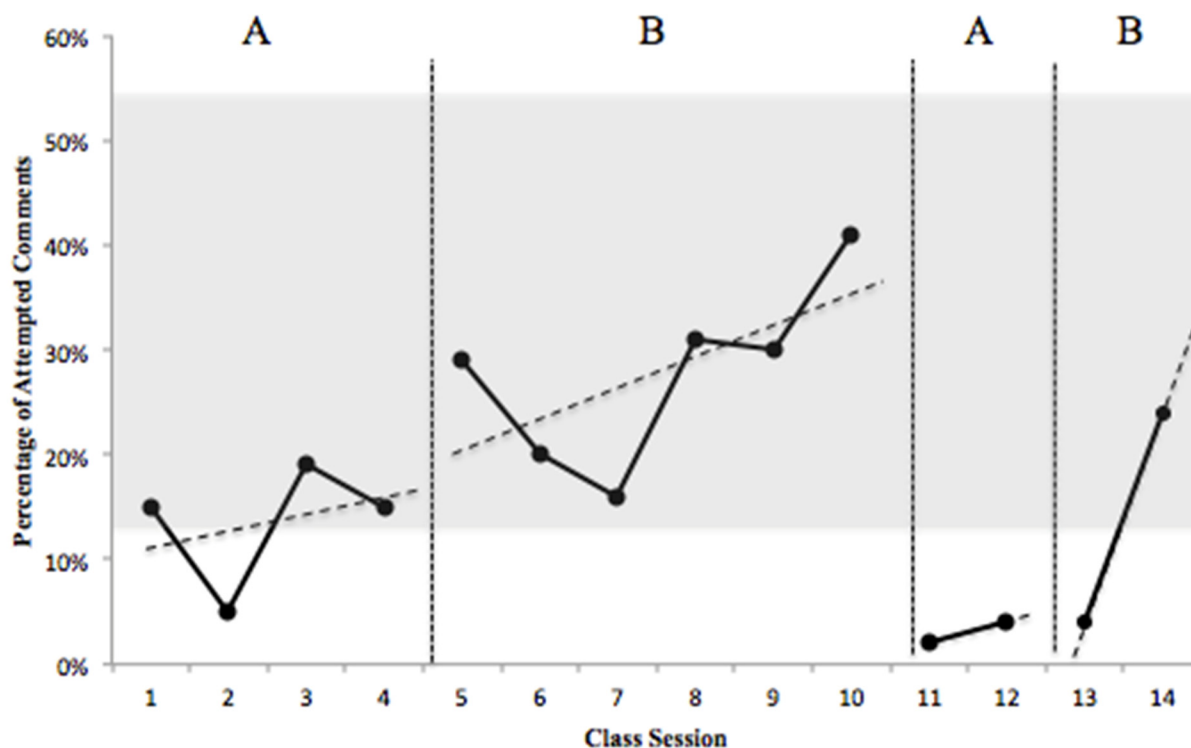


Figure 6. Student 8 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

The first day the intervention was brought back, Student 8 only attempted 4% of all opportunities to respond, but the next session the attempted comment percentage was raised to 24%. During the intervention phases, according to teacher report, she was able to complete more work during the class period because she had paid attention during group instruction, which resulted in less homework.

Students with Balanced Participation

Five students did not meet the qualifications for either high rates of participation or low rates of participation. These students had baseline attempted participation rates that varied from low to high across class sessions but were within the target range of the class average most of the time.

Student 3. Student 3 started the study with low rates of participation that grew throughout the baseline phase. Figure 7 shows all attempted participation percentages for Student 3. During the baseline phase, Student 3 had a steep increasing trend with participation percentages that ranged from 19% to 75%. As soon as the intervention began, Student 3 began a steep downward trend of attempted participation. When the withdrawal condition began, Student 3 continued the downward trend for two more class sessions. However, when the intervention was returned Student 3 again increased her attempted participation and showed a dramatic change in level.

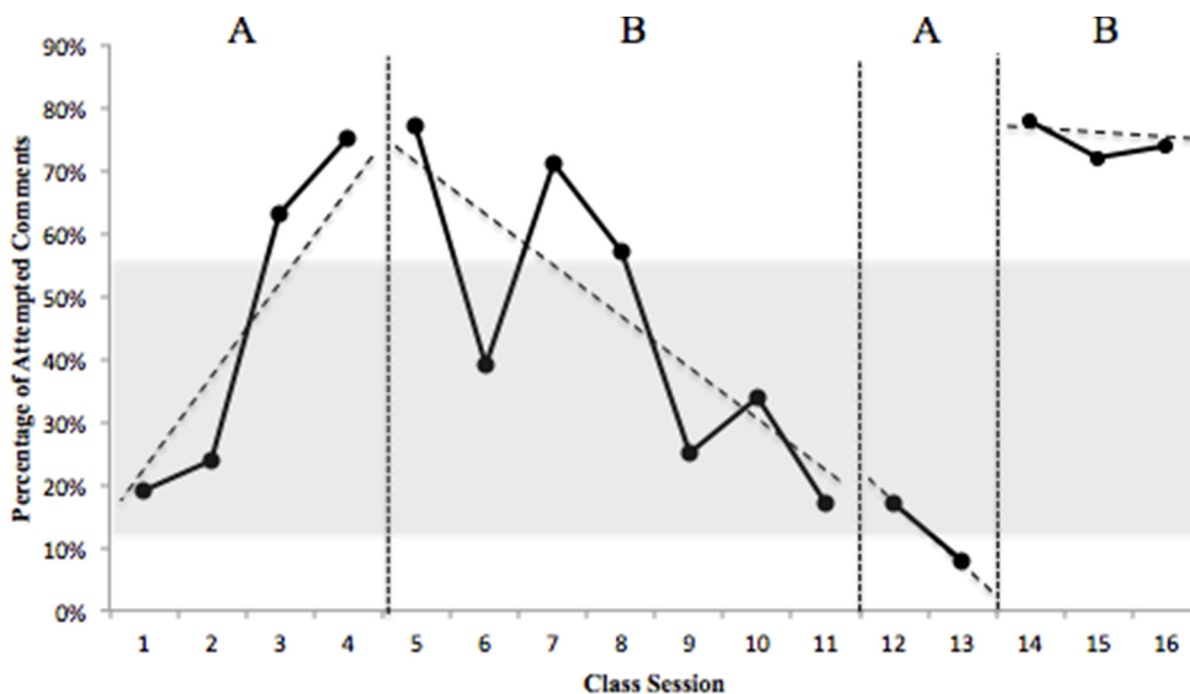


Figure 7. Student 3 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

Quantitative analysis was consistent with visual inspection of the data. Student 3 started the baseline phase with only 19% attempted participation. However, she steadily increased her attempted participation and ended the baseline phase with 75% attempted participation. Her overall mean baseline percentage of attempted participation was 45% with a standard deviation

of 28%. On the first session of intervention, Student 3 raised her hand for 77% of all opportunities to respond given by the teacher. After the first session, she slowly decreased her attempted participation and ended the intervention phase with attempting 17% of all opportunities to respond. Her average intervention attempted participation was 46% with a standard deviation of 23%. While this average is very close to her baseline attempted participation mean, it is important to note that the trend was increasing during baseline phase, but decreasing during the intervention phase. When the intervention was withdrawn, Student 3 attempted 17% and 8% of all opportunities to respond, which continued her downward trend from the intervention phase. As soon as the intervention returned, Student 3's participation increased dramatically and stabilized somewhat at a high level as she attempted 78%, 72% and 74% participation on three consecutive class sessions.

Student 7. Student 7 also did not qualify for the high or low rate of attempted participation groups. Figure 8 shows all attempted participation percentages for Student 7.

Student 7 had a highly variable baseline phase with an upward trend, with attempted participation that ranged from 4% to 64%. During the baseline phase, Student 7 had only two class sessions where his attempted participation percentage fell within the target range. During the intervention phase, Student 7 showed a stable trend with a shallow upward slope. Student 7 was able to stay within the target range of attempted participation for six of the seven intervention sessions. During the return to intervention phase, Student 7 showed a small downward trend.

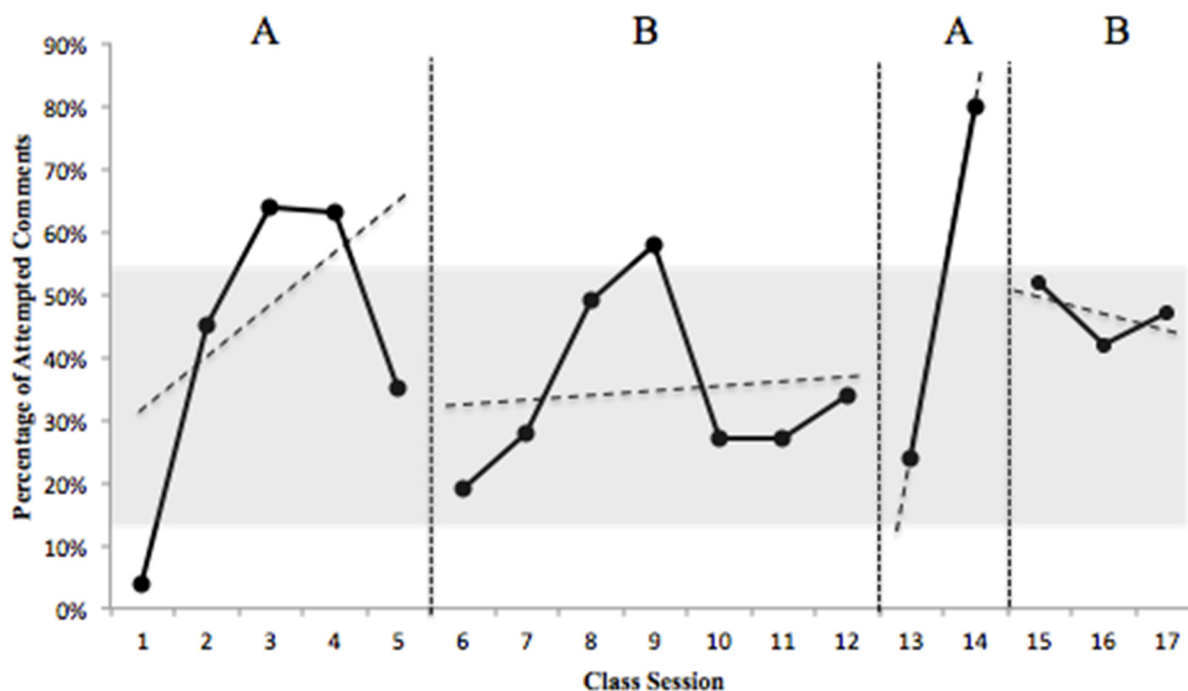


Figure 8. Student 7 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

Quantitative analysis is consistent with visual inspection of the data. Besides the first day of baseline when Student 7 attempted only 4% of all opportunities to respond, he attempted more than 30% of all opportunities to respond during the following four class sessions. His mean attempted participation percentage for the baseline phase was 42% with a standard deviation of 25%. During the intervention phase, Student 7 had an average attempted participation percentage of 35% with a standard deviation of 14%. He had a high of 58% attempted participation and a low of 19% attempted participation. Once the intervention was withdrawn, Student 7 again increased his attempted participation quickly with 24% on the first class session and 80% on the second class session. When the intervention was returned, Student 7 averaged 47% attempted participation with 5% standard deviation.

Student 9. Student 9 had varying attempted participation during the baseline phase between 15% and 60% (see Figure 9). Student 9 showed high variability during the baseline and

intervention phases. During both phases he showed a steep upward trend but stayed within the target range, except for one class session when he attempted 60% of all opportunities to respond. He maintained average participation during the withdrawal phase and showed higher than average participation rates when returned to the intervention condition.

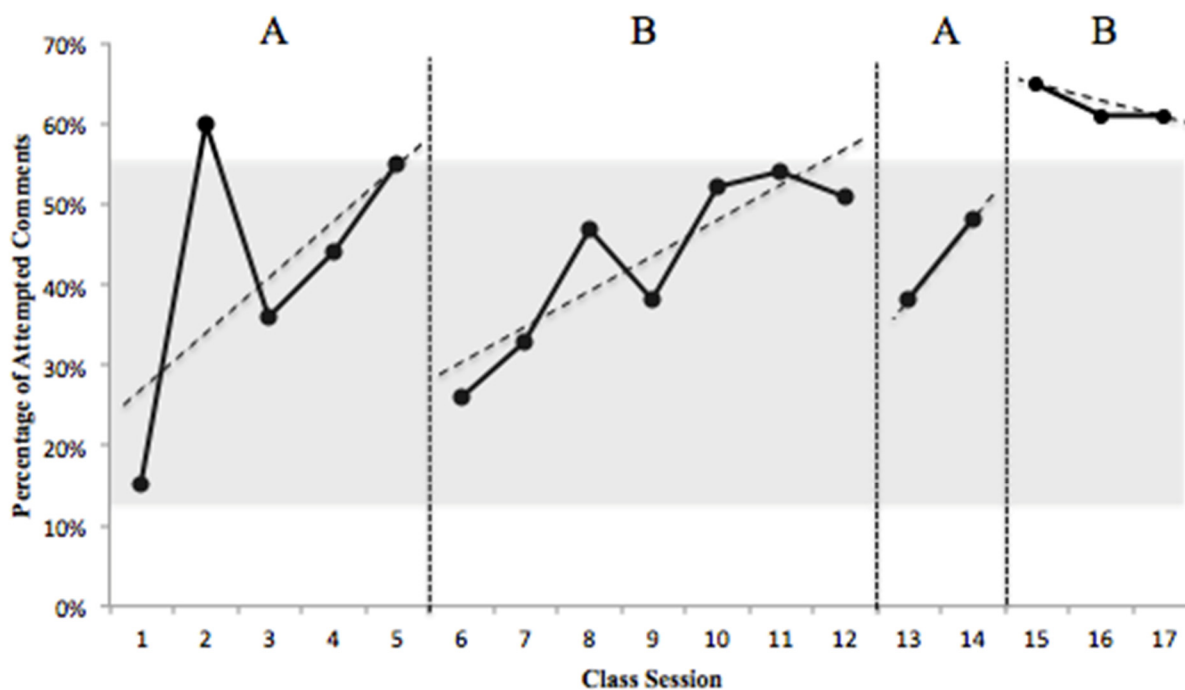


Figure 9. Student 9 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

Quantitative analysis is consistent with visual inspection of the data. Student 9 had a mean rate of 42% attempted participation with a standard deviation of 18% during baseline phase. He had a strong upward trend during baseline, which continued during intervention. When intervention began, his mean attempted participation was 43% with a standard deviation of 11%. During the intervention phase he never attempted less than 25% of all opportunities to respond. His highest session of intervention was session six when he attempted 54% of all opportunities to respond. When the class returned to baseline he attempted 38% and 48%

participation on consecutive days. On the return to intervention, he had a mean attempted participation rate of 62% with a standard deviation of 2%.

Student 10. Student 10 showed high variability during the baseline and intervention phases. Figure 10 shows all percentages of attempted participation for Student 10.

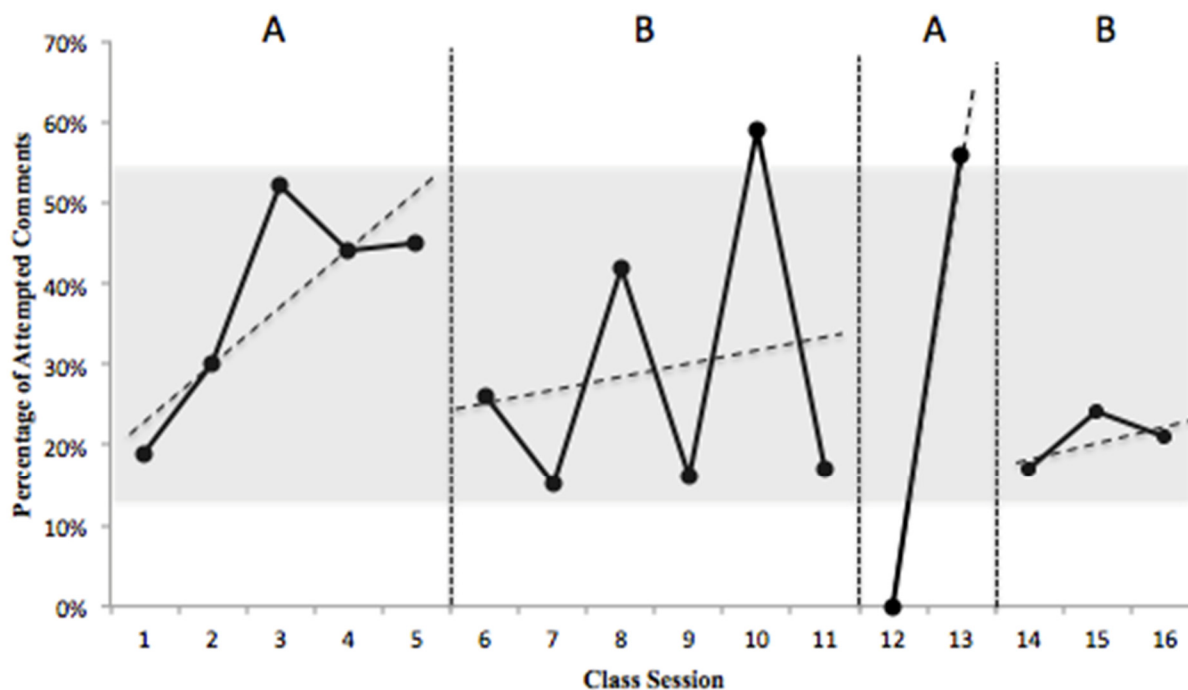


Figure 10. Student 10 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

During the baseline phase, Student 10's attempted participation fell within the target range although it showed a strong upward trend. Once the intervention phase began, Student 10 showed extreme variability with a small upward trend. Except for one class session when Student 10 attempted 59% of all opportunities to respond, he attempted participation that fell within the target range. More variability was seen in the withdrawal phase, with one day of 0% participation. Participation in the return to intervention phase was the most stable and remained within the average range.

Quantitative analysis is consistent with visual inspection of the data. Student 10 began the baseline phase with 19% attempted participation. He averaged 38% attempted participation with a standard deviation of 13% during the baseline phase. When the intervention began, Student 10's participation attempts were highly variable. He had a mean attempted participation percentage of 29% with 18% standard deviation. When the intervention was withdrawn, he attempted 0% and 56% of opportunities to respond on consecutive sessions. During the return to intervention phase he averaged 21% with a standard deviation of 4%.

Student 11. Lastly, Student 11 did not meet the requirements for a high or low rate of attempted participation as he had varying amounts of participation. Figure 11 shows all percentages of attempted participation for Student 11.

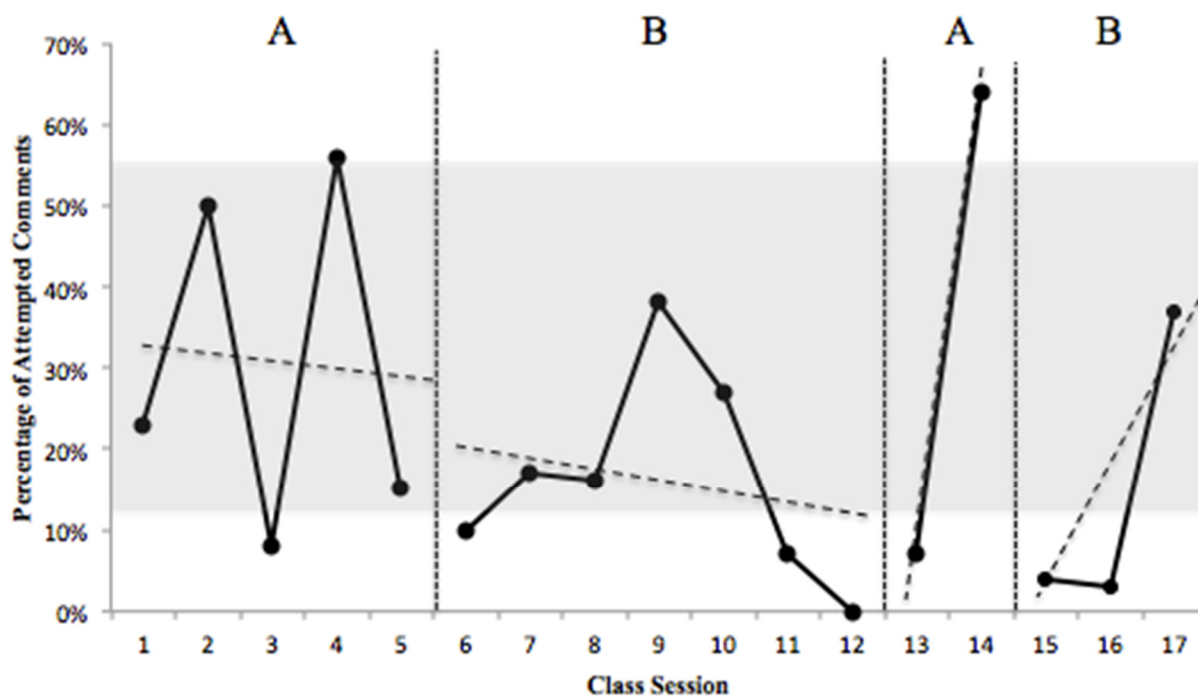


Figure 11. Student 11 percentage of attempted participation. Gray box indicates one standard deviation above and below class mean participation rate during baseline.

During the baseline phase, Student 11 showed high variability with a small downward trend. There were no immediate effects when the intervention phase began, however the level of

the trend dropped slightly. On the second day of the withdraw phase, Student 11 had a steep increase in attempted participation and attempted 64% of all opportunities given by the teacher. Returning to the intervention condition, he continued to show high variability, but returned to the target range by the last day of intervention.

Quantitative analysis is consistent with visual inspection of the data. Student 11 had a mean of 30% attempted participation during the baseline phase with a standard deviation of 21%. His lowest participation in a class session during baseline was the third session where he attempted only 8% of all opportunities to respond. The next session he recorded his highest percentage of attempted participation which was 56%. During the intervention phase, he averaged 16% attempted participation with a standard deviation of 13%. On the two withdrawal sessions, he went from 7% attempted participation on the first session to 64% attempted participation on the second session. When the intervention was returned, Student 11 attempted an average of 15% of all opportunities to respond with a stand deviation of 19%.

Lowering the Number of Talk-Outs

The total number of talk-outs made by all students was collected during each direct instruction session, including baseline, intervention, return to baseline, and return to intervention. Figure 12 shows the number of talk-outs made by all students during each session.

In addition to visually analyzing the group data for changes in level (lower during interventions), variability (lower during intervention), and trends (more stable during intervention), the effect size for talk-outs was calculated by finding Cohen's *d*. Cohen's *d* was calculated to be 2.4, which is a very large effect. During the baseline phase, the students averaged 49.6 talk-outs per session with a high of 78 talk-outs in one session and a low of 35 talk-outs in one session.

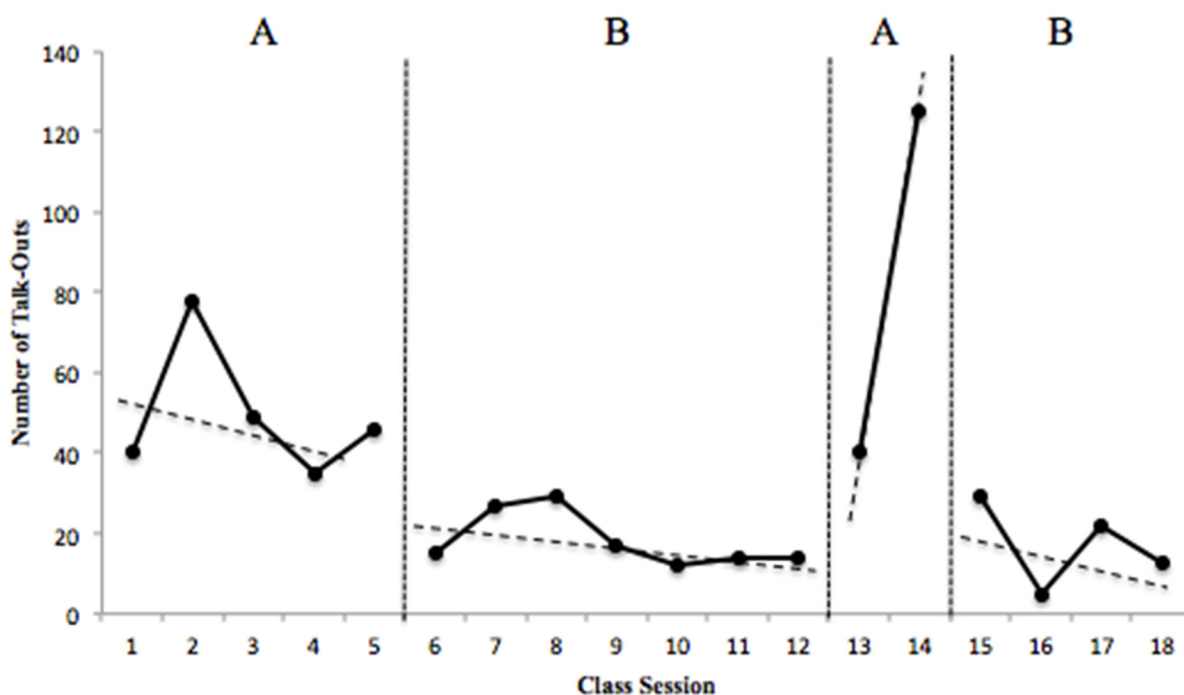


Figure 12. Number of talk-outs made by all students.

During intervention phase, the average number of talk-outs dropped to 18.3 per session with the highest day totaling 29 talk-outs and the lowest day totaling 12 talk-outs. After the return to baseline, the average number of talk-outs increased to 82.5 talk-outs per session with a high of 125 talk-outs in one session down to the low of 40 talk-outs in one session. After we returned to intervention, the average number of talk-outs per session again dropped to an average of 17.3 talk-outs per session with the highest day totaling 29 talk-outs and the lowest day totaling only 5 total talk-outs in the session.

Once the intervention began, the students were surprised at how frequently they talked out. The students were told prior to beginning the intervention that any comment that was said, even if it was about math, without waiting for their name to be called would be considered a talk-out and they would lose a USE card. If a student argued or complained after a USE card was taken, another USE card would be taken right away. The students very quickly adjusted,

mentioning that they could lose all of their “USE” cards and not receive any points if they were not careful about raising their hand first.

Analysis of Individual Data by Subgroups

To supplement the visual inspection of data and descriptive analysis, effect sizes for the individual student data and the subgroups (High, Low, and Balanced) were calculated. Tau-U analysis was performed on the change from baseline to intervention phase (see Table 2).

The High subgroup showed large effect size for one participant and medium effect sizes for the other two. The overall effect size within this subgroup was moderately high. In the Low subgroup, effect sizes showed a similar pattern, with one student showing a high effect size, one showing a moderately low effect size, and the third with a low effect size, based on no change in average participation. Positive changes in trend and level were observed for this participant during intervention phase but were not maintained after withdrawal.

Finally, the group of students who were already balanced in their participation rates at baseline showed small to moderate effect sizes individually and as a group, primarily in a direction of decreasing participation. This is interpreted as the intervention not changing much about their participation levels, but that the intervention did not harm or change their existing levels of participation, which was the intended outcome for this subgroup. This was the only subgroup in which the subgroup overall effect was not significant.

Table 2

Student Participation Groups and Quantitative Results

Participation Level	Student	Baseline Percentage Mean (SD)	Intervention Percentage Mean (SD)	Tau-U	P-Value	Confidence Interval (90%)
High	1	84% (15%)	32% (8%)	-1.00	0.0062	-1 < > -0.399
High	5	67% (19%)	52% (22%)	-0.54	0.1229	-1 < > 0.036
High	6	76% (20%)	62% (24%)	-0.60	0.1003	-1 < > 0.001
Subgroup Total				-0.71	0.0006	-1 < > -0.304
Low	2	5% (6%)	16% (12%)	0.30	0.4624	-0.372 < > 0.972
Low	4	9% (5%)	9% (12%)	0.14	0.6847	-0.436 < > 0.722
Low	8	10% (7%)	24% (11%)	0.92	0.0190	0.274 < > 1
Subgroup Total				0.44	0.0454	0.010 < > 0.879
Balanced	3	34% (28%)	54% (23%)	0.07	0.8501	-0.550 < > 0.693
Balanced	7	45% (26%)	38% (13%)	-0.37	0.2912	-0.950 < > 0.207
Balanced	9	42% (15%)	49% (13%)	-0.09	0.8075	-0.665 < > 0.493
Balanced	10	35% (20%)	26% (15%)	-0.50	0.2207	-1 < > 0.172
Balanced	11	32% (24%)	16% (14%)	-0.37	0.2912	-0.950 < > 0.207
Subgroup Total				-0.25	0.1315	-0.572 < > 0.075
Overall Group Total				-0.20	0.0803	-0.380 < > -0.012

Discussion

This study analyzed the effectiveness of a simple differential reinforcement intervention that was used to help students with autism regulate verbal participation in the classroom during

direct instruction sessions for math. The intervention was used within the framework of a token economy that was already in place where students received one point for every time they participated during group instruction. The intervention helped more students to achieve a balance of their participation rates, allowing more students opportunities to participate in class. This study also analyzed whether the same intervention could be used to help increase participation levels in students who typically do not participate much in class. Lastly, the study aimed to lower the number of talk-outs made by all students during math instruction. All three of these effects were observed throughout the intervention, with no adverse effect (no significant change) on students with pre-existing levels of participation that were variable but well-balanced over time.

Our results were consistent with prior research showing the benefits of using a token economy system to reinforce target behaviors (Dietz & Repp, 1973). The DRL aspect of the intervention produced results for students with autism consistent with prior research on a student with attention-deficit hyperactivity disorder ADHD (Thompson, McLaughlin & Derby, 2011). This study also shows that a token economy system coupled with a DRL/DRH intervention can increase target behaviors (participation) and lower problem behaviors (talk outs, meltdowns and disrespectful comments).

Better Balance of Participation Rates for Students with Excessive Participation

This study involved three students with excessively high rates of participation in class during the baseline phase (attempting to respond >55% of the time). All three students previously became frustrated and sometimes displayed meltdown behaviors if they were not called on every time the teacher posed a question. Once the intervention began, all students were able to use the simple intervention to help them lower their average attempted participation,

allowing other students the opportunity to participate in class. All students were given 6 KEEP cards and 4 USE cards at the beginning of each intervention session. The teacher reported that the number of meltdowns decreased dramatically after the intervention began. The teacher also reported that the students were no longer making disrespectful comments to the teacher or other students after the intervention was started, evidenced by no office discipline referrals (ODRs) for two students with prior histories of frequent ODRs for disrespectful comments during math instruction.

Increasing Participation Rates by Students with Minimal Participation

Three students showed low rates of participation (attempting to respond <16% of the time, on average) during the baseline phase. All three students received 4 KEEP cards and 6 USE cards. All students in this group maintained or increased participation rates. The teacher reported that these students did not need as much individual attention after group instruction. This allowed the teacher to spend more time providing differentiated instruction to the rest of the class. The teacher also reported that this intervention helped to know whether the students understood the topic being discussed or if they needed to spend more time on group instruction.

Maintaining Participation by Students with Balanced Participation Rates

There were five students who did not meet the qualifications of the high group or the low group. Their participation varied throughout the baseline phase, but on average, was not excessive (>50%) or minimal (<20%). The researchers wanted to be sure that the intervention would not lower the participation of these students. All five students continued to show varied participation when the intervention began. Some class sessions they showed higher rates (above 60%) of attempted participation, but other sessions they showed lower rates of participation (below 40%). Three of these students were neurotypical and did not have any disability. They

also commented that they enjoyed playing the “card game” and it helped keep them focus during math class. Overall, the intervention had little effect on their participation rates.

Lowering Class-Wide Talk-Outs

Before the study began, the teacher was very concerned with the number of talk-outs occurring during whole group instruction in math class. Many of the talk-outs were off topic and would result in getting the rest of the class off topic as well. It took a few minutes to get the class back on topic with the lesson. Sometimes the talk-outs were disrespectful about the teacher or other students. If the disrespectful comments involved other students, they would become upset and have a meltdown or sometimes run out of the room, which resulted in the teacher abandoning instruction to return the student to class. It was very difficult for the teacher to get through all of her prepared lesson while still allowing the students time to practice independently.

Along with the decreasing number of talk-outs, the teacher reported that the talk-outs that *were* made were more on topic for math instruction. Sometimes the talk-out would be a student shouting out the answer or telling another student they should raise their hand to help them get rid of their USE cards. When the intervention was in place, talk-outs that were disrespectful to other students were very rare. This allowed the teacher to get through the modeling and guided practice portion of her lesson and leave more time for individual instruction with students while they practiced independently.

Using a Class-Wide Intervention

By using the intervention on a class-wide basis, no students made comments about feeling like they were being singled out or picked on. Before the study began, all students were

rewarded with points for participating in class. This intervention was an easy way to help other students regulate their participation without excluding others.

Limitations

The setting (autism specialty school) provided multiple examples of the intervention effectiveness within a single class and included some students with typical development. It is not known, however, how well these results predict the intervention effects within a typical classroom. There was no uniformity across the math sessions with regard to overall length and total frequency of opportunities to respond, which introduces an uncontrolled variable to consider in interpretation of results. Because this was the students' main source of math instruction, there were sessions when the teacher needed to allow more time for individual practice and less time for group instruction to verify each student understood all lesson material, which may or may not be the case in a typical classroom setting.

This study was completed at a charter school specializing in teaching children with autism. Each classroom at the school has at least one paraeducator in the room at all times as well as the teacher. The intervention has not yet been tested in settings with just one teacher.

Another limitation in interpretation is the variable attendance of some of the students. Not all students were present every day for the study. This meant that all students did not attend the same number of baseline, intervention, and withdrawal sessions. Also, while none of the students in this study liked to tear paper, it would be beneficial to laminate the cards if the intervention were used with a student who likes to tear paper.

Because one of the cameras was behind students instead of facing students, video recordings were not able to identify all talk-outs made by specific students. Individual talk out data would have been ideal, but talk-out data had to be collected on a group basis instead of

individually by student. Testing generalization of the intervention to other classes was planned, but not conducted because the school year ended. Also, no formal measures were collected to measure social validity, but qualitative data collected through comments is informative regarding the acceptability of the intervention to students.

Implications for Further Research

Withdrawal of the intervention clearly showed the effect of the intervention in most cases, but return to baseline following withdrawal showed resistance to change for some students. Trends for returning to the target average range were less steep, with some students not returning to the target range after three class periods. This may be related to the timing, as the last intervention phase took place in the final weeks of the school year. It may also be that the withdrawal phase was harmful in terms of interrupting routine for the students. In future studies, an A-B only design with very gradual reinforcement thinning may show if the intervention is more effective when not interrupted.

While no meltdowns occurred while instruction was recorded, some meltdowns occurred during the baseline phase after the cameras were turned off. The main cause the students reported for meltdowns was that the teacher was not calling on them enough during instruction. It would be interesting to do a repeated formal measure that allows for students to rank whether they thought the teacher was calling on them too much, just right, or not enough throughout the study.

More research can be completed that allows for maintenance and generalization. After the researcher and interventionist are satisfied with progress made in the initial setting, the intervention could be taken to another setting where the majority of the students are present (i.e., art class, music class, science class, etc.) where instruction is given by another teacher. It would

be intriguing to see the effects of the intervention over the course of an entire school year. It would also be interesting to implement the intervention with the same group of students after an extended break (i.e., winter break or summer break) to analyze how quickly participation rates and talk-outs can be changed.

Conclusion

The simplicity of the intervention, its self-monitoring nature, and the requests from students to use the intervention in different settings indicate that this may be an acceptable, easy and versatile intervention for not only regulating behavior in the classroom, but to provide for improved learning environments for students. The results of this study indicate that using a simple intervention can help students with autism to regulate their verbal participation in a group instruction setting. The intervention is a concrete, visual way to help students with autism regulate how much they participate. The teacher needs to set up, teach and reinforce the intervention and the students are in charge of managing their own behavior as a self-monitoring procedure.

Students who previously had high rates of participation and attempted participation were able to lower their participation rates to within the average range without meltdowns to allow other students the opportunity to participate. Students who previously had minimal rates of participation and attempted participation were able to raise their participation rates. The students who previously had balanced levels of participation continued to stay balanced. Another benefit that came from the intervention was lowering the number of talk-outs made by the entire class during the whole group instruction period. This intervention was an easy way to regulate participation made by all students in the classroom.

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APPENDIX A: LITERATURE REVIEW

The first accounts of children who were socially unaware and exhibited repetitive behavior were originally published by Leo Kanner in 1943. Kanner identified children with severe problematic behaviors (Kanner, 1943). In 1944 Hans Asperger published more information on the same type of children described by Kanner; however, these children exhibited problem behaviors that were less severe (Asperger, 1944). For approximately 40 years, these two accounts of related symptomatic presentations were able to co-exist without controversy (Ozonoff, South, & Miller, 2000) regarding whether they were the same or different disorders.

Before the first concrete definition of autism (called autistic disorder) arose in the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III; American Psychiatric Association [APA], 1980), autism symptoms were seen as an early onset of schizophrenia (Johnson, Burkett, Reinhold, & Bultas, 2016). In the fourth revision of the DSM, autism was split into three separate disorders including autistic disorder, pervasive developmental disorder-not otherwise specified (PDD-NOS), and Asperger's syndrome (APA, 1994). After the creation of this new diagnosis and definition specifically for Asperger's syndrome (i.e., autism symptoms without cognitive or language delays), complaints started to arise about whether the two diagnoses should be considered separate or the same (Ozonoff et al., 2000). Ozonoff, South, and Miller (2000) completed an external validation process to inquire if the two conditions were actually different. In their results, Ozonoff et al. (2000) concluded the following:

Our findings of very similar cognitive profiles and current behavioral presentations suggest that Asperger syndrome is on the same spectrum as other autistic syndromes and differs primarily in degree of impairment. (p. 43; see also Prior et al., 1998)

One of the problems that arose with this diagnostic confusion was the potential for parents to believe that their child, who received an original diagnosis for Asperger's Syndrome or PDD-NOS, did not have autism. However, when the APA released the DSM-5 (APA, 2013), they combined all forms of pervasive developmental disorders into one disorder, ASD, and eliminated separate diagnoses for Asperger's Syndrome and PDD-NOS. This meant that all children with those related diagnoses were now all under the same diagnosis of autism spectrum disorder.

The Centers for Disease Control and Prevention publishes a series of studies in conjunction with The Autism and Developmental Disabilities Monitoring (ADDM) Network to find the prevalence of children age 8 years old with ASD, the most recent of which was based on data collected in 2014. The study followed the diagnostic criteria outlined in *The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV) for any disorder including “autistic disorder, pervasive developmental disorder—not otherwise specified (including atypical autism), or Asperger disorder” (p. 1). They found that the combined estimated prevalence of ASD in the 2014 sample was 16.8 per 1,000. The estimated prevalence of boys with autism was considerably higher with a prevalence of 26.6 per 1,000, while girls with autism were found to be about 6.6 per 1,000. According to the ADDM network, the estimated prevalence of children with autism has continually increased from 6.7 children per 1,000 in 2000 to the current levels in slightly less than one generation (Baio et al., 2018).

The current diagnostic criteria for autism spectrum disorder encompasses a variety of behaviors related to social communication and restricted and repetitive behaviors. The severity of the behaviors is also highly variable (Johnson et al., 2016). The DSM-5 overview describes some of the critical qualities of an ASD diagnosis as follows:

The essential features of autism spectrum disorder are persistent impairment in reciprocal social communication and social interaction (Criterion A), and restricted, repetitive patterns of behavior, interests, or activities (Criterion B). These symptoms are present from early childhood and limit or impair everyday functioning (Criteria C and D). (APA, 2013, pg. 53)

Instead of adding a level of severity or different diagnostic labels to indicate severity, the DSM-5 outlines three levels of support that a child diagnosed with ASD might need, based on symptom severity. The first, Level 1, includes those who are mostly independent. While these individuals may have difficulties starting and maintaining reciprocal conversations as well as making friendships, they are often able to speak in full sentences and possess many core communication components, with some age appropriate adaptive skills. Individuals with ASD needing Level 1 support may have problems with organization and switching between activities and need some help navigating social situations.

Individuals needing Level 2 support need multiple interventions and supports in order to communicate with others and function independently. Though these people receive supports from others, their social impairments will still be apparent. They usually have restricted/repetitive behaviors that are noticeable to a casual observer. These behaviors can interfere with their functioning in a variety of settings.

Lastly, those requiring Level 3 support have severe deficits in social and communication skills. They are likely to require “very substantial support” as they will have extreme impairments in everyday functioning (APA, 2013). These people will have a hard time changing their action or focus, as they are often very inflexible in their behavior (APA, 2013). They will need support in all activities of daily living.

As was previously stated, each person diagnosed with ASD has unique symptom manifestation. It has been found that the communication deficits that usually accompany a child with an ASD diagnosis tend to be accompanied by significant anxiety in these children as well (Davis et al., 2011). Children with lower cognitive and language abilities experience difficulties in functional communication problems. Anxiety may manifest as frustration or aggression when a child needs help or support but does not know how to ask for it. Children with age-appropriate cognitive and language abilities may still have social, pragmatic communication problems that increase anxiety. For example, children with ASD have troubles with “turn-taking” in conversations and might become agitated when other people begin to speak and they do not have a chance to say everything they would like. When children cannot communicate they may become very frustrated. When this happens, they may not have the ability to regulate their emotions as well as their peers and instead will cause them to act impulsively (Sofronoff, Attwood, Hinton, & Levin, 2006). Sofronoff et al. (2006) writes, “When feeling angry, the person with Asperger’s syndrome does not appear to be able to pause and think of alternative strategies to resolve the situation . . . There is often an instantaneous physical response without careful thought” (p. 1204). This reduced ability to regulate emotions can cause outbursts that are “colloquially referred to as ‘meltdowns’” (Mazefsky et al., 2013). When a child with ASD exhibits a “meltdown” in a classroom setting, it becomes very difficult for the teacher to continue with instruction.

Another struggle that people with autism spectrum disorder may have includes issues with executive functioning. Executive functioning (EF) is an umbrella term that includes various high-order cognitive processes (Blijd-Hoogewys, Bezemer, & van Geert, 2014). Some of these

processes might include planning, working memory, impulse control, and cognitive flexibility, as well as initiation and monitoring of action (Hill, 2004).

Because people with autism may have limited impulse control and emotional regulation, in addition to poor turn-taking abilities, many difficulties arise in the classroom that make it hard for themselves as well as other students to learn. One of the three main social communication criteria in diagnosing a child with autism is limited social reciprocity (APA, 2013). A child who exhibits social reciprocity is aware of social cues in others and is able to interpret those cues in interactions with others (Constantino et al., 2003). A person who struggles with social reciprocity will have trouble maintaining long chains of back-and-forth conversation with others because they do not have the skills to interpret social clues in an interaction (Leach & LaRocque, 2011). These students may often participate excessively during class instruction and may “talk out” instead of raising their hand and waiting until called upon and asked to speak, perhaps due to frustration at not being called on to respond. This results in a small number of students verbally participating, while the rest of the class does not have a chance to participate.

Many educators have employed the use of differential reinforcement to help decrease instances of problem behaviors, including talk-outs. By using differential reinforcement of lower rates of behavior techniques (DRL), teachers can limit the problem behavior through the use of non-aversive stimuli as positive reinforcement for lower rates of the problem behavior. DRL is usually paired with a token economy to provide quick and successful reinforcement to the student. Research in this area—interventions to help regulate participation for students with autism in a classroom setting—is currently very limited.

In their classic work, Dietz and Repp (1973) completed multiple studies that showed the effectiveness of using differential reinforcement of lower rates of responding across multiple

settings. First, they worked with one student with moderate intellectual disabilities. The boy earned five minutes of free time if he exhibited three or fewer talk-outs in a 50-minute period. Second, they used DRL in a group contingency with an entire class of students with moderate intellectual disabilities. If the entire class had five or fewer talk-outs in a specified time period, each student received a reward. Lastly, they employed the group contingency strategy with an entire high school general education class of 15 girls. They were rewarded for reducing their number of conversations with their peers during class time. Across all three studies, Dietz and Repp were able to lower the talk-outs and/or side conversations by 84% during the intervention period from the original baseline data.

A study completed by Thompson, McLaughlin, and Derby (2011) aimed to decrease the inappropriate verbalizations of a nine-year-old girl with autism. This study was completed in a special education self-contained classroom with a girl called “Molly.” The authors decided to use differential reinforcement of lower rates of behavior (DRL) to decrease the number of verbalizations made by Molly in different settings. They used a token economy coupled with the DRL to lower her commenting during calendar time, specialty classes (PE, music, library), and group work time.

Molly was told that if she spoke without first raising her hand, a tally would be recorded and she would be asked to be quiet. This would continue for the duration of the 20-minute session. At the end of the session, the researcher would tell her the number of talk-outs she had during that session. If Molly had one fewer talk out than the day before, she received a ticket. Once Molly accumulated five tickets, she could redeem them for a prize.

The authors were able to show lower average number of verbalizations across three settings. During calendar time, mean talk-out scores lowered from 12.3 per session to 4.0 per

session. During specialty classes, the mean score was decreased from 9 talk-outs in baseline, to 2.1 talk-outs during intervention. Lastly, during group work time, talk-outs were reduced from 18 talk-outs to a mean score of 2.8 talk-outs per session (Thompson et al., 2011).

While this study showed that the use of DRL is beneficial in reducing talk-outs and inappropriate verbalizations, there are many limitations with the study. This study was completed with only one student and therefore replication with the intervention was not shown. This study aimed at lowering only talk-outs and not excessive attempts at appropriately commenting throughout a lesson. The purpose of the study was to lower her talk-outs to zero during one session. Further research should be completed that would help lower the number of attempted comments throughout a lesson, but not reduce the behavior to zero. There is a gap in existing research for a self-monitoring intervention to help regulate verbal participation so the students can be in charge of their own progress and learning.

These studies give examples of students who exhibit hyper-verbal behaviors and require the use of a DRL intervention to lower talk-outs. However, some individuals with ASD exhibit the opposite behavior. When they become anxious due to communication deficits, they may instead “shut down” and not participate during class. In this case, the use of differential reinforcement of high rates of behavior (DRH) will help increase student participation. Many studies have found that student participation in a classroom setting is vital for success and leads to deeper understanding of material (Roscoe & Chi, 2008; Veenman, Denessen, van den Akker, & van der Rijt, 2005; Warner, 2008). Students who question and contribute, especially during mathematics discussion and discourse, tend to achieve higher academic success (Ing et al., 2015).

Given that autism symptoms and anxiety in individuals with age-appropriate cognitive and language skills may cause classroom problems (i.e., verbal participation rates that are either too high or too low), we sought to fill a gap in the literature on effective and simple behavioral interventions to better balance classroom participation for all students, including those with autism. Because of the nature of the problem, we chose differential reinforcement for low or high rates of behavior to address both difficulties simultaneously.

Our aim is to use a differential reinforcement token system to limit the number of talk outs and verbal participation for students with excessive participation rates (DRL) and use the same system, but with a different ratio of available incentive tokens, to increase the participation of students with very low participation rates (DRH). The use of a token is expected to provide a concrete method for students to self-monitor and self-regulate their attempts at participation by having a visual representation of expected “turns” for participation and an incentive to shape their own verbal behaviors to meet the teacher-managed quota set by the daily supply of available tokens.

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APPENDIX B: DATA RECORDING SHEET

Date _____ Time Start _____ Time End _____ Coder _____

Camera 1 or 2

Setting _____ Date Coded _____ Reliability Check? Yes / No

Opportunities to Respond for the entire class: _____ Total: _____

Student	Talk Outs	Attempted Comments	Solicited Responses	Use	Keep	Time OUT	Time IN	NOTES/ Name
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								

Talk Out = comment addressed to the class or teacher, loud enough for all class to hear.

Attempted Comments = discrete hand up all the way or partial. Count new hand raise if hand drops all the way down and then is raised again.

Opportunity to Respond (whole class) = teacher asks a question/bid for entire class to respond by raising their hands (teacher turns to look)

Opportunity to Respond (individual) = teacher asks someone by name to respond.

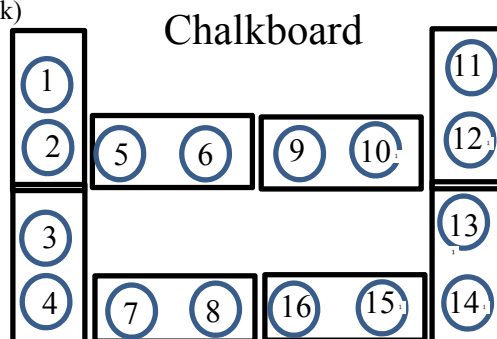
Solicited Responses = teacher calls on student to answer a question posed to entire class

Use = USE card pulled for comment

Keep = KEEP card pulled for comment or talk out

Time OUT = time elapsed on video when student went off camera

Time IN = time elapsed on video when student returned to view



APPENDIX C: ASSENT AND CONSENT FORMS

Child Assent (7-14 years old)

What is this research about?

My name is Terisa Gabrielsen and I work with Katherine Montgomery at BYU. I want to tell you about a research study we are doing. A research study is a special way to find the answers to questions. We are trying to learn more about how people decide if they want to say something in a classroom. You are being asked to join the study because you are in a classroom at Spectrum Academy.

If you decide you want to be in this study, this is what will happen.

- You get to play a game called Stack the Deck during social skills. Everyone gets to play.
- You will see a video camera during your social skills time that will be recording the group.
- You might be able to spend an hour playing games and talking with someone who does autism evaluations. You might not need to do this if this is something you have already done when you were younger. Ms. Katherine can tell you if this is something you might need to do.

Can anything bad happen to me?

We don't think anything bad will happen if you help us with our research.

Can anything good happen to me?

We think playing the game, Stack the Deck, will help you decide when you want to say something in class.

Do I have other choices?

You can choose not to be in this study. You can still play the game.

Will anyone know I am in the study?

We won't tell anyone you took part in this study. When we are done with the study, we will write

a report about what we learned so that other people can learn what you learned. We won't use your name in the report.

What happens if I get hurt?

We don't think anyone will get hurt in our study.

What if I do not want to do this?

You don't have to be in this study. It's up to you. If you say yes now, but change your mind later, that's okay too. All you have to do is tell us.

Before you say yes to be in this study, be sure to ask **Ms. Katherine** to tell you more about anything that you don't understand.

If you want to be in this study, please sign and print your name.

Name (Printed): _____

Signature _____

_____ Date:

Parental Permission for a Minor

Introduction

My name is Terisa Gabrielsen. I am a professor from Brigham Young University. I am conducting a research study with Katherine Montgomery, a graduate student, about ways to help students "budget" or regulate their comments in classroom situations. I am inviting your child to take part in the research because he/she is in an autism specialty classroom and receives instruction as part of his/her curriculum. The intervention includes using colored slips of paper that can be "spent" and "saved" to get bonus points during instruction.

Procedures

If you agree to let your child participate in this research study, the following will occur:

- "Stack the Deck" is a behavioral intervention designed to help students regulate the quantity of comments they make in group settings. The intervention involves the teachers giving each student 10 slips of paper in two different colors. At a designated time during instruction, students must give up a paper every time they make a comment. One color allows the student bonus points when they make a comment, the other color allows the student bonus points if they keep the card and don't make a comment. Points are never taken away for making comments, and all participation receives a point anyway. Students will never be restricted or punished for making comments. The colored papers simply allow for bonus points and offer the student a chance to think about how motivated he or she is about making a comment versus obtaining a bonus point.

-This will take place in their regular classroom as part of Ms. Montgomery's scheduled curriculum.

-The instruction may be observed or videotaped so we can see if the intervention is changing students' behaviors.

-We will collect some basic information about your child from his or her educational records, such as age, race/ethnicity, classification, and information from prior evaluations. This information is just to characterize our participants without identifying them. Ms. Montgomery is the only researcher who will see the educational records.

-Your child may be asked to participate in a one-hour assessment of autism symptoms if he or she has no record of formal assessment for autism spectrum disorder. Assessment will be done at no cost, will be done at Spectrum Academy, will be and directly supervised by Dr. Gabrielsen.

-You will be asked to answer some short questionnaires about your child before the study begins and after it is finished.

Risks

There are minimal risks associated with this research project. The intervention is a way to earn bonus points, and no points will ever be taken away because of participation. Comments will not be limited, but students will decide if they wish to make a comment based on how many bonus points they would like. We may wish to follow up with you after the end of the school year to see if any changes we observed are still in place after we discontinue the intervention. Your child will be able to participate in class as usual with the rest of the class during the intervention even if you choose not to participate in research.

Confidentiality

The research data collected will be kept in a secure location (or password protected and encrypted) and only the researchers will have access to the data. At the conclusion of the study, all identifying information will be removed and the data will be kept indefinitely in a locked cabinet or office. There is a possibility that this project will likely lead to replication in other populations that will then be compared with this population. Because the timeline for future studies is not yet known, we have decided that we would store the information indefinitely. All data collected will be de-identified and your child's name will not appear in any publications. Videos will not be posted anywhere.

Please refer to the separate video release form for specific questions about how you wish the videos to be used in research and training.

Benefits

Students participating in the study will have the opportunity to develop improved self-regulation skills with the support of the behavioral intervention. However, students not participating in the research, but who are in the classroom, will receive this same benefit. The intervention will be administered to all students, regardless of research participation. However, participation in research will benefit society through publication of results.

Compensation

There is no compensation for participation in the study.

Questions about the Research

Please direct any further questions about the study to Katherine Montgomery at (801) 785-9019 or kmontgomery@spectrumcharter.org. You may also contact Terisa Gabrielsen at (801) 422-5055 or Terisa_gabrielsen@byu.edu.

Questions about your child's rights as a study participant or to submit comment or complaints about the study should be directed to the IRB Administrator, Brigham Young University, A-285 ASB, Provo, UT 84602. Call (801) 422-1461 or send emails to irb@byu.edu.

You have been given a copy of this consent form to keep.

Participation

Participation in this research study is voluntary. You are free to decline to have your child participate in this research study. You may withdraw your child's participation at any point without affecting your child's grade or standing in school, or the amount of instruction he or she receives.

Child's Name: _____

Parent Name: _____ **Signature:** _____ **Date:** _____

Ver. 8/11

