

RESEARCH ARTICLE

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**The Effects of the Color Wheel System on Reducing Inappropriate Behaviors
in Students with Autism Spectrum Disorder: A Single-Subject Study**

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Abstract

This study examined the effect of using the Color Wheel System on reducing odd and repetitive behaviors among three students with autism spectrum disorder (ASD) enrolled in a full-inclusion classroom. The study adopted a single-subject experimental design of the type of ABA (A–B–A), aiming to identify the functional relationship between the visual classroom management system and behavioral change.

Three students aged between 9 and 11 years participated. The targeted behaviors included hand flapping, non-functional vocalizations, frequent leaving of the seat, and prolonged staring—behaviors that often disrupted classroom learning and social engagement. Data were collected through direct observation using the frequency recording method, with three 20-minute observation sessions conducted each week for a total of seven weeks.

During the baseline phase (A1), data were recorded without intervention to determine the natural rate of the target behaviors. In the intervention phase (B), the teacher implemented the Color Wheel System, which visually represented classroom behavior expectations using green (appropriate), yellow (warning), and red (inappropriate) cues. In the withdrawal phase (A2), the system was removed to assess whether behavioral changes would be maintained.

The results showed a clear and consistent decrease in the frequency of odd behaviors during the intervention phase for all three participants, followed by a partial return to higher levels during the withdrawal phase. These findings indicate a strong functional relationship between the Color Wheel System and behavioral improvement. The system provided immediate visual feedback and clear behavioral expectations, which appeared to help students regulate their actions more effectively.

The study highlights the effectiveness of using simple visual strategies like the Color Wheel System in inclusive classrooms to promote positive behavior, reduce distractions, and enhance the participation of students with ASD. Continued application and combination with reinforcement-based strategies are recommended for long-term success.

Keywords: Color Wheel System; Autism Spectrum Disorder (ASD); Inappropriate Behaviors

Introduction

The selection of educational strategies in schools has traditionally been the responsibility of teachers, who choose methods that shape the classroom climate and facilitate student learning (Caldarella, Williams, Jolstead, & Wills, 2016). Throughout the school day, teachers influence student behavior by modeling appropriate conduct, monitoring interactions, and fostering a supportive environment that encourages positive behaviors (Sugai et al., 2000). As classroom managers, teachers are empowered to implement strategies that promote behavioral change (Sugai et al., 2000). To ensure student engagement and minimize disruptions, they must integrate academic instruction with effective classroom management techniques (Gage & MacSuga-Gage, 2017). According to Evertson and Weinstein (2006), successful teaching is closely linked to effective classroom management, which supports appropriate behavior, active engagement, and academic achievement.

In a study conducted by Strong et al. (2011), classroom management was identified by students as the most important role of primary school teachers, reinforcing the notion that effective teachers are also effective classroom managers. Many classroom management strategies are grounded in the principles of behavior analysis, with Tier 1 of the Positive Behavioral Interventions and Supports (PBIS) framework being among the most widely adopted. PBIS Tier 1 has been implemented extensively across the United States, with approximately 80% of elementary schools utilizing its supports. This tier provides universal instruction and behavioral support to all students within the school environment (Johnston et al., 2006), addressing the needs of approximately 80–90% of the student population. Within this framework, general education teachers deliver structured, evidence-based instruction and implement core behavioral strategies to promote positive student behavior (Horner & Sugai, 2015). The primary goal of Tier 1 is to support students proactively and reduce the need for more intensive interventions at Tier 2 or Tier 3. Additionally, general education teachers play a key role in identifying students who may require additional support by monitoring indicators such as low academic performance, frequent absences, signs of abuse or neglect, behavioral challenges, and social withdrawal (Kim et al., 2018). Students who do not respond adequately to Tier 1 supports are referred for Tier 2 interventions.

Numerous studies have shown that teachers consider classroom management one of the most challenging aspects of their profession and that they often receive limited training in contemporary classroom management techniques (Gage & MacSuga-Gage, 2017). This lack of preparation significantly hinders their ability to manage student behavior and maintain classroom order (Rose & Gallup, 2005).

In the field of special education, there is a notable absence of empirical research examining the impact of classroom management strategies on students with disabilities (Abushal & Adenubi, 2003; Aldossari, 2013; Alnoaim, 2021). Across these studies, teachers consistently emphasized the importance of effective classroom management and highlighted the lack of information regarding the use of positive behavior support techniques. However, no experimental studies to date have investigated the effects of providing performance feedback to teachers working with students diagnosed with autism spectrum disorder (ASD), followed by targeted training and observation of student behavioral outcomes.

One of the most practical and visually engaging behavior management strategies is the Color Wheel System (CWS), which consists of several colors representing specific behavioral expectations. Green indicates low-structure activities, yellow corresponds to large- or small-group activities, and red represents transitions. The wheel functions as a spinner, allowing the teacher to move the arrow to signal the behavior students should exhibit (Fudge et al., 2008). Some students with ASD struggle with learning new behaviors and maintaining them (Chein et al., 2015; Goldstein, Johnson, & Minshew, 2001; Kleinhans, Akshumov, & Delis, 2005; Redziewska, 2016). The color wheel may be particularly beneficial because it provides quasi-warning cues that prompt targeted behaviors and improve engagement (e.g., cleaning desks or looking at the teacher when a new activity is introduced). Numerous studies have demonstrated that visual stimuli influence behavioral control and attention (Pierce, Spriggs, Gast, & Luscre, 2013). The CWS provides a constant visual cue for behavioral expectations (i.e., the displayed color) along with verbal prompts (e.g., time warnings during transitions), enabling students to regulate their behavior more effectively and engage successfully in classroom routines.

Background and Literature Review

Classroom management remains one of the most critical and challenging aspects of teaching, particularly when working with students who exhibit behavioral difficulties. Teachers frequently report receiving limited training in modern behavior management techniques, which directly impacts their ability to maintain order and promote student engagement (Gage & MacSuga-Gage, 2017; Rose & Gallup, 2005). This challenge is even more pronounced in special education settings, where students with disabilities, including autism spectrum disorder (ASD), often require individualized and structured behavioral support strategies.

Among the various approaches to classroom behavior management, the Color Wheel System (CWS) has emerged as an effective and visually intuitive strategy. The CWS uses three primary colors—green, yellow, and red—to represent different levels of behavioral expectations. Green signals acceptable behavior and low-structure activities, yellow serves as a cautionary reminder for behaviors that require adjustment, and red indicates inappropriate behavior that may call for direct intervention or consequence (Fudge, Skinner, & McCleary, 2008). The wheel functions as a visual cue, allowing teachers to signal behavioral expectations clearly during various classroom activities such as group work, lessons, or transitions.

This system is particularly effective because it provides immediate, quasi-warning cues that encourage students to modify their behavior proactively. For example, during a transition, students may be prompted to clean their desks or refocus on the teacher simply by observing the displayed color. The clarity and consistency of the CWS reduce the need for repeated verbal reminders, which is especially beneficial in classrooms with students who have communication or attention challenges.

Research supports the use of visual stimuli in behavior regulation, particularly for students with ASD. Visual cues help these students comprehend expectations, follow routines, and navigate transitions more smoothly (Pierce, Spriggs, Gast, & Luscre, 2013; Martin & Wilkins, 2021). Building on these findings, the principles of the CWS align closely with the Positive Behavioral Interventions and Supports (PBIS) framework—specifically Tier 1—which emphasizes proactive, evidence-based strategies for all students (Simonsen et al., 2015). Tier 1 practices aim

to prevent behavioral problems before they occur and promote a positive, structured learning environment.

The CWS offers a visually supported and research-based method for promoting appropriate behavior. Its alignment with PBIS principles and its effectiveness in special education contexts make it a valuable classroom management tool. Moreover, it is particularly beneficial for students with attention deficit hyperactivity disorder (ADHD) or autism spectrum disorder (ASD), as it provides consistent and predictable visual cues that support self-regulation and understanding of classroom expectations. Students with ASD often experience challenges related to executive functioning, cognitive flexibility, and social understanding (Chein et al., 2015; Goldstein, Johnson, & Minshew, 2001; Kleinhans, Akshumov, & Delis, 2005; Redziewska, 2016). By offering a structured and concrete visual framework, the CWS assists these students in navigating routines and transitions with greater success.

In summary, despite strong theoretical and practical support for visual strategies such as the CWS, limited experimental research has examined its direct effects on reducing inappropriate behaviors among students with ASD in inclusive classroom settings. Addressing this gap, the present study seeks to evaluate the impact of the Color Wheel System on improving behavioral outcomes for students with autism spectrum disorder using a single-subject design.

Purpose of the Study

The purpose of this study is to expand the existing body of research on effective classroom management strategies for students with autism spectrum disorder (ASD). Specifically, the study aims to examine the effects of implementing the Color Wheel System (CWS) as a visual classroom management tool to increase student engagement and reduce disruptive or inappropriate behaviors.

This study seeks to address the following research questions:

What are the effects of using the Color Wheel System on increasing positive behaviors among students with autism spectrum disorder?

Significance of Study

The significance of this study lies in its empirical evaluation of a classroom management strategy specifically designed for students with autism spectrum disorder (ASD) in inclusive classrooms. By focusing on the Color Wheel System (CWS), this research highlights a practical, low-cost, and visually based approach that teachers can easily implement to promote positive student behavior and reduce classroom disruptions. While several previous studies have examined the effects of classroom-wide interventions, this study focuses specifically on students with ASD, addressing a critical gap in the literature.

Furthermore, the study aims to broaden teachers' perspectives on evidence-based and contemporary strategies for managing the behavior of students with ASD in inclusive settings. The findings may inform teacher preparation and professional development programs by emphasizing the value of using visual management systems to support students with diverse behavioral needs, thereby fostering a more inclusive, organized, and supportive learning environment.

Method

Participants

Three students diagnosed with autism spectrum disorder (ASD), aged 9–11 years, participated in this study. All were enrolled in a full-inclusion elementary classroom at a public school providing part-time special education services. The students exhibited repetitive behaviors that interfered with classroom participation and peer interactions, including frequent hand flapping, nonfunctional vocalizations, repeated standing up from their seats, and prolonged staring. These participants were selected based on teacher recommendations and feedback from the behavioral support team.

Basic demographic information was collected for each student, including age, gender, grade level, and communication abilities. One student was nonvocal, while the other two communicated vocally using words. Some details have been modified or omitted to protect participant confidentiality (Table 1).

Table 1
Demographic Information of Participants

<i>Participant</i>	<i>Age (years)</i>	<i>Gender</i>	<i>Grade</i>	<i>Communication Ability</i>
<i>Student 1</i>	9	Male	4 th	Nonvocal
<i>Student 2</i>	10	Male	4 th	Vocal
<i>Student 3</i>	11	Male	4th	Vocal

Each teacher holds at least a bachelor's degree in special education, early childhood education, psychology, or a related field, with more than two years of experience teaching students with ASD. Classrooms typically included two to three students with ASD per semester, and teachers relied primarily on classroom management strategies acquired during their teacher-preparation programs.

Materials

The study was conducted in a general education elementary classroom that followed a full-inclusion model, where students with autism spectrum disorder (ASD) learned alongside their typically developing peers. The class consisted of 18 students, including the three target participants with ASD who received additional behavioral support from the classroom teacher. The environment was structured to promote predictability, engagement, and organization, with clearly defined areas for group instruction, reading activities, and independent work.

Each of the three participating students had a designated seat near the teacher's area to support attention and minimize distractions. The classroom followed a consistent daily routine supported

by visual cues and schedules, helping students anticipate transitions and understand expectations throughout the day.

The Color Wheel System (CWS) was prominently displayed at the front of the classroom. The teacher used it to visually communicate behavioral expectations through three colors: green for appropriate behavior, yellow for a warning or transition cue, and red for inappropriate behavior requiring correction. The teacher, who had prior training in classroom and behavior management, implemented CWS consistently during instructional and transition periods.

Observations were conducted during regular classroom activities (primarily morning literacy and math sessions) when students were most active and engaged. Conducting the study in the natural classroom environment ensured that the observed behaviors and recorded outcomes accurately reflected students' typical performance within an inclusive educational setting.

Inclusion and Exclusion Criteria

Inclusion Criteria: Participants were required to have a formal diagnosis of autism spectrum disorder (ASD), regularly attend full-inclusion classes, and receive approval from the school administration, the classroom teacher, and the students' parent(s) or guardian(s).

Exclusion Criteria: Students were excluded if they were receiving other behavioral interventions targeting the same behaviors during the study period or if they had severe or unstable medical conditions that could interfere with participation.

Research Design

This study employed a reversal (ABA) design to evaluate the effects of the Color Wheel System (CWS) on managing student behavior. The design consisted of three phases: A₁ (baseline) → B (intervention) → A₂ (withdrawal). A reversal design is appropriate for interventions that can be withdrawn, do not negatively affect learning, and allow for clear assessment of behavioral change (Cooper, Heron, & Heward, 2007).

All participants began in the baseline phase (A₁), during which target behaviors were recorded without any intervention. The study spanned approximately eight weeks, with the phases structured as follows: A₁: weeks 1–3, B: weeks 4–6, and A₂: weeks 7–8. Observations occurred three times per week, with each session lasting 30 minutes (duration adjusted to fit classroom schedules).

The methodological objectives of the study were to:

1. Measure the frequency of target behaviors during the baseline phase (A₁).
2. Evaluate changes in behavior during the intervention phase (B) when the Color Wheel System was implemented.
3. Assess whether behavioral changes were maintained or reverted during the withdrawal phase (A₂).
4. Provide practical evidence of the functional relationship between the intervention and observed behavioral outcomes.

Independent Variable

The independent variable in this study was the implementation of the Color Wheel System (CWS) as a classroom behavior management strategy. The system is a visual tool that organizes student behaviors into three categories: green for acceptable behaviors, yellow for warning behaviors that need correction, and red for behaviors that must be stopped immediately.

The teacher applied the system during regular classroom activities, including lessons and transitions between tasks. The circular-shaped color wheel was mounted in a prominent location visible to all students, and the teacher changed the color by turning the wheel to the desired section. In addition, red, yellow, and green poster boards with classroom rules corresponding to each color were displayed to reinforce expectations.

Using the CWS, the teacher provided immediate and clear visual feedback to students about their behavior. Green indicated appropriate conduct, yellow served as a warning, and red signaled that the behavior needed to stop. This approach allowed students to understand behavioral expectations in real time and adjust their actions accordingly.

The intervention was applied consistently across all observation sessions. Each session lasted approximately 20 minutes, conducted three times per week, ensuring that students received regular and systematic exposure to the system.

Dependent Variables

The dependent variable in this study was the students' frequency of inappropriate behaviors. During a prior interview with the classroom teacher, conducted to define the behavioral problem (Bergan, 1977), the teacher identified students' inappropriate behaviors as moving randomly (erratic movement) and using inappropriate language. These behaviors were selected because they interfered with classroom participation and peer interaction. For this study, inappropriate behaviors were defined as observable actions that interfered with classroom participation, peer interaction, or instruction. These behaviors were operationally defined to ensure objectivity and accurate measurement. The target inappropriate behaviors included:

- **Hand flapping:** Any repetitive movement of the wrists or palms that mimics opening and closing of the hands two or more times within 3 seconds. Each discrete movement was counted as one event. Continuous movements were recorded as separate events if the behavior stopped for more than 2 seconds and then resumed.
- **Inappropriate vocalization:** Any sounds, grunting, shouting, or verbal interruptions lasting longer than 2 seconds or disrupting classroom instructions. Examples included talking over the teacher, speaking while seated alone, or demanding answers inappropriately. Each vocalization was recorded as a single occurrence.
- **Out-of-seat behavior / Repeated leaving the seat:** Standing up and moving more than one meter without teacher permission. Examples included wandering around the classroom, crawling on the floor, or sitting on another student's chair. Each exit from the designated area (e.g., chair, rug, or workspace) was counted as one event.

- **Perseverative concentration:** Staring at or manipulating an object for more than 10 seconds without responding to teacher prompts or instructions. Each uninterrupted occurrence was recorded as a single event.

These inappropriate behaviors were the dependent variables measured throughout the study, using direct observation with 30-second time intervals during 20-minute sessions, conducted three times per week. This method ensured systematic, reliable, and objective recording of each behavior, providing valid data on the effects of the Color Wheel System (CWS) on student conduct.

Intervention Materials

The intervention employed the Color Wheel System (CWS), a behavioral visual tool designed to provide immediate, clear feedback on classroom behaviors. The system divides behaviors into three main colors (Table 2):

- **Green:** Desirable and acceptable behaviors in the classroom.
- **Yellow:** Warning behaviors that need to be corrected or modified.
- **Red:** Unacceptable behaviors that must be stopped immediately.

For this study, a traditional circular-shaped color wheel was used, purchased through Tume® (Fudge et al., 2008). The teacher adjusted the displayed color by turning the top of the wheel clockwise until the desired color was reached. Additionally, red, yellow, and green poster boards were created, with the classroom rules written clearly on each color to reinforce the expected behaviors.

The Color Wheel System was posted in a prominent location in the classroom, visible to all students. The teacher used simple visual cues to move the arrow between colors based on each student's behavior, providing immediate, consistent, and visual feedback on whether the student's behavior was acceptable, required correction, or needed to stop. This system was designed to support students in understanding and regulating their behavior in real time.

Table 2
CWS Rules for each classroom

CLASSROOM	RED RULES	YELLOW RULES	GREEN RULES
4TH GRADE	- Remain seated and quiet - Do not follow instructions - Distracting others	- Speak quietly - Keep hands and feet to self - Partial compliance with directions	- Follow directions - Hands and feet under control - Use calm and quiet voices

Intervention Procedures

The intervention was conducted after the baseline phase and involved implementing the Color Wheel System (CWS) as the primary classroom behavior management strategy. Before starting the intervention, the teacher participated in a one-hour training session conducted by the researcher, which included an explanation of the rationale behind the CWS, video demonstrations, and opportunities to practice using the system in different classroom scenarios. The researcher provided ongoing support, answering questions and giving feedback to ensure the teacher fully understood the procedures.

During the intervention phase, the teacher applied the CWS consistently throughout classroom activities, including lessons and transitions. The system used three colors to indicate behavioral expectations: green for appropriate behavior, yellow as a warning for behaviors that required correction, and red for behaviors that needed to stop immediately. The teacher adjusted the color based on students' behaviors and provided immediate visual feedback.

Key elements emphasized during training included: consistent use of red for transitions, providing brief warnings before changing colors, minimizing time spent on red by moving quickly to the next activity, and using praise and tangible rewards to reinforce appropriate behaviors. Yellow rules were used primarily during structured learning tasks, and green rules were applied during group activities or free time. The CWS was implemented as a classroom-wide intervention, while individual behavior plans were followed as needed.

Study Phases

The research was conducted in three distinct phases following a single-subject ABA design (Table 3).

Baseline Phase (A_1): The baseline phase lasted two weeks, during which each student's inappropriate behaviors were observed and recorded without any new interventions. The teacher relied on their usual classroom management strategies. Observations were conducted three times per week, with each session lasting 20 minutes, allowing the researcher to determine the natural rate of occurrence of the targeted behaviors.

Intervention Phase (B): During the three-week intervention phase, the Color Wheel System (CWS) was introduced as the primary classroom behavior management tool. The teacher used the system consistently throughout classroom activities, explaining the behavioral expectations associated with each color. The wheel was adjusted based on student behavior: green for appropriate behaviors, yellow as a warning for emerging inappropriate behaviors, and red for behaviors that needed immediate correction. Observations continued three times per week for 20 minutes each session, using the same procedure as the baseline phase, to record the frequency of inappropriate behaviors while the intervention was in effect.

Withdrawal Phase (A_2): After the intervention, the CWS was removed, and the classroom returned to the teacher's usual management methods. This phase lasted two weeks. Observations continued in the same manner to assess whether the behavioral improvements achieved during the intervention were maintained or whether inappropriate behaviors returned toward baseline

levels. Some increase in inappropriate behaviors was observed compared to the intervention phase, but they did not consistently reach the original baseline levels.

Implementation and Maintenance

During the intervention phase, the classroom teacher implemented the Color Wheel System (CWS) daily, following the same data collection procedures as the baseline phase. Each day began with a brief social story to remind students of the rules associated with each color. The teacher applied the CWS consistently throughout the day, using color changes as visual cues to guide behavior and manage transitions. The researcher observed sessions and provided feedback as needed to ensure accurate implementation and reinforce consistent use of the system to promote appropriate behaviors and reduce disruptions.

Observer and Implementer Training

Before data collection, observers and the classroom teacher received structured training to ensure accurate implementation of procedures. The training included a 2-hour theoretical session covering study objectives, operational definitions, behavior recording methods, and intervention procedures.

Participants then completed practical exercises using 3–4 reference video clips, independently recording target behaviors. Discrepancies were discussed until observers achieved $\geq 85\text{--}90\%$ agreement before actual data collection.

Supplemental materials were provided, including an emergency instruction file, the CWS color-change protocol, and a rewards checklist with a point system, to support consistent and reliable implementation.

Data Collection

Data were collected through direct observation and frequency recording of the students' inappropriate behaviors, which included hand flapping, non-functional vocalizations, leaving the seat without permission, and perseverant concentration on objects or staring. Observations were conducted three times per week on different school days (e.g., Sunday, Tuesday, Thursday), with each session lasting 20 minutes, resulting in a total of 60 minutes of observation per student per week. The weekly average of occurrences for each student was calculated to better represent the data in graphs.

Observations followed a time-sampling procedure at 30-second intervals, during which the researcher sat in a designated area of the classroom. A smartphone app with a timer was used to indicate each 30-second interval. During each interval, the researcher recorded the occurrence of any inappropriate behavior by making a mark (slash). For behaviors that were continuous, a new mark was recorded only if the behavior stopped for more than two seconds and then resumed. This method allowed for precise and reliable measurement of each target behavior during each observation session.

A second researcher was also involved to ensure inter-observer agreement (IoA), which was approximately 90%, confirming the reliability of the observations.

The study was conducted over **seven weeks**, with observations distributed across three phases as follows (Table 3):

Table 3

Number and Duration of Observation Sessions per Phase

Phase	Duration	Number of Sessions per Student	Total Observation Duration
<i>Baseline Phase (A₁)</i>	2 weeks	6	120 minutes
<i>Intervention Phase (B)</i>	3 weeks	9	180 minutes
<i>Withdrawal Phase (A₂)</i>	2 weeks	6	120 minutes
Total	7 weeks	21	420 minutes (~7 hours)

This schedule was designed to:

1. Provide sufficient data to accurately determine behavioral trends.
2. Ensure that 20-minute sessions were appropriate for classroom activities without distracting students or teachers.
3. Distribute observations across different days to minimize the influence of daily variations (e.g., mood, special activities).
4. Offer a realistic and recurring representation of student behavior in an inclusive classroom environment.

This approach allowed for consistent, reliable, and detailed measurement of the effects of the Color Wheel System on student behavior across all phases of the study.

Duration and Number of Observation Sessions

Behavior was monitored systematically to ensure accurate measurement of changes in student behavior throughout the study. Each student was observed three times per week on different school days (e.g., Sunday, Tuesday, Thursday), with each session lasting 20 minutes, resulting in a total of 60 minutes of observation per student per week.

This schedule was adopted for several reasons:

1. **Frequency of Sessions:** Observing students three times per week provides sufficient data to accurately identify behavioral trends and changes.

2. **Session Duration:** Each 20-minute session is appropriate for the classroom context, allowing the researcher to collect meaningful data without causing disruption to students or teachers.
3. **Distribution Across the Week:** Spreading observations over different days reduces the influence of daily variations, such as student mood or special classroom activities, on the results.
4. **Total Weekly Observation Time:** One hour per week per student provides a realistic and representative picture of student behavior in an inclusive classroom environment.

This observation schedule was applied consistently across all phases of the study (baseline, intervention, and withdrawal) to ensure comparability of the collected data.

Interobserver Agreement, Treatment Integrity, and Teacher Acceptability

Reliability data were collected for 20–30% of sessions, covering at least 90% of study sessions. Observers recorded behaviors independently, and reliability was calculated as the total number of agreed intervals divided by total observed intervals $\times 100$. Example: Observer A recorded 9 hand flaps, Observer B recorded 8 $\rightarrow 8 \div 9 \times 100 = 88.89\%$. Reliability $\geq 80\%$ was acceptable, $\geq 90\%$ preferred.

Treatment Integrity was monitored using checklists for both student behaviors and proper implementation of the Color Wheel System (CWS). Teachers followed the checklists and signed them to confirm completion. Procedural fidelity was calculated as the percentage of correctly implemented steps (e.g., 5 of 6 steps = 83.33%).

Teacher Acceptability was assessed through feedback on the ease of use, practicality, and perceived effectiveness of the CWS in promoting positive behavior and managing classroom routines. This ensured that the intervention was feasible for routine implementation.

Social Validity

After completing the study, the teacher completed a questionnaire designed to assess perceptions of the utility, effectiveness, and practicality of using the Color Wheel System (CWS) to manage student behavior. The questionnaire consisted of nine items rated on a 5-point Likert scale (1 = Strongly Agree, 2 = Agree, 3 = Not Sure, 4 = Disagree, 5 = Strongly Disagree).

This measure was used to evaluate the social validity of the intervention by examining the teacher's perceptions of (a) ease of implementation, (b) effectiveness of the intervention, and (c) likelihood of continued use in the future. The teacher received, completed, and returned the questionnaire electronically.

Additionally, students completed a brief social validity questionnaire to assess their perceptions of CWS and its impact on classroom behavior and routines.

Data Analysis

The collected data were analyzed using visual analysis, which is the most common and appropriate method for interpreting results in single-subject design studies. Graphs were used to display changes in the target behaviors across the three phases (A1, B, and A2).

The analysis focused on comparing the levels of behavior between phases, examining the direction and consistency of trends, and identifying clear differences that indicate the impact of the intervention. A decrease in the frequency of inappropriate behaviors and an increase in appropriate behaviors during the intervention phase (B) were interpreted as evidence of the effectiveness of the Color Wheel System (CWS). The stability or return of behaviors during the withdrawal phase (A2) was also examined to determine whether the intervention effects were maintained over time.

Ethical Considerations

This study complied with ethical standards for educational research involving students with autism spectrum disorder (ASD). Written parental consent was obtained after a full explanation of the study's purpose and procedures, emphasizing voluntary participation and the right to withdraw at any time. Participant confidentiality was protected by using coded identifiers and secure data storage.

The Color Wheel System (CWS) was selected as a safe, non-invasive classroom management tool with no physical or psychological risks. All procedures prioritized the students' best interests by adapting activities to their individual needs and ensuring comfort throughout participation.

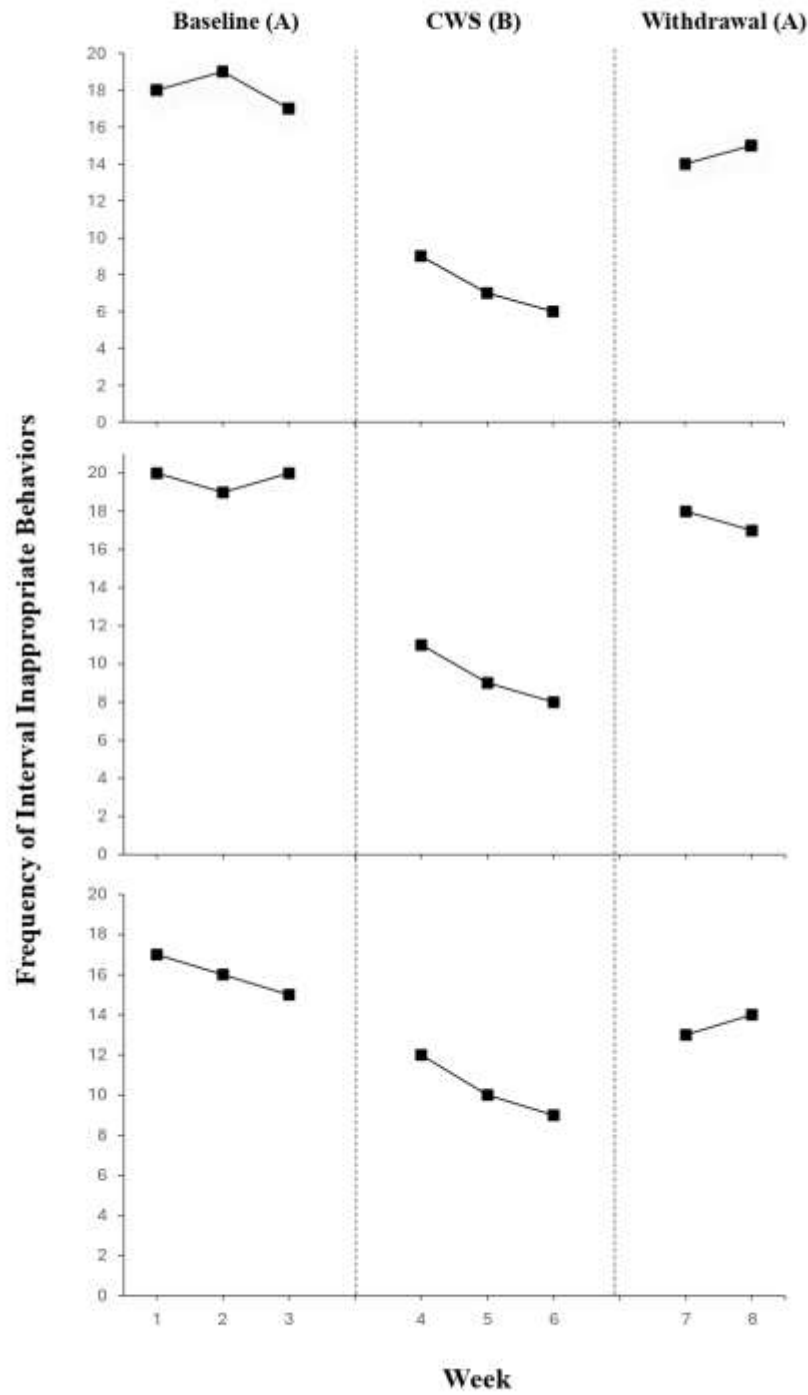
Institutional approval was obtained from the school administration, and the research plan was reviewed by a special education ethics committee. Finally, the classroom rules were introduced to all students to ensure fairness and prevent any sense of stigma or discrimination.

Results

Figure 1 displays the results of the study, based on an ABA single-subject design (Baseline–Intervention–Withdrawal), revealed clear patterns in the frequency of inappropriate behaviors among the three participating students. These behaviors included repetitive hand flapping, nonfunctional vocalizations (e.g., humming or shouting), frequent standing up from the seat, prolonged staring at objects (such as fans or pens), and ritualistic actions such as repeatedly arranging materials. Data were collected over eight consecutive weeks: Weeks 1–3 represented the first baseline phase (A1), Weeks 4–6 represented the intervention phase (B), and Weeks 7–8 represented the withdrawal and return to baseline phase (A2).

Student 1: During the baseline phase (A1), Student 1 exhibited a high rate of inappropriate behaviors (18–19 occurrences per session). After implementing the Color Wheel System (CWS) during the intervention phase (B), these behaviors noticeably decreased to 9 and reached 6 by Week 6. Upon withdrawing the intervention (A2), the rate increased again to 14–15 occurrences per session. This pattern indicates that the CWS had an immediate and direct effect on behavior reduction but required continuity to maintain outcomes.

Figure 1. Frequency of inappropriate behaviors across three phases: baseline (A), intervention using the Color Wheel System (B), and withdrawal(A).



Student 2: In the baseline phase (A1), Student 2 demonstrated very high levels of inappropriate behaviors (20–21 occurrences), especially nonfunctional vocalizations and prolonged staring. With the introduction of CWS (B), the frequency decreased to 11, then to 8 by Week 6. However, after the withdrawal phase (A2), the rate increased to 17–18, showing partial loss of behavioral control once the intervention was removed.

Student 3: Student 3 displayed moderate but consistent inappropriate behaviors during baseline (15–17 occurrences). These included body rocking and repetitive arrangement of objects. The frequency declined during the intervention phase (B) to 12 and later 9, reflecting a positive behavioral change. However, during withdrawal (A2), the behaviors rose again to 13–14 occurrences, suggesting partial regression.

Overall Patterns: All three participants showed similar patterns (Table 4):

High frequencies of inappropriate behaviors during baseline (A1).

Marked reductions following the introduction of the CWS intervention (B).

Partial return of behaviors after withdrawal (A2).

These findings confirm that the Color Wheel System effectively reduced inappropriate behaviors and enhanced on-task engagement. Moreover, it improved classroom participation by decreasing self-stimulatory and off-task behaviors, allowing more consistent interaction between students, peers, and teachers in inclusive classrooms.

Table 4. Frequency of Inappropriate Behaviors Across Phases

Student	Baseline (A1)	Intervention (B)	Withdrawal (A2)
1	18–19	6–9	14–15
2	19–20	8–11	17–18
3	15–17	9–12	13–14

Note: Values represent approximate frequencies of inappropriate behaviors per observation session

Discussion

The findings of this study are consistent with a growing body of research demonstrating the effectiveness of visual support and structured behavior management systems for students with autism spectrum disorder (ASD). Across all three participants, the implementation of the Color Wheel System (CWS) led to a noticeable decrease in inappropriate behaviors such as hand flapping, non-functional vocalizations, frequent standing, and prolonged object gazing, compared with the baseline phase.

These outcomes align closely with Colvin and Sugai (1989), who reported that clear visual signals help students understand classroom expectations and reduce behavioral disruptions. Similarly, Dunlap et al. (1994) found that structured visual cues significantly improved classroom behavior and engagement among students with ASD. The current study extends these findings by confirming that even simple visual systems, like the CWS, can produce meaningful behavioral improvements when applied consistently in inclusive classrooms.

The observed decline in disruptive behaviors during the intervention phase supports prior findings by Kern et al. (2001) and Dettmer, Simpson, Myles, and Ganz (2000), who highlighted that visual strategies, when combined with positive reinforcement, promote self-regulation and reduce problem behaviors in students with autism. In the present study, the use of immediate, color-coded feedback provided clear and consistent information about behavioral expectations, allowing students to adjust their actions in real time.

When the intervention was withdrawn (A2), a partial return of inappropriate behaviors was observed, suggesting that the effectiveness of the system is directly linked to its continuous application. This finding parallels Hodgdon (1995) and Bryan and Gast (2000), who emphasized that visual supports must be maintained over time to ensure stable behavioral outcomes. Similarly, Ganz, Heath, Parker, Rispoli, and Vollmer (2012) reported that discontinuation of visual or structured interventions often results in a gradual reemergence of undesired behaviors, especially among students who rely heavily on external structure.

Individual differences among the three students were also evident. Student 1 exhibited the most consistent and stable improvement, possibly due to higher responsiveness to visual cues and reinforcement. Student 2 showed a sharp reduction during the intervention but quickly regressed after its withdrawal, indicating dependence on external behavioral supports. Student 3 demonstrated moderate improvement, reflecting variability in individual learning styles and levels of behavioral rigidity—a pattern also observed by Dettmer et al. (2000) and Knight, Sartini, and Spriggs (2015), who found that student responsiveness to visual systems varies based on cognitive flexibility and reinforcement history.

From an applied perspective, these results reaffirm that the Color Wheel System is not merely effective in reducing the frequency of inappropriate behaviors but also enhances the overall quality of classroom participation and engagement. This aligns with findings from Hume and Odom (2007), who demonstrated that visual and environmental supports contribute to greater task engagement and fewer behavioral disruptions in inclusive settings.

In summary, the current study contributes additional evidence supporting the use of structured visual interventions to promote positive behavior in students with ASD. The consistency of these results with previous literature indicates that visual supports, particularly the CWS, can serve as an accessible, low-cost, and teacher-friendly strategy to enhance inclusion outcomes. However, sustained implementation and individualized adaptation are essential for maintaining long-term behavioral gains. Future research should explore the combined effects of the CWS with positive behavior support (PBS) frameworks and self-management training to enhance durability and generalization of behavioral improvements.

Limitations

Despite the current study demonstrating a clear and effective impact of using the color wheel system in reducing atypical behaviors among three students with autism spectrum disorder (ASD), several limitations should be considered when interpreting the results. First, the small sample size, limited to only three participants, restricts the generalizability of the findings to the broader population of students with ASD in inclusive settings. Second, the intervention was implemented over a brief period of three weeks, which may be insufficient to produce long-term effects or to assess the sustainability of the outcomes. Third, the study did not include a follow-

up phase after the intervention, leaving it unclear whether the observed effects would persist or diminish over time. Fourth, individual differences among the students were evident, suggesting that the effectiveness of the system may be influenced by personal factors such as the severity of the disorder, self-regulation skills, or motivation to learn. Finally, although direct observation was used to collect behavioral data, such measurements may be affected by subjective factors, including the observer's experience or unintentional biases.

Recommendations

Based on the findings and the identified limitations, several recommendations are proposed for future research and educational practice. Future studies are encouraged to include larger and more diverse samples representing different age groups and varying levels of autism spectrum disorder (ASD) severity. This expansion would enhance the generalizability and external validity of the findings. In addition, extending the duration of the Color Wheel System (CWS) intervention and incorporating follow-up phases would provide valuable insights into the long-term sustainability of behavioral improvements observed during the study.

It is also recommended that future research integrate CWS with complementary strategies, such as positive reinforcement or self-regulation training, to increase its overall effectiveness and to promote self-management skills among students with ASD. Providing comprehensive training for teachers and parents on how to implement the system consistently across different contexts (both in school and at home) may help maintain behavioral gains and foster continuity between settings.

Moreover, comparative studies examining CWS alongside other visual behavior management approaches, such as visual schedules or behavior cue cards, could help identify which visual interventions are most effective for particular student profiles or classroom conditions. Finally, employing multiple sources of data collection, including teacher rating scales, self-report measures, or video-based observations, would strengthen the reliability and validity of behavioral assessment and provide a more holistic understanding of intervention effects.

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