A Pilot Study of Using Picture Books to Improve the Social Skills of Children in the Autism Spectrum Disorder

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Abstract

Evaluating the effectiveness of using picture books in teaching behavior to children with Autism Spectrum Disorder (ASD), five children with ASD intellectual disabilities (ASD+ID) were taught queuing behavior using picture books. Multiple baselines with a staggered introduction of the independent variable of picture books to participants were employed to evaluate the dependent variable of the percentage of correct behavior observed. Children without exposure to picture books continued to fail to line up, whereas there was an increase in queuing behaviorwith picture book exposure. The results showed that picture books could be used to teach children with ASD+ID queuing behavior sustainably and effectively.

1. Introduction

1.1 The Characteristics of ASD

One of the early signs of Autism Spectrum Disorder (ASD) is the lack of eye contact (Apicella et al., 2020; Franchini et al., 2019), and this can be observed in toddlers as young as six months of age, regardless of the cultural environment (Oliveira et al., 2021). ASD is a developmental disorder that can be detected in the first two years of life, with later irregularities in social behavior and corresponding skill deficits (American Psychiatric Association, 2013). Social skill deficits or excesses may impact social interaction and limit the development of meaningful connections (Hood et al., 2022). Ranging from mild to severe, children with ASD can manifest deficits in initiating and maintaining reciprocal social interaction, communication difficulties, and characteristics of idiosyncratic language and repetitive motor mannerisms (Min & Wah, 2011). Other features demonstrated by children with ASD include limited social skills, which affect their abilities to establish and maintain friendships (Locke et al., 2010). These deficits impede a child's social and emotional development, increasing the risk of social withdrawal and isolation (Matson et al., 2009). With social isolation likely to result in peer rejection (Kagohara et al., 2012), prompt detection is crucial for early intervention programs in kindergarten (Elder et al., 2017). Without explicit teaching, social deficits and lack of friendships will likely persist into adulthood (Howlin et al., 2004; Taylor et al., 2015; Taylor & Seltzer, 2011).

1.2 Research on Picture Books and Social Stories Current Situation

Picture books contains pictures or photos as the main body with text as a supplement. Picture books are different from other forms of illustrations, focussing on the continuity of the picture content to convey a central message (Lian et al., 2023). Previous studies showed that teaching with picture books can improve the academic performance of ASD children (Lian et al., 2023). Without the help of picture books, children with ASD's attention

and academic performance decreased significantly (Bryan & Gast, 2000). As an auxiliary tool, picture books help to improve the social skills, communication skills, and imagination of ASD children (Tabernero & Calvo, 2020; Azano et al., 2017; Tabernero & Calvo, 2020). Pierson and Glaeser (2007) found that social stories and comic strip conversations assisted students with resolving difficult social situations by increasing eye contact and voice volume when they greeted others. Wilson et al. (2022) demonstrated that storytelling with social contextual information regarding eye gazes or faces in social contexts was helpful to children with typically developing (TD) and ASD.

Social stories are a commonly used intervention for individuals diagnosed with ASD by behavioral analysts and other professionals (e.g., teachers, speech-language pathologists, and parents) (Leaf et al., 2020). Social Story interventions are designed to increase the quality and quantity of the social interaction manifested by individuals with ASD in social contexts with others by teaching specific concepts (Karal & Wolfe, 2018). A Social Story intervention is developed to provide ASD individuals with the needed description and explanation to navigate social situations and contexts of appropriate cues and responses (Del Valle et al., 2001; Karal & Wolfe, 2018; Kuoch & Mirenda, 2003; Sansosti et al., 2004). Gray (1998) indicated that the primary purpose of a Social Story is to share and deliver relevant information about the time and place of a given situation, the persons involved, what is occurring and why it is happening. Through stories, multiple skills can be taught to increase the social interaction of ASD students, including addressing and responding to others (verbal, physical and gestural), retaining conversations, offering help, giving needed information, and engaging in games (Bellini et al., 2007). These skills allow ASD students to learn better from their peers and adults and promote positive social interaction. Using a single-subject, Almumen and Almuhareb (2020) used a multiple baseline design to investigate the acquisition of gratitude skills by seven elementary students with ASD in a Kuwaiti self-contained Special Education school, finding that they used more gratitude words after reading the "Social Story" delivered via iPads. Students increased their use of "thank you" in and out of school. Bordoff-Gerken and Asaro-Saddler (2021) studied four male 7-9-year-old ASD students with an iPad-based Social Story, and it decreased the number of teacher redirects in attending a group lesson. Cathy et al. (2018) presented a review of 22 single-case research design (SCRD) studies on social story intervention for individuals with ASD, using four non-overlap indices to assess intervention, maintenance, and generalisation effects, finding that social stories intervention was effective.

Social Stories have shown some effectiveness in improving behavior (Reynhout & Carter, 2011). Positive outcomes such as reducing disruptive behaviors (Scattone et al., 2002), decreasing inappropriate social behaviors (Graetz et al., 2009), and increasing prosocial behaviors for preschool children with ASD (Crozier & Tincani, 2007) have been found. At the moment, Social Stories are used in classrooms to improve the behavior of ASD students, given their cost-effectiveness and easy implementation, allowing a quick, rapid positive change in behavior as a result of the intervention (Reynhout & Carter, 2009).

1.3 Theoretical Principle

Applied behavior analysis (ABA) is a therapy that teaches skills and expected behavior using preference items (Yu et al., 2020). Some experts claim it is the "gold standard" for autism treatment (Callahan et al., 2019). At its core, ABA utilises the psychological principles of learning theory to enact change in the behaviors commonly seen in ASD (Lovaas et al., 1974). Ole Ivar Lovaas produced a method based on the principles of B. F. Skinner's theory of operant conditioning in the 1970s to help treat ASD children (Lovaas et al., 1973; Skinner, 1953; Smith & Eikeseth, 2011). Over the past 60 years, ABA has moved from the core principles established in the early Lovaas model and subsequent UCLA Young Autism Project into many comprehensive treatment models and focused intervention practices, methods, and teaching strategies, all aiming to address ASD functioning, including cognition, language, social skills, problem behavior, and daily living skills (Reichow et al., 2018). One notable and often cited foundational model is "antecedents, behavior, and consequences," otherwise known as the ABC model, in which manipulating either or both the antecedents and consequences of behavior is intended to increase, decrease, or modify the behavior, generating a transferrable tool to target behaviors of interest effectively (Bijou et al., 1968; Dyer, 2013). There are also several techniques commonly associated with ABA that are worth noting, including preference items, extinction, prompting, video modelling, as well as the Picture Exchange Communication System (PECS), though many of which are widely used in other intervention and education settings (Granpeesheh et al., 2009; Sandbank et al., 2020; Stahmer et al., 2005).

In this study, the investigators assumed that the picture book "Queuing" would help children with ASD+ID establish queuing behavior, and will use picture books to conduct behavioral intervention studies for children with ASD.

2. Research Design

2.1 Research Object

This study recruited five children with ASD+ID (Mean age = 5.8, range = 5 to7) (see Table 1 for detailed demographic information). A few special schools were invited to participate via invitation emails detailing the purpose and procedure of the experiment, the use of the research data, the potential contributions of the findings, and assurance of participants' safety (i.e., no physical or mental harm would be induced). Formal written consent and assent were obtained during the interviews.

The participants were from the same local area and education Institution (see Table 1). The study subjects are Chinese, speak Mandarin, and have prior exposure to picture book reading. The participants had normal visual acuity. The parents were all informed of the experimen''s purpose and procedure before they signed a consent form to acknowledge their children's participation. The ethics committee approved the study (2022, Ethical Review No. 229 of the Second Dental Hospital of Fujian Medical University, 2022229).

Recruitment of the ASD+ID children was based on the following conditions: (1) The diagnosis of the CNBS-R2016 (Chen et al., 2021; Li et al., 2019; Luo et al., 2020; Yang et al., 2021; Li & Lu, 2008); (2) an intelligence level between 55 and 69 based on the diagnostic report provided by the children's physician (M = 65, SD = 3.24), (3) aged between 5 to 7 years old, and (4) ASD-at-risk when evaluated using CARS for severity (Range = 30-39, M = 34.6, SD = 1.82). The sole exclusion criteria was the presence of other types of developmental disorders. The speech and intelligence of the children with ASD+ID were not matched, as some of them had poor verbal function and were unable to offer verbal responses.

Table 1. Basic information of subjects

Variable	Category	Number	Percentage
Score	Children with ASD+ID	5	100%
Age	5 years old	2	40%
	6 years old	2	40%
	7 years old	1	20%
Sex	Male	5	100%
	Female	0	0%
IQ	IQ scores >70	0	0%
	69>IQ scores >60	5	100%
	59>IQ scores >55	0	0%
CARS	30-35	4	80%
	36-39	1	20%

2.2 Materials and Picture Book

A picture book, "Queuing" (1920 x 1080); one slide (high, long); camera, one bracket, touch screen hanging computer, five small chairs, one slide, one simulated zebra crossing, one simulated bus, and one simulated stair.

"Queuing" is a picture book published by Southwest Normal University Press (a national-level publishing house) that was classified as suitable for children aged 3 to6. Previous studies utilized homemade picture books, but to avoid the impact of limitations in picture book selection, "Queuing" was chosen as it had no picture book background (see Figure 1) to incorporate the previous research findings on picture book background fixation (Lian et al., 2023; Lian & Hong et al., 2023a; Lian & Hong et al., 2023b).
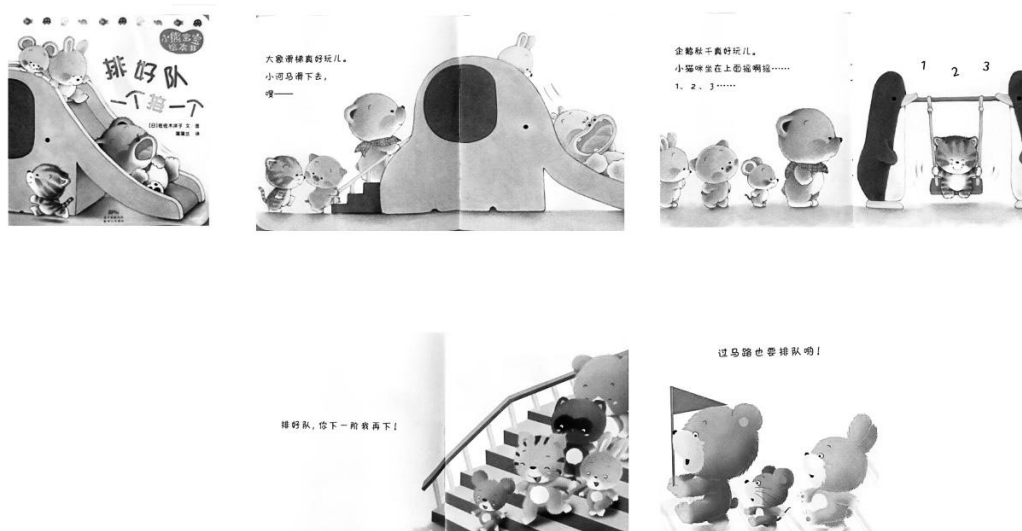
Figure 1. Pages from the "Queueing" picture book

2.3 Experimental Design

A multiple baseline design across participants was employed, sequentially incorporating a staggered introduction of the independent variable to participants (Ledford & Gast, 2009).

Independent variable: the teacher showed the picture book during the giving of instructions to the students to complete the queuing behavior within 5 seconds.

Dependent variable: The percentage of correct queueing behavior during the study within 5 seconds in 3 consecutive games after the queuing instruction was given, and without any queue jumping.

2.4 Research Process

The research process underwent the Baseline, Training, and Maintenance periods (see Figure 2). Firstly, the teacher brought the ASD+ID children to the classroom with a hanging touchscreen computer, study desk, and chair. The children sat on the chair 2 meters away from the computer, with the chair's height and table optimized for their learning. Secondly, the picture books were played on the computer without obstruction of sight. Lastly, the participants were asked to queue based on the content of the picture book. The entire learning process was recorded for subsequent analysis by the researchers. The detailed process is as follows:

Baseline period: the teacher instructed the students to "queue up" and records the queuing behavior of the subjects (see Appendix Table 1). The desired outcome was for the students to stand in line in three consecutive game activities within 5 seconds without queue jumping. The researcher recorded three videos of the subjects' queuing behavior for a week. In the baseline phase, if the participants did not queue up correctly, they were left uncorrected to get the baseline percentage of correct queuing behavior after listening to the instructions.

Social Behavior period: A list of preference items was provided to the teachers (see Appendix Table 2) to encourage the participants during the teaching process.

Training period: The teachers instructed the participants to use picture books twice a week, page by page. After the teaching activities, games and the reduced usage of picture books were gradually implemented. For example, the first page of the picture books about queue behavior was shown on the slide. Following which, the teachers switched the slide and directed the students to line up in the correct order and avoid jumping the queue. If the subject exhibited the anticipated target behavior, the researcher provided social preference items or food fortification; if the subject performed inappropriate queuing behavior, the teacher gave correction, including verbal prompts and action assistance. Two months later, the picture book teaching activity ended. The teacher led the subjects to test the participants in different living environments.

Maintenance period: there was no behavioral intervention, and the participants participated in game activities in the integrated kindergarten. When the teacher gave the "queuing" instruction, the researchers would observe the queuing behavior of the participants. The passing requirement was for the participants to queue up for three consecutive game activities within 5 seconds without jumping queues. The process was recorded for later research analysis.

After the experiment, parents and teachers were interviewed and asked for suggestions (see Appendix Table 3). In the absence of feedback from the parents and teachers, feedback was sought from experts, as shown in Table 2.

Figure 2. Behavioral Intervention Process Editing

Note. 1 Baseline period, 2-3 Training period, 4 Maintenance period

Table 2. Expert information

#	Occupation	Affiliation	Work experience	Residence
1	Associate Professor	South China Normal University	More than 20 years of experience in teaching and research in higher education; research interest includes the educational support of autism spectrum disorder groups	Guangzhou
2	Professor	Suihua College	Long-term engagement in the editor work of the special education journals, and research on educational support for children with autism	Suihua
3	Professor	Chongqing Normal University	Long-term engagement in teaching in higher education; research interests include the basic theoretical issues of special education	Chongqing
4	Professor	Liaoning Normal University	Long-term research in the higher education field; research interests include the diagnosis and evaluation of patients with extensive developmental disorders	Dalian
5	Associate Professor	Heilongjiang Preschool Teachers College	Long-term research on educational support for children with autism and adults with autism	Mudanjiang

2.5 Research Hypothesis

Previous studies found that the background of picture books caused fixation results among ASD+ID children, and picture books without background are more conducive to the fixation results of picture books (Lian et al., 2023; Lian & Hong et al., 2023a; Lian & Hong et al., 2023b). Based on this, it was hypothesized that the picture book "Queuing" would help children with ASD+ID establish queuing behavior better.

2.6 Research Tools

The investigator used visual analysis to pilot the data, which were then analyzed using SPSS 24.0, specifically Tau-U, to verify the results further. Tau-U is a method for measuring data nonoverlapping between two phases (Parker et al., 2011). It is a "distribution-free" nonparametric technique with a statistical power of 91%-95% of linear regression, with the data conforming to parametric assumptions (Brossart et al., 2018). Tau-U follows the "S" sampling distribution. Therefore, p-values and confidence intervals are available. The interpretation of Tau-U effect sizes is as follows. A numerical score between 0.93-1 is considered a significant effect, 0.66-0.92 is a medium effect, and 0-0.65 is a small effect (Parker et al., 2011).

3. Results

3.1 Accuracy of Queuing at Different Stages

Figure 3 in the Appendix shows the correct percentage of participants (codenamed accordingly) lining up during the five participants' baseline, intervention, and generalisation condition phases. Generalization conditions "Gen 1" in the cross-walking setting, "Gen 2" in the classroom setting, and "Gen 3" in the bus queue-up setting. Trends in the intervention period for all participants showed increase in queueing behavior.

'Jason' frequently lined up correctly during the baseline condition at an average rate of 55.7% (range = 10%-100%), and this percentage increased when picture books were introduced. His intervention data were stable since 80% of his data fell within 25% of the median level. All data in the intervention condition showed that he had mastered the criterion. While in the generalization condition, Jason attained an average accuracy of 100% (range = 100%-100%), with trend stability in the gen 1, gen 2, and gen 3 conditions.

Lee did not respond to lining up in the baseline condition; but once the picture book intervention condition was performed, the frequency of lining up increased, reaching an average percentage of 56.4% (range = 10%-100%) to mastering the behavior at an average accuracy of 100% (range = 100%-100%) in the Gen 1, Gen 2, and Gen 3 conditions, all with a stable data trend.

Wong did not respond to lining up during the baseline initially; however, his performance improved after introducing the picture books in the intervention. From an initial average percentage of 57.9% (range = 10%-100%), the behavior was mastered at an average accuracy of 100% (range = 100%-100%) in the gen 1, gen 2, and gen 3 conditions, all with a stable data trend.

David partially lined up correctly in the baseline condition with an average accuracy of 68.6% (range = 10%-100%). After the picture book intervention, there was mastery of the behavior at an average accuracy of 100% (range = 100%-100%) in the Gen 1, Gen 2, and Gen 3 conditions, with a stable data trend.

Frank did not respond much to lining up during the baseline condition, with an initial average accuracy of 57.5% (range = 10%-100%), but with the intervention, it increased to an average accuracy of 100% (range = 100%-100%) in the Gen 1, Gen 2, and Gen 3 conditions, with a stable data trend.
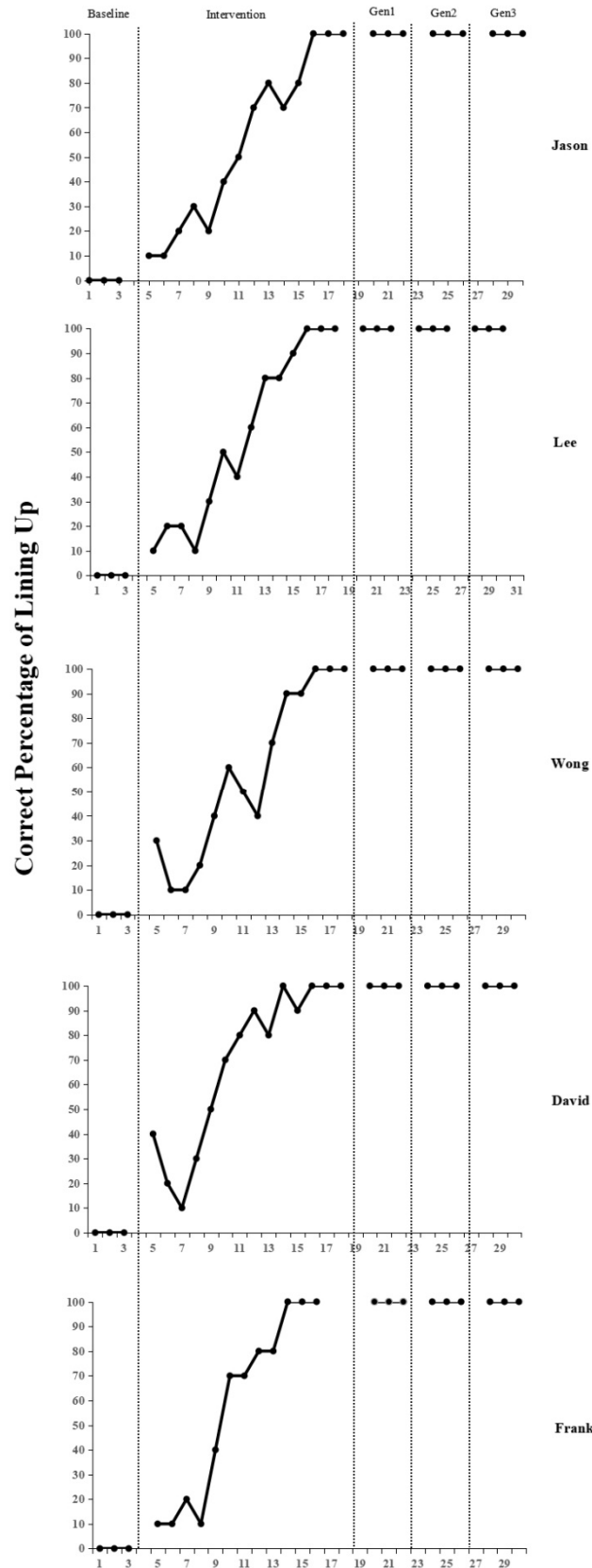
Figure 3. Correct percentage of lining up during the baseline, intervention, gen 1, gen 2, and gen 3 for Jason, Lee, Wong, David, and Frank. The y-axis depicts the percentage of lining up correctly, while the x-axis represents the number of sessions

3.2 Social Validity

The average ratings were 4.69 (SD = 0.01) for the acceptability of the intervention, 4.49 (SD = 0.19) for feasibility, and 4.14 (SD = 0.11) for satisfaction, which all indicated good social validity using picture books for lining up (see Table 3). In the interview, parents and teachers suggested that picture books would improve the lineup, yielding the desired effect. For example, Frank's mother stated, "He is good at lining up after the intervention, especially for shopping check outs. He keeps saying 'line up' and then stands behind me, ready to check out."

Table 3. Social validity for five participants

Participant	Acceptability	Feasibility	Satisfaction
Jason	4.72	4.51	3.6
Lee	4.82	4.42	4.2
Wong	4.52	3.8	4.3
David	4.68	4.9	4.1
Frank	4.71	4.8	4.5

4. Discussion and Conclusion

In this study, five ASD+ID children were taught to use picture books to queue.

4.1 Discussion

Utilizing Applied Behavior Analysis (ABA) as the theoretical basis, this study used picture books on ASD+ID children to examine the development of queuing behavior. In agreement with previously related studies (Tabernero & Calvo, 2020; Azano et al., 2017; Tabernero & Calvo, 2020; Wilson et al., 2022), picture books were found to be successful as a tool for establishing social behavior. The narrative of the picture books (crossing the street, sliding the slide, climbing the stairs, etc.) frequently coexisted with the recurring instructions to "queue." When the ASD+ID children encounter a similar outdoor setting, they were expected to queue when instructed. Thus, the picture book content serves as a prerequisite stimulus for behavioral expression and a compelling visual cue, which is significant for establishing behavior. Nevertheless, it was suggested that any other interventions would be as effective without the Social Story component (Zimmerman & Ledford, 2017) since simply strengthening or shaping behavior can also guide ASD+ID children to queue. ASD+ID children can have long-term dependence on preference items, which is not conducive to the stability and continuity of behavior establishment. Nonetheless, this study also showed that picture book content without the background mentioned in previous research (Lian et al., 2023) would be more conducive to providing learning support for ASD+ID children.

Secondly, the behavior taught by the picture book was relatively continuous. From a low baseline queueing rate for the ASD+ID children, a higher rate of queuing behavior, going upstairs, crossing the road, and playing slide at the generalization stage was achieved. Picture book teaching thus had a positive impact on queuing behavior, with a persistent effect that can continue to the generalization stage of different situations. This finding is consistent with previous relevant research findings (Cathy et al., 2018) advocating for the use of picture books for ASD+ID children's behavior teaching.

When the parents of the five ASD+ID children were interviewed, they reported that their ASD+ID children queued up when shopping and in everyday life instances sustainably.

Picture books should not be viewed as an isolated teaching method but should be combined with other methods. In this study, the preference items of the five ASD+ID children were selected in advance and used as stimuli. Also, when the participants did not queue, the teacher assisted (action, speech, and physical assistance). Through the aid, the participants completed and increased the frequency of active queuing behavior. From the perspective of ABA theory, when individuals exhibit expected behavior, they ought to be reinforced timely with the preference items stimuli. Thus, the next time a situation similar to the picture book page appears in an outdoor activity, teachers should provide relevant guidance.

4.2 Conclusion

Teaching children with ASD+ID through picture books helps them establish queuing behavior sustainably with a good generalisation effect in other situations.

5. Educational Advice and Research Limitations

5.1 Educational Advice

Picture books can be an essential teaching tool for establishing social behavior. Teachers could transform social behaviors in daily life into picture books and use picture books to educate and develop target behaviors. Therefore, the content of picture books should be based on everyday life and be relatable to the real lives of ASD+ID children to establish their behavior through picture books and apply it to everyday life.

Secondly, teachers should strengthen the preference items to reward desirable explicit behavior. If ASD+ID children enjoy reading picture books, picture book learning can be augmented through preference items. When expected behaviors are performed, teachers should strengthen them timely for autonomous display in similar situations.

Finally, teachers should combine picture books with the social environment when establishing social behavior. After acquiring knowledge from picture books, it is imperative to apply generalization in diverse living environments, which necessitates consistent practice in daily life. For example, using picture books to establish queuing behaviour in the classroom and generalizing it to different living situations, such as crossing the road, taking the bus, and taking the elevator in daily life, can ensure that the established behaviour remains stable and sustainable.

5.2 Research limitations

First, the number of research subjects is limited because this study is only exploratory and a pilot. In future studies, the scope and quantity of research subjects could be increased to allow for the comparison and analysis of differences among different research subjects.

Secondly, the picture books used in this study are unique, with distinct pictures without background compared to ordinary picture books. In future research, picture books with and without background could be explored with regards to their effectivenes in establishing behavior.

Finally, several approaches typically used in social skills training, such as video modelling (e.g., Scattone, 2008), prompting (e.g., Crozier & Tincani, 2007), systematic desensitization (Lian, 2012), role-playing, and specific instruction (Almumen & Almuhareb, 2020) could be explored in future studies.

As this study solely examined the efficacy of picture books in instilling queuing behavior, whether alternative methods are equally effective in investing queuing behavior, or whether alternative methods are more convenient than picture books in instilling queuing behavior could be explored.

Conflicts of Interest

The authors declare no conflicts of interest to report regarding the present study.

Data Availability Statement

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Acknowledgement

Ethics Approval and Consent

Ethical approval is not a requirement for non-intrusive studies with autistic children. The research period is 6 months (2022.08-2023.02). However, the parents of the autistic children were well-informed of the purpose and procedures of the experiment in two rounds of interviews. Written consent was also obtained from the legal guardians.

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Appendices

Table 1. Inter-observer consistency data collection form

Stage	Antecedent (A) Behavior (B) Consequence (C)	Round (Correct: +; Error: -)									Accuracy%
Baseline period	A: Teacher standing in front of the classroom										
	SD: Stand up, come and queue up										
	B: Students queue up in order										
	C: If the student responds correctly: give reinforcement If the students react incorrectly: ignore, reinforce non target behavior										
Stage	Antecedent (A) Behavior (B) Consequence (C)	Round (Correct: +; Error: -)									Accuracy%
Training period:	A: Teacher presenting pictures (multimedia)										
	SD: Stand up, come and queue up										
	B: Students queue up in order										
	C: If the student responds correctly: give reinforcement If the student responds incorrectly: based on verbal prompts (but does not repeat instructions)										
Stage	Antecedent (A) Behavior (B) Consequence (C)	Round (Correct: +; Error: -)									Accuracy%
Maintenance period	A: The teacher is in the classroom										
	SD: Come and queue up/go, queue up										
	B: Students queue up in order										
	C: If the student responds correctly: give reinforcement If the student responds incorrectly: based on verbal prompts (but does not repeat instructions)										

Table 2. preference items list

Consumption of preference items (such as ice cream, candy, etc.)		
Serial Number	preference items name	preference items grade
1	Candy	1
2	Mr. Photo	2
3	Ballon	4
4	Sand Bucket	5
5	Teddy Bear	3
Active preference items (such as watching movies, watching TV, etc.)		
Serial Number	preference items name	preference items grade
1	Swimming	3
2	Watching Cartoons	2
3	Listening to Music	5
4	Scrolling iPad	1
5	Playing Hide & Seek	4
Social preference items (e.g. you are beautiful, you are smart, etc.)		
Serial Number	preference items name	preference items grade
1	Well Done	3
2	Good Job	2
3	High five	1
4	Wonderful	4
5	Brilliant	5
Other supplements:		

preference items grade: 1(very like); 2(a little like); 3(indifferent); 4(a little dislike); 5(very dislike)

Dear Parents:

Hello! Thank you for your support and cooperation in this study, which has successfully entered the final stage. I would like to know your views and opinions on picture book teaching. I hope you can answer truthfully without distinction between right and wrong. The survey results are for research reference only. Thank you for your participation and cooperation!

Table 3. Social Validity Questionnaire (Parents)

Question number	Title	Very disagree	Disagree	Indeterminacy	Agree	Very much agree
1	This teaching research is very suitable for children's learning needs					
2	Queuing skills are of great significance to the lives of children and those around them					
3	Picture book teaching format is suitable for children's learning needs					
4	Reasonable arrangement of class frequency and duration					
5	Appropriate teaching location					
6	Appropriate teaching environment setting					
7	The setting of teaching duration is appropriate					
8	Children's learning progress					
9	Children like participating in picture book intervention courses					
10	Recommend this tutorial to other parents					
Open-ended questionnaire						
Do you think children's queuing skills in daily life have improved after teaching is completed? What specific changes have occurred? Please provide detailed explanations and teaching suggestions.						

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