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Research Article

Enhancing Social Skills in Autistic Children through Magic Arts

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Background

Autistic children often experience challenges with social participation and forming relationships. Previous studies have shown that learning to perform magic effects (i.e., magic tricks) and demonstrating them to others can promote improvements in social behaviors among autistic children.

Objective

This qualitative study used thematic analysis with a phenomenological approach to explore how autistic children and their parents perceived a virtual magic-arts training (MAT) program.

Methods

Fifteen autistic children participated in a virtual magic camp conducted through Zoom (Zoom Communications Inc., United States of America). The program consisted of 45-min sessions, held 3 times/week for 3 weeks, during which participants were trained to perform magic effects for others. Following the program, 1-time semi-structured interviews were conducted individually with both the child participants and their parents.

Results

Three major themes emerged from the participant interviews: (i) increased social motivation, (ii) gained self-confidence in social communication, and (iii) built self-esteem. Participants stated that the ability to demonstrate magic effects for others made them more inclined to initiate and engage in social interactions. Similarly, three themes emerged from the parent interviews regarding their children's experiences: (i) improved social motivation and social communication, (ii) built children's self-confidence and self-esteem, and (iii) learned implicitly. Both participants and parents expressed interest in continuing MAT programs.

Conclusion

This study identified several key features and themes related to improved social skills among autistic children following participation in a virtual magic camp. These findings align with existing literature suggesting that programs incorporating special interests can positively influence social participation in autistic children. This study lays the groundwork for developing a conceptual model to better understand the mechanisms linking MAT and social skills improvement.

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1. INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder (NDD) defined by the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) as involving significant difficulties in social communication, social-emotional reciprocity, and the development and maintenance of (peer) social relationships. It is also characterized by deficits in non-verbal communicative behaviors used in social interactions.[1,2] The severity of impairment in social communication is one of two diagnostic criteria outlined in the DSM-5.[1]

Among autistic children, about 43% have an intelligence quotient score within the average or above-average range.[3] Although these children often possess the cognitive and verbal abilities needed for successful social relationships, their ability to initiate and sustain social interactions is frequently impaired.[4] These limitations collectively manifest as poor social skills – one of the most complex and persistent challenges faced by autistic individuals.[5,6] If left unaddressed, such deficits can hinder academic performance [7,8] and persist into adulthood,[9] with long-term negative effects on mental health[10,11] and future employment outcomes.[12]

Many autistic children experience significant challenges in social participation and forming relationships.[13] As children transition into adolescence, the social demands of peer interaction increase, further drawing attention to the differences between autistic and neurotypical social behavior. For example, autistic children often struggle to initiate and engage in social interactions due to feelings of awkwardness or anxiety[14] and tend to have fewer friendships than their neurotypical peers.[15,16] As a result, many autistic children develop secondary psychological difficulties, such as social isolation.[17] Their social awkwardness and isolation may increase the likelihood of peer rejection or bullying, which in turn can reduce self-esteem and elevate the risk for mental health issues.[18,19]

Despite the need, there are relatively few effective strategies that provide autistic children with affirming and sustainable support for social participation. School-based social skills interventions (SSIs) for autistic children have reported an overall positive, but relatively small, effect on enhancing social behaviors.[20,21] However, despite high service utilization and associated costs of school-based SSIs,[22] the skills children learn in these programs rarely generalize to real-world social settings.[4,20,23] SSIs for autistic children conducted outside the school environment primarily improve self-reported social knowledge, yet they demonstrate little to no improvement in parent- or teacher-reported social functioning.[20,23] Further, social gains achieved through SSIs often fail to translate into meaningful changes in children's everyday social interactions.[24,25]

Other evidence-based interventions—such as school-based, peer-mediated interventions that engage neurotypical peers as social models—may improve social outcomes among autistic children.[26] However, in most middle and high school settings, changing classroom schedules and fewer opportunities for unstructured social interactions between neurotypical and ASD students reduce the feasibility of implementing peer-mediated interventions.[26] In addition, the benefits of such interventions are often limited to interactions within the school environment. A randomized controlled trial examined the efficacy of peer network interventions aimed at improving the social connections of 25 high school students with autism.[27] While many students maintained peer relationships one to two semesters later, the study found only limited spillover effects beyond the school day. Therefore, there is an urgent need to supplement school-based approaches with innovative strategies to improve social skills development in autistic children.

Theater-based interventions show promise for improving social participation among autistic children.[28] Unlike didactic social skills training, theater interventions do not rely on the explicit instruction of social rules and norms.[29] Instead, as autistic children engage in drama within a supported environment, they implicitly learn the conventions and schemas of these interactions.[28] The flexible, experiential, and context-driven nature of implicit learning may offer advantages over more rigid instruction. For example, social skills gained through theater intervention, including the ability to engage in peer interactions and form reciprocal friendships, have shown greater generalizability across contexts and more sustained gains compared to outcomes from didactic social skills training.[30-34]

Magic arts – the practice of performing magic effects or tricks[35,36] – may similarly provide autistic children with a spontaneous and engaging means to interact with peers. Like theater, magic arts integrate elements of drama and improvisation with appropriate use of facial expressions and gestures to deliver a verbal and/or non-verbal narrative to an audience.[37] However, compared to theater, magic-arts interventions may elicit greater curiosity, enhancing autistic children's motivation to learn and perform magic effects.[37] In addition, learning a simple magic effect requires only a few minutes, and each effect is learned independently of the others. Each new effect autistic children learn reinforces their gains in social-emotional skills (self-awareness, self-management, social awareness, and relationship building) and increases their opportunities for social interaction.[37]

Occupational and speech therapists often advocate for the use of motivating and purposeful activities to promote repeated opportunities for autistic children to engage in social interactions with neurotypical peers.[38] Although autistic children have acquired social skills through various therapeutic activities in school and clinical settings, many of these activities, such as meal preparation, are difficult to demonstrate to individuals outside the home and do not typically spark interest. In contrast, performing magic effects, which require less elaborate setups than theater interventions, can enhance autistic children's ability to initiate and sustain social interactions with peers.[37]

In our previous research, a magic-arts training (MAT) program delivered through a virtual magic camp format improved the social skills and self-esteem of autistic child participants.[39] In this non-randomized, waitlist-controlled pilot trial, we trained occupational therapy (OT) graduate students to deliver the MAT program to autistic children across the United States of America through Zoom. Seventeen autistic children aged 8.5 – 15 years (nine in the MAT program cohort and eight in the waitlist control cohort) from seven states participated in a 3-week online MAT program (i.e., magic camp), which consisted of three 45-min sessions per week, totaling nine sessions. Participants completed two self-reported assessments – the Rosenberg Self-Esteem Scale (RSES) and the Social Skills Improvement System (SSIS) – at three-time points: Baseline (T0), post-intervention (T1), and 1-month follow-up (T2). The SSIS is a norm-referenced assessment and is widely considered one of the most reliable tools for evaluating social skills in autistic children.[40] Participants in the first cohort completed the assessments at T0, T1, and T2 in alignment with their

participation in the MAT program. Participants in the second cohort (i.e., the waitlist group) completed assessments at T0 and T1 before receiving the MAT program, and again at T2 as their post-intervention assessment.[39]

Between-cohort analysis at T1 indicated that participants who completed the MAT program demonstrated greater improvements in their social skills than those in the waitlist group. The effect size of the MAT program on SSIS was 0.58, which is considered moderate. Combined data from both cohorts revealed statistically significant improvements in both SSIS and RSES scores following program participation.[39]

Several studies[41-44] have explored the experiences of children with NDDs—such as cerebral palsy and attention-deficit/hyperactivity disorder—after participating in magic-based interventions (e.g., camps or clubs), along with their parents' perspectives on these activities. However, none of these studies included autistic children, who face unique challenges in social participation and relationship-building.

The purpose of the present qualitative study was to explore the experiences of autistic children who completed a 3-week virtual magic camp (i.e., the MAT program), as well as the perspectives of their parents, with the aim of developing a more nuanced and comprehensive understanding of the program's impact. We analyzed interview responses from both the participants who completed the program and their caregivers to: (i) capture outcomes not anticipated at the beginning of the program or measured by standardized quantitative assessments, and (ii) identify potential salient themes that could inform a conceptual model for understanding the mechanisms linking MAT program participation and social skills improvement.[45]

2. METHODS

2.1. STUDY DESIGN

This qualitative study involved 1-time, individual, semi-structured interviews with autistic children who participated in a virtual magic camp and their parents. A phenomenological approach was used in conjunction with thematic analysis to identify emerging themes from interview transcripts, focusing on the participants' and parents' perceptions of the magic camp experience.[46,47] The study was approved by the University of Alabama at Birmingham Institutional Review Board (IRB-300005328) and registered at ClinicalTrials.gov (NCT04840498) before the enrollment of the first participant.

2.2. PARTICIPANTS

The Department of OT at the University of Alabama at Birmingham hosted a virtual magic camp for children with disabilities during the summer of 2021. Campers were recruited through various strategies, including flyers, social media, and word of mouth. Eligibility criteria for attending the magic camp were as follows: (i) aged between 8.5 and 17 years; (ii) ability to follow at least two to three verbal instructions in English to complete a task; (iii) ability to remember a simple sequence of actions to execute a task; and (iv) functional verbal communication. Exclusion criteria included: (i) severe visual or hearing disorders that would prevent learning and performing magic effects; or (ii) lack of access to the internet, a computer, or a smartphone with web-browsing capabilities.

Of the 53 campers, 20 had a diagnosis of ASD, and 15 of these children (12 males and 3 females, aged 8.5 – 15 years) participated in the study and completed both baseline and post-camp evaluations, including an exit interview. None of the participants had prior formal experience learning or performing magic effects. Participants resided in six states in the United States of America: Alabama, California, Colorado, Hawaii, Maryland, and Texas.

2.3. PROCEDURES

Before the 1st day of magic camp, OT graduate students contacted the participants' parents and obtained written informed consent for their child's participation in the study. Once baseline evaluations were completed, the 3-week virtual magic camp commenced. Immediately following the magic camp, participants and one of their parents were asked to complete a post-test evaluation and participate in an individual semi-structured interview through Zoom to share their experiences with the virtual magic camp. Participant and their parents were interviewed separately, except in one case where the parent was present during the child's interview.

Interview questions for participants focused on four key areas: (i) reactions to the magic camp experience; (ii) difficulties, preferences, and perceived usefulness of the magic camp; (iii) the program's impact on the participant; and (iv) suggestions for improvement. Interview questions for parents addressed their expectations of the magic camp, perceived benefits and limitations of the camp, and suggestions for improvement (Tables 1 and 2 for the interview guides).

Trained OT graduate students served as interviewers and were instructed to primarily follow the interview guides and suggested question sequences. However, they were allowed to adapt the question order and incorporate off-script, non-leading, probing questions to elicit responses based on the unique flow of each interview. Interviewers actively employed member checking during the interviews – reflecting and probing to ensure they accurately understood participants' responses. All interviews were audio-recorded with the consent of participants and their parents and transcribed verbatim for thematic analysis. On average, the core portion of each interview lasted 10 ± 4.5 min (range: 4 – 20 min) for participants and 8 ± 4 min (range: 2.5 – 15 min) for parents. All participants were assigned numerical pseudonyms to protect confidentiality.

2.4. THE SUMMER MAGIC CAMP PROGRAM

One week before the start of magic camp, a professional magician trained OT graduate students in multiple magic effects that they would later teach to campers. Each magic effect was recorded and made available to each OT student for further review as needed. Pairs of OT students evaluated each other to ensure that both were capable of performing and teaching each effect. The same pairs of OT students were consistently assigned to the same set of campers for the duration of the study.

Before the start of camp, each camper received a parcel containing all necessary materials, including a deck of cards, paper clips, rubber bands, a rope, and a magic wand. OT student pairs coordinated with each camper's parents to schedule virtual session times. Each magic camp session lasted approximately 45 min and was conducted 3 times/week through Zoom. Two of the weekly sessions were

Table 1. Post-magic camp interview guide for autistic child participants

Topic	Question
Reactions to the magic camp experience	1. How would you describe the magic camp experience? 2. Describe what it was like to participate in the magic camp. 3. How would you compare the magic camp experience with other summer camps?
Difficulties, likes/dislikes, and usefulness of the magic camp	1. Based on your experience, what were the difficulties you encountered in practicing magic tricks after the magic camp? 2. What do you like/dislike about the magic camp? 3. Of all the sessions, do any of the sessions from the magic camp stand out to you? 4. How useful was learning the magic tricks? 5. What was the most useful part about the magic camp to you? 6. What would you tell others about the magic camp?
Impact on the participants	1. Compared to before the magic camp, how do you feel about yourself? 2. Did attending the camp affect you? If so, how?
Suggestions for improvement	1. What can we change to make the magic camp better?

Table 2. Post-magic camp interview guide for parents

No.	Guide
1.	What did you hope for your child in signing up for the virtual magic camp?
2.	How did your hopes for the virtual magic camp compare and contrast with your actual experience?
3.	What benefits of the virtual magic camp were there for you, your child, or your family?
4.	What downsides of the virtual magic camp were there for you, your child, or your family?
5.	What would you like to change about the virtual magic camp if it is offered in the future?

one-on-one, involving an OT student pair and a camper. During these sessions, the OT students trained the camper to perform selected magic effects (Table A1 for examples).

The final session of each week, typically held on Fridays, was a group session involving multiple campers. During these sessions, OT students encouraged campers to demonstrate the magic effects they had learned to the group. On the final day of magic camp, a culminating performance was held in which campers demonstrated their favorite magic effect to fellow campers and invited guests. On average, each camper learned three magic effects per week. The number (mean and standard deviation) of individual sessions was 6.5 ± 1 (range: 5 – 8), while the number of group sessions was 2 ± 1 (range: 0 – 3).

2.5. DATA ANALYSIS

A phenomenological approach incorporating thematic analysis was used to identify emerging themes from interview transcripts related to participants' and parents' perceptions of the magic camp.[46,47] This approach was chosen because it is particularly well-suited for studies examining individuals' lived experiences and typically involves a one-on-one interview methodology.[48,49] Previous studies investigating lived experiences in the context of magic camps have used the same analytical approach.[41-44]

The analysis was conducted through the following steps.[46] Four trained coders (OT graduate students) independently reviewed the interview transcripts multiple times. During this initial phase, they focused on the content, context, and language used by both participants and their parents, generating preliminary codes (i.e., open coding). Throughout the coding process, care was taken to ensure that the codes remained faithful to the original transcripts and accurately reflected the meaning intended by the interviewees. As analysis progressed, conceptually related codes were grouped into broader themes (i.e., axial coding) that captured the experiences described. The coders reviewed these preliminary themes in relation to the coded extracts, refining them as needed through an iterative process to ensure that they remained grounded in the data. Coding and analysis were conducted over the course of a full academic semester. Once finalized, the coders defined and named the main themes and selected representative quotations from both participants and parents to illustrate and contextualize each theme.

To reduce bias and enhance credibility, coders were instructed to approach the data with neutrality and an open mind (i.e., bracketing).[47] In addition, we confirmed that the coders had not conducted prior literature reviews on MAT or social skills, minimizing the risk of interpretive bias. The four coders also reviewed one another's theme categorizations and met regularly to compare their findings, assess plausibility, and discuss interpretations until a consensus was reached. To further strengthen analytic rigor, all interpretations and emergent themes were consistently checked against the original interview transcripts to ensure the themes accurately reflected participants' and parents' words. In cases of disagreements, the coders re-examined the relevant transcripts, discussed the differences, and resolved the disagreements collaboratively. Finally, to enhance the trustworthiness of transcript interpretations, an independent arbiter (the last author), who had substantial experience in qualitative research and familiarity with the study, reviewed the coding process and verified the emerging themes.

3. RESULTS

A total of 15 autistic children completed the 3-week virtual magic camp and the immediate post-camp interview; their characteristics are presented in Table 3. Participants noted that they enjoyed spending time with the OT students, having fun together, and "sharing happy magic tricks" (camper [C] 13). They were motivated and eager to participate in the sessions and learn magic effects, as reflected in parental observations of their children's attitudes toward the magic camp sessions. For example, the parent of C13 noted, "… she was always looking forward to it [the magic camp session] every time, and that's not always been her experience." Similarly, the parent of C4 reported:

> …normally he just sits here, not wanting to do it and he would normally resist, saying "no, do I have to" or "no, I don't want to do it." But when it was time for his meeting [the magic camp session], he would even remind me, like "oh is the meeting today at 12:00?" And I was like "no, it's

Table 3. Demographic characteristics of autistic child participants (*n*=15)

ID	Age (year)	Gender	Race	Secondary diagnosis	Individual sessions (*n*)	Group sessions (*n*)
C1	11.4	Male	Hispanic	None	6	3
C2	9.3	Male	Asian	None	8	1
C3	9.5	Male	Black	ADHD	5	2
C4	15.4	Male	Hispanic	SPD	8	0
C5	12.4	Male	White	ADHD	6	3
C6	9.6	Male	Black	ADHD	6	2
C7	12.5	Male	White	None	6	3
C8	13.2	Male	Black	None	7	2
C9	9.9	Male	White	ADHD	7	2
C10	13.9	Female	White	ADHD, ID	6	3
C11	8.6	Female	White	None	7	1
C12	15.2	Male	Asian	None	6	3
C13	11.5	Female	White	None	6	2
C14	10.7	Male	Other	ADHD, OCD	6	3
C15	11.0	Male	Other	None	6	3

Abbreviations: ADHD: Attention-deficit/hyperactivity disorder; ID: Intellectual disability; OCD: Obsessive-compulsive disorder; SPD: Sensory processing disorder.

2:00," and he was like, "oh okay." He would set his alarm on his phone for 2:00.

Both the participants and their parents reported enjoying the magic camp and expressed interest in attending more frequent camp sessions. Thematic analysis of participant and parent interviews revealed several themes (Table 4).

3.1. THEMATIC ANALYSIS OF PARTICIPANT INTERVIEWS

3.1.1. INCREASED SOCIAL MOTIVATION

Multiple participants reported increased social motivation after completing the magic camp. Participants stated that having a magic effect to demonstrate to others made them more likely to initiate and engage in social communication with others. For example, "…I can like show people something that, like, they may, they might not know about. Like something different" (C5) and "… I could do new tricks, and I could um show them to my friends"… "The most useful part about the magic camp to me is that um that I could is that I could teach these tricks in real life" (C8). One participant (C10) said the best part about the card trick effect was that she showed it to her teacher.

The OT students also assisted in organizing small-group social opportunities for campers to gather during the last session of each week. During these gatherings, participants were motivated to engage socially with other campers and demonstrate the effects they had learned. In response to a question asking which magic camp session was most enjoyable, a participant (C9) stated, "Uh, the one where I got to uh got to do it in front of other people." When a participant was asked, "What can we change to make the magic camp better?" the participant (C8) responded, "If we had more if we had more time together!" Participants reported feeling positive about these interactions and identified them as an important benefit of the magic camp experience.

3.1.2. GAINED SELF-CONFIDENCE IN SOCIAL COMMUNICATION

In addition to mastering each magic effect correctly, participants, with coaching from the OT students, were required to create a story to accompany each presentation. When asked about the weekly small group gathering in which they recounted a story and performed the related effect, participants reported increased confidence in social communication both during and after the magic camp. Illustrative responses include, "I feel like I just got to talk like I just got to like, I don't know like, interact, some more" (C5) and "I like this hanging out with everyone basically…Which is kind of like making new friends" (C13). Further, participants shared that they envisioned themselves using the magic effects in the future as an avenue for interacting with others. The interviewer asked participants, "Will you share what you learned?" A participant (C6) responded, "I will teach to uh do magic tricks in front of people." Another participant (C7) said he would carry a pack of cards in his backpack so he could show the card tricks to his classmates.

3.1.3. BUILT SELF-ESTEEM

The magic effects provided participants with a predictable script and plan to demonstrate a novel skill that they felt was likely to be well received by others, which helped them develop positive self-esteem. Participants were proud and confident as they showed the effects to their family members and others. This was illustrated in participants' responses to the question, "Compared to before magic camp, how do you feel about yourself?" Examples of participants' responses included: "I feel proud of myself for learning magic tricks" (C15); "It [learning magic tricks] made me proud of myself a little bit" (C6); "… I can do like more tricks now. I was able to like show people it" (C9); and "…I feel like I can like kind of trick people, and like kind of show them [the effects] off a bit" (C5). Participants also expressed overall satisfaction with their experiences and a more positive attitude toward themselves, with responses such as feeling "pretty good, pretty good about life" (C8), "excited" (C10), and "excited, WHOOOOO" (C1). Participants reported that participating in the magic camp helped them recognize their own strengths. For example, "I feel like I have more confidence and that I learned new tricks" (C11) and "I feel like I have more qualities I guess like, or character traits" (C5).

Table 4. Emergent themes from interviews with autistic child participants and their parents regarding the magic camp experience

Participants	Theme	Key outcome	Example quotes
Child	Increased social motivation	Magic effects encouraged participants to initiate and engage in social communication.	(i) "I got to do it in front of other people" (C9). (ii) "If we had more time together!" (C8).
	Gained self-confidence in social communication	Developing stories and presenting magic effects boosted confidence in social communication.	(i) "I feel like I got to interact more" (C5). (ii) "I will teach…magic tricks in front of people" (C6).
	Built self-esteem	Performing magic effects fostered pride and positive self-perception.	(i) "I feel proud of myself for learning magic tricks" (C15). (ii) "I feel like I have more confidence" (C11).
Parent	Improved social motivation and social communication	Learning magic effects encouraged family and peer interactions, and even engagement with healthcare providers.	(i) "He would learn tricks and want to show us" (Parent of C9). (ii) "[C10] showed her rope tricks to hospital nurses" (Parent of C10).
	Built children's self-confidence and self-esteem	Children's ability to perform magic effects and communicate confidently boosted their self-esteem.	(i) "It was fun for him…to see a sense of pride" (Parent of C15). (ii) "She can share with friends…that would be a benefit" (Parent of C13).
	Learned implicitly	Children gained occupational therapy-related skills (e.g., fine motor skills, following directions) without consciously realizing it.	(i) "It required lots of different OT skills, and they didn't even know it" (Parent of C2). (ii) "He wasn't worried about learning…it was interesting" (Parent of C7).

3.2. THEMATIC ANALYSIS OF PARENT INTERVIEWS

3.2.1. IMPROVED SOCIAL MOTIVATION AND SOCIAL COMMUNICATION

Parents expressed that improvements in their children's social communication, especially within the family, were a positive outcome of the magic camp. For example, one parent shared, "The benefits I think were it gives opportunity to do things together as a family, he would learn tricks and then want to show us" (parent of C9). Parents also reported that performing magic effects provided their children with a new avenue for social communication. The magic camp experience motivated many children to use magic effects to engage with family members, friends, and peers. One participant, who had a medical condition requiring frequent hospitalization, used a magic effect to interact with her healthcare providers. Her parent described the impact: "[C10] took her rope to the hospital the very first night of magic camp … she was very sick. However, she was so excited to show the nurses her rope tricks" (parent of C10). This participant continued to use magic effects as a tool for social communication with multiple people. Her parent further noted, "She showed her relatives, church camp friends. She told her teachers at school and showed them tricks. She also shared tricks with her sister" (parent of C10).

3.2.2. BUILT CHILDREN'S SELF-CONFIDENCE AND SELF-ESTEEM

Parents observed an increase in their children's self-confidence and self-esteem following the final performance for campers and friends. One parent commented, "Really the first time, other than acting, he's been comfortable doing some kind of performance in front of other people" (parent of C7). Another shared, "Plus, it builds his confidence when he keeps repeating the magic trick until he gets it down pat" (parent of C5). Parents frequently noted that their children felt proud of acquiring a special skill (i.e., the ability to perform magic tricks). When asked how their expectations for magic camp compared to their experience, the parent of C15 responded:

> It was very good, he actually showed his skills to family members we met, he did magic tricks for everybody, so it was lots of fun there to entertain the family, so it was fun for him just to see a sense of pride in learning new skills.

The parent of C13 noted the value of positive reinforcement:

> Um … because she gets plenty of negative attention. Um for things that she's doing a good job of getting control over, but like anything that she can do that garners positive attention helps to kind of balance out the negative attention, so like you know, simple magic trick or something like that that she can share with friends … that would be a benefit, and I think that she's gotten that.

Other parents noted that the magic camp gave their children the confidence to perform magic effects and engage socially with their typically developing peers. For example, a parent of C7 shared, "… he definitely seemed enthusiastic about this. And when it came to, you know, showing off what he had learned and I am almost positive that he mentioned something to me about telling his friends about it." This same parent also mentioned that her child had become more socially comfortable. Although he had previously kept his camera off during all virtual school lessons, he turned it on during the Zoom sessions with the OT students.

3.2.3. LEARNED IMPLICITLY

Parents identified new skills that their child gained through the magic camp experience, such as listening, following directions, and fine motor skills. Several parents noted that the skills their children acquired during magic camp were learned implicitly. For example, the parent of C2 noted:

> …it [magic camp] was really great because it required lots of different OT skills, and they [the participants] didn't even know it. All the manipulations of the cards, rubber bands, tying knots, and everything. They had to be active listeners, pay attention to the steps, following directions well, being able to process the order of the tricks, it's everything that they would need to be working on without knowing it.

Similarly, the parent of C7 shared, "…he enjoyed the subject matter [learning magic tricks] to where he wasn't worried about socializing, or learning, or this is boring, you know, it was, oh this is interesting, and I somewhat enjoy myself."

4. DISCUSSION

The MAT program provided a space for autistic children to engage in enjoyable leisure activities that did not involve screen time (a specific benefit noted by several parents) while also offering a positive social and learning experience. Comments from both participants and parents indicated that the magic camp facilitated campers' social engagement with family, friends, and peers. Parents' perceptions that the magic camp increased their children's social motivation, social communication, confidence, and self-esteem closely mirrored the three themes that emerged from the participant interviews: Increased social motivation, gained self-confidence in social communication, and built self-esteem. An additional theme identified from the parent interviews was that their children acquired social and functional skills (e.g., listening and following directions) through implicit learning that occurred during the MAT sessions.

The themes reported by participants and parents in the present study are consistent with those reported by other studies on magic camps for children with NDDs.[42-44] Specifically, previous research has reported that participants experienced a sense of pride when performing magic effects for family members and others. Our findings align with this literature, which suggests that programs promoting social participation through special interests can positively impact autistic children.[50-52]

A recent systematic review exploring the effects of learning to perform magic effects in children with NDDs found only two studies that specifically investigated the impact of MAT on social skills.[53] In one study, Spencer[54] implemented an 11-week magic-arts curriculum for children with NDDs, including an unspecified number of autistic students, in four public school classrooms. After completing the curriculum, participants reported enhanced social motivation, self-confidence, self-esteem, social communication, and greater comfort when interacting with peers.[54] The themes identified in our present qualitative study align with those reported by Spencer[54] and complement the quantitative findings of improved SSIS scores from our non-randomized, waitlist-controlled pilot trial.[39]

Exit interviews with participants and parents in the present study demonstrated that participants were motivated to participate in the magic camp sessions. Both children and their parents noted that participants were often eager to perform magic effects for others, which encouraged them to initiate social interactions, a benefit not commonly observed with theater-based intervention.[55] Thematic analysis revealed that knowing how to perform a magic effect enhanced autistic children's motivation to engage in social participation.[44,54] This may be because the skills involved in learning magic effects provided participants with a plan for engaging in social interactions. Casually performing a simple magic effect often draws attention and curiosity, creating natural opportunities for social communication between autistic children and their peers, who are typically eager to learn how the magic effect was accomplished. This conversational icebreaker enabled autistic children to initiate peer interactions and practice the social skills they had learned during the MAT program in real-life settings. Therefore, magic arts can encourage an autistic child's interest in social engagement while also creating opportunities for continued social interaction.

Both participants and their parents reported that children experienced increased self-esteem and were more likely to engage in social communication with peers and family members after learning to perform magic effects. Some participants also described planning social interactions specifically to showcase their new skills. These increases in confidence in social communication, self-esteem, and motivation for social participation were reflected in the observable increase in actual social interaction time noted by their parents.

Children's accounts of performing magic effects for peers, along with the enthusiasm reported by both children and parents, were likely driven by the novelty of magic effects. Since most children and adults are unfamiliar with how magic effects are performed, the act of learning and demonstrating these effects provided participants with a unique and valued skill, one that they expected would elicit positive responses from others. This positive social feedback may contribute to improved psychological well-being and serve as a protective mechanism against the negative social stigma autistic children often face.[56] In addition, this unique skill set required to perform magic effects may encourage peers to reevaluate pre-conceived notions about autism and recognize the many strengths of autistic children.

Another benefit of the magic camp, as reported by parents, was implicit learning. Through their participation in the camp, children learned social skills – such as listening and following directions – as well as functional skills for everyday activities, including fine motor manipulation, often without realizing they were learning these abilities. Although participants did not explicitly articulate the concept of implicit learning, several responses suggested awareness that they were learning more than just magic effects. For example, one participant (C13) reflected, "Well, I really liked it. I thought there was like a lesson in there somewhere, but I haven't really thought about it. I think it is probably maybe exploring the magic and in me." Similarly, another participant (C5) stated, "I feel like there's a moral to it, like, or like I feel like it's like trying to teach me something."

In summary, the analysis of exit interviews with participants and parents about their experiences with the virtual magic camp provided insights into the mechanisms behind improved social participation among autistic children. These improvements appeared to occur through a series of steps. First, the virtual magic camp created a supportive and engaging environment for learning a novel skill (performing magic effects). As children acquired these skills, they experienced a sense of pride (building self-esteem), which motivated them to demonstrate their newly learned abilities to family members, friends, and peers (increasing social motivation). Successful performances were often met with praise and positive feedback from the audience (friends and family), further enhancing the children's self-esteem. This reinforcement contributed to growing confidence and motivated children to initiate and engage in social communication. The desire to repeat these positive experiences inspired autistic children to learn additional magic effects, perform them for others, and practice social communication more frequently, leading to additional gains in self-esteem and self-confidence in social communication. Further, through the process of learning and performing magic, autistic children also implicitly learned various social skills, such as listening and following directions. These skills were integrated into their social communication repertoire and contributed to more effective and meaningful social interactions.

As this was a preliminary study, we did not aim to construct a formal conceptual model from the interview data. The main aim of this qualitative study was to identify salient themes that contribute to understanding the perspectives of autistic children and their parents following participation in the virtual magic camp. These themes were not defined based on frequency or recurrence, and it is likely that theoretical saturation was not reached. However, the thematic patterns identified in this study may inform the determination of an appropriate sample size for future studies aiming to reach theoretical saturation and may serve as a foundation for developing a robust model to explain how learning magic tricks can improve social skills in autistic children.

A viable approach to expanding the MAT program (i.e., enhancing the scalability of the intervention) is to incorporate MAT into the therapeutic practices of school-based OT practitioners. Delivering MAT in this setting, as opposed to through online platforms or at designated physical campsites, would eliminate the need for parental or staff supervision during camp sessions, as well as reduce logistical, connectivity, and scheduling issues. Therefore, incorporating MAT into school-based OT services as a supplement to conventional therapy could provide meaningful benefits to autistic children across a wide range of educational settings.

5. LIMITATIONS

While the present study provides important insights into the unique experiences of autistic children participating in the MAT program, several limitations should be acknowledged. A key limitation is the absence of a standardized delivery method for the magic camp sessions. Although a professional magician who developed the MAT program trained OT graduate students, the participants' varying skill levels and learning styles made it difficult to standardize the instructional approach. As a result, each OT student pair adapted their teaching style to the individual needs of their assigned participant. In addition, logistical and scheduling challenges prevented some participants from regularly attending the small group gatherings held during the last session of each week.

Another limitation is the potential for bias arising from having the same pair of student coaches conduct the exit interviews with participants whom they had taught. Although the interviewers were trained to adhere to a standardized interview guide and avoid leading questions, their prior relationship with participants may have affected both the way questions were asked and the participants' inclination to respond positively. The rationale for assigning the same students to both instructional and interview roles was that the rapport established could create a more comfortable interview environment, encouraging more authentic responses. Importantly, interviews with participants and their parents were conducted separately, and the responses were consistent across both groups. Furthermore, several themes that emerged – such as motivation, self-confidence, and self-esteem – were consistent with a previous study involving parents of children with NDDs who had participated in learning magic effects.[42,44]

As the interviews were conducted immediately after the completion of the magic camp, the present study's findings reflect only the immediate perceived impact of the program. Future research should consider a longitudinal design, with data collection conducted both immediately post-intervention and at later time points (e.g., several months later), to better understand the immediate and sustained impact of the magic camp.

6. CONCLUSION

The virtual magic camp yielded promising outcomes in enhancing autistic children's social motivation, self-confidence, self-esteem, and communication skills. Future directions include expanding on this line of research using a longitudinal design and addressing logistical barriers to improve access to MAT interventions for a broader population of autistic children.

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CONFLICT OF INTEREST

No potential conflict of interest was reported by the author(s).

AUTHOR CONTRIBUTIONS

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the University of Alabama at Birmingham Institutional Review Board (IRB-300005328) and registered at ClinicalTrials.gov (NCT04840498) before the enrollment of the first participant. Before the 1st day of magic camp, OT graduate students contacted the participants' parents and obtained written informed consent for their child's participation in the study.

CONSENT FOR PUBLICATION

Consent was obtained to publish their data.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author (Hon Yuen) upon reasonable request.

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Appendix

Table A1. Sample magic effects taught in the magic camp program

Week	Monday	Wednesday
#1	Challenge Knot (easy) One 40" piece of cotton rope https://vimeo.com/151136606/cb33d3e777	4 Aces (easy) One deck of cards https://vimeo.com/526234819/3c09bac17d
	Instant Knot (easy) One 40" piece of cotton rope https://vimeo.com/151135838/fd6863ab08	Party Queens (easy) One deck of cards https://vimeo.com/525826269/32fa13fe6e
#2	Vanishing & Reappearing Coin (easy) One quarter coin Two penny coins https://vimeo.com/525040206/93d3322168	Salt Shaker Thru Table (moderate) Salt shaker Several napkins or paper towels One quarter coin https://vimeo.com/524915030/a5ac600a20
	Vanishing Coin Through Elbow (difficult) One quarter coin https://vimeo.com/510225990/e6c7b6ccd3	Jumping Rubber Bands (easy to moderate) Three average-size rubber bands of different colors https://vimeo.com/156415448/f54f182e4f https://vimeo.com/156415451/6917f5585e https://vimeo.com/151136259/81707912c8 https://vimeo.com/156415449/78c7b7d301
#3	Linking Paper Clips (moderate) Two 2" paper clips One banknote https://vimeo.com/151136465/afff0ae6d4	Vanishing Rubber Band (easy to moderate) Several average-size rubber bands https://vimeo.com/510267676/4c083a720c
	Floating Bank Note (moderate) One quarter coin One banknote https://vimeo.com/526318940/f3114fd232	Vanishing Toothpick (easy) One toothpick Invisible tape https://vimeo.com/510342301/e2beebe1c8