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# The effects of individualized teaching of school readiness skills to children in preschool with attention-deficit/hyperactivity disorder symptoms

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## Abstract

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders diagnosed among children and adolescents. ADHD is associated with a wide range of health and developmental risks, emotional and behavioral disorders, lack of social skills, and academic underachievement. The purpose of this study was to evaluate the effectiveness of the preschool life skills (PLS) program in teaching important life skills to a 5-year old girl being assessed for ADHD. The participant was taught eight PLS, divided into three units that focused on instruction following, functional communication, and tolerance skills. Teaching included instructions, modeling, role-play, and feedback/descriptive praise. The PLS program effectively increased PLS, and skill achievement was only evident when teaching targeted each unit of skills.

## KEYWORDS

attention-deficit/hyperactivity disorder, preschool life skills, school readiness skills

This study was conducted in collaboration with the department of education at the municipality of Kópavogur, Iceland, and the principal and teachers at the participating preschool.

## 1 | INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a behavioral and emotional disorder usually occurring in early childhood and adolescence (World Health Organization, 1993). ADHD is one of the most common neurodevelopmental disorders diagnosed among children and adolescents and can have a detrimental effect on everyday life (American Psychiatric Association, 2013a; Baldursson, Magnússon, Haraldsson, & Halldórsson, 2012; Gelfand & Drew, 2003). Symptoms of ADHD can vary between individuals but are most often characterized by difficulties with sustaining attention, instruction following, completing activities, waiting, excessive talking and moving, social intrusiveness, and interrupting conversations or activities (American Psychiatric Association, 2013b; Baldursson et al., 2012). In addition to these symptoms, ADHD is associated with a wide range of health and developmental risks, such as cognitive and academic difficulties, aggression, and anger (Kelly, 2009).

Children diagnosed with ADHD may experience challenges in completing daily activities, lasting into adulthood, if symptoms are not treated (Baldursson et al., 2012). In Iceland, elementary school attendance is mandatory for all children ages six to 16 (Compulsory School Act, 2008), and children of all ages spend the majority of their day in school. The elementary school environment entails new demands, new academic challenges, new expectations, and a new peer group (Ladd & Price, 1987). Because most children in Iceland spend their first few years in preschool (ages 1–5; Statistics Iceland, 2018), the preschool years are an essential part of preparing children for the elementary school environment (Daley & Birchwood, 2010). During the preschool years, the teachers can prepare the children by teaching them skills that make them better equipped for dealing with the new challenges and demands that these students will face. The skills that are necessary for children to have before entering elementary school are sometimes referred to as school readiness skills and can be categorized into social, behavioral, and academic skills. According to preschool and elementary school teachers, the most important school readiness skills are social and behavioral skills (e.g., telling needs and thoughts, not being disruptive, and following directions; Lin, Lawrence, & Gorrell, 2003). Conversely, academic skills (e.g., naming colors, shapes, letters, and numbers) are deemed less important for children to know before entering elementary school. Symptoms of ADHD may hinder children with this diagnosis from acquiring school readiness skills. Therefore, they must receive an appropriate level of support to increase the probability of developing these skills before entering elementary school.

According to clinical guidelines, a treatment plan for ADHD should address psychological, behavioral, and educational needs (Baldursson et al., 2012; National Institute for Health and Care Excellence, 2019). For preschool children, the first choice of treatment is behavioral and psychosocial interventions, where the goal is to modify the environment and teach skills to promote behavior change (Gelfand & Drew, 2003). Psychopharmacological treatment, involving psychostimulants, effectively reduces restlessness, inattentiveness, impulsiveness, and aggression, while increasing compliance (Taylor et al., 2004). However, because of the adverse effects and limited evidence on the effectiveness and long-term effects of psychostimulants on development, psychostimulants should only be offered if symptoms are persistent and impair the child's life after behavioral and psychosocial interventions (Graham & Coghill, 2008; National Institute for Health and Care Excellence, 2019; Subcommittee on Attention-Deficit/Hyperactivity Disorder, Steering Committee on Quality Improvement and Management, 2011).

The preschool life skills (PLS) program, developed by Hanley, Heal, Tiger, and Ingvarsson (2007), is an evidence-based behavioral intervention. This preventive approach's main feature is teaching preschool children appropriate social skills in situations where problem behavior is likely to occur (Hanley et al., 2007; Luczynski & Hanley, 2013). The PLS program consists of thirteen skills, derived from the functional assessment and treatment literature and from the school readiness literature. These skills are divided into four units, instruction following, functional communication, tolerance for delay, and friendship skills, with each unit include two to four related skills.

The PLS program has been effective in decreasing problem behavior and increasing school readiness skills in preschool environments with larger groups ( $\geq 10$ ; Beaulieu, Hanley, & Roberson, 2012; Gunning, Holloway, & Healy, 2018; Hanley, Fahmie, & Heal, 2014; Hanley et al., 2007), smaller groups ( $< 10$ ; Luczynski & Hanley, 2013; Luczynski, Hanley, & Rodriguez, 2014), in one-on-one teaching (Falligant & Pence, 2017; Francisco & Hanley, 2012;

Kraus, Hanley, Cesana, Eisenberg, & Jarvie, 2012; Robison, Mann, & Ingvarsson, 2020), and with children with autism spectrum disorder and developmental disorders (Falligant & Pence, 2017; Francisco & Hanley, 2012; Pelletier, 2018). The PLS may be a good treatment option for children diagnosed with ADHD since these children often lack necessary school readiness skills that are important for successful transition from preschool to elementary school (American Psychiatric Association, 2013b; Baldursson et al., 2012) and intervention for ADHD is considered most effective when individualized (Gelfand & Drew, 2003). However, a search of relevant literature yielded no research evaluating the effects of the PLS program in one-on-one teaching, specifically, with children diagnosed with ADHD.

The purpose of the current study was to evaluate the effectiveness of the PLS program to teach important social skills to a preschool child being assessed for ADHD. Typical responses in targeted life skills situations and ADHD symptoms were assessed before and after individualized teaching.

## 2 | METHOD

### 2.1 | Participant and setting

The participant was a 5-year-old girl, called Anna, who exhibited symptoms of ADHD. She was being assessed for ADHD and was nominated by a psychologist at her municipality to be a participant in this study. Anna attended a full-time preschool program for approximately 8 h per weekday.

The study took place at Anna's preschool. The class consisted of five teachers, a social educator, and 42 children (ages 5–6). The classroom was divided into five separate areas, consisting of three small play areas and two larger group areas with tables and chairs. The classroom's daily schedule included group time, playtime, and mealtime, and was similar on weekdays, with occasional exceptions.

Individualized teaching sessions were conducted in a small room (4 m × 4 m) next to the classroom, equipped with a table, chairs, teaching materials, and toys. Individualized teaching was conducted one to three times per week, each session lasting approximately 15–30 min.

### 2.2 | Dependent variables

The dependent variables were acquisition of PLS and symptoms of ADHD. PLS were defined as three units of eight target skills (adapted from Hanley et al., 2007; Hanley & Road, n.d.; Luczynski & Hanley, 2013; see Table 1 for definitions of each PLS). Symptoms of ADHD were derived from the Diagnostic and Statistical Manual of Mental Disorders and the International Classification of Diseases and defined as abnormality of attention, activity, and impulsivity for age and developmental level (American Psychiatric Association, 2013b; World Health Organization, 1993).

### 2.3 | Measurement

#### 2.3.1 | Direct measures

PLS were measured with direct observation. Data were collected by the researcher and the participant's teachers for each skill across three contexts: preteaching, individualized teaching, and post-teaching sessions. During all sessions, data were recorded if the participant emitted the target skill. Performance-based mastery criteria were the same as Luczynski and Hanley (2013) and defined as the participant engaging in correct responding of the target skill for at least 85% of trials in a given session over three nonconsecutive sessions.

TABLE 1 Definitions of three units of eight skills and problem behavior

Dependent variables	Definition
Unit 1. Instruction following skills	
Skill 1: Responding appropriately to name	Within 2 s, the child will stop competing behavior, orient toward speaker, and say "Yes."
Skill 2: Complying to simple-step instructions	Within 3 s, the child will initiate completion of the instruction and will complete the instruction in a timely manner.
Skill 3: Complying to multistep instructions	Within 3 s, the child will initiate completion of the instruction and will complete the instruction in a timely manner.
Unit 2. Functional communication skills	
Skill 4: Requesting assistance from an adult	The child will complete task or request assistance by saying "Can you help me, please" (with appropriate tone and voice volume) within 45 s of instruction delivery.
Skill 5: Requesting attention from an adult	The child will recruit attention by saying "Teacher" or the adult's name (with appropriate tone and volume) without engaging in excessive physical contact (i.e., no more than three light taps).
Skill 6: Requesting access after obtaining attention from an adult	Within 10 s of reaching adult, the child will say "Teacher" or the adult's name to gain adult's attention, wait for a response, and then request access to the area or material in the form of "May I have..." or "Can you pass me the..."
Unit 3. Tolerance skills	
Skill 7: Tolerating delay from an adult	The child will say "Okay," and wait patiently for 30–90 s for the adult-mediated event.
Skill 8: Tolerating denial from an adult	The child will say "Okay" and continue the activity it was previously engaged in.

### 2.3.2 | Indirect measures

Before and after implementation of the PLS program, two types of questionnaires were administered to parents and teachers (PLS-Q and ADHD-rs). A questionnaire about PLS (PLS-Q) was used to measure perception of the participant's responses in certain life skills situations (see Appendix A). The ADHD rating scale (ADHD-rs) was used to measure symptoms of ADHD (see Appendix B). In addition, Anna's parents and teachers were asked if they had concerns for the participant's adjustment in elementary school (*Do you have concerns about how the child will adjust to a more demanding elementary school environment, where there are more students in the classroom, and more students per teacher?* Responders were asked to rank their response according to a 5-point Likert scale, where 0 = No concerns and 4 = Very concerned).

### 2.4 | Experimental design and procedure

A multiple baseline design across behaviors (Barlow, Nock, & Hersen, 2009) was used to evaluate the impact of the PLS program on skill acquisition.

Appropriate permission for the study was obtained from the Icelandic data protection authority, the National Bioethics Committee in Iceland (approval no. VSN-18-110), a psychologist and head of the department of education at the participant's municipality, the principal and teachers at the participating preschool, and parents.

Before and after implementation of the individualized teaching, Anna's parents and teachers were asked to answer the PLS-Q and the ADHD-rs.

### 2.4.1 | Preteaching sessions

An evocative situation was arranged in the participant's classroom throughout the school day by a teacher or the researcher. These included various situations that presented an opportunity for the participant to display appropriate PLS and resembled situations that occur normally in a classroom. On each trial, the participant's behavior was recorded as a correct or incorrect response. The participant received three to nine trials in one session across one to three days for each unit of skills. Individualized teaching was implemented if the participant did not meet the mastery criteria.

### 2.4.2 | Individualized teaching sessions

Individualized teaching sessions were conducted in a small meeting room next to Anna's classroom. Each session included the participant, the researcher, and a teacher. Similar to previous studies, behavior skills training (BST) was used to teach each skill. BST consists of instructions, modeling, role-play, and feedback or descriptive praise (Hanley et al., 2007; Luczynski & Hanley, 2013; see Figure 1 for teaching procedure). When each skill was first introduced in individualized teaching session, the researcher implemented the teaching procedure while the teacher observed and collected interobserver agreement (IOA) data. In the following teaching sessions, after the skill was first introduced, the researcher and teacher randomly exchanged the roles of implementing the teaching procedure and observing.

The participant received four to eight trials to practice the skill in each teaching session before the skill was tested in post-teaching sessions. If the first four responses were correct, or after eight trials, the practice session ended. Individualized teaching of a skill ended when the participant engaged in correct responding of the target skill for at least 85% of trials in a given post-teaching session over three nonconsecutive sessions.

### 2.4.3 | Post-teaching sessions

After individualized teaching session, the skill was tested in post-teaching sessions. Evocative situations in post-teaching sessions were identical to evocative situations in preteaching sessions. The participant received three to nine trials in one session over one-to-three days for each unit of skills.

## 2.5 | Interobserver agreement

IOA was collected by the researcher or a teacher across all PLS units. An agreement between the teacher and the researcher was defined as scoring the same response across the three response categories during preteaching, individualized teaching, and post-teaching sessions. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100 to obtain a percentage. IOA was collected during 46% of preteaching sessions, agreement averaged 85% (range 0%–100%), during 33% of individualized teaching sessions, agreement was 100%, and during 56% of post-teaching sessions, agreement averaged 88% (range 50%–100%). Midway through the study, a second teacher started collecting IOA data. Prior to the new teacher, the agreement averaged from 80% to 100%. The low agreement (0% in one session containing two trials)

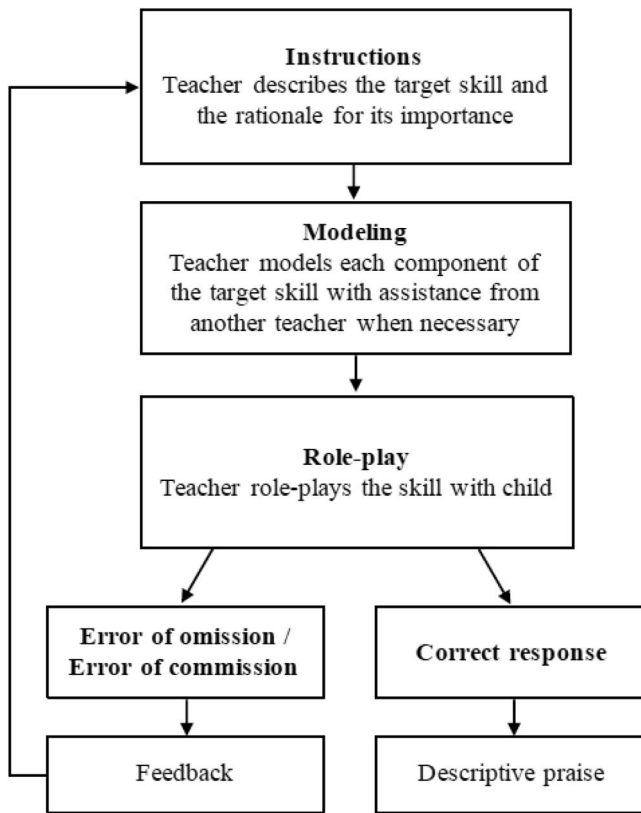


FIGURE 1 Individualized teaching session procedure

was observed soon after the new teacher started collecting the data. Additional training was implemented for the second teacher which resulted in higher agreement for the following sessions.

## 2.6 | Social validity

After implementation of the PLS program, stakeholders, that is, the primary teacher and the principal, were asked to rate the acceptability of the program, the teaching methods used, and their view on the behavior change. The questions were open ended and asked about overall acceptability of the teaching, the importance and improvement of certain skills, and pros and cons with implementation of the program.

## 3 | RESULTS

Anna's overall performance for each unit of skills and performance for each target skill in evocative situations are depicted in Figure 2. The figure includes six panels with two panels per unit in the order in which the units were taught. The top panel in each unit (the line graphs) show the percent correct per session across the three contexts. The bottom panel in each unit (the bar graphs) depict the percent correct for each individual target skill. The timing of when the individualized teaching of each skill was introduced is indicated in the text above the corresponding bar graph.

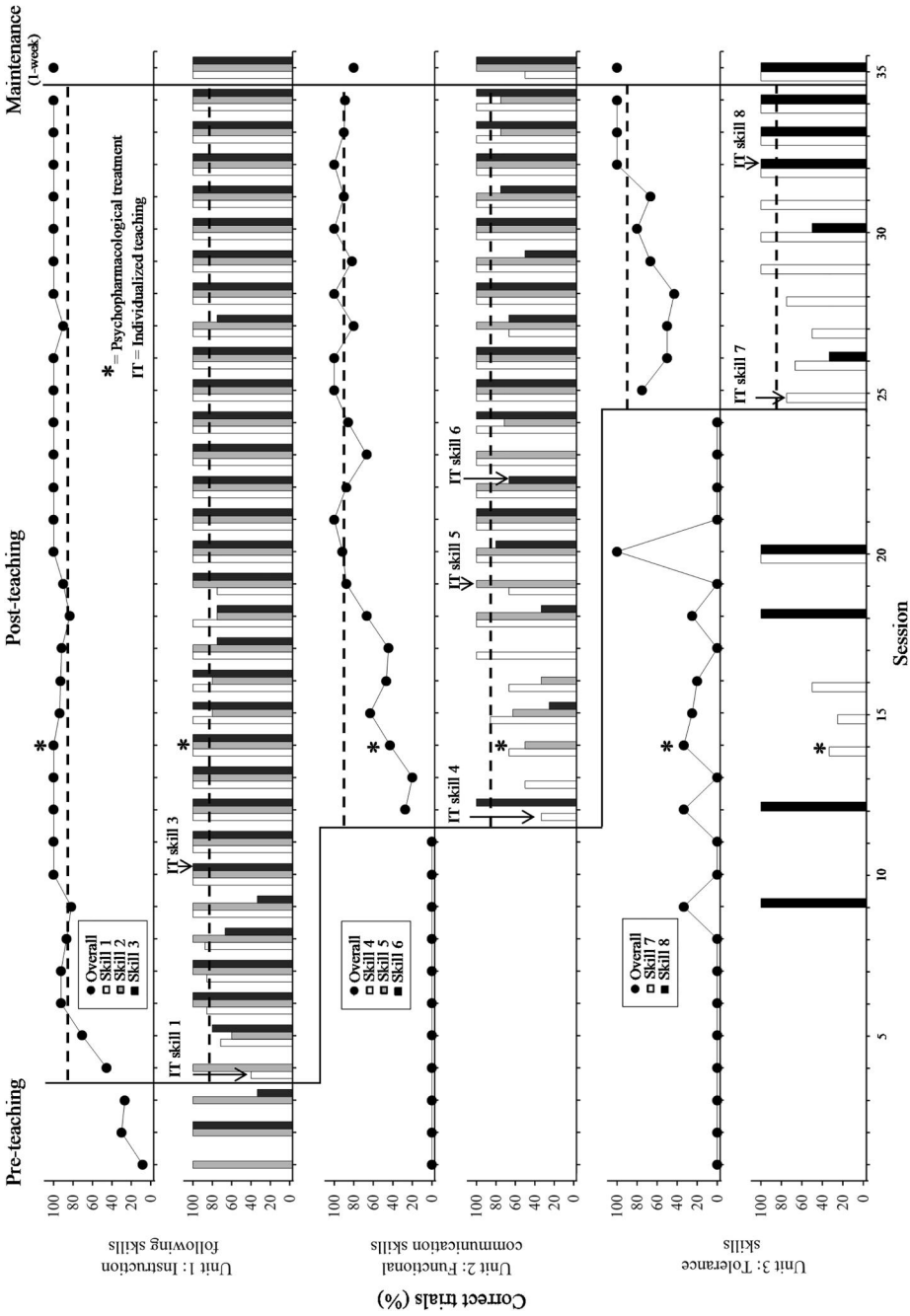


FIGURE 2 Percentage of correct trials in evocative situations. The horizontal dashed line indicates the 85% mastery criteria



Overall, 753 evocative situations were arranged across 34 sessions (175 trials in preteaching and 578 trials in post-teaching). Anna received 85 trials in 12 individual teaching sessions (not depicted), with an average of 1.71 sessions for each skill. Overall, the probability of a correct response preteaching was 10%, the probability of correct response in individualized teaching was 82%, and the probability of a correct response in post-teaching was 84%.

During preteaching sessions, Anna did not meet the 85% mastery criteria for unit 1, 2, or 3. Following teaching of skills in unit 1, correct responding steadily increased for unit 1 (top two panels) and responding for unit 2 (middle panels) and unit 3 (bottom two panels) remained at low levels. Following teaching of skills in unit 2, correct responding steadily increased for unit 2, responding for unit 1 remained at high levels, and responding for unit 3 remained at low levels. Following teaching of skills in unit 3, correct responding steadily increased for unit 3, and responding for unit 1 and unit 2 remained at high levels.

Anna received individual teaching for skills 1 and 3 in unit 1, skills 4, 5, and 6 in unit 2, and skills 7 and 8 in unit 3. Anna met the mastery criteria on skill 2 in the preteaching sessions, therefore individualized teaching was not implemented for that skill. Correct responding for skill 3 steadily increased following teaching of skill 1; however, Anna did not meet mastery criteria, thus individual teaching was implemented. Anna met mastery criteria for all skills in unit 2 and unit 3 after individual teaching.

Anna started receiving psychopharmacological treatment, namely psychostimulants (medication type and dosage unknown), at session 14 (see Figure 2, depicted by an asterisk in each panel). Anna met the mastery criteria for unit 1 before psychostimulants. An increase in responding for skill 4 was also evident before psychostimulants were introduced and responding for skills in unit 3 remained at similar levels before and after psychostimulants.

Preteaching, Anna's scores on the PLS-Q indicated a low number of appropriate responses in certain life skills situations; her parents scored Anna's appropriate responses as 38 and her teachers scored Anna as a 32 (the highest possible score is 96). Scores on the ADHD-rs were over criteria, based on age and developmental level for inattention (six symptoms or higher) and hyperactivity-impulsivity (six symptoms or higher). For inattention, Anna's parents and teachers scored her symptoms as an 8. For hyperactivity-impulsivity, Anna's parents and teachers both scored her symptoms as a 9. In addition, on the question about adjustment concerns, Anna's parents and teachers both indicated they were very concerned.

Post-teaching, Anna's scores on the PLS-Q indicated a medium to high number of appropriate responses in certain life skills situations; her parents scored Anna's appropriate responses as 51 and her teachers scored Anna as a 78. Scores on the ADHD-rs were below criteria based on age and developmental level for inattention and hyperactivity-impulsivity. For inattention, Anna's parents scored her symptoms as 3 and her teachers scored her symptoms as one. For hyperactivity-impulsivity, Anna's parents scored her symptoms as 5 and her teachers scored her symptoms as 3. On the question about adjustment concerns, Anna's parents and teachers indicated moderate concern.

Results from the social acceptability measure indicated that stakeholders were interested in implementing the program in their classroom and were likely to recommend this teaching program to other teachers. Both of Anna's teachers reported difficulties with managing the time to arrange evocative situations and with data collection, specifically in the beginning of the intervention or on a hectic school day. Both teachers saw most improvement in skill 1, skill 3, and skill 7 post-teaching, and rated these skills as having the most benefits for the child and the teacher. The teachers reported that teaching of skill 4 and skill 5 overlapped; however, they also reported that teaching all skills was necessary. Both parties evaluated that skill 1 was most important, followed by skill 2, skill 5, and skill 6.

## 4 | DISCUSSION

The purpose of this study was to evaluate the effectiveness of individualized teaching in the acquisition of PLS with a girl who was being assessed for ADHD. Typical responses in certain life skills situations and the number of ADHD symptoms were assessed before and after individualized teaching.

Overall, there was an increase in the probability of correct responding after individualized teaching of the PLS. Anna met mastery criteria for complying with simple-step instructions before individualized teaching; however, systematic teaching was required for other instruction following skills. This is similar to previous research, where high levels of compliance with simple-step and multistep instructions and low levels of responding to name were evident before implementation of teaching (Hanley et al., 2007, 2014). Following teaching of requesting assistance there was a slight increase in requesting attention and requesting access. However, performance did not reach mastery criteria before those skills were specifically taught. A possible reason for why there was an increase in requesting attention and access could be because each unit includes skills that are related, that is, functional communication skills includes similar skills that require appropriately requesting access to preferred consequences.

The results of this study are consistent with previous studies evaluating the effectiveness of the PLS on skill achievement (Beaulieu et al., 2012; Hanley et al., 2007, 2014; Luczynski & Hanley, 2013; Luczynski et al., 2014) and in one-on-one teaching (Falligant & Pence, 2017; Francisco & Hanley, 2012; Kraus et al., 2012; Robison et al., 2020). Anna received on average, less than two individualized teaching sessions for each skill and each session lasted approximately 15–30 min, indicating that individual teaching is not time consuming nor interferes considerably with a teacher's schedule.

The researcher administered all the individual teaching sessions and Anna's primary teacher arranged most of the evocative situations, along with the researcher. It is possible that the researcher and the teacher served as stimulus control or signaled that a specific behavior would be reinforced. However, a second teacher substituted the primary teacher for several sessions (session 13–session 17) where the participant's performance remained the same, thus demonstrating generalization across teachers.

In the current study, for Anna, the probability of PLS increased and skill acquisition maintained after individualized teaching (1-week maintenance). Anna received a large number of teaching opportunities (578 trials in post-teaching) with a performance-based mastery criteria. This is consistent with previous studies, where a larger number of teaching opportunities and performance-based criteria with small groups of children have a more enhanced effect on skill acquisition than a fixed-number of teaching opportunities and time-based criteria (Hanley et al., 2007; Luczynski & Hanley, 2013). It would be interesting to see if similar effects are observed with a group of children with ADHD symptoms and if teaching these skills in a group, as opposed to individual teaching, is effective.

During the intervention, Anna started on psychostimulants for ADHD symptoms. It is possible that the medication affected Anna's performance and skill acquisition. However, because Anna's performance had improved on some skills before the stimulants were introduced and her performance remained stable preteaching and after the stimulants were introduced, we can conclude that the change in her performance was not due to medication alone. However, the effectiveness of stimulant medication on skill achievement cannot be excluded. Anna's performance following individual teaching demonstrates the importance of behavioral intervention along with psychostimulant treatment, the necessity of teaching these skills, and not merely treating the symptoms with medication. Measuring the effects of stimulant medication was not a specific aim of this study; however, future researchers should evaluate the effects of stimulants in acquiring important social skills, as well as comparing performance on skills with and without stimulants.

Before implementation of the program, Anna exhibited a high number of symptoms of ADHD and a low number of appropriate responses in certain life skills situations according to her parents and teacher. Anna's parents and teachers were also very concerned about her adjustment to more demanding elementary school environment. After implementation of the program, her parents and teacher scored the number of ADHD symptoms as lower, and Anna demonstrated a higher number of appropriate responses in certain life skills situations. In addition, her parents and teachers were moderately concerned about Anna's adjustment to more demanding elementary school environment. This indicates a change in parents' and teacher's perception of Anna's number of symptoms of ADHD, performance in certain life skills situations, and in the severity of concerns about adjustment to elementary school environment after individualized teaching.

In addition to Anna showing improvements in PLS, the overall results from the social acceptability measures were good and the teachers at the participating preschool were pleased with the program. The teachers not only noted improvements in Anna's behavior but also a change in their own approach toward the other children in the classroom. They pointed out the importance of teaching these school readiness skills to all the children in the classroom.

The maintenance of the acquisition of instruction following skills throughout teaching of functional communication skills and tolerance skills, and 1-week maintenance measurements suggests that skills are maintained over shorter periods (<3 months). Further assessment of generalization and long term maintenance (e.g. > 3 months) of the PLS program with children with ADHD symptoms are needed.

According to Statistics Iceland (n.d. a), in the year 2018, approximately 10% of preschool children received special education or support in the school environment due to a disability, social, or emotional difficulties. In elementary school, the rate of children receiving special education or support was 30% in 2018 (Statistics Iceland, n.d. b). Since ADHD is one of the most common neurodevelopmental disorders diagnosed among children and adolescents (American Psychiatric Association, 2013a; Baldursson et al., 2012; Gelfand & Drew, 2003) and difficulties with acquiring school readiness skill are more likely with this group of children (American Psychiatric Association, 2013b; Baldursson et al., 2012) it is important to prepare them for more demanding elementary school environment, more complex social interactions, and difficulties in daily activities, and thus promote more successful school attendance, acceptance by peers, and tolerance to difficulties in daily activities. Future researchers should focus on evaluating the effects of the PLS program for children with ADHD symptoms and their transition from preschool to elementary school since the number of children receiving special education increases between these two school levels. The focus should also be on evaluating the maintenance of skills in the elementary school environment and subsequently the impact on future difficulties these children face later in life.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## DATA AVAILABILITY STATEMENT

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

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**SUPPORTING INFORMATION**

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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