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The effectiveness of the SESFAR intervention program in supporting the phonological awareness of children with autism spectrum disorder

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Abstract

The purpose of this research was to determine the effectiveness of the Phonological Awareness Intervention Program in supporting the phonological awareness skills of two six- and seven-year-old children with autism spectrum disorder. Additionally, we collected follow-up and generalization data. The social validity data were evaluated by social comparison and subjective evaluation methods. The findings from the study showed that children with autism acquired phonological awareness skills with the Phonological Awareness Intervention Program presented with the direct instruction method. They maintained these skills in the follow-up sessions held after 1, 3, and 5 weeks and could generalize them to different people, tools, and settings. On the other hand, the social validity findings showed that children with autism who were the study participants exhibited similar phonological awareness skills to their peers. The findings obtained from the parents and teachers of the participating children indicated the study's social validity.

1. Introduction

Autism spectrum disorder (ASD) is a developmental disorder that manifests itself with various deficits in the domains of social interaction and social communication, accompanied by restrictive and repetitive behaviors, and emerges early in life (American Psychiatric Association [APA], 2013). The diagnostic criteria for ASD include inadequacy or limitation in two main domains. The first is the presence of a clinically significant, persistent deficit in social communication and interaction, while the second is limited, repetitive behaviors, interests, and activities (APA, 2013). Although not included in the diagnostic criteria for ASD, it is essential to evaluate the cognitive skills of the disability group to develop appropriate intervention programs (Sucuoglu, 2014). Children with ASD have deficits in cognitive skills and inadequacies in social interaction and communication. When assessed in reading skills, children with ASD perform lower than their typically developing peers (Whalon, Al Otaiba, & Delano, 2009). A standard reading profile for children with ASD involves limitations in typically developing decoding ability, deficiencies, and inconsistencies in comprehension skills (Nation, Cocksey, Taylor & Bishop, 2010; Wei, Christiano, Jennifer, Wagner, & Spiker, 2015). Although many children with ASD fit this profile, children with ASD may not be literate. Children with ASD constitute a heterogeneous group with deficits in different areas: (a) decoding words (Nation et al., 2006; Wei et al., 2015), (b) reading fluency (Kamps, Barbetta, Leonard, & Delquadri, 1994), and (c) text comprehension (Nation et al., 2010; Ricketts et al., 2013). Hence, even children with ASD who fit the typical reading profile display high variability; some children underperform or overperform at the same level in decoding and comprehension skills (Nation et al., 2006; Wei et al., 2015).

Determining the relationship between early and later reading skills in children with ADS is essential. Dynia, Bean, Justice, and Kaderavek (2019) found that the existing literature on the early literacy skills of children with ASD includes only five published research studies (Davidson & Ellis Weismer, 2014; Dynia et al., 2017; Dynia

** The researchers produced this study from the first author's doctoral thesis under the supervision of the second author.*

***All responsibility belongs to the researchers. The implementation of the research was carried out with the approval of the Governorship Provincial Directorate of National Education, dated 12/11/2019 and numbered E-2020/01.*

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et al., 2014; Lanter et al., 2013; Lanter et al., 2012), one unpublished doctoral dissertation (Rosenberg, 2008), and one literature review by Westerveld, Trembath, Shellshear, and Paynter (2016). The said studies have drawn several conclusions. First, when children with ASD are compared to their typically developing peers, it is seen that they equally tend to have a reasonably good knowledge of the alphabet, but children with ASD perform behind their peers in writing concept knowledge, vocabulary knowledge, and phonological awareness (Dynia et al., 2014; Lanter et al., 2012). Second, although there seems to be a typical profile of early literacy for children with ASD, there are subgroups of children with varying low performance in early literacy skills or high-performance patterns (Davidson & Ellis Weismer, 2014; Lanter et al., 2013). Third, children with ASD know the alphabet and write well and have similar growth rates in conceptual knowledge as their peers (Dynia et al., 2019). Finally, the performance of children with ASD in early literacy measures their performance in social skills (Davidson & Ellis Weismer, 2014; Lanter et al., 2012), language (Dynia et al., 2014; Lanter et al., 2013), and cognition (Davidson & Ellis Weismer, 2014), which are related to ASD-related deficits. Considering these studies, it is possible to conclude that early literacy skills develop in children with ASD. Moreover, early phonological awareness skills are among the literacy skills in children with ASD. Hence, the limitations of the studies draw attention.

Thus, there are only three studies in which phonological awareness skills were taught to children with ASD (Heimann et al., 1995; Mohammed & Mostafa, 2012; Tjus et al., 1998). In the first study in which phonological awareness skills were taught to children with ASD, Heimann et al. (1995) examined the effectiveness of Alfa, a microcomputer program, in supporting the phonological awareness skills of 11 preschool children with ASD, nine children with various disabilities, and ten typically developing children. The study found that all participating children improved their phonological awareness skills and word reading skills using the program Alpha. The following study replicated the first study by Tjus et al. (1998). In the last study, Mohammed and Mostafa (2012) conducted research with a pretest-posttest control group experimental design, including 24 children with ASD in the experimental group and 23 children with ASD in the control group. The children in the experimental group were only taught word recognition skills. The study found an increase in the word recognition skills of children with ASD in the experimental group. As is seen, there are few studies (Heimann et al., 1995; Mohammed & Mostafa, 2012; Tjus et al., 1998) aimed at supporting the phonological awareness skills of children with ASD, and these studies are not aimed at supporting the majority or all of the phonological awareness sub-skills. Therefore, future studies should develop interventions that support phonological awareness skills for children with ASD or investigate the effectiveness of intervention programs for phonological awareness skills. The present study contributes to the literature and early literacy practices for children with ASD. This study will use the Phonological Awareness Intervention Program, also known as the SESFAR Intervention Program, for children with ASD and no reading skills. The SESFAR Intervention Program is a modular early literacy program developed by Akdal and Kargin (2019) for preschool children with inadequate phonological awareness skills. The SESFAR Intervention Program was implemented by Akdal and Kargin (2019) on 5-year-old children with poor phonological awareness skills according to the stages of the direct instruction method, and the program was proven effective. This study aimed to examine the effectiveness of the SESFAR (Phonological Awareness) Intervention Program in supporting the phonological awareness skills of children with ASD. Therefore, answers to the following research questions were sought.

1. Did the SESFAR Intervention Program support the skills of children with ASD who participated in the study in separating sentences into words, words into syllables, rhyme awareness, and combining syllables?

2. Could children with ASD maintain the skills they had learned 1, 3, and 5 weeks after the end of the intervention, and could they generalize them to their primary school teachers (a different person) and their classroom (a different setting)?

3. Can children with ASD display phonological awareness skills similar to their typically developing peers of the same age (social validity)?

4. What are the teachers' opinions of the children participating in the study about the SESFAR Intervention Program (social validity)?

2. Methodology

The implementation of the research was carried out with the approval of the Governorship Provincial Directorate of National Education, dated 12/11/2019 and numbered E-2020/01.

2.1.Participants

The participants of this study consisted of three children with ASD, twelve typically developing children, implementers, and observers.

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2.1.1. Children with ASD

Three children diagnosed with ASD, one girl, and two boys, participated in this study. One child was aged six, and two were aged seven. One of the participating children was attending a preschool, and two were attending special education classes and receiving support education at a private special education and rehabilitation center. One of the children participated in the pilot study (a substitute participant), and the others participated in the experimental process. Some prerequisite characteristics were sought when selecting participants. These prerequisite characteristics can be listed as follows: (a) not being diagnosed with a developmental disability other than ASD, (b) being able to use verbal language, (c) not having acquired literacy skills (being in the early literacy period), (d) scoring below the cut-off score in the phonological awareness skills subtest of the Early Literacy Test (EROT, Kargin et al., 2015), (e) counting numbers from 1 to 10, and (f) following two- and three-word instructions. The first child with ASD took part in the pilot study. This child diagnosed with ASD was given the code name Baran. Baran is a six-year-old boy who attends a kindergarten and receives education at a private special education and rehabilitation center. The second and third participants participated in the experimental process and were given the code names Ayse and Aras. Ayse is an 86-month-old girl who attends a special education class and receives education at a special education and rehabilitation center. Ayse has no teaching background in literacy and did not attend face-to-face and online classes during the experimental period of the study due to the COVID-19 pandemic. In other words, Ayse has not received any education on literacy. Aras is an 81-month-old boy who has not started primary school yet, has just completed kindergarten, and has no history of literacy-related instruction.

The administrations of the schools that the children attended were informed about the study and provided the contact information of the participants' families. The parents of the children were informed about the study, and their verbal and written consent for participation was obtained. The practices were carried out with the children during the COVID-19 pandemic, and the health-protective behaviors required by the pandemic (cleaning, wearing a mask, and social distancing) were considered.

The Turkish version of the Gilliam Autism Rating Scale-2 (TV-GARS-2) (Diken et al., 2012) was applied to determine the degree to which the participants were affected by autism. The autistic disorder index was 90 points for Baran, 103 for Ayse, and 88 for Aras. According to the TV-GARS-2, if the autistic disorder index is 85 or higher, the probability of ASD is relatively high (Diken et al., 2012). Accordingly, the probability of ASD was considered high in all three children.

The EROT was used to assess the early literacy skills of children with ASD. According to the phonological awareness subtest of the EROT, Baran's and Ayse's scores were .25, and Aras's score was .18. According to the EROT, children with a cut-off score below .50 are considered to need support in the relevant area (Kargin et al., 2015). Accordingly, it was found that all three children needed support in phonological awareness skills.

2.1.2. Typically developing children

To obtain social validity data, one of the sub-objectives of the present study was aimed to determine whether the children with ASD who participated in the study exhibited phonological awareness skills at a similar level after the intervention to their typically developing peers who were attending preschool education classes. Therefore, twelve typically developing children attending preschool education classes participated in the current study. The children's ages ranged from 76 months (6 years 4 months) to 83 months (6 years 11 months). Verbal permission to participate in the study was obtained from their mothers.

2.1.3. Research staff

The first researcher carried out the study's implementation process. The researcher was a 34-year-old female working on her doctoral degree in special education during the study period. She conducted all sessions. The first researcher has certificates of participation for the TV-GARS-2, EROT, and SESFAR Intervention Program. The second researcher has the title of professor in special education and has been working in this field for twenty-three years. The second researcher consulted the first researcher in designing and conducting the study.

2.2. Settings

The pilot study, experimental process, and external validity were conducted in the three children's rooms in their homes. There was a table and two chairs in their rooms, a video camera, and activity materials for the SESFAR Intervention Program, including picture cards on the table, data collection forms, and predetermined reinforcers for the children. It was ensured that all children sat facing each other.

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2.3. Materials

2.3.1. Picture cards

The study process consisted of baseline, probe, intervention, follow-up, and generalization sessions, and picture cards were used to carry out activities in all sessions. Since the SESFAR Intervention Program is taught to the participants through direct instruction, the same picture cards were used for modeling and guided practices. In contrast, different picture cards were used for independent practice. Picture cards were used with the BIFF 1, 2, 3, and 4 during the data collection phase, baseline, follow-up, and probe sessions. Therefore, the researchers prepared picture cards for these sessions. The picture cards in the BIFF used in the baseline phase consisted of sentences, words, rhymes, and syllables not used in the SESFAR Intervention Program activities.

The picture cards in the BIFF-1 were prepared for the skill of separating sentences into words, including sentences such as "Ela ran.", "Go to school early.", "Ants work hard.", and "Giraffes are very tall." The sentences were visualized on the front of the card, and the related sentences were written on the back. When selecting sentences, the researchers tried to ensure that sentences consisting of 2, 3, 4, 5, 6, and 7 words were equally distributed.

The picture cards in the BIFF-2 were prepared for the skill of separating words into syllables. For example, the words cat, airplane, elephant, and automobile (the English equivalents of the words are presented here) were used and visualized on the front side of the card. The related words were written on the back. When selecting words, the researchers tried to ensure that they were not used in the intervention sessions and that words consisting of 1, 2, 3, and 4 syllables were equally distributed.

In the picture cards in the BIFF-3 prepared for the rhyme awareness skill, words such as “stair-chair" (the English equivalents of the words are presented here) were visualized on the front of the card, and the related words were written on the back. When selecting words, the researchers noted that they were not used in the intervention sessions.

In the picture cards in the BIFF-4 prepared for the skill of combining syllables, the words, e.g., "tea-cup," "cup-cake," and "rain-coat" (the English equivalents of the words are presented here), were visualized on the front of the card, and the related syllables were written on the back. When selecting syllables, the researchers noted that they were not used in the intervention sessions and were meaningful syllables.

2.3.2. Video camera

This study used a Sony video camera to record the baseline, intervention, follow-up, and generalization sessions during the pilot study and experimental process. The camera was placed in a setting that would not distract the children's attention.

2.3.3. Reinforcers

The reinforcers preferred by the participants were determined before the skill using the "offering a pre-task choice" technique.

2.4. Dependent variables

The study's dependent variables were the participants' levels of learning phonological awareness skills (separating sentences into words, separating words into syllables, rhyme awareness, and combining syllables). The levels at which Ayse and Aras performed the skills of separating sentences into words, separating words into syllables, rhyme awareness, and combining syllables were obtained by multiplying the ratio of their correct responses to the Baseline, Intervention, and Follow-up Form (BIFF) 1, 2, 3, 4 to the total responses in each test by 100. The participants were expected to perform each skill at an accuracy level of 80% and above.

2.4.1. Independent variable

The study's independent variable was the Phonological Awareness Skills Support Intervention Program (SESFAR), which was presented with a direct instruction method. The content of the SESFAR includes a total of 72 activities. Activities include eight skill areas supporting the skills of separating words into syllables, combining syllables, separating sentences into words, rhyme awareness, matching according to the first sound, matching according to the last sound, dropping the first sound of words, and dropping the last sound. The first activity for

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each skill aims to help children understand the targeted skill. The researchers reviewed the literature and prepared all of the activities used in the intervention program. For their use in the implementation phase, different playgrounds for the activities and 595 pictures were prepared, and graphic designers drew them.

2.5. Data collection tools

2.5.1. TV-GARS-2

The Gilliam Autism Rating Scale-2 (GARS-2, 2005), the revised version of the Gilliam Autism Rating Scale (1995), was recommended to be used as a type-two (level two) assessment instrument by Johnson, Myer, and the Council on Children with Disabilities guidelines (2007). The TV-GARS-2 was developed based on the current definitions of the DSM-IV-TR (2000) and the Autism Society of America (2003) and standardized by Diken et al. (2012) on 1191 individuals with autistic disorder aged between 3 and 23 years. The TV-GARS-2 consists of three subscales with specific, observable, and measurable behaviors related to stereotypic behaviors, communication, and social interaction. The TV-GARS-2 includes a total of 42 items, with 14 items in each subscale. While the internal consistency (Cronbach's alpha) coefficient of the total scale was .88, the internal consistency coefficient of the stereotype behaviors subscale was .79, the internal consistency coefficient of the communication subscale was .77, and the internal consistency coefficient of the social interaction subscale was .85. In the test-retest reliability study, the test-retest reliability coefficients for the subscales and Autistic Disorder Index (ADI) were above .90 (Diken et al., 2012).

2.5.2. EROT data recording form

Developed by Kargin et al. (2015), the EROT is a valid and reliable tool that aims to measure the early literacy skills of preschool children in seven dimensions. Validity and reliability studies were conducted on 403 children aged 60-72 months attending kindergartens. Internal consistency (KR-20), two-half test reliability (Spearman-Brown), and test-retest reliability coefficients were calculated in the reliability analysis. Regarding the content validity of the EROT, the expert panel formed for the content validity of the EROT stated that the items in each subtest of the EROT reflected children's competencies in the relevant tests. In this respect, it was accepted that the EROT adequately reflected the areas to be measured. The findings from the exploratory and confirmatory factor analyses regarding the construct validity of the EROT showed that the EROT consists of seven subtests. The factor loadings of the items in each subtest ranged from .43 to .93, and the subtests gave the expected fit within themselves. According to these results, it was accepted that the construct validity of the EROT was sufficient.

The EROT consists of the following subtests: (a) vocabulary knowledge in receptive language, (b) expressive vocabulary, (c) general naming, (d) functional knowledge, (e) letter knowledge, (f) phonological awareness, and (g) listening comprehension. All subtests except listening comprehension were used in this study.

2.5.3. BIFF 1, 2, 3, 4

The study used the BIFF 1, 2, 3, and 4 to record the baseline, intervention, and follow-up sessions during the pilot and experimental process to collect reliability data for the dependent variable and social comparison data from social validity data. The BIFF-1 was used for the skill of separating sentences into words, the BIFF-2 for the skill of separating words into syllables, the BIFF-3 for the rhyme awareness skill, and the BIFF-4 for the skill of combining syllables. No reaction was given to the participant's responses to the BIFFs, and correct and incorrect responses were recorded on the data collection form. An average percentage of correct responses was calculated at the end of each session by dividing the total number of steps responded correctly by the total number of steps in the BIFF 1, 2, 3, and 4 for each trial.

2.5.4. SESFAR Intervention Program Procedural Fidelity Forms (SESFAR-PFFs)

The SESFAR Intervention Program procedural fidelity forms (SESFAR-PFFs) 1-2 were developed to collect procedural fidelity data. The SESFAR-PFF-1 items consisted of the teaching steps of the direct instruction method and the SESFAR Intervention Program. In these steps, the first researcher (1) prepares the tools and activity materials, (2) attracts the participant's attention, (3) tells the participant the purpose and importance of the session, (4) presents the reinforcer, (5) presents the skill instruction, (6) performs the teaching by applying the SESFAR Intervention Program activities according to the stages of the direct instruction method, (7) gives feedback to the participant, (8) presents the reinforcer, and (9) ends the session. The SESFAR-PFF-2 included the behaviors that the first researcher should exhibit in the baseline, probe, follow-up, and generalization sessions. These are (1)

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preparing tools and activity materials, (2) attracting the participant's attention, (3) providing skill instructions, (4) remaining unresponsive to the participant's responses, and (5) reinforcing the participant's cooperation.

2.5.5. SESFAR intervention program implementation opinion form for teachers and mothers (SESFAR Intervention Program-IOF-T-M)

The SESFAR Intervention Program-IOF-T-M was developed to collect subjective evaluation and social validity data from teachers and mothers. The form included open-ended questions about the effectiveness of the SESFAR Intervention Program for children, its usefulness, and whether they would use the program.

2.6. Experimental design

A sub-model of the multiple probe design with probe trials across subjects, one of the single-subject research designs, was employed in the present study.

2.7. General procedure

The general procedure of the study consisted of the preparation phase, pilot study, and experimental process.

2.7.1. Preparation phase

Before initiating the experimental process of the study, the researchers applied the EROT and the TV-GARS-2 to three participants with ASD. Thus, the participants' early literacy skill levels, the accuracy of their autism diagnoses, and the degree of being affected by autism were determined.

2.7.2. Pilot study

Before initiating the experimental process, a pilot study was conducted to determine the number of activities that should be included in an intervention session and the duration of the intervention session to prevent possible problems that might arise during the intervention sessions and decide on the phonological awareness skills to be acquired.

In the pilot study, the phonological awareness skills in the SESFAR Intervention Program, which consist of separating sentences into words, separating words into syllables, rhyme awareness, combining syllables, matching words according to their final sounds, matching words according to their first sounds, dropping the final sound of words, and dropping the first sound of words, were practiced with Baran. However, Baran had difficulty learning all the skills in the SESFAR Intervention Program sequentially; he especially had difficulty acquiring the skills of matching words according to their final sounds, matching words according to their first sounds, dropping the final sound of words, and dropping the first sound of words. However, during the pilot study, it was determined that one instructional session lasted approximately 30 to 40 minutes, and a maximum of three activities could be practiced in one instructional session. Additionally, when the pilot study was completed, it was seen that it took approximately 120 minutes to teach each skill in the SESFAR Intervention Program. According to the information from the pilot study, it was decided to work with the participants with ASD (Ayse and Aras) in the experimental process on the skills of separating sentences into words, separating words into syllables, rhyme awareness, and combining syllables and to conduct three activities in each intervention session.

2.7.3. Experimental process

The experimental process of the study consisted of baseline, intervention, follow-up, and generalization sessions.

Baseline sessions. Ayse and Aras participated in the experimental process, which was first conducted with Ayse and then with Aras after Ayse's experimental process ended. The first researcher conducted the baseline sessions in the participants' homes, in their rooms, three days a week, one session a day, with each session consisting of 10 trials, due to the restrictions caused by the COVID-19 pandemic. In the baseline sessions, data were collected sequentially for four different skills: separating sentences into words, separating words into syllables, rhyme awareness, and combining syllables. For both participants, the baseline phase was continued for at least three consecutive sessions until stable data were obtained (the difference between data points was no more than ±15%). Data during the baseline phase were collected with the BIFF 1, 2, 3, and 4.

Intervention sessions. After stable data were obtained in the baseline phase for five consecutive sessions, the first researcher started to teach the SESFAR Intervention Program. She first started to conduct the intervention

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sessions with Ayse. After the SESFAR intervention program affected Ayse's phonological awareness skills, the first researcher started to conduct the intervention sessions with Aras. In other words, she performed systematic replication for Aras. Systematic replication tests whether the experimental effect from a study will be obtained under different conditions, such as a different setting, time, behavior, or participants (Tekin-İftar, 2018).

The intervention process included teaching the sub-skills of separating sentences into words, separating words into syllables, rhyme awareness, and combining syllables, and three activities for each skill. The program was taught by the direct instruction method. Therefore, the intervention sessions consisted of pre-activity preparations, modeling, guided practices, and independent practices. At the first stage, the first researcher informed the participant about the activity to be carried out, the rules to be followed by the participant, and that if the participant followed these rules, the participant would receive a reward of their choice at the end of the activity. Then, the materials to be used in the activity planned for the relevant intervention session were placed on the table, and the participant was allowed to examine them. The modeling stage was started after this stage was completed, and the first researcher explained and demonstrated each skill. The first researcher primarily demonstrated the activities by modeling. Then, the guided practice phase was started, and the participants performed the activities together with the first researcher, respectively. Finally, the participants were asked to complete these three activities independently in the independent practice phase. The intervention sessions continued until the activities in the SESFAR Intervention Program were completed, the targeted criterion (80% and above accuracy) was reached, and stable data (the difference between data points was no more than ±15%) were obtained in three consecutive sessions for the skills of separating sentences into words, separating words into syllables, rhyme awareness, and combining syllables, respectively. Then, the intervention phase was terminated, and the follow-up and generalization phases were initiated. The BIFFs 1, 2, 3, and 4 were again used to collect data during the intervention and follow-up phases.

The COVID-19 pandemic affected Ayse's intervention phase process. For example, to start the third session for the first skill, intervention sessions had to be interrupted for ten days within the scope of the circular. The remaining sessions were completed three days a week, with one intervention session per day, considering the restriction measures. In this process, studies were completed by considering the health protective behaviors (cleaning, wearing a mask, and social distancing) required by the COVID-19 pandemic.

Probe sessions. Probe sessions were organized at the end of each intervention session consisting of three activities, using the BIFF 1, 2, 3, and 4 prepared for each skill. In the probe sessions, there was a waiting period of one to two minutes between probe trials. The first researcher told the child, "I am going to show you some picture cards now. Let us take a look together, shall we?" and asked ten questions related to the studied skill in the BIFF-1, 2, 3, and 4, respectively. The first researcher did not react to the participant's answers and put a "+" sign in the BIFFs for correct answers and a "-" sign when the participant did not respond or gave an incorrect answer.

Follow-up sessions. The first researcher conducted the follow-up sessions 1, 3, and 5 weeks after the end of the intervention sessions in the same way as the probe sessions.

Generalization sessions. The researchers evaluated the generalization of the phonological awareness skills acquired by Ayse and Aras by implementing the SESFAR Intervention Program in three different ways before and after the intervention. In the generalization sessions, the participants and their support teachers sat at the study table in their classrooms. After drawing the participant's attention, the teacher started administering the phonological awareness subtest of the EROT to the participant by saying, "Now I am going to ask you some questions, and I expect you to answer them." The implementer and the teacher conducted the generalization sessions without providing any prompts or feedback to the participant. The participant's correct responses were recorded as "+," while non-responses or incorrect responses were recorded as "-" on the EROT data collection form.

2.8. Reliability studies

In the research, two reliability studies with independent observers were conducted: inter-observer reliability and procedural fidelity study. An inter-observer reliability study was conducted by two observers independently evaluating the same intervention sessions (Alberto & Troutman, 2009), and the reliability coefficient was calculated with the formula "[(agreement) / (agreement + disagreement)] x 100" (Tekin-Iftar, 2018). First, the independent observers explained the expected responses of the participants and the correct and incorrect responses, and they were informed about the BIFF 1, 2, 3, and 4 on which they would record the data. Then, the independent observers watched the recordings (30% of the total recordings) randomly selected from among the video

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recordings of all sessions and independently recorded the participant's responses to the questions about phonological awareness skills on the BIFF 1, 2, 3, and 4. As a result of the study, the inter-observer reliability coefficients for Ayse and Aras were found to vary between 94% and 100%.

The researchers revealed whether the independent variable was implemented as planned by conducting a procedural fidelity study (Kazdin, 2011; Tekin-Iftar, 2018). To this end, the independent observers watched the recordings (30% of the total recordings) randomly selected from among the video recordings of all sessions of the experimental process and evaluated whether the first researcher exhibited the behaviors that the first researcher should display in each phase of the experimental process using the SESFAR-PFF-1 or SESFAR-PFF-2. Then, the responses were analyzed with the formula "[(observed implementer behavior/planned implementer behavior) x 100)," and the procedural fidelity coefficient was obtained (Tekin-Iftar, 2012). The procedural fidelity coefficient was found to vary between 88% and 100% for Ayse's experimental process and 100% for Aras' experimental process.

2.9. Social validity

The researchers conducted social validity studies using subjective evaluation and social comparison (Kazdin, 2011). For the subjective evaluation, the first researcher reached the teachers and mothers of the participants and asked them the questions on the SESFAR Intervention Program-IOF-T-M. The researcher audio-recorded the interviews and transcribed them descriptively to analyze the data.

Social comparison is the process of comparing the performance of the individual or individuals who are the target of the behavior change process with the performance of the group defined as a reference group consisting of individuals who are thought to exhibit the target behavior or behaviors in the desired form and level before and after the intervention and who do not need the behavior change process (Tekin-İftar, 2018). In this study, the researchers used social comparison to determine whether they selected socially essential skills for the participants and whether the obtained effects led to a functional change in the participants. Therefore, the first researcher reached typically developing children for social comparison and administered the BIFF 1, 2, 3, and 4 to these children. Thus, the phonological awareness skills of both groups of students were compared.

3. Findings

This study aimed to determine the effectiveness of the SESFAR Intervention Program in supporting the phonological awareness skills of children with ASD. The data demonstrated that the training improved the performance of the two children. Figure 1 and Figue 2 show the percentage of the four correct phonological awareness skills for the baseline, intervention, and follow-up sessions.

3.1. Findings on the effectiveness of the sesfar intervention program for Ayse

When Figure 1 is examined, in the first phonological awareness skill, separating sentences into words, Ayse's baseline correct response average was 14% (range 10-20%). Afterward, a total of 6 intervention sessions were conducted with Ayse using the SESFAR Intervention Program. After the first two sessions, the intervention sessions were interrupted in line with the COVID-19 pandemic circular, and they were resumed ten days later. Ayse responded 90% correctly in the first session and 100% in the subsequent five sessions. In the second skill, separating words into syllables, Ayse's average correct response rate in the pre-intervention probe and baseline sessions was 0%. This skill was taught with the SESFAR Intervention Program, and the desired criterion and stability level was reached in three sessions. Ayse responded correctly at 80%, 100%, and 100%. In the probe trials, she responded correctly at 100% and 100%, respectively. With Ayse, 30 trials, ten trials in each session, were conducted to teach the skill of separating words into syllables. The data collected in these sessions showed that Ayse acquired the skill of separating words into syllables. The average of Ayse's pre-intervention probe and baseline correct responses for the rhyme awareness skill was 10%. In other words, Ayse found one rhyme-like word pair out of 10-word pairs in the first four baseline sessions. With the SESFAR Intervention Program, a total of 3 teaching sessions and 30 trials, 10 in each session, were conducted. Ayse responded correctly at an average of 93% (range=90-100%) in the daily probe sessions. In the probe trial conducted with Ayse after the intervention sessions, she responded correctly at 90%. The data collected in these sessions show that Ayse acquired the rhyme awareness skill. In the skill of combining syllables, Ayse responded 0% correctly on average in five probe trials and three baseline sessions before the intervention. Then, the researcher started to conduct the SESFAR intervention to teach the skill of combining syllables. A total of 30 trials were conducted with Ayse, including

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three intervention sessions and ten trials in each session. Ayse responded correctly at 80%, 90%, and 90% in the daily probe sessions. Since the criterion (80% and above) was reached in the intervention sessions, they were terminated.

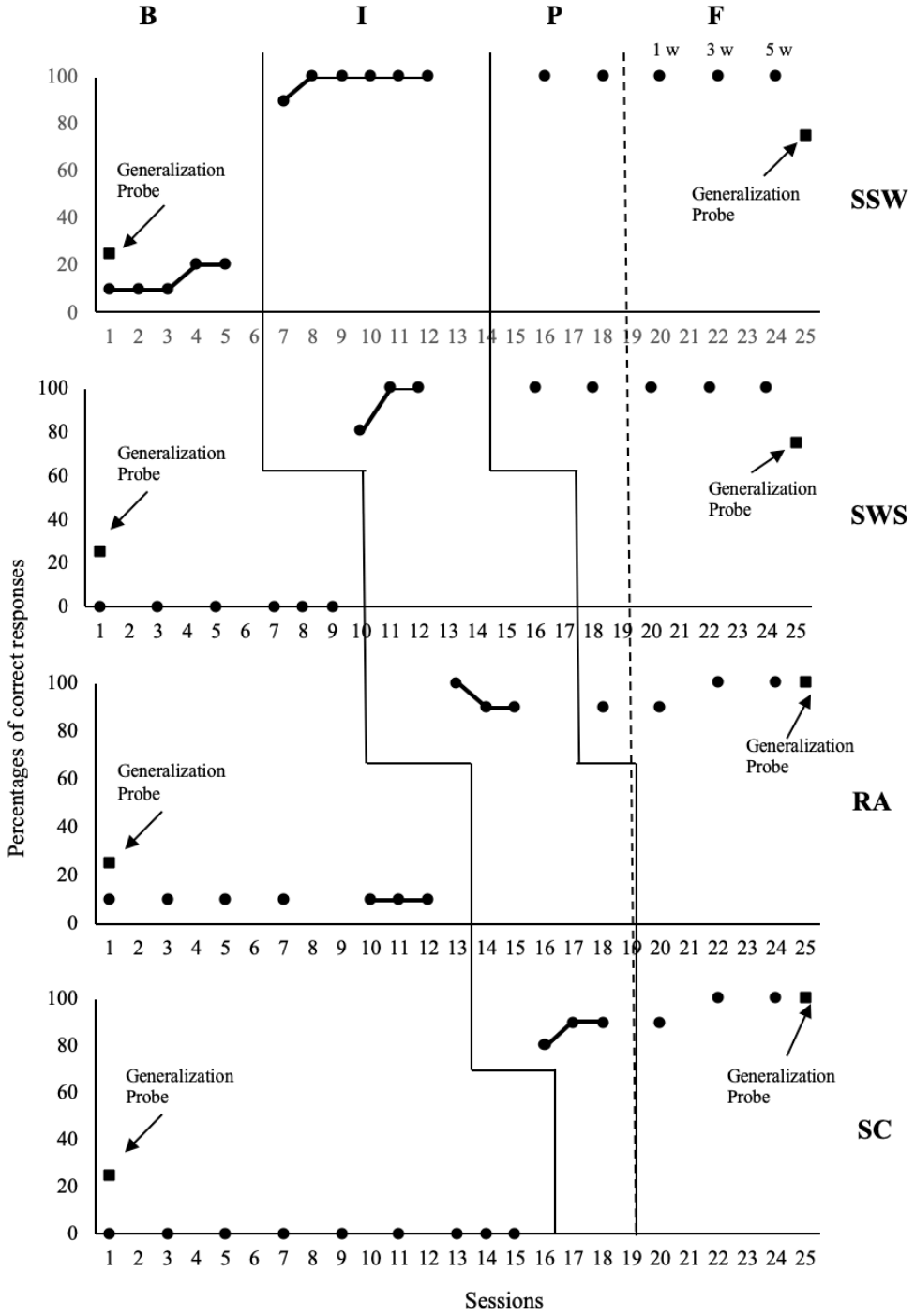

Figure 1. Percentages of correct responses of Ayse in the baseline (B), intervention (I), probe (P), follow-up (F) phases regarding the skills of SSW (Separating Sentences into Words), SWS (Separating Words into Syllables), RA (Rhyme Awareness) and SC (Syllables Combining).

3.2. Findings on the effectiveness of the SESFAR Intervention Program for Aras

When Figure 2 is examined, while Aras responded 0% correctly at the baseline level, he performed at an average of 86.6% (range=80-90%) in three intervention sessions. In the syllable segmentation skill, whereas Aras showed an average of 0% correct performance at the pre-intervention probe and baseline levels, he responded correctly at 80%, 80%, and 90%, respectively, in the daily probe sessions after the intervention was started. In the rhyme

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awareness skill, Aras responded correctly at the level of 35% (range=30-40%) before the intervention and performed with an average accuracy of 93% (range=80-100%) after the SESFAR Intervention Program. In the last skill, combining syllables, Aras displayed an average of 0% correct performance at the probe and baseline levels before the intervention. They responded correctly at an average of 96.6% (range=90-100%) in the daily probe sessions.

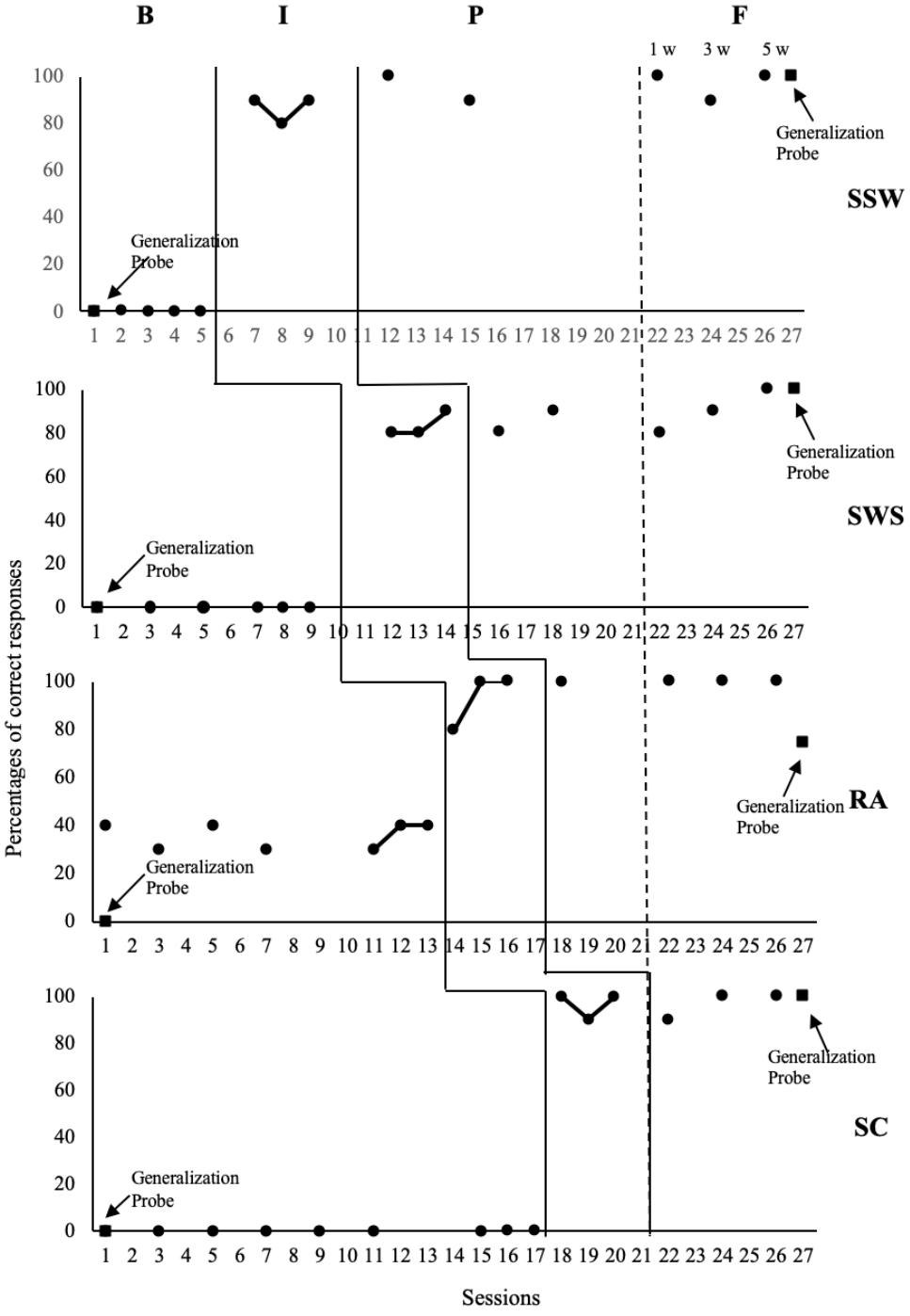

Figure 2. Percentages of correct responses of Aras in the baseline (B), intervention (I), probe (P), and follow-up (F) phases regarding the skills of SSW (Separating Sentences into Words), SWS (Separating Words into Syllables), RA (Rhyme Awareness) and SC (Syllables Combining).

3.3. Follow-up findings

The follow-up sessions were conducted with Ayse 1, 3, and 5 weeks after the end of the intervention sessions regarding the maintenance of phonological awareness skills. In the follow-up sessions, Ayse maintained the

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phonological awareness skills she had acquired by performing the skill of separating sentences into words with 100%-100%-100% accuracy, the skill of separating words into syllables with 100%-100%-100% accuracy, the skill of rhyme awareness with 90%-100%-100% accuracy, and the skill of combining syllables with 90%-100%-100% accuracy.

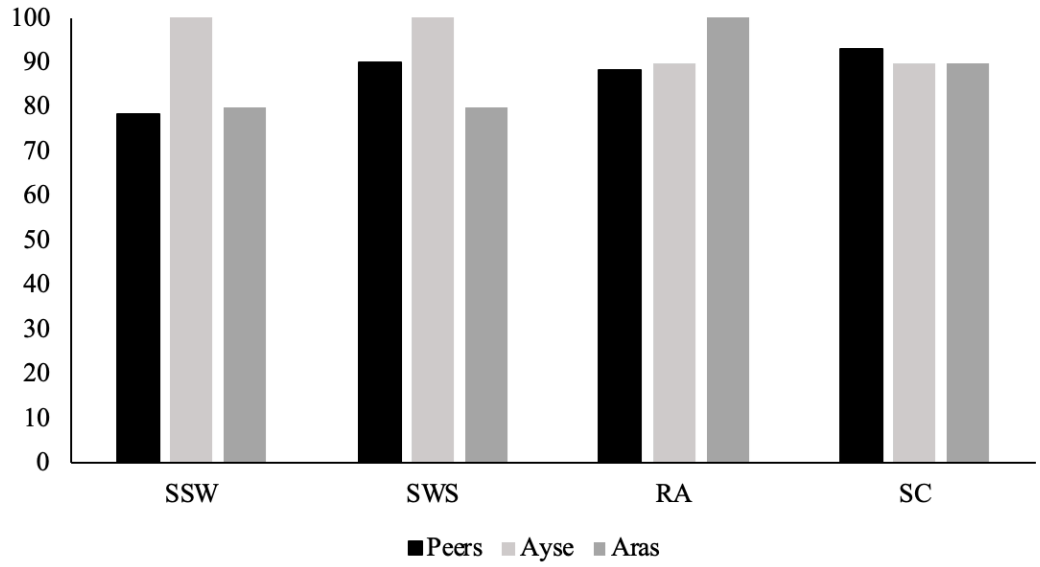
One, three, and five weeks after the intervention, Aras maintained the sentence segmentation skill at an average of 96.6% (range= 90-100%), word segmentation skill at an average of 90% (range= 80-100%), rhyme awareness skill at an average of 100%, and syllable combining skill at an average of 96.6% (range= 90-100%).

3.4. Generalization findings

In the study, generalization data were obtained in three ways, including evaluating the SESFAR Intervention Program by the support education teacher with the EROT in the classrooms. Results are presented in Figure 1 and Figure 2. According to the EROT results, in the skill of separating sentences into words, Ayse scored 25% in the pretest and 75% in the posttest, whereas Aras scored 0% in the pretest and 100% in the posttest. In separating words into syllables, Ayse scored 25% on the pretest and 75% on the posttest, while Aras scored 0% on the pretest and 100% on the posttest. In the rhyme awareness skill, Ayse scored 25% on the pretest and 100% on the posttest, whereas Aras scored 0% on the pretest and 75% on the posttest. In combining syllables, Ayse scored 25% on the pretest and 100% on the posttest, while Aras scored 0% on the pretest and 100% on the posttest. These results showed that Ayse and Aras generalized the skills they had acquired with the SESFAR Intervention Program.

3.5. Social validity findings

The opinions of the students' mothers and teachers were obtained to investigate the social validity of the study. Interviews were conducted using the qualitative research approach, and data were collected using a semi-structured interview form. The following questions were asked of the children's teachers: Are phonological awareness skills essential? What kind of improvements did the SESFAR Intervention Program cause in your student? What do you think about the SESFAR Intervention Program? In which settings did you observe your students using their acquired skills? The teachers stated that phonological awareness skills were essential and that learning them before reading instruction would make it easier for children to learn to read. The teachers said that their students could tell how many words a sentence contained and that they started to separate words into syllables. They also stated that the picture cards and activities used in the program were beneficial. Teacher 1 said, "Ayse started to separate words into syllables by keeping tempo in the lessons. I realized that she had learned new words." Teacher 2 stated, "Aras' attention span increased in the lessons. He also learned the number of syllables and started to say words that rhyme with each other spontaneously."



Graph 1. Comparison of the levels of realization of phonological awareness skills between participants and peers with normal development. SSW: Separating Sentences into Words, SWS: Separating Words into Syllables, RA: Rhyme Awareness, SC: Syllables Combining

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In the study, the levels of the participants and 12 typically developing peers in performing the skills of separating sentences into words, separating words into syllables, combining syllables, and rhyme awareness were compared by conducting a probe session using the questions on the BIFF 1, 2, 3, and 4. The peers were asked to participate in one session for each skill, and the average of these sessions is shown in Graph 1.

Ayse correctly separated ten sentences from 10 picture cards into words and performed at 100% in the skill of separating sentences into words, correctly separated ten words from 10 picture cards into syllables and performed at 100% in the skill of separating words into syllables, correctly matched nine rhyme pairs from among 10 rhyme pairs and performed at 90% in the rhyme awareness skill, and correctly combined the resulting word by combining nine meaningful syllable pairs and performed at 90% in the skill of combining syllables. Aras correctly separated eight sentences from 10 picture cards into words at 80% in the skill of separating sentences into words, correctly separated eight words from 10 picture cards into syllables at 80% in the skill of separating words into syllables, matched ten rhyme pairs out of 10 rhyme pairs and performed at 100% in the rhyme awareness skill, and correctly combined the resulting word by combining nine meaningful syllable pairs and performed at 90% in the skill of combining syllables. The twelve participants in the reference group performed at an average level of 78.3% in the sentence segmentation skill, 90% in the word segmentation skill, 88.3% in the rhyme awareness skill, and 93.3% in the syllable combination skill. The study participants, Ayse and Aras, displayed phonological awareness skills at a higher level than the reference group.

4. Discussion

This study examined the effectiveness, maintenance, and generalizability of the SESFAR Intervention Program in teaching phonological awareness skills: separating sentences into words, separating words into syllables, rhyme awareness, and combining syllables for children with ASD. They also investigated the social validity of the SESFAR Intervention Program through subjective evaluation and social comparison. The study findings showed that the SESFAR Intervention Program was effective in teaching phonological awareness skills to children with ASD; children maintained the phonological awareness skills they had learned 1, 3, and 5 weeks after the intervention, and children could generalize these skills to different settings, different equipment, and different people, the children's teachers and mothers had favorable opinions about the intervention process, and children with ASD exhibited phonological awareness skills at a similar level to their typically developing peers at the end of the intervention.

4.1. Theoretical implications

The study's first finding is that the SESFAR Intervention Program is effective. Ayse reached the targeted criterion in the first intervention session for the sentence segmentation, syllable segmentation, and rhyme awareness skills (90%, 80%, and 100% for each skill, respectively), performed with 70% accuracy in the first intervention session for the syllable combination skill, and reached 100% accuracy in the subsequent intervention and probe sessions for all four skills. The findings on the effectiveness of the study overlap with the findings of research in the international literature on supporting early literacy skills (Fleury & Schwartz, 2017; Grindle, Carl Hughes, Saville, Huxley, & Hastings, 2013; Hudson et al., 2017; Kimhi, Achtarzad, & Tubul-Lavy, 2018) and phonological awareness skills (Heiman et al., 1995; Mohammed & Mostafa, 2012; Tjus et al., 1998) in children with ASD. For example, Kimhi et al. (2018) emphasized that children with ASD often display poor reading comprehension abilities and conducted a study to investigate a naturalistic, standards-based national literacy program for five kindergarteners with ASD aged 5-8 years. The researchers adapted the program for children with ASD, implemented it for six weeks, and demonstrated the effects of the study with pretest and posttest measures. They found that children with ASD acquired skills related to code and meaning. Furthermore, three studies (Heiman et al., 1995; Muhammed & Mostofa, 2012; Tjus et al., 1998) on supporting phonological awareness skills in children with ASD were found in the international literature. In the first study, the researchers examined the effect of the microcomputer program Alfa on supporting the phonological awareness skills of 11 children with ASD, nine children with various disabilities, and 10 typically developing children (Heimann et al., 1995). The study revealed that all participating children increased their phonological awareness and word reading skills. The following study replicated the first study (Tjus et al., 1998). In the last study, Mohammed and Mostafa (2012) conducted an intervention only for word recognition skills with a pretest-posttest control group experimental design. As a result of the study, the word recognition skills of children with ASD increased. As is seen, there are few studies (Heimann et al., 1995; Mohammed & Mostafa, 2012; Tjus et al., 1998) that aim to support the phonological awareness skills of children with ASD, and these studies do not aim to support the majority or all of the phonological awareness

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sub-skills. Few studies (Heimann et al., 1995; Tjus et al., 1998; Mohammed & Mostafa, 2012) have focused on word recognition skills. To support the phonological awareness skills of children with ASD, the skills of separating sentences into words, separating words into syllables, rhyme awareness, and syllable combining were discussed separately, and the teaching of these skills was included in this study. The study found that students with ASD learned these four phonological awareness sub-skills. Hence, the study contributed to the literature in this respect.

The second important finding of this study is the systematic replication of the effectiveness obtained in Ayse for Aras. After it was determined that the SESFAR Intervention Program affected Ayse's phonological awareness skills, the intervention was performed with Aras. Thus, the effectiveness of the SESFAR Intervention Program on Aras' sentence segmentation, syllable segmentation, rhyme awareness, and syllable combination skills was examined. The results showed that Aras acquired the four targeted phonological awareness skills in three intervention sessions.

The third main finding of the study is that children with ASD maintained the phonological awareness skills they had learned after the intervention. There is no study in the literature investigating whether the acquisitions obtained after teaching phonological awareness skills to children with ASD were maintained. There are few experimental studies on supporting the phonological awareness skills of children with ASD (Heimann et al., 1995; Tjus et al., 1998; Mohammed & Mostafa, 2012), and there are no single-subject experimental studies. A longitudinal study (Dynia et al., 2019) examined the early literacy skills of children with ASD (Davidson & Ellis Weismer, 2014). In the aforesaid study, Davidson and Ellis Weismer (2014) longitudinally followed the early literacy skills of 127 children with ASD from age 5 to age 9. The study showed that the early literacy skills of children with ASD varied; children performed worse in comprehension skills and better in alphabet knowledge, while children with verbal language skills had good early literacy skills, the others had inadequate early literacy skills. In other words, if children with ASD do not receive any education, they continue to have inadequate early literacy skills. The finding from the present study is that children with ASD could maintain phonological awareness skills approximately one month after acquiring them. This result shows the importance of phonological awareness practices for children with ASD.

The fourth finding of this study is that children with ASD could generalize the phonological awareness skills they had acquired to different people, settings, tools, and materials. In the study, a different implementer applied the EROT in a different setting before and after the intervention, and it was observed that children with ASD could generalize the phonological awareness skills they had acquired according to the assessments with this tool. This study also showed that the SESFAR Intervention Program was generalizable. The generalizability of the SESFAR Intervention Program was ensured with the second participant in the study. The data from the baseline and intervention sessions conducted with the second participant with ASD demonstrated the external validity of the SESFAR Intervention Program, in other words, its generalizability. This finding will shed light on the research and practices to be conducted on phonological awareness skills and the SESFAR Intervention Program.

The fourth finding of the study shows that children with ASD can exhibit phonological awareness skills at a similar level to their typically developing peers, and the opinions of their mothers and teachers demonstrate the positive social outcomes of the intervention. The social comparison method provides clues about social validity to determine whether the child performs similarly to his/her peers. In the current study, social comparison data were collected to this end. Since few experimental studies in the literature support the phonological awareness skills of children with ASD (Heimann et al., 1995; Tjus et al., 1998; Mohammed & Mostafa, 2012), social comparison findings could not be found in the related studies. On the other hand, studies compare the early literacy skills of children with ASD and typically developing children (Dynia et al., 2014; 2017; 2019; Westerveld, Paynter, Brignell, & Reilly, 2020). For example, Dynia et al. (2019) compared the phonological awareness skills of 125 children, including 27 children with ASD, 28 with language impairment, and 70 typically developing children.

4.2. Practical implications

In addition to the four main findings, the present study yielded other significant results. The first is that the external validity of the SESFAR Intervention Program was proved. Ardal and Kargin (2019) developed the SESFAR Intervention Program for children with poor phonological awareness skills. The current study used the SESFAR Intervention Program for children with ASD. However, this study has three main differences from the study by Akdal and Kargin (2019). The first is that the current study was conducted with children with ASD, the second is the use of the multiple-probe across skills design, one of the single-subject research designs, and the last is that only the first four phonological awareness skills were taught instead of the eight phonological awareness skills included in the program. According to the findings, the SESFAR Intervention Program was effective in children

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with ASD, and even teaching only the first four skills in the program could improve children's phonological awareness and early literacy skills. The study contributed to the literature and practices in this respect.

The researchers also revealed that six- and seven-year-old children with ASD who had not received literacy education did not have phonological awareness skills with the Early Literacy Test pretest data (EROT). The first child with ASD scored 0.25, whereas the second child scored 0.18 on the test. The cut-off score for the phonological awareness subtest of the EROT is 0.50, and those who score below this score are considered to need support in the relevant domain (Kargin et al., 2015). Likewise, according to the information from the baseline sessions of the SESFAR Intervention Program, the first child with ASD performed at an average level of 4% (the sum of all baseline data / the total number of trials in the baseline phase x 100) (27 / 110 x 100), while the second child performed at an average level of 5% (27 / 140 x 100) in phonological awareness skills. These findings reveal that children with ASD have very inadequate phonological awareness skills. Studies examining the phonological awareness skills of children with ASD (Smith Gabig, 2010; Lanter, 2009; Rosenberg, 2008; Kilic-Tulu, Okcun-Akcamus, & Ergul, 2023) found that children with ASD have significantly higher letter knowledge and significantly lower phonological awareness and vocabulary compared to typically developing children. Although the current study was limited to two students with ASD and twelve typically developing children, it supports the results obtained from the above-mentioned research. Despite the limitations of this study, it contributes to the literature.

The study revealed that typically developing children had average phonological awareness skills, whereas children with ASD had inadequate phonological awareness skills. Westerveld et al. (2020) compared the early literacy (phonological awareness and letter knowledge) skills of four-year-old children with and without ASD. They found that the levels of early literacy skills of the two groups did not differ. There are no social comparison studies in the literature. Moreover, few studies have compared the early literacy skills of children with ASD and typically developing children, and these studies have obtained different results. Therefore, there is a need for further research that compares the phonological awareness skills of children with ASD and typically developing children and performs social comparison after an intervention.

4.3. Limitation and future research

The present study has some limitations. The first limitation is that the study could not be conducted with children with ASD in the age group of 5 years and more. Although the participants of this study have not received literacy education, the SESFAR Intervention Program was developed for the 5-year-old age group. The fact that the study coincided with the COVID-19 pandemic made it difficult to reach children with ASD and prerequisite skills aged between 5-7. On the other hand, a cause-and-effect relationship was established for the effect of the independent variable, the SESFAR Intervention Program, on the phonological awareness skills of children with ASD, the dependent variables, and a solid functional relationship was revealed in the study. However, future studies can be conducted with a younger age group and a higher number of children with ASD. Another limitation of the study is that the entire content of the SESFAR Intervention Program could not be applied to children with ASD. The pilot study determined that teaching all the sub-skills of the SESFAR Intervention Program took a very long time, and considering the COVID-19 pandemic, the first four skills were taught instead of the eight skills that make up the SESFAR Intervention Program. However, it is recommended that the entire content of the SESFAR Intervention Program be applied to children with ASD in future research.

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Author contribution statements

The researchers produced this study from the first author's doctoral thesis under the supervision of the second author. The study's applications were conducted under the second author's supervision and guidance. Elif Sazak Duman, by mentoring and guiding the first author in the practice of the study, prepared the article for publication.

Disclosure statement

The authors reported no potential competing interest.

Ethics committee approval

All responsibility belongs to the researchers. The research related to human use has complied with all the relevant national regulations and institutional policies and, by the tenets of the Helsinki Declaration, has been approved by the author's institutional review board or equivalent committee. The implementation of the research was carried out with the approval of the Governorship Provincial Directorate of National Education, dated 12/11/2019 and numbered E-2020/01.

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