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THE EFFECTS OF MIRROR- AND SCREEN-BASED FACIAL EXPRESSION INSTRUCTION ON THE SELF-AWARENESS OF STUDENTS WITH AUTISM

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Abstract:
In the present study, it was aimed to examine the effect of facial expression training activities in front of the mirror and screen on the self-awareness of students diagnosed with autism spectrum disorder. This study employed alternating treatments design, one of the single-subject research methods. The dependent variable of the study was the self-awareness skill levels of students with autism spectrum disorder (ASD); the independent variable was the facial expression training activity program in front of the mirror and the screen. Three students with ASD, one female and two males, with prerequisite skills participated in the study. As a result of the analyses, it was seen that both applications (mirror and screen) were effective on all participants in terms of exhibiting self-awareness skills during facial expression training, and the students maintained the skills they acquired in the follow-up sessions held 1, 2 and 4 weeks after the sessions completed. The effectiveness findings of the study are consistent with the findings of other studies on self-awareness in individuals with ASD in the literature. The findings were discussed by comparing them with the related literature and suggestions were made for future research and practice.

Keywords: autism spectrum disorder, self-awareness, facial expression training, mirror application, screen application

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1. Background

Autism spectrum disorder (ASD), which falls under the umbrella of special education, is one of the areas of special needs with its own unique characteristics. Research in this area can be said to have begun with Kanner and Asperger. From the earliest studies to the present day, numerous studies have been conducted and continue to be conducted on what ASD is, its causes, and how to intervene in its negative effects on individuals. In this context, alongside topics aimed at strengthening the developmental areas of individuals with ASD, research has increasingly focused on developing new and effective techniques.

American child psychiatrist Kanner (1943) observed that children with ASD did not exhibit characteristics similar to those of children with other disabilities or schizophrenia, and that they behaved differently. He defined ASD as "*a neurodevelopmental disorder in which these children are born with an innate inability to establish ordinary, biologically provided contact with people*" (Harris, 2018). Not limited to Kanner, many researchers studying ASD have made similar definitions over time, emphasizing its negative impact on social interaction, communication, and other social skills (Grandin and Panek, 2018). ASD, which is a neurodevelopmental disorder, may present with symptoms such as lack of eye contact, avoidance of physical contact like hugging, showing an interest in spinning objects and rocking, observable from the early years of life, beginning in early childhood (Mukaddes, 2019; Bolourian *et al.*, 2018; Darıca *et al.*, 2017; Sucuoğlu, 2009). Defined by social deficits (Bird & Cook, 2013), ASD is defined in the DSM-5 guideline published by the American Psychiatric Association (APA) in 2013, as a condition characterized by (a) difficulties in social communication and interaction, and (b) restricted, repetitive behaviors, interests, or activities. This definition in the APA guideline has been universally accepted, and what ASD is has now been clearly established. Consequently, it can be said that there is no conceptual confusion regarding the definition of ASD.[ii]

Although the nature of ASD is known, unfortunately, a clear cause for ASD and the factors that cause it are still not definitively stated. However, current research emphasizes both genetic and environmental factors, focusing on how the interaction of these factors may lead to ASD (Mukaddes, 2019; Fiene & Brownlow, 2015). In their study, Grandin and Panek (2018) used MRI images and explained that the brain development of individuals with ASD is not the same as that of individuals with typical development, but instead shows notable differences. Using MRI image examples, they stated that both lobes of the brain do not develop at the same rate, that there are differences in their development; some areas are not developed at all or are less developed, which leads to sensory insensitivity or sensory sensitivity. In recent years, with technological advancements, the ability to conduct more comprehensive and detailed research in the

[ii] This study is based on a doctoral thesis presented at the NEU Institute of Educational Sciences on March 6, 2024.

scientific world has led scientists to focus on studies investigating genetic factors. Unfortunately, it can be said that the exact gene or genes that cause ASD have not yet been definitively identified. This uncertainty, that is, the inability to determine the exact cause of ASD, makes it difficult to take measures to prevent or reduce the increasing prevalence of ASD.

Identifying the root cause of a problem is crucial in finding an effective solution. Although scientists have conducted extensive research, the lack of a clear and definitive conclusion regarding the cause of ASD may lead the situation to appear pessimistic. It can be argued that when the cause of a problem is unknown or its source cannot be clearly identified, taking preventive measures and producing effective solutions becomes more difficult. However, researchers consistently emphasize that ASD is not a hopeless condition and that education is the most significant and essential factor in facilitating the process, thanks to increasing knowledge and experience from the past to the present, as well as the support of developing technology (Grandin, 2021; Gülsöz & Çıkılı, 2018; Duff & Flattery, 2014). In addition to early diagnosis and early intervention, an intensive and effective educational program should be designed and implemented through appropriate planning (Koçak, 2020). In this way, the difficulties negatively affecting all aspects of these individuals' lives can be eliminated or alleviated, and deficiencies can be transformed into competencies.

One of the deficiencies observed in this area of special needs is the weakness of self-awareness skills in individuals with ASD. Self-awareness, which can be briefly defined as a person's knowledge of oneself, refers to the ability to engage in introspection and to perceive oneself as a distinct individual, separate from others, with one's unique characteristics. According to experts, self-awareness involves recognizing the uniqueness of one's body and mind (Davis & Hayes, 2011) and being aware of one's individuality and differences as a person (Kantogianni & Nanou, 2020). Self-awareness develops from the early years of life through interactions with adults, peers, and the learning context (Kabat-Zinn, 2003). Morin (2006) conceptualized the development of self-awareness in individuals by categorizing it into stages, which are listed as follows:

- **Unawareness:** In this initial stage, the individual is unresponsive to both the self and the environment.
- **Consciousness:** With several months of growth and maturation, this stage involves focusing on the environment and perceiving stimuli, reflecting the emergence of a basic sense of self.
- **Self-awareness:** At this stage, the individual directs attention to the self and to specific aspects of the self.
- **Meta-self-awareness:** In this final stage, the individual is fully aware of both the environment and the self, and is conscious of being a distinct entity and a part of that environment with one's own differences (as cited in Elmose, 2016).

Self-awareness, a cognitive skill, aims to enhance and strengthen our ability to comprehend our subjective experiences and the events and situations occurring in the

external world around us. This ability, also referred to as a skill or practice, enables us to recognize and understand our own thoughts, feelings, and emotions in our inner world by directing our attention inward (Baer, 2003). Self-awareness, also defined as focusing on thoughts through attentive listening and introspection, makes us aware that our mind and body are constantly active and that we are aware of what we are feeling and experiencing at any given moment, influenced by environmental stimuli. As a result, with a better ability to know and understand ourselves, we can interpret our emotions more accurately, manage our emotional reactions more effectively, make more appropriate and rational decisions for ourselves, and ultimately lead a more meaningful and satisfying life (Brown & Ryan, 2003; Baer, 2003). Self-awareness, which so profoundly affects our lives and the process of becoming individuals, is one of today's popular research topics, and numerous researchers in psychology, medicine, and even education are conducting studies on it. To promote the development of self-awareness skills, which are of great importance for personal and social life, psychologists and psychotherapists recommend various techniques and practices such as meditation, yoga, journaling, nature walks, and empathy-building exercises (Davis & Hayes, 2011; Kabat-Zinn, 2003; Brown & Ryan, 2003).

One of the characteristic features of ASD is difficulty in social communication, which can lead to problems in social cognition and reciprocal social interaction. A frequently observed problem in the development of social cognition and reciprocal social interaction in this area is an unusual self-perception and representation of others (Lombardo & Baron-Cohen, 2010; Hobson, 1990). A systemic problem in bodily stimulus-receptive (perceptual) awareness, i.e., a deficiency in body awareness or integrating sensory feedback in cortical image formation, is observed. As is known, brain functioning in individuals with ASD may differ from that of typically developing individuals. Based on analyses of brain imaging, researchers have reported that the cingulate cortex, thalamus, and insula regions of the brain function differently in individuals with ASD (Grandin & Panek, 2018). This different functioning can cause these individuals to have difficulty understanding the psychologically and emotionally related bodily postures and behaviors of others around them (Hobson & Mayer, 2005). In this context, deficiencies in self–other representation play an important role, as they contribute to the cognitive and behavioral difficulties and challenges experienced by individuals with ASD (Kana *et al.*, 2017).

Hobson (1990) explains that self-awareness consists of two stages in terms of the development of self and other representations: self-awareness and reflective self-awareness. The first stage, self-awareness, is the individual's physical awareness of their body, which is a prerequisite for reflective self-awareness. The second stage, reflective self-awareness, is the awareness of being separate and different from others in terms of cognitive characteristics, providing an external rather than internal perspective on one's own attitudes and behaviors. In this context, self-awareness does not develop sufficiently or remains weak in individuals with ASD, thus failing to support reflective self-

awareness. The aspect of self-awareness that affects communication and social interaction in individuals with ASD is the inadequacy of their ability to identify with the attitudes of others (being related to or connected with others), and the low or weak awareness of themselves and others (Hobson, 2010). Furthermore, since self-awareness is responsible for controlling cognition and behavior, a lack or insufficiency of self-awareness in individuals with ASD leads to problems with self-regulation, manifesting as difficulties in communication and social interaction (Lind *et al.*, 2020; Scarpa & Reyers, 2011).

The lack of self-awareness in individuals with ASD creates difficulties in distinguishing their own ideas from the views of others and in understanding the behaviors of people around them (Elmose, 2016). The challenges they experience in understanding their own and others' mental states affect their ability to understand, interpret, and cope with their own and others' emotions; consequently, problems such as stress, anger, and harmful behavioral disorders may emerge in their emotion regulation abilities (Scarpa & Reyers, 2011). Moreover, these difficulties are not limited to the aforementioned skill areas; teaching personal hygiene and self-care, as well as daily living skills, becomes challenging in cases where the student lacks or has a limited sense of self-concept (Duff & Flattery, 2014). Recent research indicates that individuals with ASD experience difficulties not only in understanding others, but perhaps even more so in understanding themselves. These difficulties manifest as insufficient emotional self-awareness or alexithymia (Bird & Cook, 2013), and difficulty in decision-making (Lind & Bowler, 2010). Such difficulties in self-awareness can lead to many problems in the daily lives of individuals with ASD, including difficulty regulating emotional responses and making decisions without a clear perception of preferences (Brezis *et al.*, 2021). Developing self-awareness skills is therefore particularly important for individuals with ASD. It is recommended that self-awareness be fostered in individuals with ASD by enabling them to interact with their environment (Duff & Flattery, 2014; Scarpa & Reyers, 2011).

When studies related to the topic are examined, it is seen that research on self-awareness is very limited in our country. In their study, Alioğlu (2019) stated that there is a significant relationship between personality disorders and emotional self-awareness, and that emotional self-awareness is positively correlated with emotional intelligence and empathy, and negatively correlated with alexithymia. Ferrari and Matthews (1983), in their study examining the behaviors and self-awareness of 15 children aged 3-11 years diagnosed with ASD in front of a mirror, concluded that 8 of the children exhibited self-awareness behavior when looking in the mirror, 7 children could not show self-awareness behavior by touching the mirror surface, and the remaining 4 children were either shy or unresponsive towards the mirror, thus failing to demonstrate self-awareness skills. Findings from the reviewed studies indicate that children with ASD show inadequacies in demonstrating self-awareness skills (Kontogianni & Nanou, 2020; Duff

& Flattery, 2014; Scarpa & Reyers, 2011; Reddy *et al.*, 2010; Lind & Bowler, 2009; Hobson & Meyer, 2005).

Improving the quality of life of individuals with ASD will have a positive impact not only on the individuals themselves but also on their parents. To achieve this, development in areas such as social interaction, communication, daily living and personal care, and academic skills is of great importance. In this context, in order to support the development of bodily and emotional awareness in individuals with ASD, self-awareness skills should be prioritized and fostered.

2. Purpose of the Study

The purpose of this study is to comparatively examine the effects of facial expression instructional activities conducted in front of a mirror and in front of a screen on the self-awareness levels of students with ASD. In line with this purpose, the following research questions were addressed:

1) What is the effect of facial expression instructional activities conducted in front of a mirror on the self-awareness levels of students with ASD?
2) What is the effect of facial expression instructional activities conducted in front of a screen on the self-awareness levels of students with ASD?
3) Do the instructional activities conducted in front of a mirror and in front of a screen differ in terms of effectiveness?
4) What are the parents' views regarding the social validity of the intervention?
5) What are the teachers' views regarding the social validity of the intervention?

2. Literature Review

This study is based on a doctoral thesis presented at the NEU Institute of Educational Sciences on March 6, 2024.

3. Material and Methods

3.1 Research Model

In this study, an alternating treatments design, one of the single-subject research models, was employed to compare the effectiveness of facial expression instructional activities conducted in front of a mirror and in front of a screen on the self-awareness of participants with ASD. The alternating treatments design is a comparative design in which the effects of two or more independent variables on a dependent variable are examined (Tekin-İftar, 2018; Tekin, 2000). In this model, the alternation of independent variables/interventions should be rapid, and the interventions should be presented in a randomly determined order (Rakap, 2020; Sarı *et al.*, 2015). Presenting interventions in a random sequence minimizes the potential effect of one intervention on another

(Kratochwill *et al.*, 2010). The researcher must ensure that each intervention is presented an equal number of times, and baseline data collection is not mandatory in this model. However, arranging a baseline phase allows for predicting performance in the absence of the independent variable and provides more detailed information regarding the effects of the independent variables (Rakap, 2020; Tekin-İftar, 2018). In the present study, baseline data sessions were initially conducted simultaneously with all participants. Instruction sessions were initiated with the participant for whom stable data were obtained across three consecutive sessions, while no intervention was implemented with the remaining participants during this period. The instruction session for the second participant was initiated only after the first participant achieved the same performance level (stable data) in at least three consecutive sessions following the instruction. This process was applied sequentially to all participants. To conduct this study, an application for legal permission was submitted to the Scientific Research Ethics Committee. Ethical approval was obtained from the Konya Necmettin Erbakan University Social and Human Sciences Scientific Research Ethics Committee at its meeting dated June 18, 2021, with decision number 2021/343. The study was deemed to be in compliance with scientific research and publication ethics.

3.2 Participants

In determining the students to be included in the study group, the following procedures were employed: establishing criteria for participation, conducting interviews with teachers, obtaining parental consent, identifying eligible students, and assessing students' prerequisite skills.

The following criteria were considered in selecting the participant students who constituted the study group:

1) Their age should be between 7-10 years old. As it is known that early diagnosis and early intervention significantly affect the quality of life of children with ASD, primary school–aged students were preferred in this study, with attention paid to keeping the mean age relatively low.
2) Having been diagnosed with ASD,
3) Having obtained permission from their parents to participate in the study,
4) Possessing the prerequisite skills specified for the study,
5) Lacking self-awareness skills.

In the first stage, students who met the first two criteria listed above were identified by consulting the opinions of special education teachers working in ASD classrooms. Parents of students aged 7-10 diagnosed with ASD were contacted, and interviews were conducted with them. Parents were informed about their children's participation in the study, and written informed consent was subsequently obtained from the parents. The characteristics of the students in the study group are presented in Table 1.

Table 1: Demographic Characteristics of the Study Group

Study Group	Age	Gender	Diagnosis
Student 1	10	Male	Autism Spectrum Disorder
Student 2	8	Male	Autism Spectrum Disorder
Student 3	7	Female	Autism Spectrum Disorder
Student 4 (Alternate)	7	Male	Autism Spectrum Disorder

Student 1 is a ten-year-old male student. He has receptive language skills and is able to follow given instructions. However, his expressive verbal language skills are limited, and he expresses his needs and desires through gestures and meaningless sounds. He receives education five days a week at a special education school (first stage) affiliated with the Ministry of National Education (MoNE) and additionally receives supportive special education for two hours per week at a private special education and rehabilitation center. During desk-based instructional activities, he is able to maintain attention to the activity for 10–15 minutes.

Student 2 is an eight-year-old male student. He has receptive language skills and is able to follow one-step instructions; however, he experiences difficulty with two-step instructions. His expressive verbal language skills are limited, and he communicates his desires and needs through gestures and signs. He receives education both at a special education school (first stage) affiliated with the Ministry of National Education (MoNE) and at a private special education and rehabilitation center where he receives supportive special education and physiotherapy services. He interacts with his peers. During desk-based instructional activities, he is able to maintain attention to the activity for approximately 5–7 minutes.

Student 3 is a seven-year-old female student. She was diagnosed with ASD at the age of 1.5 years and has been living with a foster family in Konya, Turkey, for the past four years. Her parents live separately, and legal custody is held by her father, who currently resides in Germany. She has receptive language skills and is able to follow given instructions. Her expressive language is limited to single words and is characterized by echolalia. She continues her education five days a week at a primary-level special education school affiliated with the Ministry of National Education and additionally receives supportive special education for two hours per week at a private special education and rehabilitation center. While she can follow single-step instructions, she has some difficulty with two-step instructions. During desk-based instructional activities, she is able to maintain attention to the activity for approximately 5–7 minutes. Among the researchers of the study, the first author holds both a master's and a doctoral degree in the field of special education. The first author has 21 years of teaching experience, 19 years of which have been in special education classrooms and special education practice schools. The researcher personally collected data related to the pre-instruction, instruction, and follow-up sessions, as well as qualitative data demonstrating the social validity of the study. The second author is a faculty member in the Department of Special Education at a higher education institution.

To collect the social validity data of the study, face-to-face interviews were conducted with the mothers and teachers of the participating students. During the interviews with the students' mothers and teachers, the principles of voluntary participation and confidentiality of personal information were strictly observed. The interviews were carried out with the voluntary participation of the mothers and teachers. Finally, to support the collection of interobserver reliability and treatment integrity (procedural fidelity) data, the opinions of two experts were consulted. These experts are faculty members in the the Division of Education of Individuals with Intellectual Disabilities and the Division of Autism within the Special Education Department of the university.

3.3 Setting and Materials

The study was conducted in a special education school affiliated with the Ministry of National Education (MoNE) in the city center of Konya. All sessions of the intervention (baseline, instruction, and follow-up sessions) were conducted in a room of approximately 15 square meters, arranged by the school administration for one-to-one education. The setting included a teacher's desk, a wheeled teacher's chair, a student's chair, a 75cm x 155cm floor-standing mirror, and a tripod. Immediately prior to each session, the setting was arranged by the practitioner in accordance with the activity to be implemented. For activities conducted in front of a mirror, the mirror was positioned along the long wall of the rectangular-shaped classroom, approximately 3 meters from the door. The teacher's desk was placed next to the mirror, with teaching materials (photographs, black and white drawings, event pictures, reinforcements, a package of wet wipes) placed on the desk. In activity sessions conducted in front of the screen, the mirror was removed from the environment, and the desk was positioned in the exact center of the classroom, with a student chair for the student to sit on, a teacher's chair for the teacher to sit on, and a tablet computer placed on the desk along the long edge of the desk. A camera was placed at the entrance of the classroom to record the intervention sessions. The camera was positioned to clearly observe the student without causing distraction. During the sessions, only the student and the practitioner were present in the setting.

3.4 Data Collection Tools

In the study, facial expression instructional activities (happy, sad, angry, scared) were planned to be presented in front of a mirror and a tablet computer screen in order to monitor the self-awareness skills of the participants. A Self-Awareness Skill Data Recording Form was prepared to collect effectiveness data in the form of baseline, instruction, and follow-up sessions. The data recording form included columns for objectives, outcomes, and sessions. In the data recording process on the data collection form, students' correct responses were marked with a plus sign (+), and incorrect responses or lack of response were marked with a minus sign (-). To collect the social

validity data of the study, a Social Validity Data Collection Form for Teachers and a Social Validity Data Collection Form for Parents were developed and administered to the teachers and parents of the participating students. Qualitative data were collected using these semi-structured forms, which included open-ended questions. To collect treatment integrity (procedural fidelity) data, reliability data recording forms were developed for the instruction and follow-up sessions by the researchers.

3.5 Dependent and Independent Variables

In an intervention, the variable that is examined to see whether it is affected by an independent variable is referred to as the dependent variable (Kırcaali-İftar, 2018). The dependent variable of this study is the self-awareness skill levels of students with ASD participating in the study. The intervention whose effect on the study group is examined is defined as the independent variable (Kırcaali-İftar, 2018). This study includes two independent variables. The first independent variable is the facial expression instruction conducted in front of a mirror based on the direct instruction method. The second independent variable is the facial expression instruction conducted in front of a screen based on the direct instruction method.

3.6 Experimental Process

The experimental process consisted of the pilot implementation, baseline sessions, instruction sessions, and follow-up sessions.

3.6.1 Pilot Implementation

A pilot implementation was conducted in order to identify any potential problems or disruptions that might arise during the implementation process of the study in advance. New revisions to the program were planned if necessary. The pilot implementation was carried out with a 7-year-old male student with ASD who had characteristics similar to those of the study group but was not included in the study group. The pilot implementation consisted of a total of four sessions, with two sessions conducted in front of a screen and two sessions conducted in front of a mirror. No problems or disruptions were encountered during the pilot sessions. Therefore, the implementation process was carried out as planned.

3.6.2 Baseline Sessions

In the alternating treatments design, conducting baseline sessions before instruction and collecting baseline data is not mandatory. However, collecting baseline data is recommended to predict the participant's potential performance regarding the dependent variable and to strongly demonstrate the functional relationship (Tekin-İftar, 2018). In this study, baseline sessions were conducted to determine the participants' current performance levels regarding the dependent variable before starting the instruction sessions. The intervention process began with the collection of baseline data

from all participants simultaneously through baseline sessions. Instruction sessions were started with the first participant, from whom stable data was obtained in three consecutive sessions.

3.6.3 Instruction Sessions

Instruction sessions were conducted by the first author in accordance with the prepared instructional programs and were implemented as Mirror-Based Instruction and Screen-Based Instruction. At the beginning of both interventions, participants' self-awareness skills were observed. Prior to the initiation of the interventions, the instructional sets to be taught through mirror-based and screen-based instructional activities were determined using random assignment. The instruction sessions were conducted during the school's academic term. Before each instruction session, the researcher picked up the participating students from their classrooms and took them to the instruction room arranged for the intervention. Sessions were conducted in a one-to-one instructional format. The intervention flow was planned such that each participant received one instruction session for each intervention, and a minimum one-hour interval was provided between the two sessions. The mirror-based and screen-based instruction sessions were counterbalanced across the participants.

Table 2: Alternation of Interventions 1 and 2 Across Participants

	Student 1		**Student 2**		**Student 3**	
Intervention 1	Mirror-Happy	Screen-Angry	Screen-Angry	Mirror - Happy	Mirror - Happy	Screen-Angry
Intervention 2	Screen-Scared	Mirror-Sad	Mirror-Sad	Screen-Scared	Screen-Scared	Mirror-Sad

Student 1 performed the activity in front of a mirror in the first session of the first intervention and in front of a screen in the second session. In the second intervention, the first session involved activities in front of a screen and the second session involved activities in front of a mirror. Student 2 performed the activity in front of a screen in the first session of the first intervention and in front of a mirror in the second session. In the second intervention, the first session involved activities in front of a mirror and the second session involved activities in front of a screen. Student 3 performed the activity in front of a mirror in the first session of the first intervention and in front of a screen in the second session. In the second intervention, the first session involved activities in front of a screen and the second session involved activities in front of a mirror.

Table 3: Presentation Order of Instructional Activities

Student	**Happy (Mirror)**			**Sad (Mirror)**			**Angry (Screen)**			**Scared (Screen)**		
1	IA1					IA 4		IA 2		IA 3		
2		IA 2		IA 3					IA 1		IA 4	
3			IA 1		IA 4		IA 2					IA 3

After completing the instructional activities of the first intervention (Mirror/Happy-Screen/Angry) with all three participants, the instructional activities of the second intervention (Mirror/Sad-Screen/Scared) were carried out with the three participants in sequence, but in a different order than the instructional activities of the first intervention.

3.6.4 Follow-up Sessions

Instruction sessions were completed when the target skills, self-awareness skills, were demonstrated at a criterion level of 4 out of 5 correct responses across three consecutive sessions. Follow-up sessions were conducted 1, 2, and 4 weeks after the instruction sessions to examine the maintenance of the skills acquired by the students, and maintenance data was recorded in the follow-up session data record form.

3.7 Data Analysis

The findings aimed at determining the effect of facial expression instructional activities conducted in front of a mirror and in front of a screen on the self-awareness skills of students with ASD were analyzed using graphical analysis. Line graphs were used as a graphical analysis technique. Graphs were prepared separately for each student. The number of sessions conducted during the intervention process was presented on the x-axis (horizontal axis) of the graphs, and the percentage of correct responses given by the students was given on the y-axis (vertical axis). The graphs included data from baseline, instruction, and follow-up sessions. Social validity data were collected from the parents of the students who participated in the intervention and from the classroom teachers of these students in their schools. The collected data were analyzed using qualitative analysis methods.

3.7.1 Treatment Integrity (Procedural Fidelity)

Within the scope of the study, the data recorded using data recording forms for the instruction session and follow-up session data were analyzed separately. The obtained data were analyzed using the formula "Observed Practitioner Behaviors / Planned Practitioner Behaviors x 100" (Tekin-İftar, 2012). To obtain treatment integrity data, 30% of the recorded intervention videos were watched by the observers, and the mean treatment integrity score was calculated based on the watched videos. The resulting data are presented in Table 4.

Table 4: Treatment Integrity Data of the Instructional Activities in Front of a Mirror and in Front of a Screen

	Instruction activity in front of a mirror (%)	**Instruction activity in front of a screen (%)**
Instruction Session	90,0	86,6
Follow-up Session	90,4	88,0
Total	**90,2**	**87,3**

3.8 Social Validity

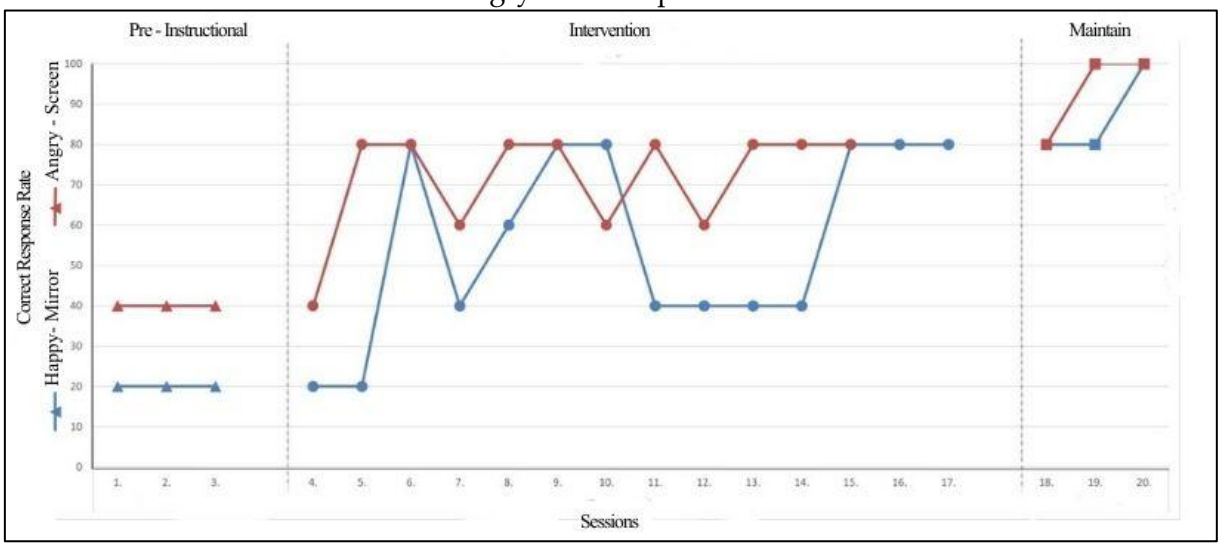
Within the scope of the study, social validity data were collected from the teachers and parents of the students who participated in the intervention. The social validity data collection process was conducted through semi-structured interviews using the Social Validity Questionnaire developed by the researcher. Prior to administering the interview questions, written consent was obtained from the participants for audio recording. The interviews were then recorded using an audio recording device. The collected data were analyzed qualitatively using the descriptive analysis method.

4. Findings

4.1 Effectiveness Findings

4.1.1 Findings Related to the Self-Awareness Intervention Conducted with Student 1 During the Instruction of the Happy Facial Expression in Front of a Mirror and the Angry Facial Expression in Front of a Screen

Graph 1: Data from the Self-awareness Intervention Conducted with Student 1 during the Instruction of the Happy Facial Expression in Front of a Mirror and the Angry Facial Expression in Front of a Screen

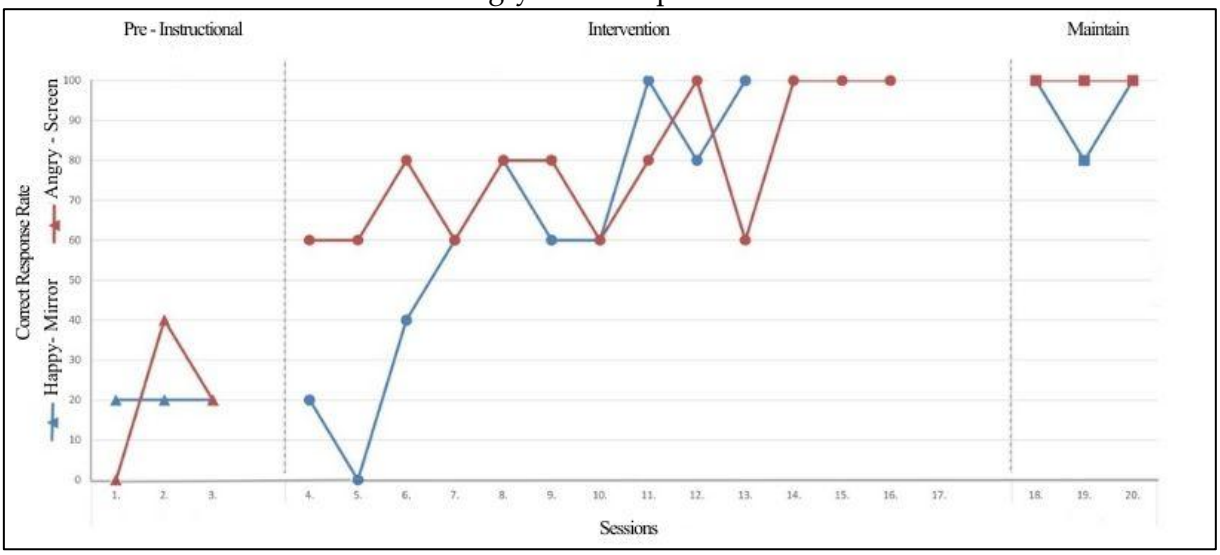


When the pre-instructional data of Student 1 were examined, it was determined that the participant student's level of achievement of the target behaviors was 20% in front of a mirror and 40% in front of a screen, as shown in the graph. Based on the obtained data, it was revealed that both mirror-based and screen-based interventions were effective in enabling Student 1 to acquire self-awareness skills and to maintain these skills over time. When the number of sessions and the trend of the graph line were examined, the screen-based intervention was found to be more effective than the mirror-based intervention for Student 1. In interviews conducted with Student 1's teacher and parents prior to the interventions, it was reported that the student showed reluctance towards structured

activities, became bored quickly, and exhibited aggressive behaviors with the onset of adolescence. During the interventions, it was observed that the student occasionally entered the instruction setting in a tense state and, in such cases, gave random answers to instructions in order to complete the session quickly.

4.1.2 Findings Related to the Self-Awareness Intervention Conducted with Student 2 During the Instruction of the Happy Facial Expression in Front of a Mirror and the Angry Facial Expression in front of a Screen

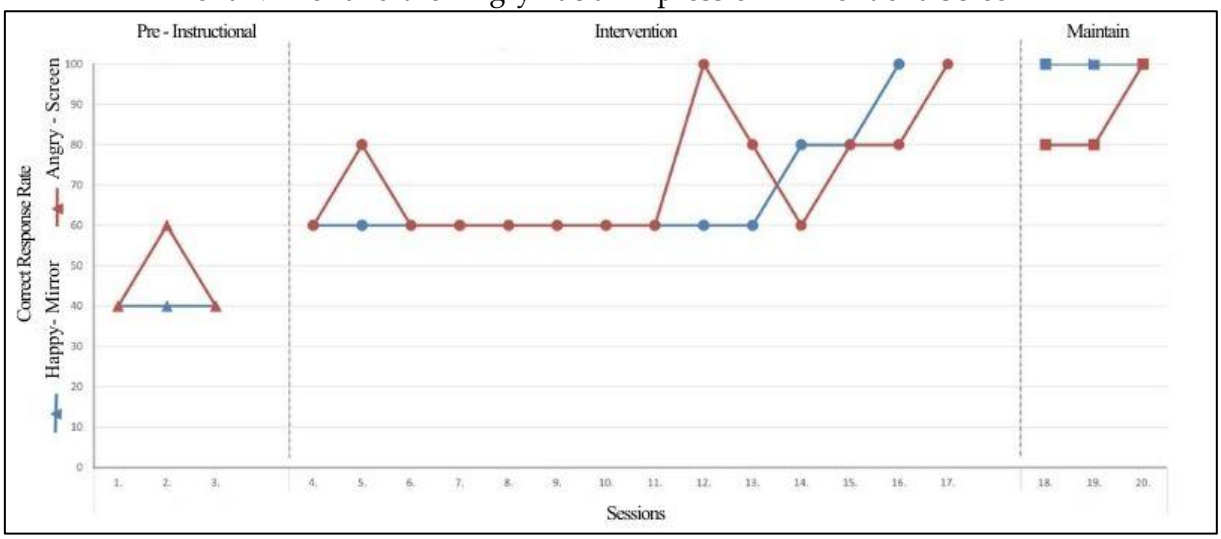
Graph 2: Data from the Self-awareness Intervention Conducted with Student 2 during the Instruction of the Happy Facial Expression in Front of a Mirror and the Angry Facial Expression in Front of a Screen



Student 2's average level of achievement of the target behavior in both the screen-based and mirror-based interventions before instruction was 20%. The obtained data indicated that both mirror-based and screen-based interventions were effective in the acquisition and maintenance of self-awareness skills in Student 2. However, although the number of sessions for the screen-based intervention was higher than that of the mirror-based intervention, the student demonstrated stable performance at 100% accuracy across both instruction and follow-up sessions, suggesting that the screen-based intervention was more effective than the mirror-based intervention in both the acquisition and maintenance of self-awareness skills. In interviews conducted with both the student's teachers and parents before the interventions, it was reported by the interviewees that Student 2 had sleep disorders, which negatively affected the student's performance in classroom activities and school attendance. During the intervention process, observation notes indicated a decrease in performance on days when the student had insufficient sleep.

4.1.3 Findings Related to the Self-Awareness Intervention Conducted with Student 3 During the Instruction of the Happy Facial Expression in Front of a Mirror and the Angry Facial Expression in Front of a Screen

Graph 3: Data from the Self-awareness Intervention Conducted with Student 3 during the Instruction of the Happy Facial Expression in Front of a Mirror and the Angry Facial Expression in Front of a Screen



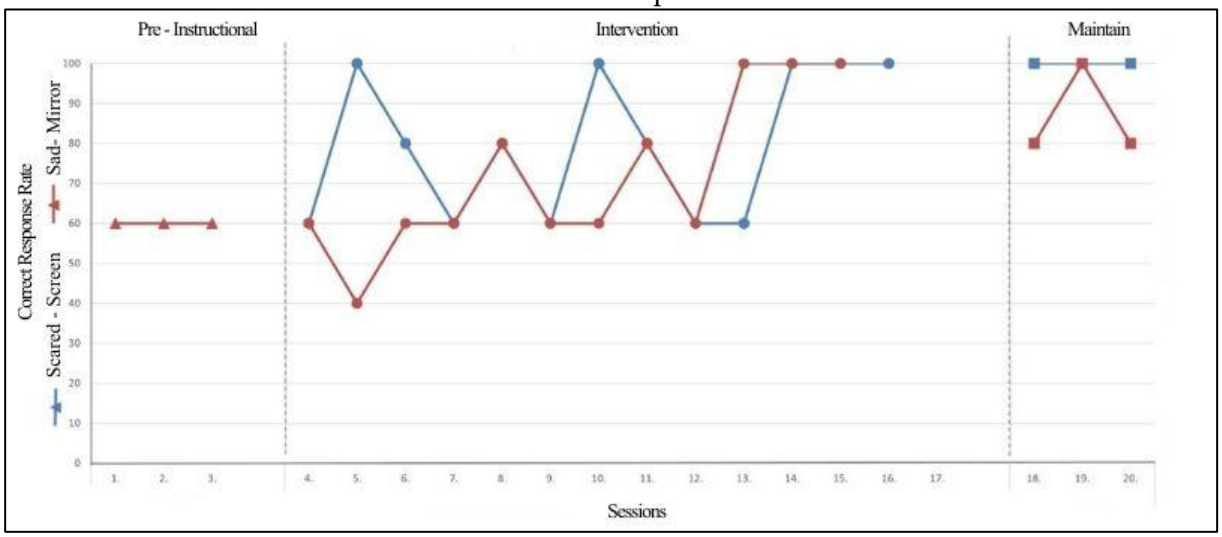
Prior to instruction sessions, Student 3 demonstrated a 40% correct response rate in the mirror-based intervention and 46% in the screen-based intervention. As shown in the graph, both interventions were effective in acquiring self-awareness skills for Student 3. However, based on the trend of the graph and the observation that the student maintained 100% accuracy in the follow-up sessions, it can be concluded that the mirror-based intervention was more effective for Student 3.

4.1.4 Findings Related to the Self-Awareness Intervention Conducted with Student 1 During the Instruction of the Scared Facial Expression in front of a Screen and the Sad Facial Expression in Front of a Mirror

When examining the graph presenting the data obtained from interventions with Student 1, it can be seen that the student's level of achieving the target behaviors during the pre-instruction sessions of both mirror- and screen-based interventions was 60%. Student performance showed stability at the 60% level for three consecutive sessions. The progress achieved by the student in the previous self-awareness intervention affected the baseline level in this intervention being 60%. Based on the data obtained from the mirror- and screen-based interventions with Student 1, it can be concluded that the screen-based intervention was relatively more effective than the mirror-based intervention in both the acquisition and maintenance of self-awareness skills. During the preparation process of the study, interviews with the student's teacher and parents revealed that Student 1 showed disinterest in the mirror and did not like it. Considering both the data from the

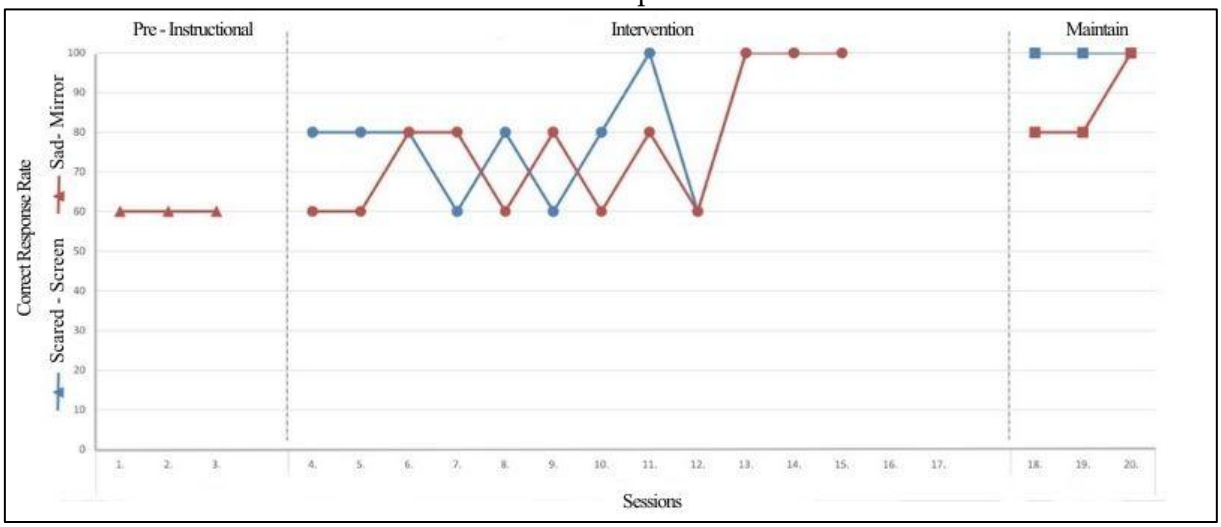
first and second interventions, this factor may have affected the effectiveness of the mirror- and screen-based interventions on the student.

Graph 4: Data from the Self-awareness Intervention Conducted With student 1 during the Instruction of the Scared Facial Expression in Front of a Screen and the Sad Facial Expression in Front of a Mirror



4.1.5 Findings Related to the Self-Awareness Intervention Conducted with Student 2 During the Instruction of the Scared Facial Expression in Front of a Screen and the Sad Facial Expression in Front of a Mirror

Graph 5: Data from the Self-awareness Intervention Conducted with Student 2 during the Instruction of the Scared Facial Expression in Front of a Screen and the Sad Facial Expression in Front of a Mirror

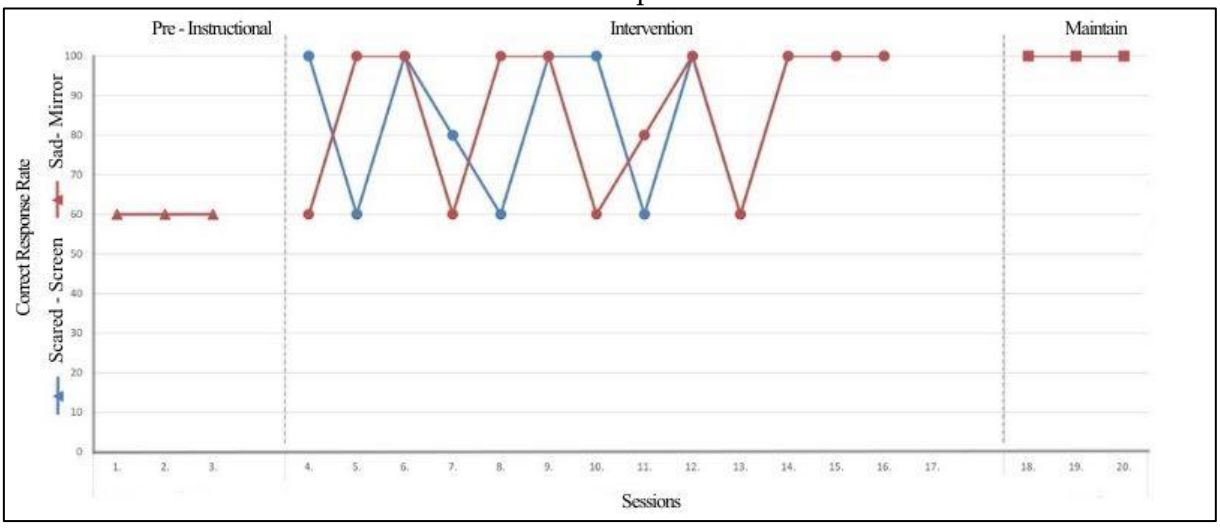


Similar to Student 1, Student 2 also achieved a 60% achievement level of target behaviors in the pre-instruction sessions of both mirror- and screen-based interventions. In the first instruction session of the screen-based intervention, the student achieved 80% of the

target behaviors and maintained the same level of success in the second and third sessions. The performance level, which decreased to 60% in the fourth session, increased to 80% in the fifth session. The student's performance in achieving target behaviors remained at 60% in the sixth session. The performance level, which increased to 80% in the seventh session, reached 100% in the eighth session. In the ninth session, the student exhibited a performance level of 60%. It is thought that the student's health problem, which caused a one-week break from the intervention between these two sessions, contributed to the decline from 100% in the previous session to 60%. The student's performance, which reached 100% in the tenth session, remained at the same level (100%) in the eleventh and twelfth sessions. This trend of the graph shows that the student acquired the target behaviors. The intervention was completed with the acquisition of the stability data. The data collected also showed that the student maintained a 100% performance level during the follow-up sessions. As can be understood from the trend of the points in the presented graph, it can be stated the screen-based intervention was more effective than the mirror-based intervention in acquiring self-awareness skills for Student 2.

4.1.6 Findings Related to the Self-Awareness Intervention Conducted with Student 3 During the Instruction of the Scared Facial Expression in front of a Screen and the Sad Facial Expression in Front of a Mirror

Graph 6: Data from the Self-awareness Intervention Conducted with Student 3 during the Instruction of the Scared Facial Expression in Front of a Screen and the Sad Facial Expression in Front of a Mirror



As with other participating students, Student 3's level of self-awareness skills in the pre-instruction sessions of mirror- and screen-based interventions was determined to be 60%. It can be stated that both mirror- and screen-based interventions were effective in the acquisition and maintenance of target skills for Student 3 in both the first and second sessions of the interventions. Based on information obtained from interviews with the

classroom teacher and parents, the fluctuating success rate between 60% and 100% in the mirror- and screen-based interventions with Student 3 is thought to be affected by the student's experiences at home before attending the sessions.

Although all participating students were diagnosed with ASD, the study group was heterogeneous due to the students' diverse characteristics and lifestyles. Therefore, the effectiveness level of the interventions varied among each participating student. According to the data collected from the interventions, it was found that the screen-based intervention was more effective than the mirror-based intervention in achieving self-awareness skills for Students 1 and 2; and the mirror-based intervention was more effective than the screen-based intervention for Student 3. Furthermore, in the later sessions of the interventions, particularly during the skill of matching event images with appropriate facial expressions, Student 2 and Student 3 showed changes in their facial expressions, mimicking the facial expression in the image, as noted in the intervention observation notes.

4.2 Social Validity Data

This section presents the social validity findings reflecting the opinions of the participants' parents and teachers regarding the study.

4.2.1 Families' Views on the Social Validity of the Study

Regarding the changes observed in their children, parents reported that the interventions increased mirror-looking behaviors. For example, one parent stated, "*He started looking at the mirror more frequently*" (P1). Parents also noted improvements in their children's understanding of surrounding events and the ability to follow instructions: "*I think T.'s ability to understand and follow the commands we give has improved*" (P3). Parents emphasized that the mirror-based activities positively contributed to their children's development and facilitated learning of emotion-related concepts: "*He learned the concepts of sadness, anger, and happiness*" (P1). It was found that the activity conducted in front of a screen contributed to an increase in rule-following skills, enabled learning the differences between emotional transitions, and improved distinguishing skills: "*She is quite successful in distinguishing emotions on the screen*" (P2). All parents indicated that the study positively affected their children's ability to notice and understand facial expressions: "*With this study, T. now knows where and how to behave, and how our responses will be, and acts accordingly*" (P3).

Based on the parents' responses to the social validity questions, it can be concluded that they held positive views toward the study, indicating that the study demonstrates social validity from the perspective of parents.

4.2.2 Teachers' Views on the Social Validity of the Study

At the end of the study, teachers reported observed changes in students, including improved awareness of their own and others' physical changes, increased participation

and completion of activities, development of social skills, enhanced communication and self-confidence, more effective use of facial expressions, and better utilization of gestures and body language. For example, one teacher stated: "*Since our student does not have verbal expression, she uses facial expressions more effectively when expressing her emotional state*" (T4). Regarding the effects of the instructional activity in front of the mirror on students, teachers reported that it enabled students to notice themselves and the details on their faces; improved awareness of their physical appearance and body integrity; increased the use of body language; positively contributed to noticing changes in their emotions; and that doing an activity while seeing themselves in the mirror positively influenced students' behavior. One teacher commented: "*She started to become aware of her physical appearance, body integrity, and behavioral-physical movements*" (T2). Regarding the effects of the instructional activity in front of the screen on the students, teachers stated that it enabled students to recognize their own image among multiple images, developed their ability to use screens appropriately within specific contexts and rules, positively influenced their ability to express their desires and emotions, led them to begin using facial expressions more effectively; and enhanced their self-awareness skills. One teacher noted: "*Observing how my student reacts to different situations on the screen and demonstrating appropriate behaviors improved his self-awareness skills*" (T5). Teachers also highlighted that, in terms of learning emotions, students showed improvements in responding appropriately to others' facial expressions, distinguishing emotions, and expressing their own emotions, which contributed positively to their emotional learning. As one teacher observed: "*When we smiled at the student, he responded with a smile; when we expressed anger, he stopped engaging in undesired behavior and also reacted with anger appropriately*" (T1). Regarding the effects of this study on students in terms of self-awareness skills, teachers reported that the study helped students recognize their own bodies, progress in understanding their emotions and facial expressions, enhance self-confidence, and develop self-awareness skills. One teacher stated: "*His self-confidence increased*" (T3). All teachers answered "yes" to the question about their preference for using mirrors and screens in classroom teaching activities. Based on the teachers' responses to the social validity questions, it can be concluded that they held positive views regarding the study, indicating that the study demonstrates social validity from the perspective of teachers.

5. Results and Discussion

In this study, the effects of facial expression instructional activities conducted in front of a mirror and in front of a screen on the self-awareness skills of students diagnosed with Autism Spectrum Disorder (ASD) were examined. Additionally, the views of the parents and teachers of the students who participated in the study were investigated. In this section, the effectiveness and social validity are discussed in light of the findings of the study.

In this study, a facial expression instructional program was implemented to improve the self-awareness skills of students with Autism Spectrum Disorder (ASD). During the mirror- and screen-based facial expression instructional activities, students' performance in self-awareness skills, including looking at their own face, touching a mark on their face, identifying their own photograph among two photographs, and matching a situational photo representing one of four emotions with an appropriate facial expression of their own, was observed. The results indicated that both mirror- and screen-based interventions were effective in improving self-awareness skills in students with ASD. Participants were able to perform the target skills successfully, and the acquired skills were maintained at 1-, 2-, and 4-week follow-up sessions. Furthermore, the social validity data collected from teachers and parents supported these findings, indicating that the interventions conducted in front of a mirror and in front of a screen were perceived as effective in improving self-awareness skills.

The review of the literature indicates that studies on self-awareness are limited and that existing studies have predominantly been conducted in the field of clinical psychology. With the exception of a few studies, most studies have focused on observing participants' self-awareness skills in front of a mirror or a screen (Ferrari & Matthews, 1983; Rochat & Striano, 2002; Nielsen *et al.*, 2003). Studies that examine participants' self-awareness skills during the implementation of an instructional program, as in the present study, are limited (Kontogianni & Nanou, 2020; Duffy & Flattery, 2014).

The reviewed studies generally preferred either a mirror or a screen as materials. In one study where both the mirror and screen were used simultaneously, infants of different age groups with typical development were placed in front of a mirror and in front of a screen at the same time; that is, the mirror and screen were not presented separately in different sessions. Infants' reactions to their own reflection in the mirror and to the moving image of a different person on the TV screen placed just above the mirror were observed (Rochat & Striano, 2002). However, this study differs from Rochat and Striano's (2002) study in that the mirror and screen were presented in separate sessions, the students' reactions to their own images in front of both materials were observed, and the developmental characteristics of the participating students were also considered.

Prior to the instruction sessions, baseline data were collected for self-awareness skills. Analysis of the data revealed that the participating students' level of self-awareness skills was significantly below the specified skill criterion (80%). The results of previous studies in the literature were found to be consistent with the baseline data of this study (Reddy *et al.*, 2010; Hobson and Meyer, 2005; Ferrari and Matthews, 1983).

This study examined the effect of facial expression instructional activities conducted in front of a mirror and in front of a screen on students' performance in demonstrating self-awareness skills, without direct instruction on self-awareness. According to the data obtained, the interventions conducted in front of a mirror and in front of a screen were effective on students' self-awareness skills, and the students performed the self-awareness skills determined for this study. Furthermore, it was

determined that in two of the three students participating in the study, the screen-based intervention was more effective than the mirror-based intervention in developing self-awareness skills; while in one student, the mirror-based intervention was more effective than the screen-based intervention. Duff and Flattery (2014) conducted a single-subject design study with six adolescents diagnosed with ASD, focusing on self-awareness. They implemented four-step Mirror Self-Awareness Enhancement Activities combined with joint attention strategies and reported that the activities increased students' self-awareness and that their study also contributed to understanding the stages of self-development. These findings are consistent with the findings of the present study. Another study supporting the findings of the current study is by Kontogianni and Nanou (2020), which examined self-awareness and self-regulation using a mixed-method design. The researchers aimed to examine the effect of Yoga Therapy on self-awareness and self-regulation skills in individuals with ASD. A single participant, an 11-year-old child with ASD and severe behavioral problems, participated in the program once a week for three months. The data were collected through research diaries and observation reports. Although the researchers could not generalize their findings as they studied with only one participant, the study concluded that Yoga Therapy had an effect on improving the self-awareness and self-regulation skills of children with ASD.

The social validity data of the study also indicate that the intervention was effective in improving the self-awareness skills of the participating students. Both parents and teachers reported positive opinions at the end of the study, stating that the intervention positively contributed to the students' self-awareness and social skills. Among the opinions received from parents and teachers regarding the validity of the study, the most notable statements supporting the intervention data were that the students developed the behavior of looking at themselves in the mirror, gained body awareness, and increased self-confidence.

5. Recommendations

Due to the nature of the research methodology, conducting the interventions rapidly enabled the learning process to occur quickly for the participating students. Despite the fast-paced implementation, it should be noted that pre-assessment of prerequisite skills was conducted prior to the interventions, and factors such as developmental changes during adolescence, unexpected health issues, and students' home experiences or psycho-emotional state on the day of the session could potentially affect the flow of the intervention. Another important consideration for this study is that the mirror- and screen-based interventions were conducted in a structured learning environment, and a generalization study between environments could not be performed. Consequently, although the results are positive, the study is limited to mirror- and screen-based interventions involving four distinct facial expressions (happy, sad, angry, scared) and three students, which restricts the generalizability of the findings. Additionally, this

study was derived from a doctoral thesis, and therefore, the literature of the study is limited to the interventions carried out in the study environment.

In this study, facial expression instruction was planned to enhance self-awareness skills. In front of a mirror, different skills can be taught to provide students with opportunities to demonstrate their self-awareness skills. Similarly, in front of a screen, teaching various skills can allow students to practice and develop their self-awareness skills. Since the study involved students who needed intensive support and had insufficient verbal expression skills, a demonstration-based instruction was employed. Activities focusing on the use of "I-you-he/she/it" pronouns can be planned for students with good verbal expression skills. The present study included students aged 7-10 with ASD who needed intensive support. Self-awareness activities can be planned with those who need mild support, individuals of different age levels, and individuals from different needs groups. In this study, facial expression instruction was used to observe self-awareness skills. Future research could design studies where embedded instruction is used to teach various skills while simultaneously targeting self-awareness. In this study, photographs and slide presentations were used in both mirror- and screen-based sessions. Future studies could explore the use of different technological materials, such as digital content or virtual reality, to enhance self-awareness interventions.

6. Conclusion

In this study, the effects of facial expression instructional activities conducted in front of a mirror and in front of a screen on the self-awareness skills of students with ASD were examined. The following results were obtained:

1) The intervention in front of a mirror was effective in enabling the students with ASD participating in this study to perform self-awareness behaviors.
2) The intervention in front of a screen was effective in enabling the students with ASD participating in this study to perform self-awareness behaviors.
3) The intervention in front of a mirror was effective in enabling the students participating in this study to recognize happy and sad facial expressions.
4) The intervention in front of a screen was effective in enabling the students participating in this study to recognize angry and scared facial expressions.

The opinions received from the parents and teachers of the participating students regarding the social validity of the study reveal that the interventions conducted in front of a mirror and screen are effective in performing self-awareness skills and teaching facial expressions.

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Conflict of Interest Statement
The authors declare no conflicts of interest

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