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The effect of PİYAP on piano education of children with autism spectrum disorder

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Abstract

In the research, it is aimed to determine the effect of PİYAP, which is designed to make education effective, fast and easy by embodying an abstract process, on piano education. In the method of the research, multiple probe model among the participants from single-subject studies was applied. In this context, piano training was applied to three children diagnosed with ASD and the effect of PİYAP, which supports the hand position of the participants, on piano education was examined. In this process, in the piano training of the participants; data on the starting level, teaching, end of teaching, follow-up and generalization sessions were obtained. The application of PİYAP, which is used in piano education, in participants with ASD was found to be effective.

1. Introduction

Every individual's perception of music is different from each other. Music education plays a major role in the socialization and skill development of individuals with special needs by helping to develop and improve their behavior. Therefore, taking into account the problems encountered in the musical education of children with Autism Spectrum Disorder (ASD) and producing solutions for these problems allows these students to create opportunities for musical development. This means that children with autism, who benefit from musical educational opportunities, help them reach the processes of making and producing music.

The main areas that are aimed to be acquired by the individual in the musical education process; It is processed cognitively, affectively, and psychomotor (Çorbacı Serin, 2017). The instrument playing process is important in a psychomotor context. Improving the motor skills of children with ASD with kinesthetic movements and increasing their cognitive skill levels can be achieved with piano education. It is known that children with autism receiving piano training contribute positively to their social life and development of motor skills, as well as to increase their hand-eye coordination. According to Işıkdemir (2019) "The most important step in piano education is the initial stage that forms the basis of the performance technique and theoretical knowledge that the student will need at advanced levels". The teacher plays an active role in healthily learning the basic information in the beginning phase and making progress with the right practices step by step.

In the light of all this information, it is seen that the beginner level, hand position, and technique, materials used, activities including affective, cognitive, and psychomotor processes from learning areas, and the stages that affect development in a multifaceted manner are important in piano education. Aytemur (2018), suggested that course materials should be created for the musical education of individuals with autism and special needs the belief

**All responsibility belongs to the researchers. This research has ethical approval from Abant İzzet Baysal University, Ethics Committee of Human Researches in Social Sciences* (Protocol No: 2019\159 – 03.05.2019)

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of supporting the piano, which is the most basic step for performing all these stages with correct and robust equipment, with a technological design was born. Although explaining the hand position on the piano abstractly during the learning phase and showing it only individually provides the student's instant learning, it can disappear because it does not support the tactile perception (motor-kinesthetic) process in individual studies. It is thought that it is necessary to design a material that will support the process of reinforcing the learned behaviors and to use this design until the student's self-control in individual studies is achieved.

2. Literature review

Due to the fact that a design that supports hand position on the piano was made for the first time and it was applied for the first time in children with ASD, the literature reached is not directly related to the relevant literature, and similar studies in this field have been examined. Since music is a language of emotion and music performance is an element that brings people together, it has been emphasized that making instrumental music for children with autism helps them develop their ability to communicate and interact with the world around them (Frazier, 2010). As a result of the music and piano education of children with ASD; shows that it has a positive effect on their social, emotional, and educational development to a great extent (Yılmaz, Topaloğlu & Akyüzlüer, 2014; Aytemur, 2018; Yurteri Çetin & Akdemir, 2019; Jimenez, 2014; Gawlick, 2016; 2018).

When the studies of Thaut (1984), Wigram (2000), Shore (2002), Frazier (2010) are examined, it is stated that children with ASD can learn to associate with tactile, visual, and auditory stimuli through the manual discovery of musical instruments, and teach these children instruments and make instrumental music. Gökmen (2010) stated that musical studies are a tool that triggers the desire for relationship and communication in children with ASD. Bruscia, (2016) on the other hand, in music therapy; He stated that there are different skills such as rhythm repetition to improve memory, instrument learning to develop motor skills, listening to music to improve auditory attention and perception, and improvisation to learn to move. Pektaş (2016); If music is included correctly and effectively; she emphasized that quite successful results can be obtained in the development of cognitive and social skills of children with autism and in teaching concept skills.

Looking at the relevant literature, Wigram (2000) stated that music therapy has an important role in the diagnosis and evaluation of children and adults with pervasive developmental disorders. Whipple (2004) meta-analyzed 12 dependent variables of 9 quantitative studies that compared music with non-musical conditions during the treatment of children and adolescents with autism. Stanutz, Wapnick, and Burack (2014) stated in their study that voice perception increased in people with an autism diagnosis. Zhang, Malhotra, and Matsuoka (2011) examined musical piano performance with the robotic hand they developed in their research. They provided a physical simulation of muscle movements by imitating the structure and biomechanics of the human hand. Sağırkaya (2014), used the Orff-Schulwerk approach as a method during the research in his master's thesis titled "The Use of Orff-Schulwerk Method in the Development of Communication Skills in Children with Autism Who Can Use Basic Motor Skills", combining music therapy techniques with Orff music therapy technique. examined the effect of an individual with autism on the development of their ability to socialize and communicate. Studies have shown that successful results can be achieved if music and piano lessons are adequately and effectively included in the education of children with ASD. The lack of materials on this subject and the result of the need to improve educational opportunities made us think that the studies in this field should increase.

3. Method

3.1. Purpose and importance

The purpose of the research is to determine the effect of PİYAP, which is designed to support the hand positions of children with ASD, on piano education. This study, it was aimed to design the starting level hand position support apparatus for piano education, and the behaviors expected to be achieved as a result of its application and application were determined as sub-goals. First of all, the idea of designing an apparatus to support hand positions, which is seen as a necessity in piano education, was formed. It is aimed to realize the gains of the beginner level, which covers the most important and basic process in piano education, in a healthy, efficient and correct way. The researcher carried out the research process competently in the field of piano education at the university (piano education specialist), determined the needs by taking expert opinions and completed the design process in line with the determined needs.

The main goal is to use PİYAP only at the beginning level and to cease its use when the desired level is reached and to ensure the correct formation of the hand position without PİYAP.

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3.2. Research problem and sub-problems

In this context, in the research; The answer to the question "What is the effect of the apparatus designed to support the hand positions on the piano on piano education in children with autism spectrum disorder?" For this purpose, the following sub-problems were sought. Does PİYAP, designed to support the hand positions of children with ASD, have any effect on piano education?

(1) Does PİYAP, designed to support the hand positions of children with ASD, have any effect on piano education?

(2) The five basic behaviors of PİYAP, which is designed to support the hand positions of children with ASD on the piano; Does it affect the ability to maintain the hand position, find the mid-do position, adjust the wrist-arm height, place the fingertip on the keyboard and perform an etude or piece with basic behaviors?

(3) Do children with ASD continue their gains (after 3, 5, and 8 weeks) after the beginner-level piano training practice with PİYAP?

(4) Can children with ASD transfer the behaviors they practice in the post-teaching etude or piece they work into a piece of similar content (generalization)?

(5) What are the opinions of students and parents about PİYAP, which is designed to support the hand positions of children with ASD on the piano?

Fig. 1. PİYAP (Piano Auxiliary Apparatus)*

Çelik Demiray, (2021).

Fig. 2. Hand on PİYAP (Piano Auxiliary Apparatus)*

Çelik Demiray, (2021).

3.3. Designed PİYAP

The name of the design has been determined as the Piano Auxiliary Apparatus. Piano education is a design developed to support the hand positions of students at the beginner level by covering both visual and tactile (motor-kinesthetic) areas concretely way and to determine their role in teaching the correct hand position. PİYAP; It is a technological device that enables the use of the hand position and hand position with the correct technique by placing the palms on the heads moving on the rail system. For this purpose, the hand position is supported by placing the palms on the heads so that the hand does not collapse and the joints can be used clearly and comfortably, the hand balance and arm height can be adjusted by placing the fingertips towards the touch and it is designed to prevent any tension in the shoulder and arm muscles with the free and comfortable use of the hand. By taking the opinions of three expert piano trainers, the needs were determined, developed, and revised in line with the recommended. Among the features of PİYAP; For the correct positioning of the hands, arms, and wrists on the piano, an adjustable mechanism has been created on the rail system, which can be lengthened and shortened, since each

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arm height is not the same. In addition, since the hand sizes of each individual are not the same, a mechanism that can be adjusted with screws has been developed to position the palms on the ball-shaped heads that can be moved back and forth and left and right, and care has been taken to ensure that the heads supporting the palm are movable.

3.4. Research model

This research was approved by the Human Research Ethics Committee of Bolu Abant İzzet Baysal University (Protocol No: 2019/159 – 03.05.2019). In the research, "The effect of PİYAP, which was designed to support the hand position of children with ASD on piano education" was investigated. The research was planned according to the multiple probe model design among the participants from single-subject studies. “Single-subject studies are studies defined in the experimental research group developed based on the quantitative research approach. The fact that it is among the experimental studies is since the control of the independent variable is completely under the researcher” (Tekin İftar, 2018). “Multiple probe model among participants is a research model in which the effectiveness of an independent variable is examined on three different participants” (Tekin İftar, 2018). In this context, PİYAP-supported piano education beginner level targets were determined and the application was carried out with three primary school students diagnosed with atypical autism.

After the piano education application process was completed, semi-structured interview questions were created to determine the views of students and parents about PİYAP. Each participant was interviewed one-on-one, and additional opinions and suggestions they wanted to convey were presented. Parents were also included in the implementation process of piano education with the support of PİYAP, they were asked to witness the stages their children have reached by following the process and to report their views on the design based on their observations as the people who closely follow their children in both home and school environments. According to Tekin Gürgen (2018), "Children's beliefs and perceptions about their musical potential begin to take shape in the family, as in many other areas, from an early age. For this reason, studies that reveal the behaviors, thoughts, and beliefs shown by families in this learning process are becoming increasingly important” (p. 707). Parents' follow-up of the development and implementation process of their children during the education process enabled the process to be continued with the interaction of teachers, children, and parents and played a role in the motivation process of success. The findings obtained through the interview technique were included in two separate categories as the opinions of the parents and the participants and were presented in reports. In addition, community involvement is not required in this research.

3.5. Participants' characteristics

Three students diagnosed with autism spectrum disorder from Bolu province participated in the study. Participants were chosen from among the students who fulfilled the pre-requisites. These prerequisites are;

- Having an average of 80% and above from the standard hearing test,
- Can use muscle skills without any obstacle in hand, arm, and finger muscles,
- Only diagnosed with atypical (mild) autism spectrum disorder,
- Able to speak and receive commands,
- Sensitive to deep, middle, and high-pitched sounds on the piano but not disturbed by the timbre of the voice,
- Student selection has been completed by considering the student criteria, who can recognize the numbers from 1 to 5 when they see them (note: note training and finger numbers on the piano will be carried out while teaching the keyboard).

Table 1. Demographic characteristics of the participants

Participant	Age	Gender	Diagnostic features	Aptitude test score
Participant A	7	Male	Atypical autism, Hyperactivity and Attention Deficit	95
Participant B	11	Male	Atypical autism	90
Participant C	9	Male	Atypical autism	90

Çelik Demiray, (2021).

After the Bolu Provincial Directorate of National Education and BAIBU (Bolu Abant İzzet Baysal University) human research ethics committee application permissions were obtained, the preliminary criteria determined for

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the selection of the participants with a diagnosis of atypical ASD were taken into consideration by negotiating with private "special education" institutions. Participants were determined by making the highest score ranking among the children with an average of 80% and above in the skill determination for playing the piano. While creating the participant list with three ASD as principal, 2 persons were determined as the replacement list.

3.6. Application environment

On the voluntary basis of the research, music rooms were established in two different institutions but practices were carried out in one institution so that the participants could benefit from the same opportunities under equal conditions. Pianos were donated to both institutions since the selected participants were from different institutions and two electric pianos could be purchased with the amount of donation. Thus, in the music classes created, the groundwork was prepared for many students to benefit from educational opportunities after the application.

3.7. Data collection tools

3.7.1. Piano education beginner level goals-behaviors evaluation form

The behaviors of the participants observed in the baseline, probe, application, post-teaching evaluation, generalization, and permanence processes were recorded in the piano education goal-behavior evaluation form. Piano education goal-behavior form consists of ten basic behaviors. These 10 basic behaviors are; Undergraduate 1st Year 1st Term Piano Lesson was created by taking the Draft Curriculum (Durak, 2007). In the form that was created, the goals included in the beginner level of piano education were included as observed behavioral expressions. It was observed whether the participants performed the correct behaviors regarding the hand position on the piano and the way of vocalizing the pieces in the music class and it was recorded in the evaluation form. Afterward, the number of correct behaviors was checked and the progress process was determined according to the number of correct behaviors. When the stable data (observed behavior) obtained in three consecutive sessions was obtained, the session was terminated and the next step was passed.

3.7.2. Calculating inter-observer reliability

In the research, the interobserver reliability was calculated for at least 30% of the evaluation processes by taking samples from each student, including all evaluation stages (baseline, post-teaching evaluation, permanence, and generalization). Observer works as an associate professor in the field of piano in the department of music education. The observer was chosen from the piano major in order to have a good command of the piano education and to observe whether the evaluations are correct. The application and evaluation processes were explained to him in detail and she was informed about how to apply the evaluation form. Then, the videos of the evaluation sessions were watched and the observer reliability forms were given and the students were asked to determine the number of correct behaviors they performed. Inter-observer reliability calculation; was made by dividing the total consensus of the researcher and the observer by the sum of the consensus and differences of opinion and multiplying by 100 (House, House & Campbell, by cited Karabulut, 2015). After the observer filled out the forms, the percentages of the responses of the observer and the researcher were calculated by looking at the recorded evaluation charts.

8 sessions (33%) of participant A's evaluation sessions (baseline, post-teaching evaluation, permanence, generalization) from a total of 24 sessions were watched to the observer and the inter-observer reliability was found to be 92.5%. 9 out of 27 sessions (32%) of participant B's evaluation sessions (baseline, probe, post-teaching evaluation, permanence, generalization) were watched by the observer and the inter-observer reliability was found to be 97.7%. 10 sessions (32%) of participant C's evaluation sessions (baseline, post-teaching evaluation, permanence, generalization) out of 31 sessions in total were observed to the observer and the inter-observer reliability was found to be 96%.

3.7.3. Application reliability

Application reliability; It was organized for the evaluation process and implementation sessions. An application reliability form was created for each stage of the application and evaluation sessions, and in this direction, a checklist containing the teaching steps was prepared to be given to the observer. Since the practice sessions included the direct teaching method, they were followed by an expert lecturer working in the field of special education. She was presented with examples from each participant's practice and evaluation sessions, and she was shown

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some videos to create at least 30% of all applications. Application reliability was calculated by dividing the observed researcher behavior by the planned researcher behavior and taking the percentage (Billingsley et al. 1980, by cited in Karabulut, 2015).

8 sessions (33%) of participant A's evaluation sessions (baseline, post-teaching evaluation, permanence, generalization) from a total of 24 sessions were followed to the observer and the application reliability was 100%. 9 out of 27 sessions (32%) of participant B's evaluation sessions (baseline, probe, post-instruction evaluation, generalization, permanence) were followed by the observer and the application reliability was found to be 100%. Ten sessions (32%) of participant C's evaluation sessions (baseline, post-teaching evaluation, permanence, generalization) out of 31 sessions in total were followed to the observer and the application reliability was found to be 100%.

3.7.4. Participant and parent opinions on PİYAP

A semi-structured interview form was prepared to determine the opinions of the participants and parents regarding the practice of piano education with PİYAP, which is designed to be used at the beginner level of piano education. In the interview form prepared, there were questions about the use of PİYAP during the piano education application process and the impressions it creates in the use process. Parents of the participants were active throughout the piano training process. As the people who closely followed their children's attempts to practice without PİYAP in the home environment by observing and observing the whole process, their opinions about piano education with PİYAP were taken.

Student Opinions were received about PİYAP, which was designed to be used in Beginner Level Piano Education. Opinions of the participants about PİYAP were positive and they stated that PİYAP generally helped the stance of their hands. In the opinions of the parents about PİYAP, which is designed to be used in Beginner Level piano education, they also stated that their children can play more comfortably because it supports their palms, they touch the touch more comfortably, they understand that the position of the hands on the piano is important, so the sounds are clear.

3.7.5. Ensuring internal validity of the research

(1) To prevent subject loss and subject bias in the study, pre-conditions were determined for the participants, (2) in the music class created with the participants to reduce the artificial environment effect, it was worked one week before, (3) application reliability was calculated to determine if the application environments were performed as planned and to determine whether the independent variable was implemented as planned, (4) in order to obtain the same data for the dependent variable, the application reliability of the evaluation processes was also calculated, (5) inter-observer reliability was calculated to ensure the reliability of the data related to the dependent variable and to evaluate the data obtained for the target behavior of two different observers.

3.8. Experiment process

The names of the participants were expressed as participant A, participant B, and participant C, in the order of application. During the teaching process, each session lasted three days a week until the post-teaching teaching. The implementation process was completed in 4 months in total. Sessions are planned as 45 minutes. In the experimental process, a direct teaching method was used, (1) introducing the piano instrument and PİYAP, (2) being a model, (3) guided application, (4) independent application stages.

"In the multi-probe model among participants, it is aimed to bring the same behavior to three different participants in the same environment. For the participants to meet the prerequisite features in multiple probe models, they must be independent of each other and be people who are likely to be affected by the independent variable whose effect is examined in the study" (Tekin İftar, 2018). The implementation steps of the beginner level piano training application carried out with PİYAP in the multi-probe model among the participants are gradually described below.

In the study, to evaluate the piano performances of the participants, a separate probe measurement was taken from three participants on the same day. Baseline data were collected in three sessions from the first participant (participant A) to start the teaching process until the determined target behaviors were determined. For both probe measurements and for collecting baseline data, the participants were asked questions about sitting, posture, and hand positioning, which are included in the piano education beginner level goals, and they were asked to demonstrate what they know in practice. In this process, probe data were taken from the second and third participants (participant B and participant C), respectively. When the piano starting level data of Participant A showed stability,

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the piano education application was started with PİYAP and the piano beginner level objectives were taught in order. During the implementation phase of the independent variable of the study, the measurement continued until the performance of participant A reached the target behavior, which is the criterion, until stable data was obtained. The application session was ended when stable data were obtained in at least three sessions. In this process, baseline data were obtained for participant B, while probe data for participant C were obtained. When the baseline data of Participant B showed stability (completed in three sessions), participant B passed the independent variable application phase and continued until stable data was obtained. The process was the same in participant A, as well as in other participants, respectively. To evaluate the continuity of target behavior and skill acquisition after the instruction, permanence sessions were held once a week with three participants 3, 5, and 8 weeks after the end of the instruction. Finally, to obtain generalization data; ın order to measure the ability of the participants to transfer the learned skills to other works (etude or piece) at a similar level, one session generalization data was obtained from each participant in the relevant weeks 3, 4 and 5 weeks after the end of the instruction.

3.8.1. Participant A, B and C

Piano training for each participant started with the correct posture and sitting rules at the beginning level. By using the guitar stand under the feet, the swinging of the feet in space is prevented. Later, PİYAP was rehearsed many times and meticulously adjusted according to individual characteristics. Information was given about the use of PİYAP and the position of the hands. In the middle C position, note values and names were taught by A. Burkard's piano method and finger numbers were taught gradually in different lessons and played. In this process, the participants were motivated by giving reinforcements after each exercise they played correctly. In order not to get bored, different methods used in the application process were also used, different melodic and easy etude/pieces were played. Participants completed the implementation process at different times due to individual differences. PİYAP attracted their attention and it was observed that they could play with it more comfortably in the process of being used. A. Burkard's mid-C position from the piano method was determined as the 20th exercise for the beginner level. Participants made progress by coming to the 20th exercise and when stable data were obtained, the application process was ended. In the process of the gradual abolition of PİYAP towards the end of the teaching practice of the participants, their level works were played first with the right hand PİYAP without the left hand PİYAP, then with the left hand PİYAP without the right hand PİYAP. During this time, PİYAP was removed at the end of the teaching, after the participant got used to the practice by observing their hands.

4. Findings

4.1. PİYAP's effectiveness findings on piano education

In the baseline data of Participant A, the status of playing the piano in three sessions is seen as 0 points. In the baseline data, no behavior that he could perform correctly from the goal-behaviors determined on the piano was observed. While performing the behaviors in the teaching application process carried out with PİYAP in a consistent and interconnected way, stable data was obtained at 100 points and the post-teaching application was started. It is seen that he consistently maintained the gains he obtained in the end-of-education findings and completed three sessions with 100 points. In the permanence session held 3 weeks after the post-teaching evaluations, there was no change in behavior and it was found that he continued the learned 10 behaviors in the same way. However, after the 5 and 8 weeks of the permanence sessions, there was a change in the behaviors he performed, the 10 behaviors he applied dropped to 9 and he completed the sessions in the 5th and 8th weeks with 90 points.

There was no difference between participant B's probe data and baseline findings. The probe and baseline findings were determined as 0 points, and piano education did not display any of the initial level target behaviors correctly. The target behaviors of the PİYAP during the application process of the piano education were degrading and subtractive at different levels due to the individual characteristics of the participant but when stable data were obtained in three consecutive sessions, the teaching score was found to be 90 and the application process was terminated. Considering the post-teaching findings, it is seen that participant B consistently performed 9 target behaviors at 90 points in all three sessions. In the permanence evaluations made at the 3rd, 5th, and 8th weeks, there was no change in behavior and it was concluded that he continued the knowledge he acquired.

Considering the effectiveness findings of Participant C, it is seen that the attendance and baseline data did not change and were evaluated with 0 points. The piano training process carried out with PİYAP lasted longer than the other participants but the management process of problematic behaviors reflected in the participant's behavior due to the symptoms of pre-puberty was also reflected in the teaching phase. Instead of steadily progressing behaviors in teaching practice, it was encountered with the situation that increased to 90 points but ended the teaching

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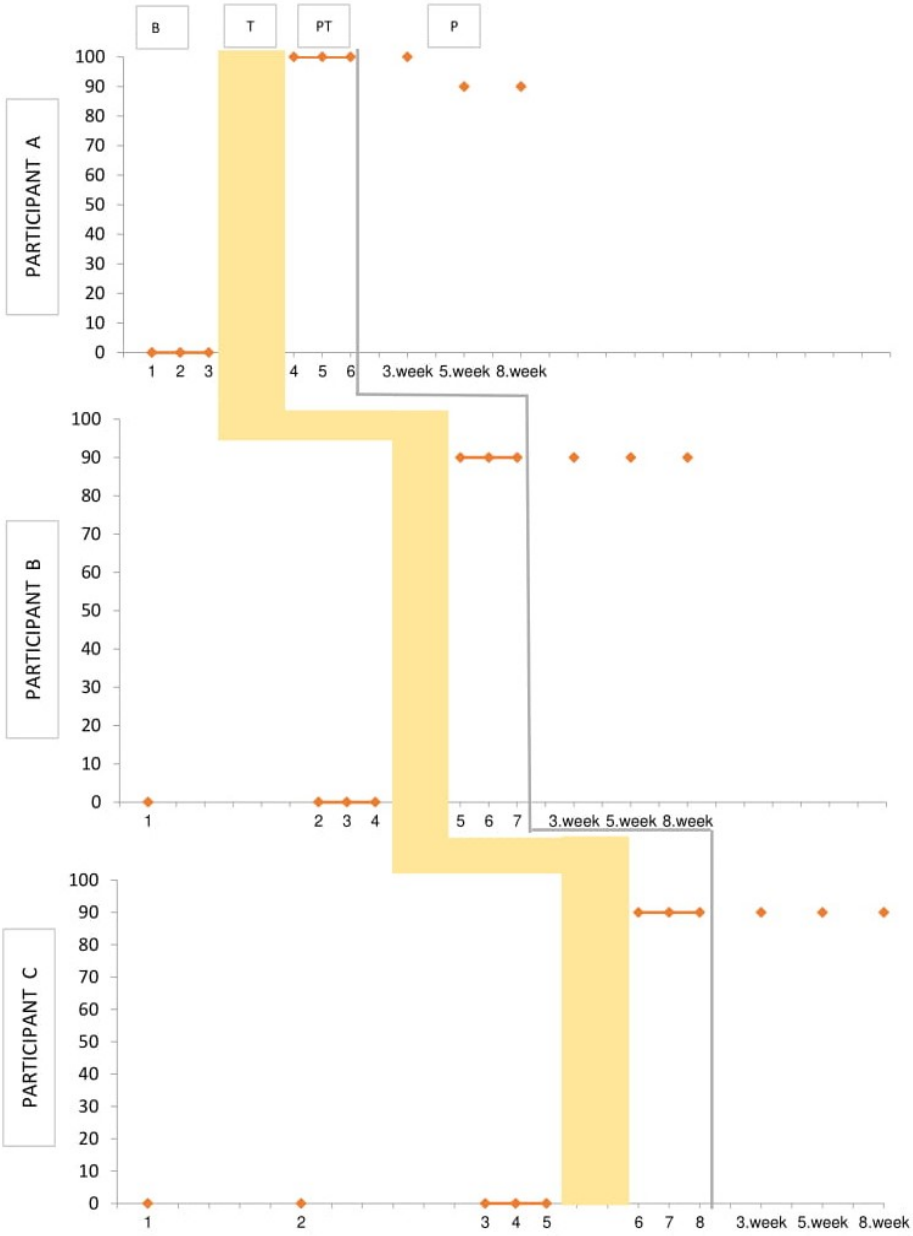
practice by obtaining stable data at 80 points again. The post-teaching evaluation findings showed determination by increasing to 90 points in all 3 sessions. The permanence findings continued with the same determination, it was observed that participant C continued with 90 points without any change in his behavior.

Graphic 1. Beginning, teaching, end of instruction, and permanence findings regarding the effect of PİYAP on piano education, which was designed to support the hand positions of the participants on the piano



B: Baseline Data, T: Teaching, PT: Post-teaching, P: Permanence (follow-up)
Çelik Demiray, (2021).

4.2. PİYAP's effectiveness findings on 5 basic behaviors in the piano

In the teaching process with the participants; (1) providing hand positions, (2) finding the middle C position, (3) adjusting the height of the wrist and arm correctly, (4) placing the fingertip on the keyboard, (5) playing the piano etude or piece with basic behaviors were taken as the basis. The effectiveness of PİYAP on basic behaviors in piano education was evaluated according to the distribution of performing these behaviors in the teaching process and separate graphical analyzes were made for each participant in terms of giving an idea of which behaviors occurred during which time intervals and how long during the lesson.

It is seen that participant A can use the hand position correctly, find the middle C position and adjust the wrist-arm height from the 2nd session until the 12th session. After performing the behaviors of being able to stand

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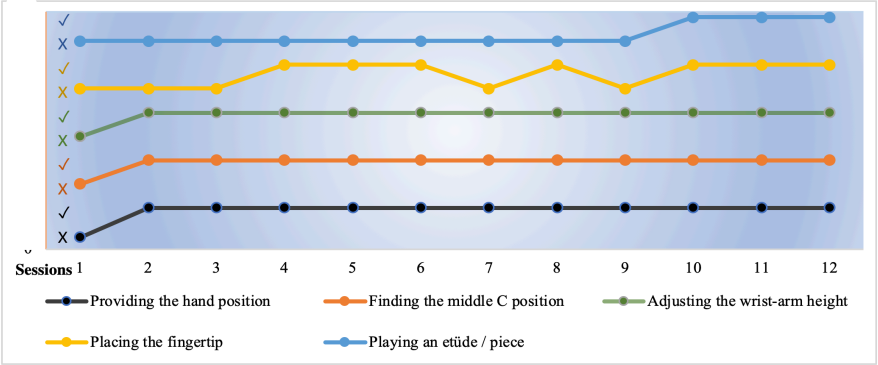
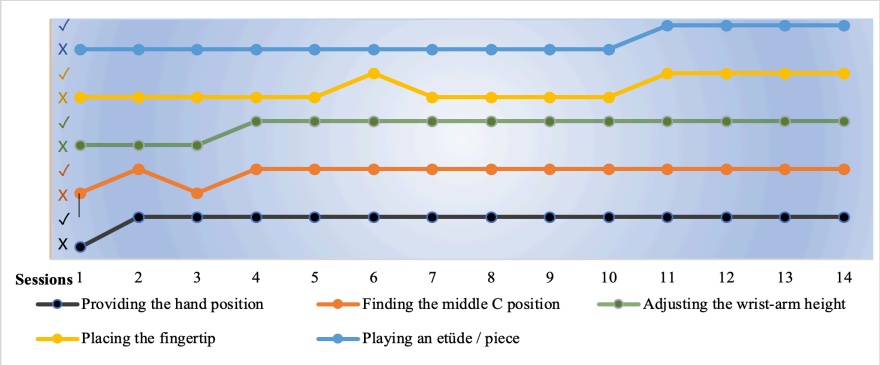
upright without breaking his fingers in the 4th session, impairments were observed in the 7th and 9th sessions but it was understood that he consistently applied the behavior in the last three sessions. The reason for this may be that due to the hyperactivity and attention deficit diagnosis of participant A, the position of the fingertip may have caused it to vary depending on his mobile nature. Finally, it is seen that he can perform the behavior of playing the piano etude or piece with basic behaviors in the 10th session and after. It was found that when he reached the specified level (A.Burkard 20th exercise), he could perform all behaviors.

Graphic 2. The effect of PİYAP on the 5 basic behaviors in the piano - Participant A's findings



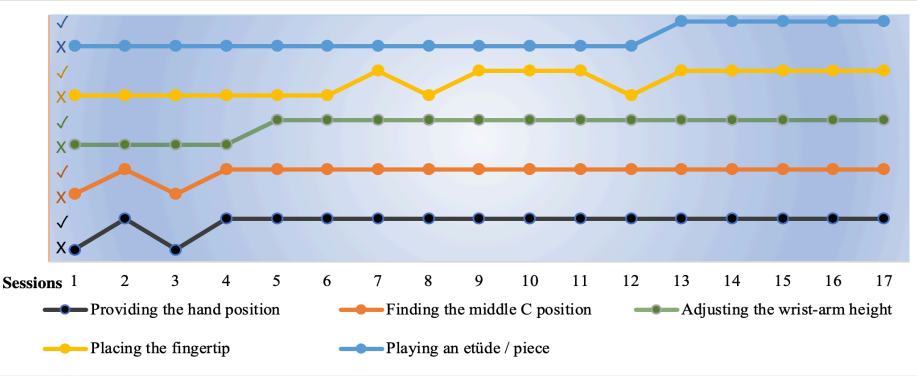
Note: X mark: Failed to perform the behavior / ✓ mark: It has performed the behavior.

Graphic 3. The effect of PİYAP on the 5 basic behaviors in the piano - Participant B's findings



Note: X mark: Failed to perform the behavior / ✓ mark: It has performed the behavior.

Graphic 4. The effect of PİYAP on the 5 basic behaviors in the piano - Participant C's findings



Note: X mark: Failed to perform the behavior / ✓ mark: It has performed the behavior.

The teaching sessions of Participant B with PİYAP lasted 14 lessons. The behavior of maintaining the hand position has been maintained consistently since the second session. He performed the behavior of finding the middle C position in the 2nd session but the behavior was not observed in the 3rd session and he became able to constantly apply the behavior correctly in the 4th session and subsequent sessions. He could not exhibit the behavior of adjusting the wrist and arm height in the first 3 sessions but was able to perform the behavior steadily afterward. He was able to perform the behavior of placing his fingertip on the keyboard in the 6th session, but it

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was observed that he could not apply it correctly from the 7th session to the 10th session. It is understood from the graphic 3 that he can apply the behavior after the 11th session. It is seen that he started to exhibit the behavior of playing the piano etude or a piece with basic behaviors when he reached the level of the work determined, that is he continued the behavior he had performed since the 11th session.

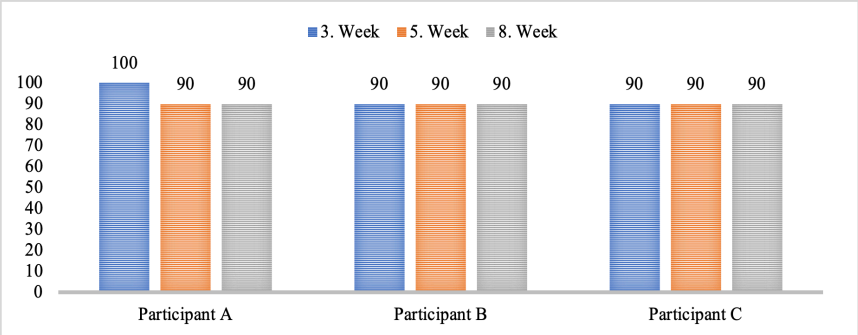
Teaching sessions of Participant C carried out with the use of PİYAP, covered 17 lesson processes. He achieved the behavior of maintaining the hand position and finding the middle C position in the 2nd session but the behaviors were not observed in the 3rd session and it was observed during the next sessions that he continued the behaviors consistently by repeating the behaviors in the 4th session. He was able to apply the behavior of adjusting the wrist and arm height in the 5th session and it was observed that he continued the behavior in all other sessions. The behavior of being able to place the fingertip on the keyboard was maintained in the last 5 sessions and the behavior he performed in the 7th, 9th, 10th, 11th sessions was not observed in the 8th and 12th sessions. He was able to perform the behavior of playing the piano etude or piece with basic behaviors, from the 13th session, throughout 5 sessions.

4.3. Generalization-transfer findings

Generalization findings to the piece named "Şikayet" (E. Tufan) selected as similar level what Participant A learned from A. Burkard No. 20 exercises at the end of the instruction; It was obtained from the sessions held with participant A in the 3rd, 4th and 5th weeks without PİYAP support. While deciphering the piece titled Şikayet, which he did not know at all, the initial level goal-behaviors observed were evaluated and the findings were determined. In the first decipher, he gave his attention and fulfilled all the behaviors completely, and got 100 points. However, in the following sessions, disruptions were observed in the integrity of the etude (fluent playing) due to his inability to focus his attention and play fluently, he completed the sessions with 90 points due to his failure to fulfill a goal-behavior.

Considering the findings of generalization-transference at the 3rd, 4th and 5th weeks, which were carried out with Participant B and Participant C without PİYAP support, the behaviors observed by deciphering the piece named "şikayet" that he did not know yet were evaluated in the form of initial level goal-behaviors and it was observed that he received 90 points in all sessions respectively. Participants B and C also interrupted the integrity of the etude (fluent playing) from time to time while playing but completed the process by fully performing all other behaviors. It was determined that Participant B was able to generalize what he learned from the previous piece to different pieces at a similar level, with a score of 90%, 9 behaviors followed.

Graphic 5. Generalization-transfer findings of participants A, B, and C



5. Discussions

It has been observed that PİYAP is effective in the acquisition of piano education beginner-level behaviors of students with ASD and the acquired behaviors continue 3, 5, and 8 weeks after the end of the instruction and PİYAP is effective in the permanent acquisition of behaviors. During the implementation of PİYAP; It has been observed that the behaviors determined for the beginner level of piano education are provided, that they can be practiced easily and comfortably, that the participants can perceive by supporting the posture of the hands concretely, by feeling and seeing and that they provide the technique of playing effortlessly without effort. However, it has been observed that the movements of the hands to the right and left in the PİYAP's rail system can be turned into a game by causing a loss of time in such students. For this reason, it has been determined that fixing the rail system in specially educated children as in the picture below is important in terms of not interrupting the process.

PİYAP has played a role in the success of the participants with ASD in piano education. At the same time, as

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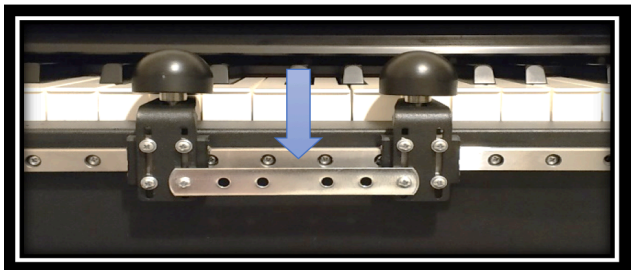
a result of the piano training of the participants, the parents; their views that thanks to piano education have increased their children's attention skills, that they perceive what is said better in the process and that their tendency to establish social communication with their surroundings increases, showing the effects of piano education on these children. In addition, the behaviors of the participants with the PİYAP showed similarity and consistency with the same behavior score close to each other.

Fig. 3. Fixing the headers in the rail system*



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6. Conclusion and suggestions

Participants with ASD; Teaching, post-teaching, permanence, and generalization-transfer scores of 90% and above demonstrated the effect of PİYAP, which supports the hand position, on the piano education of the students with ASD. In addition, by supporting the hand positions of the PİYAP, its effect on the beginner level 5 basic behaviors showed itself by providing a positive development even during the application process. It has been observed that PİYAP is not only a tool that supports the hand position but also provides wrist-arm height, shoulder-arm freedom, fingertip use. It has been observed that piano education facilitates and accelerates the process of achieving the initial goals and it has been determined that the process matures more effectively and efficiently. In the participant and parent interviews, it was found that PİYAP is a technological tool that indicates its place and importance in piano education, demonstrates its necessity and motivates success.

It is thought that students with ASD reveal their importance, necessity, and effect in providing self-control and self-awareness after a while, providing the opportunity to be trained as musicians in social and professional fields. In addition, since it is the first study conducted for piano education of children with ASD; as it is seen that the findings obtained from the research are important in terms of enabling the improvement of the educational opportunities of these students. Also; in terms of muscular and skeletal health; It is predicted that the use of PİYAP will help students to prevent physiological disorders that may occur in their muscles.

The fact that PİYAP, which encourages piano educators and encourages them to work on children with special needs, laid the groundwork for new studies, showed that this field should be voluntarily taken up, and it showed that new different initiatives and studies should be tried in order for these students to benefit from educational opportunities voluntarily. The role of PİYAP is important in providing the teacher with a technological tool that can be easily used at the beginner level of piano lessons, and the discovery of talented students with OSB and the opportunity to be trained as musicians in social and professional fields.

As a result of the observed situations related to PİYAP in the piano education teaching process; (a) the use of caps by attaching them in accordance with the characteristics of 3 different sizes of people, and also adding a removable feature to the caps when a soft tissue is necessary, (b) changing the situation of adjustability according to individual characteristics from the screw system to a more practical system in 3 stages, and (c) It can be reconfigured by making PIYAP portable on any piano.

PİYAP is recommended to be used by students who are beginning piano education at the beginner level. After the beginner-mid-C position phase is completed, the PİYAP support should be removed gradually. In this process, for the students to get used to the playing process without PİYAP support, it is recommended to adapt the works by playing them once with PİYAP, once without PİYAP. If the students who will take piano education have a moving structure and problems such as attention and focus, it is recommended to fix the movable rail system of the PİYAP with the fixing mechanism, paying attention to individual characteristics. The fixing mechanism can be disabled if needed in the following stages.

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If PİYAP is used in individuals with special needs, the student's tactile, auditory, etc. It should be determined in advance whether they have any sensitivity, whether they are obsessed with objects or objects and it is recommended not to continue using PİYAP if they feel uncomfortable with the use of PİYAP. PİYAP is recommended to be used in the process of regaining the behaviors that are gained in piano education but fade as a result of wrong individual studies. It is recommended that students continue to use it until their self-control and self-awareness levels are observed.

In order for individuals with ASD and special needs to benefit from piano education and music activities, social responsibility projects should be carried out, and studies should be included in the creation of music classes in private education institutions and the purchase of piano and or instruments. Thanks to the two pianos purchased with this research, it is a good development that many students can benefit from music class facilities, but it is not enough. It is the conscientious responsibility of educators to provide these opportunities in each of the special education institutions and to support the skills, behavior and social development of each of these students.

Author contribution statements

Author contributed all to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Disclosure statement

No potential conflict of interest was reported by the authors.

Ethics committee approval

All responsibility belongs to the researchers. All parties were involved in the research of their own free will. This research was approved by the Human Research Ethics Committee of Bolu Abant İzzet Baysal University (Protocol No: 2019\159 – 03.05.2019).

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