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## **INVESTIGATION OF THE EFFECT OF NeuROPLAY METHOD ON DEVELOPMENTAL PROCESSES OF CHILDREN WITH AUTISM SPECTRUM DISORDERS AND PARENTAL INTERACTIONS**

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### **Abstract**

*This study was conducted to examine the effect of neuroPLAY on the developmental processes and parental interactions of children with autism spectrum disorder. A mixed method was used*

*in the study. In the quantitative dimension of the study, 41 children with an autism spectrum disorder age 18-42 months, and in the qualitative dimension five children and their parents with autism spectrum disorder were included. The qualitative dimension of the study was used and the observation method was carried out in the institutional environment through individual participant and unattended and video recordings in the home environment. Observation was conducted both to determine the developmental process of the child and the parental interaction and to monitor the process of applying the parent/caregiver's neuroPLAYy method. In the quantitative dimension, experimental design is used. The experimental training period lasted at least 3 months as neuroPLAY. Prior to the start of the experimental training period, five days of training were given to parents and caregivers, and the experts provided feedback on the parent/caregiver through the process of observation. The results of the research show that neuroPLAY has positive effects on developmental processes and parental interactions of children with autism spectrum disorder.*

**Keywords**

Children with Autism Spectrum Disorder, Autism, Neuro, Neuroplasty, Development

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**1. Introduction**

Autism is characterized with communication problems, social interaction problems, and limited/recurrent interests and behaviors which occurred in the first three years of life (Filipek, Accardo, Baranek, Cook, Dawson, Gordon, et al. 1999; Emmons & Anderson; 2005). Due to DSM-V, autism spectrum disorder is defined in two main categories. According to this, the first criterion of the autism spectrum disorder measures' first category is the social-emotional inadequacies that start from the unconventional social convergence and retention/continuity of dialogue and extend to the absence or lack of interests, sharing of emotions and social interaction prolongation. The second criterion of this category is the limitations of non-verbal communication, ranging from poorly constructed verbal-non-verbal communication, to eye contact and body language anomalies or to inability to understand and use non-verbal communication or to lack of facial expressions or mimicry. The last criterion of this category is the difficulties for establishing and maintaining age-appropriate relationships as from adapting behavior in different settings, extend over to sharing fanciful games, and making fanciful friends and to being completely indifferent to other people. The first criterion of the second category is related to stereotypic behavior. This criterion is stereotypic or repetitive speech, motor movements

or object use, or specific verbal patterns. The second criterion of this category is related to the routines. This criterion is in the form of extreme dependence on routines, verbal-nonverbal ritual movements, or extreme resistance to change. The third criterion is abnormal and limited interests in terms of focus and intensity. The last criterion of this category is very few responses to sensory inputs or unusual responses to the sensory properties of the environment (American Psychiatric Association, 2013).

In this respect, the inadequacy in interpretation, difficulty in the perception of the whole (sense), lack of paying attention to the desired point, concrete thinking, difficulty in combining ideas, weakness in executive function, lack of imitation skills, lack of symbolic play, and sensory difficulties are particularly seen in children with autism spectrum disorder. These features may also shape as parallel to each other (Toth, Munson, Meltzoff & Dawson, 2006; Whitman, 2004; Leekam, Nieto, Libby, Wing & Gould, 2007; Weber & Newmark, 2007). Also limited interest and behaviors can be seen in the area of feeding, sleeping etc with autism children. So early intervention should be for them (Balıkçı & Çiyiltepe, 2017).

Since recognition of autism spectrum disorder as inadequacy, family and family characteristics have been extensively examined as the main reason for this inadequacy. Parents who are not interested in their children have been shown as a cause of autism spectrum disorder for a while, and these parents have also been described as refrigerator families. However, investigations have shown that autism spectrum disorder is not related to parenting characteristics or socioeconomic status (Tidmarsh & Volkmar, 2003).

Although the years after the definition and description of "refrigerator families" and many scientific studies on this subject have shown that children with autism spectrum disorder have no significant association with almost none of the familial variables, there are many studies that show the effect of the family on reducing the effects of autism spectrum disorder. (Hendrickson, Woods-Groves, Rodgers & Datchuk, 2017; Hartmann, Kozikowski, Urbano, Williams, & Peterkin, 2018). For this reason, family-centered approaches stand out in supporting the development of this group of children. These are studies in which the entire family system is supported in order to support any disabled, or risk group children/infant in both social and biological sense, for their inadequacy, and/or in order to acquire new skills, to prevent future developmental problems and to make positive changes of the child (Odom, Yoder & Hill, 1988; Carriveau, Kodak & Campbell, 2017; Roche, Bush & D'Angelo, 2018). Short-term (4-5 weeks) or longer cycle programs for children and their families at different age and risk groups are

implemented in three different ways, expert-centered, family-oriented or family-centered. In the family-centered approach the family and the expert make a mutual exchange of ideas and a program in the direction of the needs and demands of the family is determined and the family also practice. In the family-centered approach, all the items of the training program are determined according to the needs and demands of the family and family performs practice ( Bryson, Rogers, & Fombonne, 2003; Carriveau, Kodak & Campbell, 2017; Roche, Bush & D'Angelo, 2018).

In other words, in spite of long-standing scientific research, the inability to pinpoint the source of autism leads to questions about how education in this area should be offered to children with autism spectrum disorder (Holmes, 1998). National Autism Center and National Research Council Division of Behavioral and Social Sciences and Education are the institutions that evaluate the most effective of scientific-based practices in the field of special education. The National Autism Center - NAC (2009), collected the applications for the education and rehabilitation of children with autism spectrum disorders under three titles as scientific-based applications, newly developed applications and under-scientific base applications, on the basis of the National Standards Report which had been previously published. The preliminary based practices among educational practices, behavioral practices and comprehensive behavioral practices in early childhood, common attention teaching, model presentation/offer and natural teaching strategies, peer-mediated teaching (PRT), basic reaction teaching, activity charts, story-based teaching practices are/take place in scientific based practices (<http://www.nationalautismcenter.org/>)

The prevalence of autism spectrum disorder is among the most important reasons for the occurrence of these approaches in recent years. The survey studies to screen autism spectrum disorder for children has gained importance for this situation. The American Academy of Pediatrics (AAP) has developed and published many documents for early detection of children with autism spectrum disorders. Accordingly, AAP recommends that all children should be screened for autism spectrum disorder at their 18<sup>th</sup> and 24<sup>th</sup> months. However, there is no routine screening test for the early detection of autism spectrum disorder in our country (Turkey). The families usually notice this anomaly on the developmental stages after 18 months, and usually seek medical assistance around the age of 2 years (Johnson & Myers, 2007; Webb & Jones, 2009). Also the successful identification and implementation of practices is best made at the local level by informed professionals, working with families, as they have the most knowledge and

information about the needs of individual children with autism spectrum disorders (Simpson, 2008). However, communication skills (Wodka, Mathy & Kalb, 2013). and social communication skills in the early-school-age period are strong predictors for later development (Howlin, Moss, Savage & Rutter ,2013). For this reason, it is very important to construct an early intervention program (structure) for children with autism spectrum disorder that can be diagnosed early. The neuroPLAY is an individual and family based-home centered early intervention method that is based on these features and realizes the play, in the child's natural environment, by shaping it as sensory based, common attention based, interaction and child-based (Ekici, 2017).

In family centered practice, it is aimed to increase the development of children by supporting the relationship between child with autism spectrum disorder and his/her parent. Because family-centered intervention practices that require parental involvement in early childhood can provide to find more opportunities to observe communicative problems, social interaction limitations, or repetitive behaviors of children with autism spectrum disorders by parental (and child) interaction, as well as having an impact on the development of children with autism spectrum disorder (Griffith , Hastings, Nash & Hill, 2010; Stansberry-Brusnahan & Collet-Klingenberg, 2010).

This ensures that parents have more support by more awareness/knowledge of their children (Pickles, Harris, Green, Aldred, McConachie, Slonims, Le Couteur, Hudry& Charman, 2014). It is noteworthy that this situation has been seen in the studies performed. Bennett Baker, Messinger, Lyons & Grantz (2010) found that the response approach of mothers in their first two years of life to their children were determiner the development of the child's language skills, cooperation, adaptation and low level of problem behavior at three years of age. Diken (2012) found that there was a close relationship between positive behavior management and language support in the parent-child interaction in the daily routine, and that low-response mothers were found to be unable to control their children's behavior and to provide a rich language environment for their children.

Early parent-child interaction may play a key role in maximizing achievement in young children at risk for autism spectrum disorder (Dawson, 2008). Hence, the observation of the child's social interaction with the parent/primary caregiver is very important in terms of pedagogic/educational diagnosis and intervention planning (Elder & Goodman, 1996). Also we know that autism effects children's both information processing in the brain by getting control of

brain cells and their connections in knowledge organization (Aksoy, 2018). For this reason, this method, which overlaps with the information presented above, was carried out to examine the effects of autism spectrum disorder on child developmental processes and parental interactions.

## **2. Material and Method**

This section includes the research design, the study group, the data collection tools and processes, and the analysis of data.

### **2.1 Aim of Research**

This study was conducted to examine the effect of neuroPLAY on the developmental processes and parental interactions of children with autism spectrum disorder.

### **2.2 Research Design**

Both quantitative and qualitative research methods have been used together in the study to investigate the effect of neuroPLAY on the developmental processes and parental interactions of children with autism spectrum disorder. As a quantitative research method, it is a pre-test/post-test experiment without control group from semi-experimental designs. The descriptive dependent variable of design is the developmental characteristics of children and parental interactions while the independent variable is the program of the neuroPLAY method (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz and Demirel, 2014).

The observation method was used in the qualitative dimension of the study and it was performed to determine both the developmental process of the child and the parental interaction as well as to monitor the process of the parent/caregiver neuroPLAY method application. The type of observation varies depending on whether or not the observer is involved in the observed event or group. In the Unattended Observation, the observer does not directly participate in the observed situation. In the Participated Observation, the observer takes as a participant in the observed situation and obtains as much data as possible (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2014).

In this study, the observation method was used in the institutional environment as participatory and unattended. The unattended observation was used to determine the process of child parental interaction and the parent/caregiver's neuroPLAY method application, while participatory observation was particularly used to determine the child's developmental process in the institution. The observation forms created by researchers were used in both

observations. The same observation forms were filled in every week in the home environment via video recordings.

### **2.3 Study Group**

In determination process of study group, objective sampling from non-random sample types was used and limitations such as the voluntary participation of the mother in the study and at least three months neuroPLAY (child) training were considered (Büyüköztürk et al., 2014). In this context, forty autism spectrum disordered children of 18-42 months-age group with their parents were included in the study.

**Table 2.1: Demographic Characteristics of Children and their Families Constituting the Study Group**

<b>Demographic Characteristics</b>		<b>n</b>	<b>%</b>
<b>Sex</b>	Male	12	29,3
	Female	29	70,7
	Total	35	100
<b>Age (as months)</b>	15-18 months	6	14,6
	19-21 months	5	12,2
	22-24 months	5	12,2
	25-28 months	6	14,6
	29-32 months	9	22,0
	33-36 months	5	12,2
	37-42 months	5	12,2
	Total	41	100
<b>Mother's Education</b>	University and upper	30	73,2
	High School and Middle School	11	26,8
	Total	35	100
<b>Father's Education</b>	University and upper	40	97,6
	High School and Middle School	1	2,4
	Total	35	100

It is seen that the majority of the children are female (70.7%) and at 29-32 months age (22%) when Table 2.1 is examined. If we look at the findings concerning the educational status of parents, it is seen that majority of both mothers (73.2%) and fathers (97.6%) are college graduate and upper.

### **2.4 Data Collection Tools and Processes**

Different evaluation tools were used in the quantitative and qualitative aspects of the study.

The General Information Form was used in order to obtain demographic information about the children and their families in the quantitative aspect of this research, and the PICCOLO- Parenting Interactions with Children: Checklist of Observations Linked to Outcomes which was developed by Roggman Cook, Innocenti, Norman and Christiansen (2013) and adapted to Turkish children by Bayoglu, Elibol, Ünal, Karabulut and Innocenti (2013) was used to determine parental interactions.

In the qualitative part of the study, the Observation Form to Evaluate of the Child Developmental Process and The Parent/Caregiver Interaction was used in order to determine the child's development process and child parental interaction while using the Observation Form to Evaluate the Application Process of NeuroPLAY Method (Home and Institutional Environment) to reveal the process of applying the neuroPLAY method of the parent/caregiver.

#### **2.4.1 General Information Form**

This form contains questions about the child's gender, age (in months), and the level of parental/mother education.

#### **2.4.2 PICCOLO- Parenting Interactions with Children: Checklist of Observations Linked to Outcomes)**

PICCOLO was created by Innocenti, Roggman et al. and Turkish validity and reliability was published simultaneously by Bayoglu, Elibol, Ünal and Innocenti (2013). Parental Interaction is evaluated with 29 items in 4 sub-dimensions as "emotional closeness, sensitivity, encouragement and teaching". The total score is calculated with 8 items in the teaching sub-dimension and 7 items in the other sub-dimensions; strong and weak areas of the parent are identified.

#### **2.4.3 Observation Form for Evaluating the Implementation Process of NeuroPLAY Method (Home and Institutional Environment)**

This form is an observation form prepared by researchers by taking into account the philosophy and implementation strategies of the NeuroPLAY method. Some of these items are:

- In the environment, the stimulus concentrates on the attention of the child.
- The television is not turned on.
- Toy selection is suitable.
- Parent-child physically close.
- The parent does not give instructions in the play.



- The tone of voice is loving and lively.
- The tutorial does not show playing behavior.
- It imitates the voices of the child, gives feedback.
- Parental energy is sufficient for the child's interest.

#### **2.4.4 Observation Form for Evaluating Child's Developmental Process and Parental Interaction**

This form is an observation form prepared by researchers, taking into account the child's developmental characteristics and the theoretical knowledge of parent-child interaction. There are 26 items/articles in total and a description of each article (in this form and) some of these items are presented in the following Table 2.2.

**Table 2.2:** *Example Items of Observation Form for Evaluating Child's Developmental Process and Parental Interaction*

<b>Item</b>	<b>Explanation</b>
Caring speaks with a happy tone of voice.	The parent speaks cheerful expressions that he is enjoying the game, away from the single level and dull speech.
He does not try to talk to the child in the back position. It takes care to establish eye contact during communication and conversation.	It forms the position with physical movements to establish eye contact while verbally communicating.
The child is smiling.	She smiles at the right time and meaningfully. Interacts or tries to interact.
Speak by making different sound tones during the play.	When communicating with the child or during play, the tone of voice means a sense of emotion. "Oh you made it great, yeah I was very upset, I live so much I like to eat".
Sit in the distance where you can make comfortable physical contact with the child in the play.	If the parent is able to make comfortable contact with the child when he or she extends it to the child, it is in close proximity. It means that you should be a little closer at the distance that you can not touch when you stretch your arm.
There is a play with the child in the play process.	Hugging shows closeness like caressing and kissing his hair and back.
The child waits 4-6 seconds to make a toy or play selection.	The parent gives the child the time to move on to the thing that the child chooses, without being sensitive to the child's wishes during the play. The child wants to stay in the same room or else he is aware that he is paying attention to something else and directs the play.

Works to include the child without giving commands to the play he plays.	He works independently from the child to attract the child by adding different tonalities and entertainment to the game. When you do this, come, look, sit down, do not direct, just talk about the play.
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#### **2.4.5 NeuroPLAY Method**

NeuroPLAY method is a home-based family centered early intervention program developed by Ekinçi, Yıldız Bıçakçı, Dursun, Kutlu and Gürkan (2017) for children aged 12-42 months. It is the intensive game therapy process which is based on parent-child interaction. The home, which is the natural environment of the child, is taken into consideration in the NeuroPLAY early intervention method. It is aimed to cure (determined) social disorders of the children with social play that takes place in the home environment. The reason for focusing on the home environment in particular is that the house/home is the place where child usually spend time and the place where he lives. The NeuroPLAY early intervention program is based on the philosophy of generalization and support sustainability in the home environment (Ekinçi, 2017, Yıldız Bıçakçı, Emre Bolatbaş and Aksu, 2018).

The general features of this program can be listed as follows:

- For children aged 12-42 months
- Interaction is the basis.
- Family participation is essential.
- It is intended for natural and daily living environments.
- It is an unstructured play.
- The play directs the child.
- Common attention is determined.
- It is based on developmental and sensory properties.
- The individual is.
- Home based program.

The parents/caregivers are trained first, since this program is implemented by parents/caregivers.

**The NeuroPLAY Education Program for Parents/Caregivers** took five days in total, one hour per day theoretically and practically. In the theoretical part of this program, the points to be considered in the philosophy, preemption and implementation/application process of the neuroplay method were mentioned and in the application part, a model to one-to-one

applications, and then the opportunity of the parents/caregivers' application was provided. After the practice of parents/caregivers, the implementation process has been discussed mutually. After five days application process, first month once a week, second and third month in 15 days institutional application and home applications are discussed through videos and the theoretical and practical education process continues. It is decided that parents/caregivers can carry out the program after this process (or not).

#### **2.4.6 Application Process**

This process is presented as below:

- Signing the form to accept to participate in the study
- NeuroPLAY Education Program for Parents/Caregivers
- Observation Form for Evaluating the Implementation Process of NeuroPLAY Method (Home and Institutional Environment)
- PICCOLO- Parenting Interactions with Children: Checklist of Observations Linked to Outcomes)
- Observation Form for Evaluating Child's Developmental Process and Parental Interaction
- Intervention Program Based on NeuroPLAY Method for Children (3 months)
- Observation Form for Evaluating the Implementation Process of NeuroPLAY Method (Home and Institutional Environment)
- PICCOLO- Parenting Interactions with Children: Checklist of Observations Linked to Outcomes)
- Observation Form for Evaluating Child's Developmental Process and Parental Interaction

#### **2.4.7 Data Analysis**

In the analysis of this research, the difference between PICCOLO- Parenting Interactions with Children: Checklist of Observations Linked to Outcomes), Observation Form for Evaluating the Implementation Process of NeuroPLAY Method (Home and Institutional Environment) and Observation Form for Evaluating Child's Developmental Process and Parental Interaction that is applied before and after neuroPLAY is evaluated by t-test (Büyüköztürk *et al.*, 2014).

### 3. Findings

The results of the study are presented in tabled form.

**Table 3.1:** *The t-test results on pre-test and post-test score averages regarding PICCOLO of children in the study group*

PICCOLO- Parenting Interactions with Children: Checklist of Observations Linked to Outcomes)	Test	$\bar{X}$	SS	p
Emotional proximity	Pre test	5,11	1,65	,000
	Post test	8,88	2,33	
Sensitivity	Pre test	6,11	1.44	,000
	Post test	10.45	2.02	
Encouragement	Pre test	7,23	1.04	,000
	Post test	12,88	2.40	
Teaching	Pre test	7,93	1.97	,000
	Post test	11.76	2,09	
Total	Pre test	26,38	2,80	,000
	Post test	43,97	3,23	

There is a significant difference between the pre-test and post-test scores of the children of the study group in favor of the post-test scores of the PICCOLO Scale ( $p < .001$ ) if Table 3.1 is examined. According to this; the early intervention program based on the neuroPLAY method appears to be effective in (positively) changing characteristics of children with autism spectrum disorder.

**Table 3.2:** *The t-test results on pre-test and post-test score averages regarding Observation Form for Evaluating the Implementation Process of NeuroPLAY Method (Home and Institutional Environment) of children in the study group*

Observation Form for Evaluating the Implementation Process of NeuroPLAY Method (Home and Institutional Environment)	Test	$\bar{X}$	SS	p
	Pre test	8,80	2,81	,000
	Post test	17.82	2,95	

There is a significant difference between the pre-test and post-test scores of the children of the study group in favor of the post-test scores of the Observation Form for Evaluating the Implementation Process of NeuroPLAY Method (Home and Institutional Environment) if Table 3.2 is examined ( $p < .000$ ). According to this; the early intervention program based on the neuroPLAY method appears to be effective in (positively) changing characteristics of children with autism spectrum disorder.

**Table 3.3:** *The t-test results on pre-test and post-test score averages regarding Observation Form for Evaluating Child's Developmental Process and Parental Interaction of children in the study group*

Observation Form for Evaluating Child's Developmental Process and Parental Interaction	Test	$\bar{X}$	SS	p
	Pre test	19,02	3,98	,000
	Post test	39.11	4,49	

There is a significant difference between the pre-test and post-test scores of the children of the study group in favor of the post-test scores of the Observation Form for Evaluating Child's Developmental Process and Parental Interaction ( $p < .001$ ) if Table 3.3 is examined. According to this; the early intervention program based on the neuroPLAY method appears to be effective in (positively) changing characteristics of children with autism spectrum disorder.

#### 4. Discussion and Suggestions

The closest communication partners of infants are often the primary care-giving parents, in the interactional environment in which pre-tongue communicative behaviors exhibited for the purpose are emerged. In this respect, early period-social environment experiences of infants involve interactions with their parents who are often primary caregivers (Wan, Green, Elsabbagh, Johson, Charman & Plummer, 2012). However, there are also environmental factors that affect the interaction between the parent and the infant (Bornstein, Hendricks, Haynes & Painter, 2007; Green, Aldred, Charman, Le Couteur, Emsley, Grahame, Howlin, Humphrey, N., Leadbitter, McConachie, Parr, Pickles, Slonims, Taylor & PACT-G Group, 2018).). One of the most important factors is the presence of the baby's disability/barrier (Ceber-Bakkaloğlu & Sucuoğlu, 2000). Here the infant with autism spectrum disorder and his/her parent come to mind (as barrier).

As it is known, the social interaction and social communication seen in children with autism spectrum disorders significantly affect the relationship between the infant and its parents/primary caregivers (Diken, 2009; Luyster, Kadlec, Carter & Tager-Flusberg, 2008; Tager-Flusberg, Paul & Lord, 2005; Mundy v & Mastergoerge, 2011). Parents with a autism spectrum disordered child are also noticed that the duration of play interactions with their children is short and the quality of play interactions with them is low, besides (their) negatively affected the relationship (Töret, Özdemir, Gürel-Selimoğlu & Özkubat, 2014). Considering the results of this study, it is expected that NeuroPLAY early intervention program developed with interaction,

play, free play, common attention philosophy, especially in natural environment, will positively affect the communication between parents.

The studies performed, shows that the support given on this scale positively affects communication with parents and infants with autism spectrum disorder. Anderson & Romanzcyk (1999), stated that children with autism spectrum disorder exhibited more game-interactive initiative behaviors towards their siblings than their parents in their free-play interaction. Siller and Sigman (2002) suggested in their research in which they investigated developmental interactions between children with autism spectrum disorders and their mothers during the game interaction that a developmental link between the development of subsequent communication skills of children with autism spectrum disorder and parental responsiveness in terms of mother-child interaction could be established. In addition, mother's voluntarily acceptance of the NeuroPLAY-early intervention program and their willing may influence this outcome.

Some studies with autism spectrum disordered children and their mothers clearly demonstrate the efforts of their mothers. It is known that the mothers of children with autism spectrum disorder give more instructions on play activities and start more play sketches (Freeman & Kasari, 2013). In their study, Lemanek, Stone & Fishel (1993) found that parents with children with autism spectrum disorders have physically spent more time and had more physical contact with their children in order to ensure their children's intervention. Doussard-Roosevelt, Joe, Bazhenova, & Porges, (1998) reported that parents with children with autism spectrum disorder are offering more verbal and nonverbal stimuli to get their children's attention. In this direction, it is known that the relationship between the caregiver and the child is mutually influential, as well as affecting each other socially (Bronfenbrenner, 2004, Sameroff, 1995).

These results as well as the observation of parent-child interaction is a/an (important) point of effective interaction of the children with their parents in their natural environment (Mahoney & Wheeden, 1997). In empirical studies, it is known that the relationship-based application (Mahoney & Perales, 2005) which is one of parent-centered and relationship-based early service models are also effective in accelerating development of children with autism spectrum disorder (Karaaslan, Diken & Mahoney, 2011; Kim & Mahoney, 2005; Mahoney & Powell, 1988; Mahoney, Boyce, Fewell, Spiker & Wheeden, 1998; Mahoney & Perales, 2003). In this research/study/work, it is clear that the NeuroPLAY practice in the family involved-natural environment, where the family centered education is included, influences the development of children as well as the communication between mother and child.

In context of these results, it is necessary to expand the use of this new method and to increase the efforts towards this.

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