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Evaluating the Lexico-Semantic Aspects of the Spoken Language of Preschool Aged Children with Autism Spectrum Disorder (ASD)

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Abstract
Autism Spectrum Disorder (ASD) is believed to impact the language patterns, particularly the lexico-semantic abilities among children which retards their communicative abilities. This study aims to evaluate the lexical-semantic aspects of spoken language in preschool-aged children with ASD. The methodology involved assessing both expressive and receptive vocabulary using a specific evaluation method. The sample consisted of 35 children with ASD, aged 3 to 7 years. The results indicated variance in lexical-semantic capabilities, with some children showing high proficiency and others showing lower levels. Early intervention programs, particularly those that are individualized and intensive, have been shown to significantly improve language outcomes. Such interventions should focus on both expressive and receptive vocabulary, incorporating evidence-based practices such as Applied Behavior Analysis (ABA) and other speech and language therapy techniques. Additionally, the findings suggest that continuous monitoring and adaptive strategies are essential to cater to the diverse range of lexical-semantic abilities in children with ASD.

Keywords: Autism Spectrum Disorder (ASD), Preschool Aged Children, Language Disorder, Lexical Aspect of Spoken Language, Semantic Aspect of Spoken Language.

Introduction

Autism Spectrum Disorder (ASD) is a developmental neurological disorder that affects an individual's thinking, perception, and attention to the environment, as well as social skills and behaviour. Over the past

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hundred years, various terms have been used with extensive research conducted to describe ASD and understand different levels of this disorder, particularly among children; however, difficulties are faced in providing a common description of ASD. It is defined differently such as childhood autism, atypical autism, Asperger syndrome, non-specific developmental pervasive disorder, Rett syndrome, or child psychosis. The number of children with ASD is increasing worldwide. Before 1980, children with ASD in Asia averaged 1.9 in 10,000; which rose to 14.8 between 1980 and 2010 (Sun & Allison, 2010). In March, 2022, World Health Organization (2018) reported that ASD occurred 1 in 100 children, which is an alarming situation (Mason et al., 2022). However, a few studies believe that the actual numbers can be much higher (Masi et al., 2017); as the methodologies used in defining ASD and the level of competence of specialists, the ASD prevalence can vary widely. In addition, the number of ASDs in low- and middle-income countries is unknown. In the Republic of Kazakhstan, the Republican Scientific and Practical Centre for Mental Health of the Ministry of Health reports that the number of children registered with ASD in Kazakhstan in 2018 was 4707; in 2019 it rose to 5193 cases; in 2020 it was 6771; and in 2021, this number was 8796 (Kurmanalina et al., 2024). The domain of ASD has been widely researched in Kazakhstan in recent years (Eleusizova, 2024; Kosherbayeva et al., 2024; Kozhageldiyeva et al., 2023; Telzhan, 2023).

Language impairment is a distinguishing symptom in children with ASD, manifest in different language patterns, with unimpaired language condition very rare (Anderson et al., 2007; Pickles, Anderson, & Lord, 2014). It is a common understanding that most of the lexico-semantic ability tasks should be developed among children with ASD during their school age, prior to they reach a high level of adolescence or adulthood. If lexico-semantic aspect of language is ignored in children with ASD, it minimizes their communicative abilities and, consecutively, makes complicated their adaptation to society. These disorders also complicate children's emotional development, making it difficult to socialize and educate them (Baenskaya & Liebling, 2001).

Previous studies have shown mixed results regarding lexical-semantic impairments in children with ASD, with some suggesting significant difficulties and others indicating relatively preserved skills. There is no consensus about the impact of ASD on lexical and semantic aspect of spoken language in children. A few studies even deny that children with ASD may have impairments in expressing the lexical-semantic aspect of spoken language (Bashina, 1993; Nikolskaya, Baenskaya, & Liebling, 2007; Peeters, 2002). In such a state, it remains poorly understood how the lexical-semantic process occurs, especially in children with ASD of preschool age; hence this domain remains underexplored. Very little research has been done in this direction and a need is felt to examine spoken language development among preschool-aged children with ASD (Charman et al., 2003; Jimenez et al., 2021; Luyster et al., 2008; Rescorla & Safyer, 2013; Sukenik & Tuller, 2023). This study aims to address this gap by evaluating the expressive and receptive vocabulary of preschool-aged children with ASD, providing insights into their language development and informing early intervention strategies.

Literature Review

The International Classification of Diseases for Mortality and Morbidity Statistics, 11th Revision, 2022 (ICD-11) defines ASD as "persistent deficits in the ability to initiate and to sustain reciprocal social interaction and social communication" (World Health Organization, 2018). When these deficits attain severity, they cause distress or impairment in personal, family, social, educational, occupational, or other important areas of functioning. Explicitly, the ASD occurs typically in early childhood, but symptoms become manifest only when social demands exceed limited capacities. The ASD are also often termed as "mental, behavioural or neurodevelopmental disorders" (Dhia, 2023; Eleusizova, 2024; Llorent, Seade-Mejía, & Vélez-Calvo, 2023), which are syndromes characterized by clinically significant disturbance in an individual's cognition, emotional regulation, or behaviour that reflects a dysfunction in the psychological, biological, or developmental processes that underlie mental and behavioural functioning (Ahtam, Braeutigam, & Bailey, 2020; Al-Qudah, 2023).

The growing importance of ASD in the medical, pedagogical, and social areas is due to the research being carried out to ascertain its precise diagnosis, understand its specific symptoms and stop its increased prevalence. It is known that about 25-30% of children with ASD can speak with minimal verbality, using single words and regular expressions to communicate with people (Pickles et al., 2014; Sibuea et al., 2022; Tager-Flusberg & Kasari, 2013). Even with early intervention of correctional-developmental work, there are significant impairments in the expressive language of children with ASD, particularly in the lexico-semantic aspect of spoken language (Alqhazo, Hatamleh, & Bashtawi, 2020; Battaglia, 2012; Hartley & Allen, 2015; Henderson, Clarke, & Snowling, 2011; Lo et al., 2013; Naigles et al., 2013; Singh & Harrow, 2014). It is consistent with the findings of the Austrian psychologist Frith (1989), who claimed that the difficulties in the ability of children with ASD to acquire language are not related to the phonetic and syntactic domain but to the lexico-semantic domain, which provides the ability to understand language and its meaning. The ability to communicate is explained by the level of pragmatism associated with the ability to use for communicative purposes. Such a language impairment is certainly a big issue that needs to be solved.

In terms of lexico-semantic abilities, studies like Fein (1996) and Tager-Flusberg et al. (1990) have found that children with ASD, like normal children, have a predominance of nouns in their vocabulary in childhood. Rescorla & Safyer (2013) found that 57 most used words by children with ASD are mainly nouns of different semantic categories, which significantly overlap in children with ASD compared to normally developing children. Eigsti, Bennetto, & Dadlani (2007), too, observed that children with higher functional ASD could understand and pronounce as many words as their peers. Swensen et al. (2007) concluded that when learning a new word, children with ASD remember the new word by matching it to an object, just as their typically developing do. Thus, the first words of children with ASD mostly refer to nouns.

One of the first researchers who studied conceptual and semantic development in children with ASD was Tager-Flusberg (1985), who showed that children with ASD could correctly place animals, food and objects, which are basic identification skills. Similarly, Mundy et al. (1987) showed in their research that no significant differences were found in the ability to classify objects by function, physical shape and colour between age-appropriate mentally developing children and children with ASD. Such results demonstrate that children with ASD have a certain level of cognitive processing that enables them to acquire new knowledge and skills, albeit with some difficulties.

However, on the contrary, a few researchers claimed that the lexical-semantic aspect of spoken language in children with ASD is not impaired (Begeer et al., 2014; Bowler, Limoges, & Mottron, 2009; Cantiani et al., 2016; Ellawadi, Fein, & Naigles, 2017; Fiebelkorn et al., 2013; Parejo Llanos & Cortón de las Heras, 2023; Speirs et al., 2011). It was postulated that difficulties in word comprehension in children with ASD are not due to impaired lexico-semantic composition, but due to late development. Barone et al. (2019) found no significant differences in eleven semantic categories (animals, vehicles, toys, food and drink, clothing, body parts, furniture and rooms, household items, foreign objects, people and actions) between normal children and children with ASD of preschool age. In some cases, the group of children with ASD showed a higher rate of vocabulary growth.

While the studies cited above show that children with ASD have age-appropriate lexical-semantic skills, other studies point to existing signs of these lexical-semantic impairments. For example, Dunn, Gomes, & Sebastian (1996) found that children with ASD give fewer prototypical responses in the fluency task than normal children matching their mental age. Kamio et al. (2007) conducted a language study using a categorical induction task for elementary school-aged children with ASD. These children cannot form other phrases for the same pattern (e.g., rabbit eats grass) in the category(s). Similarly, Gastgeb et al. (2012) compared children with ASD with normally developing children, classifying them by functional ability, age and IQ. Participants were asked to identify as quickly and accurately as possible the category to which the item depicted in the picture belonged. The results showed that children with ASD were significantly slower in categorizing non-daily pictures.

Studies have also recommended the use of scientific concepts to determine the lexical-semantic aspect of the spoken language of children with ASD. For instance, a few studies have used neuron correlations during the conversational process and recommend utilizing the electroencephalography (EEG) method in determining the lexical-semantic aspect of the spoken language of children with ASD (Cantiani et al., 2016; Maenner et al., 2020; Sharma & Thakur, 2022; Zeidan et al., 2022). Event-related potentials of brain can be measured with EEG. Similarly, ERP applications can be utilized to measure synchronized postsynaptic activity of large groups of neurons in the brain (Akula & Singh, 2022; DiStefano, Senturk, & Jeste, 2019; Worrachananun, 2022). This reflects the cognitive process in response to an irritating stimulus. In other words, it is responsible for the semantic aspect of words. Research has shown that in children with ASD, basic perception, although relatively preserved, is impaired in information processing, including lexical-semantic functions. This suggests that studying the language development and cognitive abilities of children with ASD can be compared to the process of software optimization, where high-quality development and information processing play a crucial role in the overall growth of the industrial personnel (Karamanyants). Just as cost optimization in software production using artificial intelligence helps increase efficiency and reduce expenses (Karamanyants, 2023b), precise and effective teaching methods can significantly enhance the language development of children with ASD, leading to more productive outcomes with minimal resource expenditure.

Methodology

Research Design

The study utilized the methodologies of N.V. Serebryakova and L.S. Solomokhova for assessing the quantity and quality of active and passive vocabulary of children with ASD. These methodologies ideally suit the evaluation of lexico-semantic capabilities of children with ASD, as they categorize children into high, medium, and low levels based on their scores. The research was carried out in accordance with the legal and ethnic requirements of all individuals involved in the research work. Informed consent was obtained from the parents or legal guardians of all individual participants with whom the research was conducted.

The study was conducted at the Asyl Miras Autism Centre in Kazakhstan, over participants diagnosed with ASD. There are 10 centres functioning since 2015 all over the country where more than 15,000 children receive fully free expert assistance. «Asyl Miras» Autism Centre operate in accordance with six programs aimed at identifying ASD and eliminating deficits in social, speaking, and domestic skills like social skills, speaking skills, early support, learning skills, life skills and an intensive course. Classes are taught using technology developed by international experts at the University of California and the Marcus Autism Centre in Atlanta, USA. While the centre uses M-Chat, ADOS-2 (The Autism Diagnostic Observation Schedule), OSU techniques for diagnosing child, it uses ABLLS-R (Assessment of basic language and learning skills), JASPER techniques for assessing child's abilities. They implement ABA (Applied Behaviour Analysis), VBA (Verbal Behaviour Analysis), Jasper, MCPP as an intervention program. Each child undergoes a three-month cycle of training in accordance with an individually chosen program.

Sampling

The sample of the study comprised 35 participants suffering from ASD, out of which 30 were males and 5 females; 32 of them were Kazakh-speaking, and 3 Russian-speaking. The age of participants ranged from 3 years 3 months to 6 years 11 months. The Psychological-Medical-Pedagogical Council (PMPC) diagnosed these children as having autism spectrum disorders, in accordance with normative legal acts of the Government of the Republic of Kazakhstan, Ministries of Education and Science, Healthcare, Labour and Social Protection of the Republic of Kazakhstan. These government agencies establish the right to support children with special educational needs through social and psychological-medical-pedagogical correction, determine the type of special educational programs, carry out diagnostics of mental and physical development disorders with the aim of sending them to educational organizations, and diagnose the children with special educational needs.

Data Collection

A few surveys like ADOS-2, OSU and M-CHAT-R/F for parents were used. The scales like VB-MAPP, ABLLS-R, JASPER, based on ABA (Applied Behaviour Analysis) were implemented to determine the level of children with ASD. Besides, the methodology of N.V. Serebryakova and L.S. Solomokhova adopted for this study helped in determining the lexico-semantic aspect. These methodologies recommend treating incorrect responses in the lexico-semantic assessment similarly to no responses, and attributed all scores into high, medium, and low categories based upon established psychometric principles. The High category scores fall between 160 – 108, the Medium category between 107 – 54, and the Low category between 53 – 0. To enhance clarity, a passive vocabulary assessment was also conducted by presenting children with specific arrays of pictures, and they were instructed to "point to" rather than "show" items, ensuring precision in evaluating comprehension. This modification addresses the method of interaction with the assessment materials more accurately.

Materials

The methodology of N.V. Serebryakova and L.S. Solomokhova was used to determine the quantity and quality of vocabulary. These methodologies helped to reveal the lexico-semantic aspect of the spoken language of preschool aged children with ASD. Figure 1 exhibits the technique which determines the quantity and quality of active and passive vocabulary.

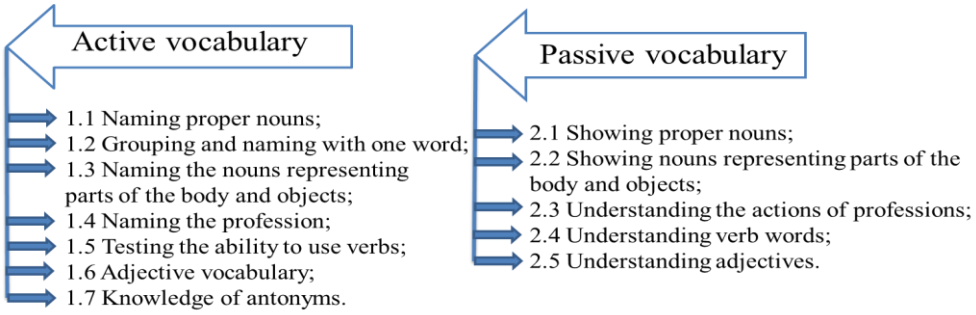

Figure 1: *Sections of the Methodologies for Determining the Quantity and Quality of Passive and Active Vocabulary of N.V. Serebryakova, L.S. Solomokhova.*

For each section, a child was given 2 points if he/she answered satisfactorily; 1 point if he/she answered with the help of the teacher or if he/she is delayed for a long time; 0 points if he/she did not answer at all. Each participant could score a maximum of 160 points. The scores in each category comprised High 160 - 108 points, Medium 108-54 points, and Low 54-0 points. The score distribution in each section required the following criteria:

Active Vocabulary

1.1 Can score a maximum of 30 points for "naming proper nouns". Must name 15 things;
1.2 Can score a maximum of 18 points for "grouping and naming with one word". Must name a group of things with one word. Nine words in total;
1.3 Can score a maximum of 8 points for "naming the nouns representing parts of the body and objects". Must name parts of four objects;
1.4 Can score a maximum of 6 points for "naming the profession". Must name three professions;
1.5 Can score a maximum of 8 points for "testing the ability to use verbs". Must answer four questions using verbs;
1.6 Can score a maximum of 18 points for the "adjective vocabulary". Must name nine different colours and shapes;
1.7 Can score a maximum of 10 points for the "knowledge of antonyms". Must name five pairs of antonyms.

Passive vocabulary

2.1 Can score a maximum of 30 points for "showing proper nouns". Must show 15 things. Must be asked questions as "Where is a doll, bear, table, etc.?";
2.2 Can score a maximum of 8 points for "showing nouns representing parts of the body and objects". Must show parts of 4 objects;
2.3 Can score a maximum of 6 points for "understanding the actions of professions". Must show 3 different professions;
2.4 Can score a maximum of 10 points for "understanding verb words". Must understand and show 5 verbs. Must be asked questions as "Who moved?" Who hit? Who ran? and so on.";
2.5 Can score a maximum of 8 points for "understanding adjectives". Must show 4 different adjectives.

Results

The age of children with ASD was an important factor in conducting experiments. Table 1 presents the age range of participants, all of whom were of pre-school age, between 3 and 7 years.

Table 1: *The Age Range of Children with ASD who Participated in the Experiment.*

Age range	Actual age presented by (year, month) (number of children of the same age)	Average age presented by year, month	Total number
3-4 years old	3, 3	3 years 3 months	1
4-5 years old	4, 1; 4, 2; 4, 4(2); 4, 5(3); 4, 6; 4, 7(4); 4, 8; 4, 10(3)	4 years 4 months	16
5-6 years old	5, 4(3); 5, 7(2); 5, 10(2); 5, 11	5 years 3 months	8
6-7 years old	6, 2; 6, 4; 6, 7; 6, 9(2); 6, 10(4); 6, 11	6 years 3 months	10
Total			35

Using diagnostic methods (M-CHAT-R/F, ADOS-2, OSU), we determined the abilities of children with ASD and divided them into 3 groups: high functional (9), medium (15), and low level (11). Table 2 presents the following findings according to the methodology of N.V. Serebryakova, L.S. Solomokhova to identify the semantic and lexical aspect of the spoken language of preschool aged children with ASD.

Table 2: *Results determining the semantic and lexical aspect of spoken language of preschool aged children with ASD* (based on of indicator N. V. Serebryakova and L. S. Solomokhova's techniques).

Levels	Scores	Total number	Number of children with ASD aged			
			3-4 years	4-5 years	5-6 years	6-7 years
High	Between 160 – 108	8	0	1	2	5
Medium	Between 107 – 54	11	0	2	5	4
Low	Between 53 – 0	16	1	13	1	1
Total		35	1	16	8	10

In each of the levels, children with ASD showed the following indicators in each age group presented in Figure 2 for 4-5 years, in Figure 3 for 5-6 years and in Figure 4 for 6-7 years. The number of children with ASD was only one in the age group 3-4 years old. The child showed the lowest score (0 points).

Children with ASD at the age of 4-5 years

High level (160-108 points)

Only 1 child of this age group was able to get the maximum score of 160. The child showed a mild degree of autism spectrum disorder. The child could understand the orders and tasks given to him by the teacher and fully carried them out. Suitable for his age in counting, pronouncing the sounds, distinguishing colours,

and shapes names. He could form sentences, as he had a vocabulary of about 400. He used verbs to form sentences. He could group things and name with one word. He named objects by showing its parts. He knew antonym words, as he knew general features of an object. As he was interested in the environment, he knew the names and understood basic functions of professions. When he behaved negatively (failing to complete the task, getting up), he completed the task if he was told "now we will complete this task and then we will rest". In general, the child's vocabulary increased in acquaintance with the world and could distinguish semantic aspects of words in speaking.

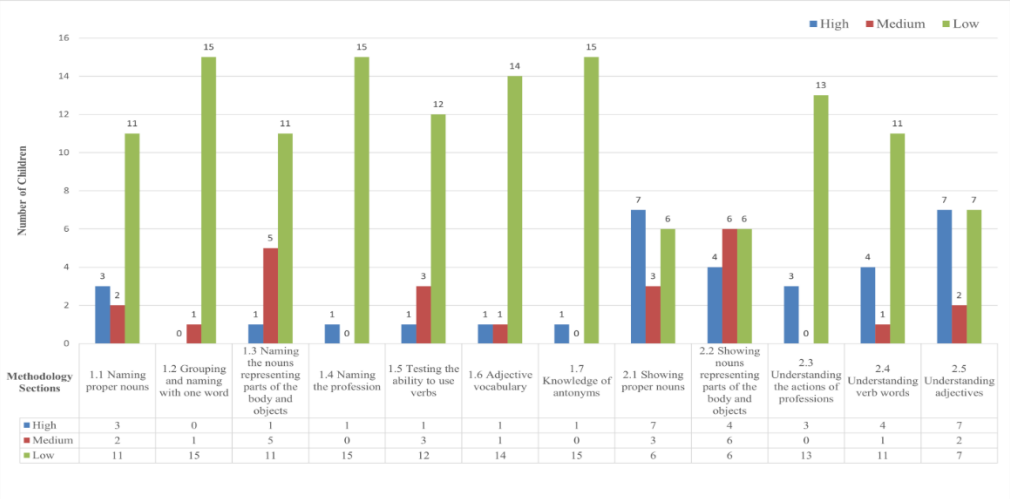

Figure 2. *The Results of Children with ASD at the Age of 4-5 Years (16 Children)*

Medium level (107-54 points)

The number of those who received a medium score when determining the lexical and semantic aspect of children with ASD of 4-5 years was two. According to the active vocabulary, children could name words from the nouns - favourite foods (apple, banana) and words of everyday use: car, phone, toy. Because, through these things he established a connection with the environment, with parents. As he had pets (dog, cat) at home, he immediately recognized them and named the pets. However, pets should match both in type and colour with the pet in the child's home. If the colour and type are different, he would start to think. He could show and name objects that were daily present in the house (chair, table). As for clothes, child did not know names of clothes because their parents dressed them. Nevertheless, he could show and distinguish by hand.

In naming things with one word, he could say "phones," which he used every day, "apples," "bananas," which were his favourite fruits, and "cars," because he was interested in toy cars. However, he could not group and name other things even if he saw them. In naming objects and body parts a child could name 3 parts of the body (head, arms, legs. As he was interested in toy cars, he could distinguish "steering wheel", or "wheel". The "steering wheel" was although not a visible toy part, he could name steering wheel by pointing with the hand, as a child had seen parents driving a car and had touched the steering wheel. According to the passive vocabulary, he could point with hands to human body parts (head, arms, legs, nose, hair), car parts (steering wheel, wheel, mirror, door), clothing parts (sleeve, zipper). Child even showed steering wheel and zipper with actions.

From antonyms child knew the word "many-little" only in passive form. He distinguished between large and small quantities of things that he needed (candy, toys, toy cars) by visually seeing them. The child did not know the names of professions and could not even distinguish them. When using verbs, he used the words "drank", "sat" and often the phrases "yum-yum" (to eat), "top-top" (run), "hop-hop" (clap). He showed gestures to explain verbs for taking a phone or toy or going to the bathroom.

In relation to adjectives, he could show and name that the objects "ball", "sphere" was "round", the objects "table", "window" was of "rectangular" form. He could also show and name “blue” and “green” colours by pointing to the objects of these colours in the room. Regarding passive vocabulary, he would think for a long time when it comes to showing "yellow" and "red" objects.

Low level (54-0 points)

The number of children with ASD of 4-5 years who scored low when determining the lexico-semantic aspect was thirteen, five of them beat themselves and cried as an act of bad behaviour. It was difficult to communicate with them. Therefore, ABA therapy helped to eliminate their negative behaviour. In communicating with the environment, they came into contact by crying, shouting, taking their own needs without permission. They might get angry while doing the task, and sometimes when they could not get what they needed, they said "Mom, give me the phone!", "Put the food down!" or would curse. Even though a child

says these words with understanding, you should not make children with autism say these words. Although speaking these words is a "momentary joy" for parents, "my child has spoken", it can be considered as "hope" that can be expressed through pedagogical, psychological corrective and developmental work with children with autism.

Although children with ASD between the ages of 4-5 at a low level do not have negative behaviour, there was only one child with a minimal level program. He needed adult help for moving, holding objects, serving himself because he had weak fine and gross motor skills. He tried to move objects, toys, because he was interested in his surroundings. He understood the words referred to him if people pointed to him. For example, if someone said "sit" and pointed to a chair, he would sit; or when he was shown to take things out of the box, he would do so. However, the child had only one or two sounds: a laugh, and a smile. By doing like that, he communicated with the people around him. He scored 0 points from the method of determining the lexical-semantic aspect of spoken language.

Out of 13 children, seven scored low on the determination of the lexical-semantic aspect of spoken language of children with ASD aged 4-5 years with a more passive vocabulary than an active one. They could differentiate between daily objects (transport, telephone, TV, clothes) and their favourite foods (apples, candy). They could distinguish pets (dog, cat), toys in passive vocabulary. Although they could distinguish shapes and colours, they did not know their names. They also did not know antonyms because they had a small vocabulary and did not know the features of things. They could name only one part of the body (head or hand with stimulation). They also could not group things and say with one word. The ability to use names of professions and verbs was also not noticed.

Children with ASD at the age of 5-6 years

High level (160-108 points)

Only 2 children of this age group were able to score the highest points (126, 128). These two children showed high levels in naming proper nouns. They knew numbers, letters because of the ability to distinguish objects, they could group and name things with one word. They could group the names of foods (vegetables, fruits), eating utensils (spoons, glasses), daily items (cars, clothes), toys, and sweets. Even though they knew the features of things, they did not know antonyms.

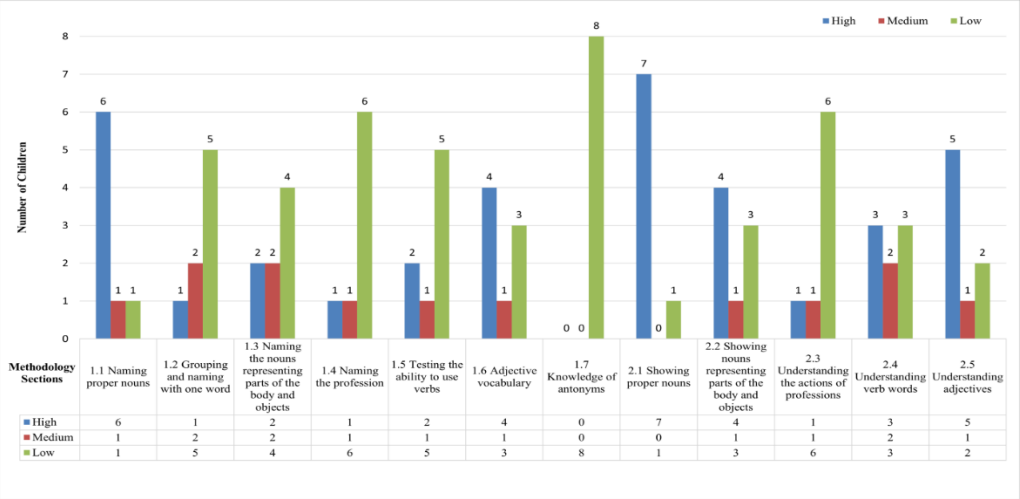

Figure 3: *The Results of Children with ASD at the Age of 5-6 Years (8 Children)*

They could distinguish the weather, by looking at nature. As they knew the weather, they knew what clothes to wear according to weather as well as the names and parts of clothes (arms, sleeves, buttons, and laces). Although they could tell the parts of the car and body, the y could only show the parts of seat and closet.

According to the method of determining the lexical-semantic aspect of spoken language of children with ASD of 5-6 years, the child with a score of 126 could distinguish and say "teacher" and "singer" by profession. The child liked to listen to slow songs, but not dynamic ones. Therefore, he knew about profession “singer”. However, he became restless at noisy, large concerts as well as was afraid of a loud voice. He did not know other professions (police, doctor). A child with autism of 5-6 years, with a score of 128, could use verbs. He could tell what he did at home, how he rested on vacation. Sometimes he could use future tense suffixes to say what he would do today. Children of 5-6-years with autism who scored 126 and 128 also could show and name adjectives. That is, they could show and name red, blue, yellow, round, square objects in the room and in nature.

Medium level (107-54 points)

There were 5 children who could score at medium level. Although children in this group scored high on nouns, they scored low on grouping things and naming them with one word. They could distinguish objects and body parts, understand, and show certain parts of an object (car, chair, clothes). They could not distinguish between antonyms and names of professions. Although the level of verb use was low, they could see and distinguish certain actions (child's crying, running, standing). According to the method of determining the lexical-semantic aspect of spoken language of children with autism aged 5-6 years who could use adjectives, 4 out of 5 children of the medium level could use them. Only one child who scored 77 points could not distinguish between colours and shapes.

Low level (score 53-0)

According to the method of determining the lexical-semantic aspect of the spoken language of children with ASD aged 5-6 years, only 1 child scored at a low level, even though he was 5 years and 11 months old. He did not have bad behaviour. As he was not interested in the environment, food, toys, and phones, while he repeated the words, he did not understand their meaning and pronounced in a vague manner. A lot of effort was needed to teach him speaking skills.

Children with ASD at the age of 6-7 years

High level (160-108 points)

There were 5 children who could score the highest level. At this level, they used nouns correctly. They could correctly use words in composing short sentences. One child (who scored 142) was stubborn and played with the teacher and named nouns, replaced them with other words on purpose. The other one (who scored 140 points) behaved negatively (failed to complete the task, reluctant to complete the task, cried and grinded) and manipulated the teacher and parents to get what he needed.

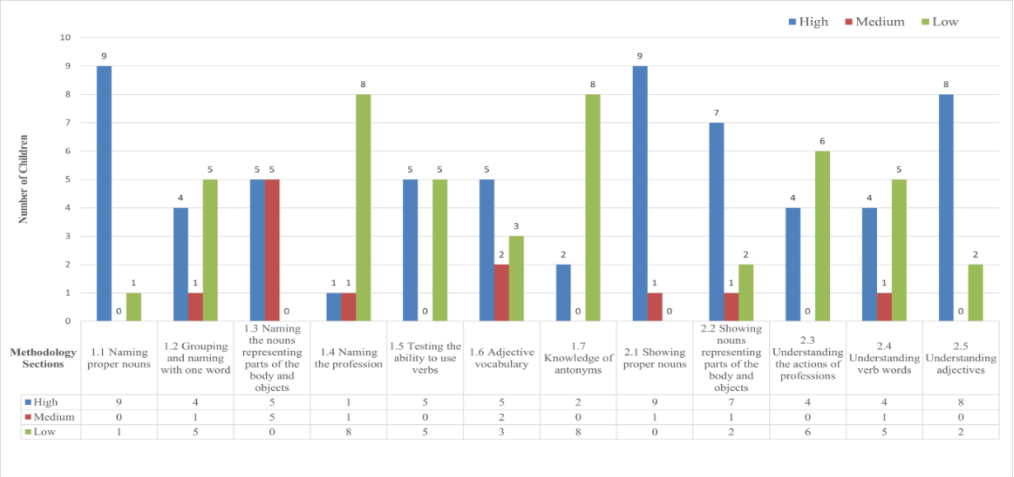

Figure 4: *The Results of Children with ASD at the Age of 6-7 Years (10 Children).*

In grouping and naming words with one word, only four children with ASD aged 6-7 years were able to score the highest score. They could add plurals to nouns and distinguish that there were many things. Only one child did not know how to group and name. They could name parts of objects and body by pointing, as they had a large vocabulary. They could brush their teeth, tell that the tooth was part of the body. Two children of the high level category knew that the belly was a part of the body, because they had a severe stomach-ache and ended up in the hospital.

According to the methodology for determining the lexico-semantic aspect of the spoken language of children with ASD aged 6-7 years, two of the high-level group could distinguish antonyms. This was because when performing tasks, they knew that things were heavy - light, little - a lot, long - short. They could express them in words. As they could distinguish emotions, they knew that crying and rejoicing were opposite terms.

Since the father of a child who scored 158 of the high-level group aged 6-7 years, was a police officer, he could differentiate "police" profession. In addition, he was familiar with the professions: "doctor", and "teacher". The children with ASD at this level also used adjectives as good as nouns.

Medium level (107-54 points)

There were 4 children who were able to score at medium level. Although children in this group knew nouns like children with high-level ASD, they did not use the plural suffixes in their vocabulary. Only one of

them could group the names of things they used every day (spoons, toys) and that could be found in large quantities (candy, apples). In naming the parts of objects and body and using adjectives, they were at the same level with the children of high level. After all, middle-level children were expanding their information about the surrounding world. Participation in family gatherings, going to public places, being in the hospital expanded their vocabulary. Although they did not use verbs, they could distinguish between pictures and the actions of people around them. While answering the questions, as "Who sat down? Who stood up? Who cried? Who lied? Who ate?" they could show the picture of a person or the person who made the action. However, one child scored 0 when it came to using names of professions and antonyms.

Low level (53-0 points)

Only one child of the 6-7-year-old children with ASD showed a low level of active and passive vocabulary according to the method of determining the lexical-semantic aspect of the spoken language. The child's age was 6 years and 10 months. This was the oldest child who took part in the experiment in determining the lexical-semantic aspect of the spoken language of preschool aged children with ASD. This child shouted to show bad behaviour. He had low interest in the surrounding and had stereotypical behaviour. It was hard to communicate with him.

Discussion

The findings of the study indicate a diverse range of lexico-semantic capabilities among preschool-aged children with ASD, underscoring the heterogeneity within this group. A progression in lexico-semantic proficiency with age was observed, suggesting that, contrary to some prior assumptions, the lexico-semantic aspect of language in children with ASD may not be inherently impaired but can develop over time, especially with targeted intervention. Comparing these results with existing literature reveals both consistencies and discrepancies. Consistent with previous studies (Eigsti et al., 2007; Tager-Flusberg, 1985; Tager-Flusberg & Kasari, 2013), our findings affirm that children with ASD can demonstrate competencies in lexico-semantic tasks, challenging the notion of a universal lexico-semantic impairment within this population. However, our observation of an age-related improvement in lexico-semantic skills diverges from some earlier reports suggesting stable lexico-semantic difficulties (Dunn et al., 1996; Kamio et al., 2007). This discrepancy might be attributed to differences in the age ranges studied, methodologies employed, or the intensity of interventions received, highlighting the complexity of lexico-semantic development in ASD.

The variation in lexico-semantic abilities observed across age groups in the current study underscores the importance of early and individualized intervention strategies. The fact that children in the older age groups demonstrated more advanced lexico-semantic skills reinforces the potential impact of early, intensive corrective work, as practiced at the Asyl Miras Autism Centre. This finding is aligned with the broader literature advocating for early intervention in ASD, which suggests that tailored, early intervention can significantly influence developmental trajectories (Anderson et al., 2007; Luyster et al., 2008). However, the current study also highlights the need for a nuanced understanding of the lexico-semantic abilities of children with ASD. The observed range of abilities suggests that interventions must be personalized, considering the individual's existing lexico-semantic skills, to effectively support their language development.

This study contributes to the domain of linguistic studies by providing empirical evidence on the variability and development of lexico-semantic abilities in preschool-aged children with ASD. It is grounded in linguistic theories such as the lexical hypothesis and semantic network theory, and references empirical studies by researchers like Eigsti et al. (2007) and Tager-Flusberg & Kasari (2013), who have explored language development in ASD. This theoretical and empirical framework underscores the importance of understanding the unique language development trajectories in children with ASD and supports the need for individualized intervention approaches.

Conclusion

Analysing the results of methodology of N.V.Serebryakova and L. S.Solomokhova, to determine the quantity and quality of passive and active vocabulary as well as to examine the lexical-semantic aspect of spoken language of preschool aged children with ASD, following conclusions were drawn. First, the lexical-semantic aspect of spoken language of preschool aged children with ASD is not impaired. This is due to the fact, that with the early intensive corrective work with a child with ASD, he gets to know his environment and increases his vocabulary. Second, the Asyl Miras Autism Centre when conducting corrective work had a great impact on the cognitive abilities of a child with ASD, especially on language development, by taking a child to play in nature, visit public places (supermarket, play centre), conducting a lesson through visual aids, constantly repeating words used in real life, and using ABA as a corrective method. Third, through awareness of the lexical-semantic aspect of words, children express their thoughts, desires to the external environment. These processes provide a great opportunity for further socialization of children with ASD.

In general, this study contributes to the understanding of lexical-semantic development in preschool-aged children with ASD, highlighting the variability and potential for improvement with early intervention. The findings underscore the importance of tailored intervention strategies to support language development in this population. Future research should focus on refining these interventions and exploring their long-term impact on language and social outcomes for children with ASD.

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Conflict of interest

There were no misunderstandings with teachers and parents and other persons in the research base during the research work and preparation of the article.

References

Ahtam, B., Braeutigam, S., & Bailey, A. (2020). Semantic processing in autism spectrum disorders is associated with the timing of language acquisition: A magnetoencephalographic study. *Frontiers in Human Neuroscience, 14*, 267. doi: https://doi.org/10.3389/fnhum.2020.00267

Akula, S. C., & Singh, P. (2022). Role Of Women Decision Making And Women's Mobility In The Relationship Between Microfinance Availability And Women Entrepreneurship Adoption. *The Journal of Modern Project Management, 10*(2), 206-217. Retrieved from https://journalmodernpm.com/manuscript/index.php/jmpm/article/view/532

Al-Qudah, F. Z. (2023). Analysis of Stress Assignment Patterns of Standard Arabic within the Optimality Theory Framework. *Eurasian Journal of Applied Linguistics, 9*(2), 246-257. Retrieved from https://ejal.info/menuscript/index.php/ejal/article/view/579

Alqhazo, M. T., Hatamleh, L. S., & Bashtawi, M. (2020). Phonological and lexical abilities of Jordanian children with autism. *Applied Neuropsychology: Child, 9*(2), 116-124. doi: https://doi.org/10.1080/21622965.2018.1534690

Anderson, D. K., Lord, C., Risi, S., DiLavore, P. S., Shulman, C., Thurm, A., et al. (2007). Patterns of growth in verbal abilities among children with autism spectrum disorder. *Journal of Consulting and Clinical Psychology, 75*(4), 594-604. doi: https://doi.org/10.1037/0022-006x.75.4.594

Baenskaya, E. R., & Liebling, M. M. (2001). *Psychological Assistance for Early Disorders of Emotional Development*. Moscow: Polygraph.

Barone, R., Spampinato, C., Pino, C., Palermo, F., Scuderi, A., Zavattieri, A., et al. (2019). Online comprehension across different semantic categories in preschool children with autism spectrum disorder. *PloS One, 14*(2), e0211802. doi: https://doi.org/10.1371/journal.pone.0211802

Bashina, V. M. (1993). *Early Childhood Autism*. Moscow: Almanac.

Battaglia, D. (2012). *Word Association and Semantic Priming in Individuals with Autism Spectrum Disorders* (Doctoral Dissertation, City University of New York). Retrieved from https://www.proquest.com/openview/e7cec450bba83a361da7f14717080e21

Begeer, S., Wierda, M., Scheeren, A. M., Teunisse, J.-P., Koot, H. M., & Geurts, H. M. (2014). Verbal fluency in children with autism spectrum disorders: Clustering and switching strategies. *Autism, 18*(8), 1014-1018. doi: https://doi.org/10.1177/1362361313500381

Bowler, D. M., Limoges, E., & Mottron, L. (2009). Different Verbal Learning Strategies in Autism Spectrum Disorder: Evidence from the Rey Auditory Verbal Learning Test. *Journal of Autism and Developmental Disorders, 39*(6), 910-915. doi: https://doi.org/10.1007/s10803-009-0697-4

Cantiani, C., Choudhury, N. A., Yu, Y. H., Shafer, V. L., Schwartz, R. G., & Benasich, A. A. (2016). From Sensory Perception to Lexical-Semantic Processing: An ERP Study in Non-Verbal Children with Autism. *PloS One, 11*(8), e0161637. doi: https://doi.org/10.1371/journal.pone.0161637

Charman, T., Baron-Cohen, S., Swettenham, J., Baird, G., Drew, A., & Cox, A. (2003). Predicting language outcome in infants with autism and pervasive developmental disorder. *International Journal of Language & Communication Disorders, 38*(3), 265-285. doi: https://doi.org/10.1080/1368203100001048 30

Dhia, A. (2023). Redesigning Organizational Learning and Development Programs: Challenges, Trends, and the New Norm. *International Journal of Construction Supply Chain Management, 13*(1), 289-301. Retrieved from https://ijcscm.com/menu-script/index.php/ijcscm/article/view/224

DiStefano, C., Senturk, D., & Jeste, S. S. (2019). ERP evidence of semantic processing in children with ASD. *Developmental Cognitive Neuroscience, 36*, 100640. doi: https://doi.org/10.1016/j.dcn.2019.100640

Dunn, M., Gomes, H., & Sebastian, M. J. (1996). Prototypicality of responses of autistic, language disordered, and normal children in a word fluency task. *Child Neuropsychology, 2*(2), 99-108. doi: https://doi.org/10.1080/09297049608401355

Eigsti, I.-M., Bennetto, L., & Dadlani, M. B. (2007). Beyond Pragmatics: Morphosyntactic Development in Autism. *Journal of Autism and Developmental Disorders, 37*(6), 1007-1023. doi: https://doi.org/10.1007/s10803-006-0239-2

Eleusizova, N. (2024). Social adaptation assistance for children with autism spectrum disorders in Kazakhstan. *International Journal of Developmental Disabilities*, 1-9. doi: https://doi.org/10.1080/20473869.2024.2385596

Ellawadi, A. B., Fein, D., & Naigles, L. R. (2017). Category structure and processing in 6-year-old children with autism. *Autism Research, 10*(2), 327-336. doi: https://doi.org/10.1002/aur.1652

Fein, S. (1996). Effects of Suspicion on Attributional Thinking and the Correspondence Bias. *Journal of Personality and Social Psychology, 70*(6), 1164-1184. doi: https://doi.org/10.1037/0022-3514.70.6.1164

Fiebelkorn, I. C., Foxe, J. J., McCourt, M. E., Dumas, K. N., & Molholm, S. (2013). Atypical category processing and hemispheric asymmetries in high-functioning children with autism: Revealed through high-density EEG mapping. *Cortex, 49*(5), 1259-1267. doi: https://doi.org/10.1016/j.cortex.2012.04.007

Frith, U. (1989). *Autism: Explaining the Enigma*. Oxford: Blackwell Publishing.

Gastgeb, H. Z., Dundas, E. M., Minshew, N. J., & Strauss, M. S. (2012). Category Formation in Autism: Can Individuals with Autism Form Categories and Prototypes of Dot Patterns? *Journal of Autism and Developmental Disorders, 42*(8), 1694-1704. doi: https://doi.org/10.1007/s10803-011-1411-x

Hartley, C., & Allen, M. L. (2015). Symbolic Understanding of Pictures in Low-Functioning Children with Autism: The Effects of Iconicity and Naming. *Journal of Autism and Developmental Disorders, 45*(1), 15-30. doi: https://doi.org/10.1007/s10803-013-2007-4

Henderson, L. M., Clarke, P. J., & Snowling, M. J. (2011). Accessing and selecting word meaning in autism spectrum disorder. *Journal of Child Psychology and Psychiatry, 52*(9), 964-973. doi: https://doi.org/10.1111/j.1469-7610.2011.02393.x

Jimenez, M. P., DeVille, N. V., Elliott, E. G., Schiff, J. E., Wilt, G. E., Hart, J. E., et al. (2021). Associations between Nature Exposure and Health: A Review of the Evidence. *International Journal of Environmental Research and Public Health, 18*(9), 4790. doi: https://doi.org/10.3390/ijerph18094790

Kamio, Y., Robins, D., Kelley, E., Swainson, B., & Fein, D. (2007). Atypical Lexical/Semantic Processing in High-Functioning Autism Spectrum Disorders without Early Language Delay. *Journal of Autism and Developmental Disorders, 37*(6), 1116-1122. doi: https://doi.org/10.1007/s10803-006-0254-3

Karamanyants, M. B. (2023a). The influence of high-quality software development on the development of the IoT industry. *Innovations and Investments,* (8), 192-195. Retrieved from https://cyberleninka.ru/article/n/vliyanie-kachestvennoy-razrabotki-programmnogo-obespecheniya-na-razvitie-otrasli-iot

Karamanyants, M. B. (2023b). Ways to optimize software production costs using artificial intelligence. *Innovations and Investments,* (9), 196-199. Retrieved from https://cyberleninka.ru/article/n/sposoby-optimizatsii-rashodov-na-proizvodstvo-programmnogo-obespecheniya-s-primeneniem-iskusstvennogo-intellekta

Kosherbayeva, L. K., Ismagulova, S. K., Kozhageldiyeva, L. K., Akhtayeva, N. S., & Pena-Boquete, Y. (2024). Issues of teachers' preparedness to support learners with Autism Spectrum Disorder in schools of Kazakhstan. *Bulletin of L.N. Gumilyov Eurasian National University. Pedagogy. Psychology. Sociology series., 146*(1), 71-83. Retrieved from https://bulpedps.enu.kz/index.php/main/article/view/421

Kozhageldiyeva, L., Sabyrdylda, Z., Akhtayeva, N., & Samambayeva, A. (2023). Intersectoral care for children with autism spectrum disorder in Kazakhstan: Parents perspective. *European Journal of Public Health, 33*(Supplement_2), ckad160.1389. doi: https://doi.org/10.1093/eurpub/ckad160.1389

Kurmanalina, S., Samambayeva, A., Akhtayeva, N., Kozhageldiyeva, L., & Kosherbayeva, L. (2024). Awareness of Autism Spectrum Disorder Among Population of Kazakhstan. *Journal of Autism and Developmental Disorders*. doi: https://doi.org/10.1007/s10803-024-06350-1

Llorent, V.-J., Seade-Mejía, C., & Vélez-Calvo, X. (2023). Lockdown, Cyberhate, and Protective Factor of Social-Emotional and Moral Competencies in Primary Education. *Comunicar: Media Education Research Journal, 31*(77), 105-114. doi: https://doi.org/10.3916/C77-2023-09

Lo, Y.-C., Chou, T.-L., Fan, L.-Y., Gau, S. S.-F., Chiu, Y.-N., & Tseng, W.-Y. I. (2013). Altered Structure–Function Relations of Semantic Processing in Youths with High-Functioning Autism: A Combined Diffusion and Functional MRI Study. *Autism Research, 6*(6), 561-570. doi: https://doi.org/10.1002/aur.1315

Luyster, R. J., Kadlec, M. B., Carter, A., & Tager-Flusberg, H. (2008). Language Assessment and Development in Toddlers with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 38*(8), 1426-1438. doi: https://doi.org/10.1007/s10803-007-0510-1

Maenner, M. J., Warren, Z., Williams, A. R., Amoakohene, E., Bakian, A. V., Bilder, D. A., et al. (2020). Prevalence and Characteristics of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2020. *MMWR. Surveillance Summaries, 72*(2), 1–14. doi: http://dx.doi.org/10.15585/mmwr.ss7202a1

Masi, A., DeMayo, M. M., Glozier, N., & Guastella, A. J. (2017). An Overview of Autism Spectrum Disorder, Heterogeneity and Treatment Options. *Neuroscience Bulletin, 33*(2), 183-193. doi: https://doi.org/10.1007/s12264-017-0100-y

Mason, D., Rodgers, J., Garland, D., Wilson, C., Parr, J. R., & McConachie, H. (2022). Measuring quality of life in autistic adults: the reliability and validity of the Brief Version of the World Health Organization Quality of Life scale. *Health Open Research, 4*(3). doi: https://doi.org/10.12688/amrcopenres.13030.1

Mundy, P., Sigman, M., Ungerer, J., & Sherman, T. (1987). Nonverbal communication and play correlates of language development in autistic children. *Journal of Autism and Developmental Disorders, 17*(3), 349-364. doi: https://doi.org/10.1007/BF01487065

Naigles, L. R., Kelley, E., Troyb, E., & Fein, D. (2013). Residual Difficulties with Categorical Induction in Children with a History of Autism. *Journal of Autism and Developmental Disorders, 43*(9), 2048-2061. doi: https://doi.org/10.1007/s10803-012-1754-y

Nikolskaya, O. S., Baenskaya, E. R., & Liebling, M. M. (2007). *Autistic Child. Ways to Help*. M: Terevinf.

Parejo Llanos, J. L., & Cortón de las Heras, M. d. l. O. (2023). Analysis of an intergenerational music education project in initial teacher training: a case study. *Electronic Journal of Music in Education,* (52), 158-177. doi: https://doi.org/10.7203/LEEME.52.27473

Peeters, T. (2002). *Autism: From Theoretical Understanding to Educational Intervention*. St. Petersburg: Institute of Special Pedagogy and Psychology.

Pickles, A., Anderson, D. K., & Lord, C. (2014). Heterogeneity and plasticity in the development of language: a 17-year follow-up of children referred early for possible autism. *Journal of Child Psychology and Psychiatry, 55*(12), 1354-1362. doi: https://doi.org/10.1111/jcpp.12269

Rescorla, L., & Safyer, P. (2013). Lexical composition in children with autism spectrum disorder (ASD). *Journal of Child Language, 40*(1), 47-68. doi: https://doi.org/10.1017/S0305000912000232

Sharma, V., & Thakur, M. (2022). Horsegram [Macrotyloma uniflorum]: an underutilized pulse crop as a sustainable plant-based protein. *Future of Food: Journal on Food, Agriculture & Society, 10*(3). doi: https://doi.org/10.17170/kobra-202204136009

Sibuea, M. B., Sibuea, F. A., Pratama, I., Siregar, G., & Putra, Y. A. (2022). Analysis of the Contribution of Agribusiness Microfinance Institutions and Government Policies on Increasing Farmers' Income in Indonesia. *AgBioForum, 24*(2), 47-57. Retrieved from http://agbioforum.org/menuscript/index.php/agb/article/view/124

Singh, L., & Harrow, M. S. (2014). Influences of Semantic and Prosodic Cues on Word Repetition and Categorization in Autism. *Journal of Speech, Language, and Hearing Research, 57*(5), 1764-1778. doi: https://doi.org/10.1044/2014_JSLHR-L-13-0123

Speirs, S., Yelland, G., Rinehart, N., & Tonge, B. (2011). Lexical processing in individuals with high-functioning autism and Asperger's disorder. *Autism, 15*(3), 307-325. doi: https://doi.org/10.1177/1362361310386501

Sukenik, N., & Tuller, L. (2023). Lexical Semantic Knowledge of Children with ASD—a Review Study. *Review Journal of Autism and Developmental Disorders, 10*(1), 130-143. doi: https://doi.org/10.1007/s40489-021-00272-9

Sun, X., & Allison, C. (2010). A review of the prevalence of Autism Spectrum Disorder in Asia. *Research in Autism Spectrum Disorders, 4*(2), 156-167. doi: https://doi.org/10.1016/j.rasd.2009.10.003

Swensen, L. D., Kelley, E., Fein, D., & Naigles, L. R. (2007). Processes of Language Acquisition in Children With Autism: Evidence from Preferential Looking. *Child Development, 78*(2), 542-557. doi: https://doi.org/10.1111/j.1467-8624.2007.01022.x

Tager-Flusberg, H. (1985). The Conceptual Basis for Referential Word Meaning in Children With Autism. *Child Development, 56*(5), 1167-1178. doi: https://doi.org/10.1111/j.1467-8624.1985.tb00185.x

Tager-Flusberg, H., Calkins, S., Nolin, T., Baumberger, T., Anderson, M., & Chadwick-Dias, A. (1990). A longitudinal study of language acquisition in autistic and down syndrome children. *Journal of Autism and Developmental Disorders, 20*(1), 1-21. doi: https://doi.org/10.1007/BF02206853

Tager-Flusberg, H., & Kasari, C. (2013). Minimally Verbal School-Aged Children with Autism Spectrum Disorder: The Neglected End of the Spectrum. *Autism Research, 6*(6), 468-478. doi: https://doi.org/10.1002/aur.1329

Telzhan, V. (2023). Modern Approach to Autism Treatment in Kazakhstan. In *Publisher. agency: Proceedings of the 1st International Scientific Conference «Research Retrieval and Academic Letters»(January 26-27, 2023). Warsaw, Poland, 2023. 317p* (pp. 275). University of Warmia and Mazury in Olsztyn. Retrieved from https://ojs.scipub.de/index.php/RRAL/article/view/745

World Health Organization. (2018). *International classification of diseases for mortality and morbidity statistics (11th Revision)*. Retrieved from https://icd.who.int/browse/2024-01/mms/en

Worrachananun, M. (2022). The effect of music in destination marketing on tourists' attitudes and intentions to visit secondary-tier destinations in the northern part of Thailand. *Przestrzeń Społeczna (Social Space), 22*(1), 345-363. Retrieved from https://socialspacejournal.eu/menu-script/index.php/ssj/article/view/23

Zeidan, J., Fombonne, E., Scorah, J., Ibrahim, A., Durkin, M. S., Saxena, S., et al. (2022). Global prevalence of autism: A systematic review update. *Autism Research, 15*(5), 778-790. doi: https://doi.org/10.1002/aur.2696