

A PROPOSED METHOD FOR SPEECH AND LANGUAGE TESTING WITHIN A HEARING SCREENING PROGRAM FOR CHILDREN STARTING SCHOOL

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A Study design/planning
B Data collection/entry
C Data analysis/statistics
D Data interpretation
E Preparation of manuscript
F Literature analysis/search
G Funds collection

Abstract

This article sets out a proposal for how one might expand hearing screening in school children so as to include testing of speech mastery. From 2008 to 2019, the Institute of Physiology and Pathology of Hearing (IPPH) implemented a program to screen the hearing of Polish children starting school, covering over 1 million children. Its success prompted the development of a screening model to cover the entire process of verbal communication. One result was the “Equal Start in Education”, a program implemented from 2019 to 2022 in the Lublin province, otherwise known as the Lublin Program for Early Detection and Therapy of Communication Disorders in Children Starting School. It was conducted by the University Children’s Clinical Hospital in Lublin and the Maria Curie-Skłodowska University, in cooperation with IPPH, and was designed to assess hearing, auditory processing, voice, and speech-language. The program was successful in addressing various issues related to the screening of all communication skills. Here we present findings from the program and propose a testing procedure used to evaluate speech. The screening procedure might be applied more widely in the future, and could diagnose those children requiring audiological and speech-language therapy.

Keywords: hearing screening • speech screening • speech therapy

PROPONOWANA METODA BADANIA MOWY I JĘZYKA W RAMACH PROGRAMU PRZESIEWOWEGO BADANIA SŁUCHU U DZIECI ROZPOCZYNAJĄCYCH EDUKACJĘ SZKOLNĄ

Streszczenie

Artykuł przedstawia proponowany sposób poszerzenia badań przesiewowych słuchu u dzieci w wieku szkolnym i włączenie do nich testów opanowania mowy. W latach 2008–2019 Instytut Fizjologii i Patologii Słuchu (IFPS) wdrożył program badań przesiewowych słuchu u polskich dzieci rozpoczynających edukację szkolną, który objął ponad 1 milion dzieci. Powodzenie tego programu stanowiło impuls do opracowania modeli badań przesiewowych obejmujących cały proces komunikacji werbalnej. Jednym z efektów był program „Równy start w edukacji” wdrożony w latach 2019–2022 w województwie lubelskim, znany też pod nazwą „Lubelski program wczesnego wykrywania i leczenia zaburzeń komunikacyjnych u dzieci rozpoczynających edukację szkolną”. Program był prowadzony przez Uniwersytecki Szpital Dziecięcy w Lublinie i Uniwersytet Marii Curie-Skłodowskiej we współpracy z IFPS. Jego celem była ocena słuchu, przetwarzania słuchowego, głosu i mowy-języka. Program z powodzeniem rozwiązał szereg problemów związanych z przesiewowym badaniem wszystkich kompetencji komunikacyjnych. W tym artykule prezentujemy wnioski z programu i proponujemy procedurę testową do oceny mowy. Procedurę badania przesiewowego można zastosować na szerszą skalę w przyszłości, może ona wykrywać dzieci potrzebujące terapii audiologicznej i logopedycznej.

Słowa kluczowe: badanie przesiewowe słuchu • badanie przesiewowe mowy • terapia mowy

Introduction

In modern terms, speech and language is “a set of activities that, with the help of language, a person performs in learning about reality and communicating its interpretations to other participants in social life” [1]. This means there are three basic functions that language performs: interactional, cognitive, and social. Verbal communication

also requires linguistic and communicative competence, as well as perceptual and implementation skills [2]. If we could recognise speech disorders in children at an early age, this would allow early therapeutic intervention. In turn, this could prevent potential communication, educational, and emotional problems, increasing the well-being of individuals and society in general. This is only possible through a large-scale screening program.

The significance of speech screening can be appreciated by looking at similar tests for vision and hearing. Wide-ranging research has shown that when vision and hearing defects are detected early, many unwanted consequences can be prevented. Thus, 35 European countries have implemented national programs for vision screening in children, while 33 of them screen the hearing of children [3]. Poland's program of universal hearing screening in newborns is the largest preventive health program in the country. It has been fully implemented since 2002, although hearing screening began in 1995–1998 in various centers in Poland using otoacoustic emissions and auditory evoked potentials methods. The program was begun by a team from the Institute of Physiology and Pathology of Hearing (IPPH) following an order from the Minister of Health.

The result has been that, over the last 16 years, Poland has implemented both national and regional programs for hearing screening in school-aged children [4–7]. More than 1 million children have been covered. In 2008–2016, IPPH, in cooperation with the Agricultural Social Insurance Fund, conducted a study of children from rural areas. It found that 1 in every 5–6 children had temporary or permanent hearing disorders which hindered learning and communication. In about 65% of detected cases of childhood hearing disorders, their parents or guardians were unaware of the problem. The children underwent permanent or periodic care from an audiologist, phoniatrist, speech-language therapist, psychologist, or educator [4–6,8]. In more detail, the study found that, in children aged 6 to 9 from rural areas, 19.5% had a positive hearing screening result (defined as a hearing threshold worse than 20 dB HL at one or more frequencies). In children aged 10 to 13, positive results were found in 10.5% [6]. A Canadian study found an even higher prevalence of hearing problems in young children [9]. No doubt the higher prevalence of hearing disorders in younger children is due to a higher incidence of middle ear disease and respiratory infections, combined with limited access to pediatric care in rural areas. Among the conclusions of the IPPH study was the need for systematic monitoring of the hearing status of children, especially younger ones, as well as the need to provide hearing health education for children, parents, and teachers.

In 2017–2019, IPPH implemented a program of hearing screening in children who were starting school in the Mazovia region [10]. The program consisted of four modules: an information campaign, educational meetings for parents/guardians and teachers, training for medical personnel, and hearing tests in children (performed by videotoscopy and pure tone audiometry). A unique feature of this program was its coverage of the entire population of first-grade students attending elementary schools in the Mazovia Province. In this study, 19.2% of the children were found to have a positive hearing screening result, and they were referred for specialised audiological diagnostics. More commonly, unilateral rather than bilateral hearing disorders were found, i.e. those disorders that are more difficult for parents and teachers to recognise. The IPPH researchers concluded that hearing screening should become standard for children starting school.

Of particular interest, during the Mazovian screening program an assessment was also made of the frequency and

nature of voice disorders of the first-grade children [11]. In this case, the assessment was carried out by parents in response to a questionnaire. Data from 7631 questionnaires showed that voice disorders were present in 12.8% of children, with dysphonia more common in boys than in girls.

Extending this idea, in 2019–2022 the Lublin “Program for Early Detection and Therapy of Communication Disorders in Children Starting School” was implemented. Called “Equal Start in Education,” it was conducted throughout the Lublin Province by the University Children's Clinical Hospital in Lublin and the Maria Curie-Skłodowska University in cooperation with IPPH.

Novel aspects of the program were that, in addition to looking for peripheral hearing disorders, screening was also performed to detect central auditory processing disorders and voice and speech-language disorders. The program reflected the importance of diagnosing children's overall communication skills rather than focusing just on hearing. The program also involved providing therapy for children with hearing disorders of central origin [12]. The introduction of this test, covering all aspects of speech, increased the figure for diagnosed speech problems appreciably. Whereas previous hearing screening of children of a similar age found problems in about 20% of the children tested [13], in the new expanded program a total of 35% of children were referred for further specialised diagnosis due to suspected speech-language disorders.

To complete the picture, hearing screening looked for both peripheral and central hearing disorders. Pure tone audiometry was used to measure thresholds for air conduction at 0.5, 1, 2, 4, and 8 kHz. For central auditory processing, tests involved the frequency pattern test (FPT), a test assessing the degree of speech understanding in noise, and the dichotic digit test (DDT). All tests were performed using a standardised device called the Sensory Testing Platform. This device is used in hearing screening, both in Poland and in other countries, and can be used for telemedicine [14].

From December 2019 to May 2022, hearing tests were performed on 28,580 children as part of the Lublin Program for Early Detection and Therapy of Communication Disorders in Children Starting School (“Equal Start in Education”). The percentage of children diagnosed with peripheral hearing disorders (temporary or permanent) was 8%, while the percentage of children with suspected auditory processing disorders was 34.8%. These figures are largely consistent with those from other Polish and foreign hearing screening programs. Similar data were presented by Feder et al. [9], who found peripheral hearing disorders in 7.7% of children from a representative sample of the Canadian pediatric population aged 6 to 19. In a U.S. study, one conducted on children aged 3 to 10, peripheral hearing impairment was found in about 11% of participants [15]. Some researchers report higher figures [16], but it must be noted that study protocols, research methods, and adopted criteria may vary and lead to slightly different estimates. A study conducted by IPPH and published in 2015 showed that central auditory processing disorders occur in about 11% of children aged 7 to 12 years [17]. It should be emphasised, however, that at that time only

the DDT test was used and a rather restrictive criterion was adopted (fifth centile as a cutoff point), which significantly reduced the number of positive results (i.e. those indicating the probable presence of CAPD). Current normative values for tests assessing central auditory processing can be found in Czajka et al. [18].

Review of speech and language screening in children

The review presented below deals only with screening tests, i.e. those that do not set out to provide a firm diagnosis of a disorder, but are sensitive enough to signal a problem that requires further investigation. From our working definition of speech and language adopted earlier, it follows that screening should include all components of verbal communication, that is, comprehension and speech expression, the latter involving pronunciation, vocabulary, correct grammar, verbal fluency, and narrative skills. This is a difficult but not impossible task. The problem as we see it is to identify the most important elements of speech and determine a suitable rating system. First we discuss the solutions adopted so far internationally and in Poland.

Worldwide, there are dozens of screening tests for assessing speech competency. The most common in the literature, and available on the Internet, are English-language tests. This reflects the ubiquity of English, well-developed systems of speech therapy in English-speaking countries, good theoretical development, and high levels of practical performance. Many tests developed in English are available in other languages (Spanish, Portuguese). However, the following deals only with English-language and Polish tests.

Screening tests are often designed for children of preschool and early school age. The skills assessed involve speech perception (comprehension), speech construction (articulatory, systemic, and pragmatic skills), and prosody (voice and fluency of speech). The age range usually covers 0 to 21 years of age, although in making a speech evaluation, a speech therapist will typically use a variety of tests depending on the age of the person being tested. Typically, speech is assessed in terms of the level of development of perceptual, motor, and cognitive skills. Tools can be completely standardised, partially standardised, or have no standards (in which case the interpretation of the results requires specialist judgment). Most investigations involve questionnaires, in which subjects are presented with material requiring them to repeat, name, or observe, after which they must respond verbally. Tests mostly take about 20 minutes. Children who fall below a certain rating are referred for further diagnostics.

Most screening tests fall into the following four types, based on the mode and scope of the examination.

1. Parents provide information based on a questionnaire presented by a speech-language therapist or electronically;
2. Parents make a report, which is then interpreted by a speech-language therapist;
3. A speech-language therapist or other professional evaluates speech against a background of overall behavior;
4. A speech-language therapist or other specialist evaluates speech and language in isolation.

The first three categories can be used with preschool children. The fourth category can be applied to children up to the age of 21. Below is an overview of selected diagnostic tools in terms of these categories.

Method 1. Parents provide information

A representative test in this category is the *Speech-Language and Learning Parent Questionnaire for Children 5 and Above* developed by the Foundations Developmental House of Arizona (USA) [19]. The questionnaire consists of 50 questions aimed at parents of children 5 or more years old. The questions are divided into sections that address: general observations about speech disorders, the presence of speech disorders in the family, the child's health and development, voice quality and speech fluency, hearing and learning skills, sensory and motor features (such as the presence of tactile or gustatory hypersensitivity), social behavior, and other relevant information about the child (e.g., disorders diagnosed by other specialists, the child's abilities, family situation, etc.). The test does not involve scoring but instead requires expert judgment of whether speech disorders are present.

A comprehensive and thorough overview of speech-related screening assessment tests for children younger than 5 years (and as young as 12 months) is provided by a 2015 report, *Screening for Speech and Language Delays and Disorders in Children Age 5 Years or Younger: A Systematic Review for the U.S. Preventive Services Task Force* [20]. The report evaluates dozens of diagnostic tools, assessing their reliability for diagnosis and intervention in early speech problems. The diagnostic sensitivity of some of them was rated to be as high as 100%.

Method 2. Reports made by parents

An example of a widespread test in which mothers self-report their child's development, including speech, is the *Minnesota Child Development Inventory* (MCDI) [21]. The MCDI measures the development of children between the ages of 36 and 60 months. The estimated sensitivity of this test is 75%, perhaps comparable to the possible 100% accuracy of assessment by professionals. Children are assessed in five categories of development: cognitive, language, motor, social, and adaptive skills. MCDI is an example of a tool in which speech is one of several areas of assessment.

Method 3. A speech therapist evaluates speech against behavior

The most popular screening test in this category is the *Denver Developmental Screening Test* (DDST), commonly known as the *Denver Scale*. Developed by Frankenburg and Dodds, it is a test for screening cognitive and behavioral problems in preschool children [22]. The test is marketed by Denver Developmental Materials, of Denver, Colorado (USA), hence the name. Tests, manuals, and other materials are available for free online at www.denverII.com. The current version is *Denver II* [23], a revision and update of DDST. The tool is designed for use by a physician, teacher, or speech-language therapist to monitor the development of infants and preschool children (from birth to age 6). The tests identify children whose development differs

significantly from others and provide a basis for further diagnosis to determine if there is a problem requiring therapy. The tests assess four basic functions: personal and social development (e.g., reciprocating a smile), fine motor skills (e.g., grasping and drawing), speech skills (e.g., sentence building), and gross motor skills (e.g., walking).

Another test in this category is the *Battelle Developmental Inventory Screening Test-2* (BDI-2) [24] designed to screen children from birth to 7 years 11 months. The test assesses the following areas: behavioral skills (self-care, showing responsibility), social skills (interactions with adults, peers, social role recognition), communication skills (speech comprehension and expression), motor skills (large and small), and cognitive skills (perception, memory, learning). BDI-2 is widely used and forms the basis of many studies described in the literature.

Method 4. A speech-language therapist evaluates speech in isolation

This category includes a number of diagnostic tools. It is also the most interesting from the point of view of constructing new tests for the screening of speech and language. In this paper we focus on the most popular, ranging from those designed for preschoolers to those that assess adolescents.

The first of the tests for preschool children is the *Bankson Language Screening Test* [25]. The test consists of 17 items, assessing speech in five categories: knowledge–semantics, morphological rules, syntactic rules, visual perception, and auditory perception. Another tool designed for preschoolers is the *Hackney Early Language Screening Test* [20]. The latter is a 20-item test divided into 7 sections: 1) comprehension of simple commands, where the child needs to follow instructions (e.g., “give the teddy bear a drink”); 2) speech expression, where the examiner manipulates a toy and the child answers questions about it; 3) comprehension of more complex commands, such as following instructions to place objects (e.g., “put the spoon in the box”); 4) comprehension, where the child needs to choose one picture from three options; 5) expression, where the child answers questions about the pictures presented; 6) expression, which is the ability to name a picture; and 7) comprehension, where the child chooses a picture from four options.

New Zealand’s *Junior Oral Language Screening Tool* (JOST) [26] is used to assess preschool and early school-age children (ages 4–7, but mostly in the range 4.6 to 5.6). The test is intended to be administered by a teacher who knows the child well. It is intended as a possible indicator for deciding whether to place the child in an appropriate educational program or to refer them to a speech therapist. The test is divided into three sections: vocabulary, pragmatics (use of language for basic social communication), and grammar. The test does not assess pronunciation. Individual tasks consist of naming body parts and functions, use of verbs, adjectives, and prepositions, recognising and naming emotional states, forming plurals, forming sentences (use of tense and negation), creating a narrative statement, answering basic questions (what school do you go to?; where do you live?; how old are you?), and

conversational skills. The test is non-standardised, and the final assessment consists of placing the child into one of three categories: 1) most answers correct, 2) a few correct answers in each section, and 3) very few correct answers. Placement in the third category is an indication for consulting a speech therapist.

A more extensive tool than JOST, but one where again the teacher administers the test, is the *Melbourne Speech Pathology Screening Package* [27], which is designed for preschool and school-aged children. The test covers the following aspects: 1) pronunciation, 2) speech reception and comprehension (following instructions, answering questions, acquiring new information, 3) pragmatic abilities (carrying on a conversation, understanding non-verbal cues), 4) speech expression (grammar, narrative and re-narrative skills), 5) fluency, and 6) voice. Each category is described and includes indicative developmental standards. The final evaluation also determines whether the child should be referred to a speech-language therapist.

For screening assessments of individuals 5 to 21 years of age, the most advanced tool is the 1995 *Clinical Evaluation of Language Fundamentals 4th edition* (CELF-4) [28]. Compared to earlier editions, there have been a number of changes. CELF-4 is used to test individuals suspected of having speech delays or disorders. It assesses four aspects of language: morphology and syntax, semantics, pragmatics, and phonological awareness. The test involves four steps: 1) determining whether a speech disorder is present, 2) describing the disorder, 3) assessing the clinical symptoms of the disorder (with reference to norms), and 4) evaluating speech and communication in a natural context (such as in a classroom). The questions are age-appropriate and therefore vary.

Compared to previous versions, CELF-4 has been expanded. In addition to the previous 10 subtests (following instructions, repeating sentences, constructing sentences, linking related words, understanding sentences, answering questions, composing sentences from scattered words, understanding of semantic relationships, naming colors and shapes, and linking words into categories), 5 more subtests have been added: 1) assessment of active vocabulary, a subtest for children aged 6–9 which involves naming pictures (nouns and verbs) and using names in spontaneous utterances; 2) ability to define words (for ages 10–21); 3) phonological awareness, which assesses how well the subject understands the sound structure of language, recognises phonemes, and can manipulate phonological units (such as in rhyming and segmenting sentences into syllables and phonemes); 4) pragmatic skills, which assesses routine conversational ability (verbal and non-verbal), asking and giving information, and using language in the classroom; and, finally, 5) an assessment of working memory, such as the ability to say the days of the week backwards and accurately repeat several items on a list. In addition, the developers added an *Observational Rating Scale* to the subtests in CELF-4 to specifically evaluate a child’s communication skills. It consists of 40 statements of possible difficulties a tested child may have with listening, speaking, and writing. The rating, on a 4-point scale, is made by the student themselves or by a parent or teacher.

Turning to tools that are specifically designed to test Polish children, a number of questionnaires have been published, but they are still mostly at the experimental stage. They are designed to be carried out by a speech therapist or other specialist (teacher, pedagogue, psychologist, pediatrician). Examples include *Screening for the detection of speech disorders in two-, four- and six-year-old children* [29] and *Test for the examination of preschool children* [30], where the assessor gauges the competency of speech development. The former tool assesses 1) understanding of verbal commands, 2) ability to speak, 3) correct utterance of speech sounds, and 4) structural basis and efficiency of articulation. The test is done during play with the child and from an interview with parents or guardians. The latter test evaluates 1) understanding of speech, 2) pronunciation, 3) efficiency and structure of the articulatory organs. The problem with both these tests is the narrow scope of the assessment and the lack of age-related norms, or at least some indication of how to interpret the result.

Among Polish standardised tools for speech screening, there are two main tests: *The Speech and Language Screening Test for School-Aged Children* [2] and *The Speech and Language Screening Test* [30]. The first is the only test that, beside implementation and perceptual skills, can assess linguistic, communicative, and cultural competency. It is designed to test children between the ages of 6 and 14. It has been standardised on a sample of 1,800 children. It contains four subtests assessing: 1) pronunciation, in which a 20-picture questionnaire tests the subject's ability to repeat four phonetically difficult sentences; 2) narrative efficiency or story-telling ability, involving the character of a dwarf and narrating a five-element picture story; 3) motor skills of the speech organs, particularly movements of the tongue; and 4) perception of speech sounds, including the hearing of phonemes and distinguishing sounds within a word. The second test, again in Polish, aims to evaluate the speech of children between the ages of 4 and 8 and has been standardised on a group of 1,000 children. It contains four subtests: 1) sentence comprehension, assessed by understanding sentences based on dog and cat figurines; 2) vocabulary, including the names of colors, animals, and plants; 3) grammar, assessed by the ability to construct sentences from given words; and 4) pronunciation and speech fluency, gauged by repeating syllables and naming pictures.

The most extensive, standardised, and normalised Polish tool for assessing speech development is the *Test of Language Development* by Smoczyńska [31], but it is more a way of accurately measuring language competency in children and is not suitable for screening purposes.

Speech testing with the Lublin Screening Tool

The *Lublin Screening Tool* which we have developed makes the assumptions that:

1. The examination will be conducted by a specialist.
2. The examination needs to cover basic linguistic competence, communicative competence, and implementation skills.
3. The examination is short, since it will be performed as part of a screening package covering hearing, auditory processing, speech, and voice. The initial plan was to

screen 32,000 children entering school, and so far more than 28,580 have been tested. The test has no absolute time limit, but the average time to conduct a test is 5–7 minutes.

4. The goal was to identify children with suspected speech and language disorders and refer them for further specialised diagnosis. This means the assessment need not be elaborate or standardised, giving just a zero or one rating.

Development of the test stipulated that a computer would be used on which images and a picture stories are displayed. After taking the test, an evaluation is performed. Scoring for each trial is 0 or 1, with each trial having separate categories, as described in the test instructions. A finding of no disturbance (a correct answer) equates to a score of 0, while finding some disturbance, giving no answer, or an incorrect response means a score of 1.

The *Lublin Screening Tool* evaluates the following categories:

1. Pronunciation.
2. Lexical and semantic competence.
3. Narrative competence.
4. Vocabulary.
5. Speech fluency.
6. Grammatical correctness (syntax and inflection).

Receiving a score of “1” in any category is an indication that further testing and diagnosis is needed.

The test should be conducted individually, in a separate room. We do not give any feedback about the performance of individual trials. At the end, if the child asks about the results of the study, the prescribed answer is “it was pretty good”. In some trials help is allowed, for example, when giving the name of a picture (pronunciation) or asking supporting questions (what does a dwarf look like? or what happened next? can you say more about it?).

Study instructions

1. Pronunciation test

The pronunciation test is based on a pictorial questionnaire containing 20 items. In addition, we assess speech fluency at this point. Fluency is also assessed during the lexical-grammatical competency test and the narration test (see item 5).

We assess the pronunciation of the name of each picture separately to its identification. If the child doesn't know the name of an item depicted in a picture, it is permissible to give them the name and ask them to repeat it. If the child fails to recognise the items in more than four pictures, the score in the vocabulary category should be given a zero.

For correct pronunciation, we consider the orthophonetic standard where the school is located (regional variations are allowed).

If there is defective pronunciation, we consider whether the child has used substitutions, deformations, elisions, or a change in the ordering of phonemes. A final score of

Table 1. Pronunciation testing in the *Lublin Screening Tool* (own study)

No	Picture name	Pronunciation correct	Pronunciation incorrect	Nonfluent syllables
1.	szafa (cabinet)	0	1	--
2.	żyrafa (giraffe)	0	1	---
3.	czapka (hat)	0	1	--
4.	czekolada (chocolate)	0	1	----
5.	dżem (jam)	0	1	-
6.	samolot (plane)	0	1	---
7.	zamek (castle)	0	1	--
8.	język (tongue)	0	1	--
9.	autobus (bus)	0	1	---
10.	cytryna (lemon)	0	1	---
11.	cukierek (candy)	0	1	---
12.	cebula (onion)	0	1	---
13.	widelec (fork)	0	1	---
14.	pełdzel (brush)	0	1	--
15.	ciastko (cookie)	0	1	--
16.	misie (teddy bears)	0	1	--
17.	rower (bike)	0	1	--
18.	korale (beads)	0	1	---
19.	guziki (buttons)	0	1	---
20.	lody (ice cream)	0	1	--
Total				/50

“1” in the pronunciation assessment is given only if the defect is repetitive (we do not fail the child based on just a single mistake).

Up to two non-fluent syllables are allowed. If the child utters more than two syllables nonfluently, then a “1” should be entered in the fluency assessment (item 5). As cases of non-fluency, we focus only on repetitions of a syllable or phoneme, or dragging out of sounds. We do not count pauses or interjections.

Command: Let me show you different pictures. Name what you see in the picture.

The names of the pictures used in the pronunciation and speech fluency screening are shown in **Table 1**. The pictures come from the Sensory Testing Platform developed by IPPH.

2. Lexical-semantic competency test

The test is a modified task from the *Logopedic Screening Test for School-Age Children* [2].

Command: There is someone who has never heard that dwarfs exist. Tell them everything you know about dwarfs.

We evaluate one by one:

1. Did the child include the dwarf character in some overarching category, e.g., human, fairy tale character, movie character, creature?
2. Did they point out the physical characteristics of the dwarf, e.g. height, appearance, clothing?

In addition, as correct answers we include:

1. Indicating the location of the dwarfs (e.g. forest, under a mushroom, cave, etc.).
2. Their mental characteristics (e.g. cheerful, hardworking, clever).
3. Modes of action (e.g., they work in a mine, mischief, play).

Passing this test requires correct answers in a minimum of two categories.

3. Narrative competency test

The test consists of telling a picture story (**Figure 1**) consisting of four narrative images, representing a narrative scheme: introduction (orientation), complication, climax, resolution/completion. We evaluate the recognition and reference of each narrative image and the construction of a coherent, logical sequence of events.

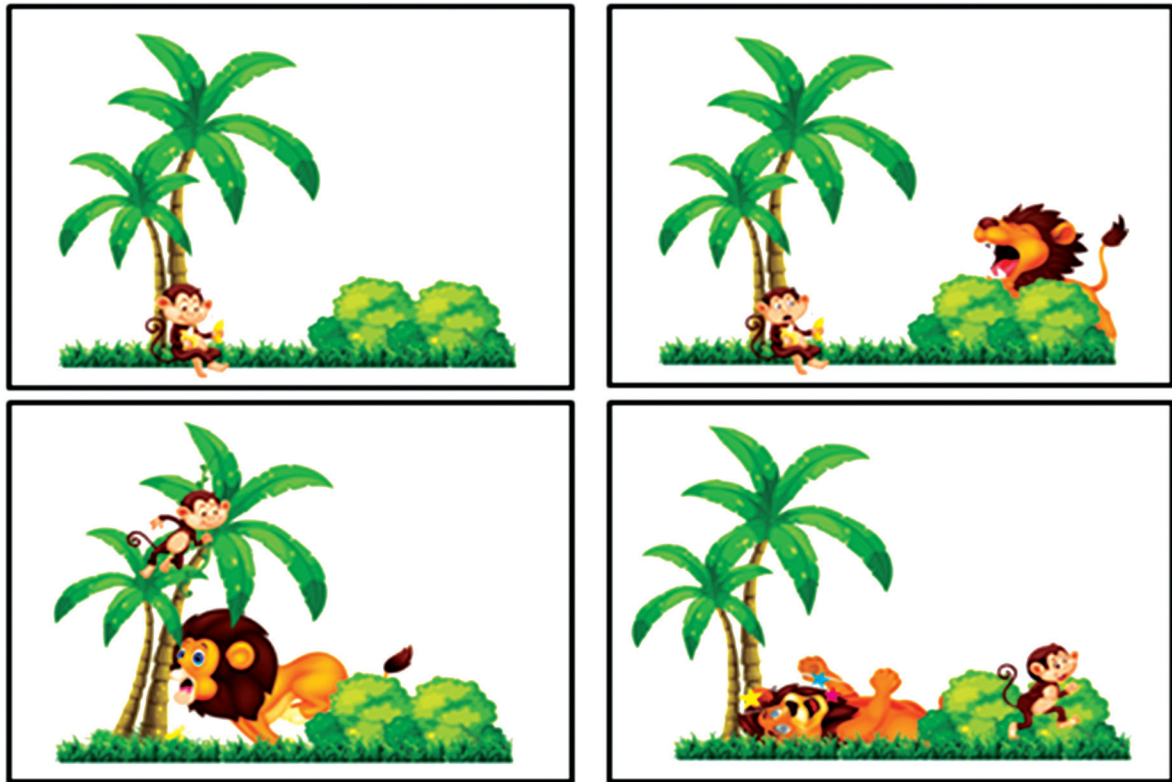


Figure 1. Picture story used in the *Lublin Screening Study* (source: own development)

Command: This is a picture story. Look at it carefully and tell someone who can't see the pictures what happened (we don't look at the monitor screen with the child).

Image 1: Shows a monkey sitting under a palm tree. The monkey is eating a banana. Next to it is a bush.

Image 2: A lion appears from the bush preparing to attack. The monkey notices it.

Image 3: The lion jumps out, but hits his head on the tree, because the monkey jumped up the palm tree just in time. The banana lies on the ground.

Image 4: The monkey has jumped down from the palm tree and is now running away. The unconscious lion is lying under the palm tree.

A positive score requires two conditions: description of all pictures and arranging them into a coherent, logical sequence of events.

4. Vocabulary (1 or 0)

Based on responses to commands 2 and 3, we also evaluate vocabulary, giving it a 1 or 0 rating. Does the child have enough vocabulary to follow instructions? We also take into account the result from the pronunciation test: if the child fails to recognise more than 4 pictures out of 20 the overall grade is "1".

5. Fluency of speech (1 or 0)

The evaluation here is analogous to that in the pronunciation test – that is, no more than two non-fluent syllables, regardless of the number of syllables spoken. Non-fluent vocalisations are regarded as repetitions of a syllable or phoneme, or dragging out of a sound. We do not count pauses and interjections. If there is a score of "1" on any of the tests then the final grade is "1".

6. Grammatical correctness of speech (1 or 0)

We consider as correct the construction of single sentences, with correct Polish syntax, including inflections. Minimally, the sentences should have correct subject, predicate, object, and adverbs, respecting syntactic relationships.

Final scoring

Obtaining a score of 1 in any of the assessed 6 categories: pronunciation, lexical-semantic competence, narration, vocabulary, fluency, and correct grammar is an indication that a more thorough diagnosis by a speech–language therapist is needed.

Conclusions

The use of the presented method has proven itself in practice, and has promoted effective hearing and voice diagnosis. Between December 2019 and May 2022, some 28,580 children have been screened despite the difficult

conditions associated with the COVID-19 epidemic. Extending screening to holistic language and communication development allows for more accurate diagnosis and presents the opportunity to prevent possible educational difficulties in the future. Speech and language screening

increases the chances of early detection of developmental delays and speech disorders. However, it needs to be kept in mind that a positive test result does not always mean there is a finding of a speech disorder.

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