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Developing a language screening scale that considers linguistic diversity in pre-school children

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This paper presents an extensive analysis of the techniques adopted in the creation of a new language assessment instrument, the Screening Scale of Language Development (SSLD). Standardized in Cyprus, the SSLD aims to identify language deviations in children before they enter primary school. The initiative addresses a significant gap in assessment tools that consider the linguistic diversity present in Cyprus. The scale items were developed based on recent studies focusing on clinical indicators and prognostic factors of developmental language disorders. This approach ensured that the items effectively represent the language varieties utilized by Greek Cypriot preschool children. The findings of the psychometric evaluation of the SSLD strongly endorse its structural validity. The evaluation demonstrates the SSLD's reliability as an instrument for assessing language growth in Greek Cypriot children. The SSLD initiative not only provides a robust tool backed by strong psychometric foundations, but also empowers professionals to confidently detect language difficulties in a diverse linguistic context. This research underscores the importance of culturally and linguistically relevant assessment tools in early childhood education.

KEYWORDS

language screening scale, linguistic diversity, pre-school children, Cypriot Greek, SSLD, language disorders

1 Introduction

This paper presents the design procedure for developing a new language screening tool, which has been standardized in Cyprus to identify language deviations in pre-primary school children. The paper also examines the structural validity of the tool that has been developed taking into consideration the language repertoire of Greek Cypriot children, who acquire the Cypriot Greek dialect as their mother tongue and learn Standard Modern Greek mainly at school.

There are significant differences between the two varieties in vocabulary, pronunciation, prosody, morphophonology, and syntax (see Newton, 1972; Arvaniti, 2001; Petinou and Okalidou, 2006; Agouraki, 1997; Kanikli, 2011). Children who are brought up in a Greek Cypriot family and social circle in Cyprus are exposed to the dialect from the very beginning. They usually learn Standard Modern Greek as a second language. The exposure to Standard Modern Greek typically starts with TV broadcasts and is later reinforced through formal education at school. Previous studies (cf. Theodorou et al., 2019, 2016) have shown that practitioners, such as speech and language therapists, psychologists and teachers, use tools that ignore the linguistic diversity in Cyprus, which may result in under-identification or over-identification and inaccurate diagnosis of language disorders. This is due to the lack of tools that consider the distinctive features of the dialect; a problem with which other countries are faced as well (Oetting and McDonald, 2002; Washigton and Craig, 2004; Wyatt, 2002).

The situation in Cyprus concerning language difficulties in children is concerning, especially because there is currently no standardized procedure for the early identification of these issues, either within the educational system or the health system. This absence of a systematic approach complicates efforts to support children who may require additional language support. Furthermore, speech therapists use informal assessment methods to provide a diagnosis, which is often based on spoken language sampling analysis, as well as their judgment as clinical practitioners (Theodorou et al., 2019). The utilization of language assessment methods that lack standardization and have not undergone rigorous psychometric testing can significantly hinder the effectiveness of language intervention programs. Thordardottir (2015) points out that many European countries do not provide practitioners with official guidelines about the screening tools, as well as the procedure they need to follow during clinical assessment.

The Screening Scale for Language Development project aimed at addressing the problem by developing and standardizing a reliable screening tool that captures the properties of the language varieties of Greek Cypriot pre-school children.

2 The sociolinguistic context in Cyprus

Greek Cypriots speak two language varieties: the "high" variety, which is a variant of the Standard Modern Greek and is widely accepted and utilized in formal settings; and the "low" variety, which is the Cypriot Greek vernacular, spoken natively by all Greek Cypriots. Scholars studying the sociolinguistic context in Cyprus have characterized the situation as "diglossic" (Arvaniti, 2002; Tsiplakou, 2003), "bidialectal" (Papapavlou and Pavlou, 1998), and "bilectal" (Rowe and Grohmann, 2013). Other researchers have argued for the existence of a dialectal continuum, in which the village Cypriot Greek is the basilect, and the Standard Modern Greek variant is the acrolect (Goutsos and Karyolemou, 2004).

The differences between the two varieties extend beyond obvious linguistic aspects such as vocabulary, pronunciation, and prosody. They encompass distinct lexical, phonetic, syntactic, and morphophonological properties (Newton, 1972; Arvaniti, 2001; Petinou and Okalidou, 2006; Okalidou et al., 2010; Petinou et al., 2011; Kanikli, 2011). For instance, Standard Modern Greek features a two-way voicing contrast with voiced and voiceless unaspirated stops. In contrast, Cypriot Greek exhibits a three-way voicing contrast, including voiceless unaspirated, voiceless aspirated, and pre-voiced stops (Okalidou et al., 2010). There are also differences between the two varieties in syntax. Cypriot Greek demonstrates clefts, whereas Standard Modern Greek displays focus movement, which is not the case for Cypriot Greek (see Agouraki, 1997; Kanikli, 2016). Another distinction lies in the placement of personal pronominal clitics: in Standard Modern Greek, these clitics precede the finite verb, while in Cypriot Greek, they follow the finite verb in indicative declarative clauses (Agouraki, 1997). Furthermore, the two varieties differ in their verbal inflection. For example, the verb form "they are playing" is rendered as [ʻpezusin] in Cypriot Greek and [ʻpezun] in Standard Modern Greek. Additionally, Cypriot Greek uses a circumfix for the past tense, such as [e'pira] ("I took") compared to [ʻpira] in Standard Modern Greek. Regarding vocabulary, Cypriot Greek retains loanwords from historical influences still in everyday use. For example, [pa't^{h}ixa] ("watermelon" from Arabic pattik^{h}) is used instead of the Standard Modern Greek [ka'rpuzi], and [fu'^{n}dana/("tap" from Italian fontana) replaces [ʻvrisi] in Standard Modern Greek (Terkourafi, 2007).

Linguistic diversity must be considered when providing speech and language services for children from various language backgrounds (Francois et al., 2023). Similarly, language dialects must be considered in language assessment, as assessment tools and normative data may not be suitable for accurately assessing communication abilities (Clark et al., 2021). Other countries like the US and Australia have established the necessary skills required for speech-language pathologists (SLPs) working with clients who speak dialects (American Speech-Language-Hearing Association, 2017, 2022; Speech Pathology Australia, 2016). However, the distinct linguistic traits of the Cypriot Greek dialect have not been given the same level of attention. The lack of acknowledgment of this fact in the Code of Ethics of the Cyprus Association of Speech Language Pathologists (2013), as well as the absence of studies on SLPs' knowledge and clinical practices for Cypriot Greek speakers demonstrate the necessity of changing the current situation.

3 The importance of early screening and the study's aims

Language disorders significantly impact a child's ability to acquire, comprehend, and utilize language. Disorders linked to biomedical conditions, such as hearing loss, or inadequate language exposure, have identifiable etiologies. Developmental language disorder, however, is not attributable to other conditions. Language disorders include a broad range of difficulties in both understanding and expressing language, which can vary greatly in their symptoms, and effects on individuals. Bishop et al. (2017) emphasize the diversity within this disorder, noting that individuals can present a variety of linguistic profiles. For example, some children with language disorders may struggle with phonology, while others may have difficulties with morphology and syntax. Many experience semantic deficits, characterized by a limited vocabulary and challenges in understanding and retrieving words. Additionally, pragmatic issues may arise, affecting the social use of language. Overall, language disorders negatively impact a child's ability to speak, listen, read, and write (Bishop et al., 2016).

Recognizing the essential role that language development plays in children's overall wellbeing, both the World Health Organization (WHO) and the United Nations (UN) stress the importance of comprehensive development, which includes physical, mental, and social dimensions (WHO, 1946, 1990). The UN Convention on the Rights of the Child highlights children's rights to optimal development, expression, and education, emphasizing the need to prioritize screening for speech and language disorders (WHO, 1990). In line with these principles, the International Association of Communication Sciences and Disorders (IALP) advocates for early screening and assessment to identify at-risk children and provide necessary language support, thereby connecting research with practical application.

Despite global recognition of the necessity of language services for individuals with language disorders, Cyprus exhibits a

critical deficiency in evidence-based policies for speech-language service provision, particularly for vulnerable child populations (Theodorou et al., 2019, 2022).

Accurately assessing language ability in individuals who speak dialects has long been challenging (Seymour, 2004; Stockman, 2010). Test bias (Qi et al., 2006; Stockman, 2000; Thomas-Tate et al., 2004) and linguistic differences between standard varieties and dialects contribute to the difficulty in evaluating the language skills of a dialect speaker, as most assessment instruments are designed for the standard variety. Proper assessment and clinical decision-making involves identifying the most appropriate assessment measures to ascertain if a child has a communication disorder (Hendricks and Diehm, 2020). In Cyprus, where the dialect is the primary spoken language, there are no language assessment tools specifically designed for children who acquire the dialect as their first language (Theodorou et al., 2019, 2016).

The absence of language assessment tools for Cypriot Greek complicates the diagnostic process and creates confusion among policymakers, teachers, and clinicians, leading to varied conceptualizations of language disorder/difficulty (Kambanaros and Grohmann, 2013; Theodorou et al., 2022). The Screening Scale for Language Development (SSLD) was developed to address the problems arising from the lack of Cypriot-Greek specific assessment tools.

This paper aims to (a) present the methodology followed in the development of SSLD and demonstrate how the fact that Greek Cypriot children speak two language varieties has been considered in its design; (b) examine the structural validity of the tool.

4 Methodology

4.1 The SSLD items' selection/development process

SSLD is the first screening scale that has been developed and standardized in Cyprus. The design of the items took into consideration the fact that Greek Cypriot children acquire Cypriot Greek as their mother language, while at the same time they are exposed from an early age to the prestige norm in the Greek Cypriot society: a variant of Standard Modern Greek as spoken in the media and schools.

In the first phase of the project, we selected or developed test items based on existing knowledge about language development and its measurement in order to determine its level of acquisition (So and To, 2022). The items measured different aspects of language and related cognitive development during pre-school age (see Klem et al., 2016; Vitrikas et al., 2017) and were carefully chosen so that they capture the language repertoire of children at this age (the language and cognitive factors measured are given in Table 1).

A pilot version of the scale with 64 test items was developed, assessing the level of language comprehension and production, as well as relevant cognitive abilities during pre-school age. The items were grouped into factors (receptive vocabulary, expressive vocabulary, verbal working memory, etc.).

This first version was administered to 54 Greek Cypriot children aged 3:11–4:3 of whom 20 had been clinically diagnosed by a speech therapist as having some language difficulty. This pilot version was simultaneously given to a small group of six Greek Cypriot speech pathologists in order to evaluate the items' face validity.

TABLE 1 The internal structure of SSLD.

Language and cognitive factors	Example	Number of items
1. Receptive Vocabulary (RV)	Cita oles tis ikones. Dikse mu Look at all the pictures. Show me to krevati. the bed	5
2. Comparative and Superlative form Comprehension Production (CSCP)	Cita tin ikona. Dikse mu to Look at the picture. Show me the mikrotero trapezi. smallest table	3
3. Expressive Vocabulary (EV)	Ti en to vivlio? What is a book?	3
4. Colour Naming/Knowledge (CNK)	Ti hroman en tuto? What colour is this?	2
5. Ability to Follow Instructions (FI)	Cita tin ikona. Dikse mu tin mikrin Look at the picture. Show me the small kokkinin bala. red ball	3
6. Grammatical Competence (GC)	Pe mu kati ya tuntin Tell me something about this ikonan. picture	2
7. Relative Clause Comprehension (RCC)	Cita oles tis ikones. Look at all the pictures. Dikse mu to alogon pu klotsa ton Show me the horse that kicks the garo. donkey	6
8. Inference Making (IM)	Ti theli na kami i gata? What wants to do the cat "What does the cat want to do?"	3
9. Numerical Reasoning (NR)	Posa pedja vlepis se tutin How many children see.2.SG. in this tin ikona? the picture? "How many children do you see in this picture?"	2
10. Preposition Comprehension and Production (PCP)	Edo, pu en o kokoras? Here, where is the rooster?	6
11. Verbal Working Memory (VWM)	To agorin epjasen tin bala. The boy caught the ball	10

Based on the results of the statistical analysis of the pilot version and the recommendations of the expert group, we assessed which items were psychometrically appropriate for pre-school Greek Cypriot children, and could serve as valid indicators of differentiating between typical children and children with language difficulties. The psychometric analysis evaluated several key properties of the items, including item difficulty, item discrimination, internal consistency, and factor structure. To further refine the scale, we conducted a multiple logistic regression analysis. This analysis aimed to identify which factors and factor

components (e.g., receptive vocabulary, grammatical competence, and inference making) best predict group membership (children with language difficulties vs. typically developing children). The factors included in the model were standardized to account for differences in the number of items per domain, ensuring comparability. The regression coefficients and odds ratios were examined to determine the relative contribution of each factor, with significant predictors retained for the final scale. Items that were identified by the expert panel or the pilot data analysis as too difficult or too easy, culturally or educationally inappropriate (e.g., dialectally marked or prestige norm forms that many children of this age may not use or know) or not aligned with developmental expectations for identifying language difficulties were excluded. Nineteen items from the pilot version of the scale were removed: three measured receptive vocabulary (e.g., chair); four, expressive vocabulary (e.g., fish); two, following directions (e.g., "Please, show me the big ball next to the table"); five, grammatical competence; two, inference making; two, numerical reasoning (e.g., "Here you see fruits and animals. Could you count how many fruits we have?"); and one, color knowledge. This refinement process resulted in a final scale comprising 45 items, of which 32 were presented in conjunction with a picture booklet.

Nineteen items from the pilot version of the scale were excluded: three were items measuring receptive vocabulary; four, expressive vocabulary; two, following directions; five, grammatical competence; two, inference making; two, numerical reasoning, and one, color knowledge. This process resulted in a scale that included 45 items/questions, out of which 32 related to different pictures presented in a picture booklet.

In summary, the scale, based on the original conceptual design, measured eight language factors: receptive vocabulary, expressive vocabulary, comparative and superlative form comprehension, color naming/knowledge, ability to follow instructions, grammatical competence, relative clause comprehension, and preposition comprehension and production; and three cognitive factors: inference making, numerical reasoning, and verbal working memory. The 11 factors of the SSLD are presented in Table 1 with the number of their items and relevant examples (see Section 5 for a detailed analysis of the factors and the items of SSLD).

4.2 Participants

A total of 520 children aged 3:6 to 4:6 years were examined. The weighted sample included 476 pre-school children aged 3 years and 6 months to 4 years and 6 months, with a mean age of 4 years (SD = 0.43 years) and a gender ratio of 258 girls to 218 boys.

To ensure the external validity of the scale under construction, a representative sample of children was selected using proportional stratified random sampling. The stratification variables (strata) used were as follows: age (3:6–3:8 years, 3:9–3:11 years, 4–4:2 years, 4:3–4:6 years), sex (male, female), educational level of parents (<6 years of education, 6 years of education, 7–12 years of education, >13 years of education), province (Nicosia, Famagusta, Larnaca, Limassol, and Paphos), and area of residence (rural, urban). Participation in the research was voluntary, and its protocol was approved by the Cyprus National Bioethics Committee (EEBK/EP/2019/56). All the children had Cypriot Greek dialect as their mother tongue.

The procedure followed during the sampling was as follows: the population of Cyprus was divided into strata according to the selected variables. For each stratum individual samples of kindergartens were selected by simple random sampling.

The principals of all the kindergartens that participated in the research distributed to the children's parents the information material regarding the research and its purposes together with the consent forms.

All the signed consent forms were collected by the six intern researchers who took part in the study, before the administration of the tool. Nineteen kindergartens and ∼1.6% of the students of public and private kindergartens in Cyprus participated in the survey. Approximately 45% of the total number of kindergarten students who participated in the survey were given the SSLD.

5 Analysis of the internal structure of the SSLD and the items selected/developed to address the Cypriot Greek linguistic context

The general structure of the language factors of the scale follows the structure of *Language4* (Klem et al., 2015). All the items include language forms that are either common in both varieties or belong to the mesolect of the Cypriot Greek dialectal continuum. That is, we avoided language forms that are either dialectally marked (basilectal) or belong exclusively to the prestige norm (acrolectal), in an effort to avoid having underperformance that is due to the children not being familiar with any of the terms/language forms used in the scale. In what follows we explain in detail the items that the final version of the scale includes and demonstrate how these take into consideration the Cypriot Greek linguistic context and the language variants spoken by children of that age.

5.1 Receptive vocabulary

Five items of the SSLD ask the child to point to an object among four colored pictures (items 1–4 and 17, see Table 1). These five items aimed to assess the range of the receptive vocabulary. The words *molivi* "pencil," *krevati* "bed," *sakkaki* "jacket," *dahtilo* "finger" in items 1–4 are common in both varieties.

In item 2, the child is presented with four colored pictures that depict a bed, a sofa, a table, and a window. The child is asked to point to the bed. We avoided using the dialectally marked word *karkola* "bed," as this is a word with which some children in the urban areas of the island may not be familiar with, whereas all children at the age of 4 know the word *krevati* "bed" (see item 3 in Table 1 given below in example 1).

(1) Cita oles tis ikones. Dikse mu to krevati.
Look at all the pictures. Show me the bed.

Item 17 includes the word *pagotaris* "ice-cream man," which is formed with the derivational Cypriot Greek morpheme *-aris*. This word is not attested in Standard Modern Greek. Nevertheless, all Greek Cypriot (GC) pre-school children are familiar with it, whereas this is not the case with the Standard Modern Greek equivalent, *pagotatzis* "ice cream man"; hence, the use of *pagotaris* "ice-cream man" was the most appropriate term to use for this task (see item 17 given below in example 2).

(2) Cita oles tis ikones. Dikse mu ton pagotari.
Look at all the pictures. Show me the ice-cream man.

5.2 Comparative and superlative form comprehension and production

Three items (items 5, 28, and 35) aim to examine the understanding and use of the comparative and superlative form of adjectives. Again, we avoided the use of the dialectally marked adjective *mitsi* "small." We used *mikro* "small," which is common in both varieties and it is a word with which all children are familiar (see example 3).

(3) Tuto to trapezi en mikro. Tuto to trapezi en . . . ?
This the table is small. This the table is . . . ?

The examiners used Cypriot Greek dialect forms when assessing children on comparative and superlative form comprehension and production. As shown in example 3, the examiners' questions include the demonstrative pronoun *tuto* "this," which is mainly used by Greek Cypriots instead of *afto* "this," which is the prestige norm equivalent. We also used the mesolectal form *en* "is" instead of the prestige norm *ine* "is," as we wanted children to feel comfortable with using the variant they commonly use in their daily life, when responding to the examiners' questions.

5.3 Expressive vocabulary

Items 26, 27, and 36 (examples 4, 5, and 6, respectively) are similar to *Language4* and examine the range of expressive vocabulary. In these items the examiner asks the children to define what an object is (see Table 1, "What is a book?").[1] Again, the mesolectal form *en* "is" instead of the prestige norm *ine* "is" is used, and we avoided the use of the dialectally marked form *indambu* "what" for the reasons explained above. The words of the objects that the children are asked to define (*tileorasi* "television," *lamba* "lamp," *vivlio* "book") are common in both varieties. Note that these words are educationally appropriate for pre-school children (Klem et al., 2015).

(4) Ti en i tileorasi?
What is a television?
(5) Ti en i lamba?
What is a lamp?
(6) Ti en to vivlio?
What is a book?

5.4 Color naming/knowledge

Two items/questions (items 16 and 29) examine color naming/knowledge, while item 7 (see example 8 below), which includes three individual subsections (7a, b, and c), further assesses the child's ability to follow directions.

(7) Ti hroman en tuto?
What color is this?

Notice the use of the mesolectal forms *en* "is" and *tuto* "this" in item 16 given above in example (7).

5.5 Ability to follow instructions

(8) Cita tin ikona.
Look at the picture.

a. Dikse mu tin mikrin kokkinin bala.
Show me the small red ball
b. Dikse mu mja balan pu ennen mple.
Show me a ball that is not blue
c. Dikse mu tin megalin mple bala mes to kuti.
Show me the big blue ball in the box

Item 7 (given above in example 8) assesses the child's ability to interpret verbal instructions of increasing number and escalating complexity to remember names, features and position of objects (e.g., in the box) and to identify the objects referred to in the instructions. The examiners' instructions/questions use mesolectal forms. That is why we included the use of *ennen* "not is," instead of the prestige norm *den ine* "not is," as the former is commonly used by pre-school children.

5.6 Grammatical competence

Two items/questions (items 30–31) assess the child's ability to create grammatically correct sentences by being given a colored picture[2] that presents a situation and asked to describe it by forming a sentence. Children that produced sentences longer than 3 words scored 1 in this item. Those who uttered sentences that had <3 words scored 0.

1 Answers that provided the properties and functions of the objects in question were marked as correct. E.g., A lamp is light, it is round etc. A television is a black thing, a box, it shows cartoons, videos etc. A book is a fairytale, a story, it has pictures and stories and we read it etc.

2 The picture in item 30 depicts a bedroom where two children are lying on their beds, reading a book. The picture was specifically designed for the scale by an artist and it was pilot tested in order to ensure that it is appropriate for pre-school children.

(9) Pe mu kati ya tuntin ikonan.
Tell me somethilng about this picture

Item 30, which is given in example (9) above, uses the mesolectal forms *pe* (instead of the prestige norm *pes* "tell"), *tuntin* "this the" (instead of the prestige norm equivalent *afti tin* "this the"). It further retains some phonological features of Cypriot Greek such as the retention of the final "n" in accusative forms, which is not attested in Standard Modern Greek.

5.7 Inference making and numerical reasoning

Mesolectal forms were also used in items 6, 18–20, and 37 (see item 18 in Table 1 given below in example 10), which assess the child's ability to draw conclusions with two of them (items 19–20) relating to numerical reasoning (see item 19 in Table 1 given below in example 11).

(10) Ti theli na kami i gata?
What wants to do the cat
"What does the cat want to do?"
(11) Posa pedja vlepis se tutin
How many children see.2.SG. in this
tin ikona?
the picture?

Item 29 assesses both numerical reasoning and color knowledge. In this item the child is asked to draw a conclusion based on the relevant picture from the picture book presented to them ("How many red balls do you see?").

In three cases (items 6, 18, and 37) the child has to make an inference about the emotional state and intentions of the protagonists of the picture (see example 10), while in the other two cases they have to report the number of the objects in question, e.g., "How many children do you see?" The wording of the questions of those items again includes mesolectal forms of the Cypriot Greek dialect continuum (e.g., *en* "is" intead of *ine*, *kami* "do" instead of *kani "do," tutin "this"* instead of *afti "this"*), whereas most of the terms were carefully chosen so that they are common in both varieties.

5.8 Comprehension and production of prepositions

Items 23–25 and 38–40 assess the comprehension and production of prepositions. There is a rooster and a hen house in the picture book. The child is asked to look at the picture and indicate the position of the rooster in relation to the hen house. That is, the child needs to say if the rooster is above, below, next to the hen house etc. Again, the examiners used mesolectal forms (*en* "is," see item 23 in Table 1 given below in example 12) when asking the child to determine the position of the rooster.

(12) Edo, pu en o kokoras?
Here, where is the rooster?

5.9 Verbal working memory

Ten items (items 8–15 and 21–22) assess verbal working memory. In particular, six items (items 8–11 and 21–22) concern the ability to recall sentences.[3] The sentences selected advance in both length and syntactic complexity. They include simple sentences as well as those with embedded arguments or adverbials. The final two items (items 21–22) assess the ability to recall interrogative sentences. The child is asked to repeat two questions: one is a yes-no question, and the other is a wh-question. The examiner utters the sentence and the child is asked to repeat it as heard by the examiner. The words of those items were again carefully selected so that they are common in both varieties, and they display mesolectal phonological features of Cypriot Greek (e.g., the final "n" in verbs, see item 9 in Table 1 given below in example 13). The remaining four items (items 12–15) examine the repetition of pseudo words.

(13) To agorin epjasen tin bala.
The boy caught the ball.

5.10 Relative clause comprehension

Items 32–34 examined the understanding of subject and object relative clauses. Several studies show that relative clauses are clinical markers for identifying language disorders (cf. Adani et al., 2016; Stavrakaki, 2001), that is why we decided to include these items in the tool.

The examiner presents a card with four pictures from the picture book and asks the child to point to the picture that matches the meaning of the relative clause. Each picture assesses both subject and object relative clause comprehension. Cypriot Greek mesolectal forms were chosen for these items as well (e.g., the mesolectal form "garos," instead of the SMG form "gaiduri," see item 33a in Table 1 given below in example 14).

(14) Cita oles tis ikones.
Look at all the pictures.
Dikse mu to alogo pu klotsa ton garo.
Show me the horse that kicks the donkey.

In summary, the 45 items included in the SSLD examined semantic, grammatical and pragmatic structures of pre-school language, as well as related cognitive abilities (see Table 1). All the items include mesolectal forms of the Cypriot Greek dialect, as we

3 Some researchers consider repetition tasks to be assessments of auditory short-term memory (Karmiloff and Karmiloff-Smith, 2001). In contrast, others argue that these tasks can provide insights into children's language abilities and grammatical skills (e.g., Lust et al., 1996; Stokes et al., 2006; Marinis, 2015). However, this discussion is beyond the scope of our paper, which focuses on the appropriateness of these tests in identifying individuals at high risk for language difficulties.

wanted children to be assessed with a language they are familiar with. That is why we avoided the use of prestige norm (acrolectal) or dialectally marked (basilectal) forms with which some children may not be familiar. The order of the items was based on the pilot study data analysis using the Rasch model.

6 Administering and scoring of SSLD

All the children were examined with SSLD in a dedicated area in the kindergartens they attend. SSLD consists of a booklet with colored pictures of objects or situations familiar to four-year-old children, an answer sheet and an assessment manual.

The administration of the scale takes ∼15 min. All the questions of the SSLD have a right or wrong answer and are scored by the examiner with 0 (wrong) or 1 (correct). The maximum score of the scale is 45. A child's maximum score on the scale can be compared with cut-off scores, which will be developed in the next phase of the study, to determine if they are at risk of experiencing language difficulties.

The SSLD project was successful in designing a tool that is easy to administer and score. The following section examines the structural validity of the developed instrument.

7 Results

In both clinical and educational settings, it is critical for practitioners, researchers, and stakeholders to trust the accuracy of the assessment tools used to identify children with language difficulties. Confidence in these tools depends on their psychometric properties including structural validity and internal consistency, as well as their ability to distinguish accurately between language impairments and typical development using language measures or standardized tests (Friberg, 2010). In what follows, we present the results of the phychometric analysis of the structural validity of the tool.

In interpreting the results, we relied on a combination of common goodness-of-fit indices because they provide different information about the measurement models: the comparative fit index (CFI), the Tucker-Lewis Index (TLI), the root mean square error of approximation (RMSEA), and standardized root mean squared residual (SRMR). We considered both adequate and excellent thresholds for these fit indices (Hu and Bentler, 1999). Thus, as rough guidelines, CFI and TLI values >0.90 and 0.95 are considered adequate and excellent, respectively. RMSEA values smaller than 0.08 and 0.06 indicate acceptable and excellent model fit, while an SRMR value <0.10 or of 0.08 (in a more conservative version; see Hu and Bentler, 1999) are considered a good fit.

Following the decision tree proposed by Swami et al. (2023), we first conducted an exploratory analysis using geomin rotation to determine the factor structure of the SSLD. All measurement models were estimated using the weighted least square mean and variance adjusted (MLSMV) in Mplus 8.7 (Muthén and Muthén, 1998–2017). The data confirmed the existence of 11 factors (see the language and cognitive factors in Table 1) explaining the variability across the 45 items of the SSLD. The exploratory factor analysis showed a perfect fit, $\chi^2(619) = 634.05$, $p = 0.33$, CFI = 0.998, TLI = 0.996, RMSEA = 0.007, RMSEA 90% CI [0.0, 0.016], SRMR = 0.06. Twenty six items presented significant factor loadings at 5% ranging from 0.2 to 0.97 without cross-loading. These fit indices suggest that the factor structure of the SSLD is well-supported by the data, indicating that the identified factors are robust and meaningful. The low RMSEA and SRMR values, along with high CFI and TLI scores, confirm that the SSLD items fit well within the specified factors. Conversely, 19 items presented one or two cross-loadings; the analysis confirmed the existence of 24 cross-loadings. The matrix of the factor correlations revealed the existence of nine correlations significant at 5% mainly between the first factor and the other factors (six out of nine correlations) ranging from 0.17 to 0.35. Generally speaking, the range of factor loadings demonstrates that the majority of items contribute strongly to their respective factors, affirming that the SSLD reliably captures language and cognitive dimensions across its 45 items.

Based on the mixed results obtained from the exploratory factor analysis, we decided to conduct a confirmatory factor analysis (CFA) to assess factor validity of the SSLD. In addition, given that the SSLD was designed as a scale for the evaluation of a general language factor, we proceeded with applying an exploratory structural equation modeling (ESEM), and a bifactor-CFA to assess its construct validity by comparing the results of CFA with those of ESEM.

The CFA was applied following the typical CFA specification, items were only loaded on their respective factor, while cross-loadings were constrained to zero. In the CFA model, the items were specified to load onto their a priori construct (i.e. verbal working memory, color knowledge, etc.). The model indices of goodness of fit indicated a marginal fit, with $\chi^2(989) = 1549.7$, $p < 0.01$, CFI = 0.919, TLI = 0.912, RMSEA = 0.03, RMSEA 90% CI [0.03, 0.04], SRMR = 0.12. While the CFA model produced acceptable fit indices, the marginal fit (e.g., CFI and TLI values below 0.95, and higher SRMR) suggests some limitations in how well the model captures the relationships between the items and their constructs. This indicates that the CFA model alone may not fully represent the complex, multidimensional structure of the SSLD, which likely involves more nuanced interrelations among the items.

In the ESEM, items were loaded on their respective factor, whereas the size of cross-loadings or factor correlations were "reduced," using geomin rotation and an epsilon value of 0.5 as recommended by Marsh et al. (2009). Also, all items were allowed to be freely estimated, and they cross-loaded onto the 11 factors. The ESEM model provided an almost perfect fit for the data, with $\chi^2(619) = 634.03$, $p = 0.33$, CFI = 0.998, TLI = 0.996, RMSEA = 0.007, RMSEA 90% CI [0.0, 0.016], SRMR = 0.06. These fit indices show that the ESEM model fits the data well, even better than the CFA model. The ESEM model allows for cross-loadings between factors, which seems to better capture the multidimensional structure of the SSLD. This suggests that language development, as measured by SSLD, involves overlapping skills that are not perfectly distinct from one another, a finding that better reflects the complexity of language acquisition.

These results indicate that the CFA model does not provide an acceptable fit to the data (significant χ^2; TLI < 0.95; RMSEA >

0.08). Conversely, the ESEM model provided an almost perfect fit to the data (non-significant χ^2; CFI and TLI > 0.95; RMSEA < 0.06). The main difference—in addition to the ESEM cross-loadings—is that the CFA model results in highly inflated factor correlations due to the unrealistic assumption of 0 cross-loadings.

The comparison of CFA and ESEM model fit results suggest that sources of construct-relevant psychometric multidimensionality may be present in the SSLD. Therefore, on the basis that SSLD includes hierarchically-organized and conceptually-adjacent constructs, we conducted a bifactor-ESEM (Morin et al., 2016). Bifactor-ESEM provided an excellent fit to the data according to all indices, with $\chi^2(583) = 578.17$, $p = 0.55$, CFI = 1.0, TLI = 1.0, RMSEA = 0.00, RMSEA 90% CI [0.0, 0.013], SRMR = 0.06. Specifically, the bifactor-ESEM model provided the best fit to the data, a slightly better level of fit to the data, and lower values for the goodness of fit indices than the ESEM solution.

The bifactor-ESEM model shows that the general language factor is well-defined by the presence of strong and significant target loadings from all the items of the SSLD, except for three ($|\lambda| = 0.231$ to 0.823, $M = 0.492$, $\omega = 0.97$), which is impressive for a general factor defined by 45 items designed to tap into different domains (see Table 2; Figure 1). Over and above this general language factor, the specific factors (see Table 2, F1–F11) related to SSLD subscales are not well-defined presenting low target loadings ($|\lambda| = 0.241$ to 0.366, $M = 0.313$). This suggests that they do not indeed tap into relevant specificity and operate as additive information to the general language factor.

Overall, the excellent fit of the bifactor-ESEM model suggests that the SSLD measures both general language ability and more specific factors related to distinct aspects of language. The strong performance of the general language factor indicates that most items on the SSLD contribute meaningfully to an overarching language skill. Meanwhile, the weaker performance of the specific factors suggests that these factors contribute less independent information beyond the general language ability. This shows that while the SSLD is highly effective at measuring overall language development, the specific factors provide limited additional diagnostic value.

8 Discussion

The paper provided a thorough analysis of the methodology that was followed when developing SSLD. Aiming to address the lack of assessment tools that consider the linguistic diversity in Cyprus, the items of the scale were specifically designed for Greek Cypriot pre-school children. The paper demonstrated how the scale items, which were chosen based on recent research on clinical markers and prognostic factors of developmental language disorders (Klem et al., 2016), were developed to capture the properties of the language varieties of Greek Cypriot pre-school children. Following a detailed analysis of the linguistic features of the two varieties and taking into consideration the sociolinguistic context, we avoided using basilectal/dialectally marked or acrolectal/prestige norm forms. As shown in Section 5, we ensured that all the items, apart from age-appropriate vocabulary, included mesolectal forms with which all Greek Cypriot children of this age are familiar.

Our goal was to develop a tool that does not only consider the distinct features of Greek Cypriot speakers' language varieties, but a tool with psychometric properties that would allow practitioners to use it confidently for identifying language development deviations. The psychometric analysis of the SSLD provides strong support for its structural validity and internal consistency, highlighting its potential as an effective tool for assessing language growth in Greek Cypriot children. The bifactor-ESEM analysis revealed a well-defined factor structure with excellent fit indices (e.g., CFI = 1.0, TLI = 1.0, RMSEA = 0.00), demonstrating strong structural validity for the SSLD. Additionally, the high reliability coefficient for the general factor ($\omega = 0.97$) indicates that the scale consistently and reliably captures key dimensions of language and cognition. These results indicate that the SSLD can effectively identify individuals who may face language difficulties and require a more comprehensive language assessment, considering various aspects of language functioning across its 45 items. Importantly, the items demonstrate strong factor loadings without significant cross-loadings, suggesting that they are appropriately aligned with their designated factors.

However, the confirmatory factor analysis (CFA) presented a marginal fit, with fit indices like CFI (0.919) and TLI (0.912) falling below the thresholds for excellent fit. This finding indicates that the CFA model's assumption of no cross-loadings may oversimplify the underlying structure of language development. By contrast, the exploratory structural equation modeling (ESEM) approach produced a nearly perfect fit, allowing for cross-loadings between factors and better capturing the multidimensional nature of language. This reinforces the idea that language development is complex and interconnected, with skills that overlap rather than function in isolation. The better fit of the ESEM model suggests that the SSLD more accurately reflects the natural variability of language skills in children when cross-factor relationships are considered.

The bifactor-ESEM model further supports the SSLD's capacity to assess both general and specific language abilities. The strong loadings on the general language factor, combined with the relatively weak loadings on the specific factors,[4] indicate that the SSLD is particularly effective at measuring overall language competence. While the specific factors related to SSLD subscales offer some additional diagnostic insight, their lower contributions suggest that the tool is primarily driven by its ability to assess broad language ability. This finding is consistent with the objective of developing an assessment tool that identifies general language difficulties while accounting for the linguistic diversity of Greek Cypriot children. SSLD, therefore, appears well-positioned to be a valuable resource for practitioners in clinical and educational settings, offering a robust measure of language development that aligns with the sociolinguistic context of Cyprus.

9 Concluding remarks

Although the present analysis shows that SSLD has satisfactory structural validity and reliability, further research is needed to study

4 See the language and cognitive factors presented in Table 1 and explained in detail in Section 5.

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TABLE 2 Standardized factor loadings for bifactor-ESEM model of the SSLD.

Item[a]	GL	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
Q4	0.13	0.615	−0.058	−0.143	−0.106	−0.201	−0.159	0.126	0.472	0.131	0.038	0.074
Q3	0.52**	0.799**	0.247	0.002	0.093	0.141	0.033	−0.201	0.068	0.037	−0.020	0.013
Q2	0.542**	0.643**	−0.010	−0.065	0.043	−0.049	0.015	0.202	−0.084	0.033	0.194	−0.058
Q6	0.452**	0.257*	−0.001	−0.428*	0.212	0.251	0.086	0.141	0.197	0.114	0.196	−0.072
Q16	0.664**	0.288**	0.109	0.240**	−0.120	0.083	0.059	−0.019	0.049	−0.037	−0.142	−0.092
Q13A	0.696**	−0.008	0.215	−0.244	0.180	−0.254	−0.009	−0.176	0.120	0.035	0.192	0.006
Q13B	0.45**	0.061	0.494**	−0.039	0.300**	0.046	0.054	0.049	0.106	−0.045	−0.091	−0.090
Q13C	0.611**	0.175*	0.641**	−0.132	0.050	0.013	−0.073	0.026	−0.048	0.072	−0.251*	0.083
Q28	0.755**	0.009	−0.255**	0.081	−0.142	−0.084	−0.172*	−0.037	−0.391**	−0.146*	0.010	−0.108
Q29	0.803**	−0.072	−0.273**	0.046	−0.060	0.019	−0.178*	−0.024	−0.216**	−0.164**	0.005	−0.233**
Q30	0.823**	−0.035	−0.267**	0.049	−0.062	−0.048	−0.126*	−0.118*	−0.040	−0.179**	0.074	−0.145*
Q31	0.824**	−0.127	0.039	0.065	0.078	−0.112	−0.034	−0.146*	0.045	−0.167**	−0.086	−0.237**
Q32	0.615**	0.291**	0.056	−0.108	−0.339**	−0.067	−0.111	−0.051	−0.136	0.024	0.115	0.032
Q33	0.685**	−0.292*	0.090	−0.040	−0.372**	−0.035	−0.321**	0.053	−0.277**	−0.017	0.283*	0.007
Q34	0.682**	−0.239	0.057	−0.180*	−0.229*	−0.140	−0.251**	−0.233**	−0.068	0.055	0.231*	0.181*
Q35	0.76**	−0.236*	−0.121	−0.033	−0.256**	−0.112	−0.250**	−0.141*	−0.103	0.006	0.072	0.037
Q12	0.479**	−0.178	0.109	−0.081	0.142	0.087	0.346**	0.023	−0.039	0.013	−0.002	−0.071
Q5	0.447**	0.080	0.131	0.093	−0.190*	−0.144	0.119	0.120	0.151	−0.110	−0.173*	0.097
Q18	0.316**	0.011	−0.093	0.213**	−0.137	−0.126	0.152*	0.020	0.101	0.091	0.061	−0.062
Q19	0.524**	0.085	0.027	0.097	−0.013	0.52**	0.039	−0.032	−0.070	−0.044	−0.007	0.002
Q20	0.551**	−0.071	0.032	0.038	0.055	0.48**	0.171*	−0.100	−0.030	0.150*	−0.008	−0.106
Q36	0.778**	−0.076	−0.424	−0.233**	0.122	0.056	−0.107	−0.011	−0.162*	−0.137*	−0.101	0.068
Q37	0.765**	−0.122	−0.303	−0.138*	0.152*	−0.040	−0.168*	−0.004	−0.046	−0.045	−0.155*	−0.045
Q21	0.305**	0.140	−0.064	0.134	0.079	0.115	0.039	0.041	0.164*	−0.124	0.055	−0.058
Q22	0.312**	−0.019	−0.016	0.016	0.106	−0.129	0.199**	−0.104	0.015	0.027	−0.008	−0.005
Q23	0.455**	0.031	0.005	0.017	0.083	−0.17*	0.468**	−0.012	0.015	0.084	−0.017	0.031
Q10	0.388**	−0.016	−0.060	0.814**	0.047	0.019	−0.082	−0.043	−0.004	−0.017	0.107*	−0.011
Q11	0.494**	0.114	0.025	0.518**	0.053	−0.079	0.002	0.084	−0.035	0.016	−0.112	−0.044
Q7	−0.13	0.093	−0.140	0.023	0.129	−0.017	0.000	−0.048	−0.084	−0.132*	0.800**	−0.059
Q27	0.524**	0.026	0.020	−0.160*	−0.050	0.598**	0.132*	−0.094	0.037	0.052	−0.038	0.050
Q15	0.341**	0.091	−0.059	0.067	−0.071	−0.037	−0.035	0.105	0.044	−0.004	−0.088	0.403**
Q14	0.311**	−0.073	0.094	0.069	−0.016	0.004	−0.012	0.083	0.087	−0.028	−0.080	0.628**
Q39A	0.497**	0.026	0.004	−0.056	−0.025	0.050	−0.020	0.740**	0.212**	0.094	−0.031	0.068
Q39B	0.521**	−0.018	0.048	0.010	−0.026	−0.138**	0.067	0.784**	0.231**	0.046	−0.023	0.002
Q39C	0.231*	−0.043	0.080	0.014	1.0**	0.028	−0.053	−0.097	−0.026	0.077	0.104	−0.051
Q38A	0.391**	0.050	−0.002	−0.038	0.096	0.083	−0.104	0.066	0.004	0.737**	−0.046	0.004
Q38B	0.384**	0.074	0.069	−0.047	0.011	−0.015	0.078	0.050	0.134*	0.906**	−0.069	−0.006
Q38C	0.19	0.168	−0.089	0.036	0.602**	−0.150	−0.267	0.207	−0.146	−0.055	0.018	0.136
Q40A	0.306**	0.078	0.029	0.020	−0.024	0.022	0.065	0.217**	0.774**	0.013	−0.152*	0.057
Q40B	0.362**	0.062	0.035	−0.022	−0.032	−0.006	−0.013	0.165*	0.700**	0.107*	0.050	−0.051
Q40C	0.254**	0.064	0.043	0.046	0.345**	−0.187	0.124	0.004	0.058	0.015	−0.041	0.077

(Continued)

TABLE 2 (Continued)

Item[a]	GL	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
Q8	0.269**	0.075	0.092	0.031	0.139	0.030	0.186*	−0.191	0.042	−0.086	0.251**	0.238*
Q9	0.305**	−0.228	−0.025	0.545**	0.114	0.032	0.124	0.005	−0.026	−0.139*	−0.003	0.245**
Q17	0.261**	0.190	−0.157	0.074	−0.082	−0.140	0.043	−0.134	−0.024	0.138	−0.021	0.339**
Q25	0.393**	−0.181	0.099	0.280**	0.241*	0.044	0.329**	−0.003	0.085	−0.017	−0.237**	0.039
Q26	0.427**	0.017	0.009	−0.076	−0.077	0.094*	0.792**	0.059	−0.071	−0.005	0.049	0.023
Q24	0.483**	−0.022	−0.006	0.016	−0.125	0.040	0.861**	0.000	0.065	−0.008	−0.006	−0.006

[a]Item 1 was excluded from all analyses due to trivial variance.
*$p < 0.05$.
**$p < 0.01$.
GL, General language factor; F1, Verbal Working Memory; F2, Ability to Follow Instructions; F3, Expressive Vocabulary; F4, Relative Clause Comprehension; F5, Numerical Reasoning; F6, Preposition Comprehension and Production; F7, Relative Clause Comprehension; F8, Relative Clause Comprehension; F9, Relative Clause Comprehension; F10, Comparative and Superlative form Comprehension; F11, Grammatical competence.

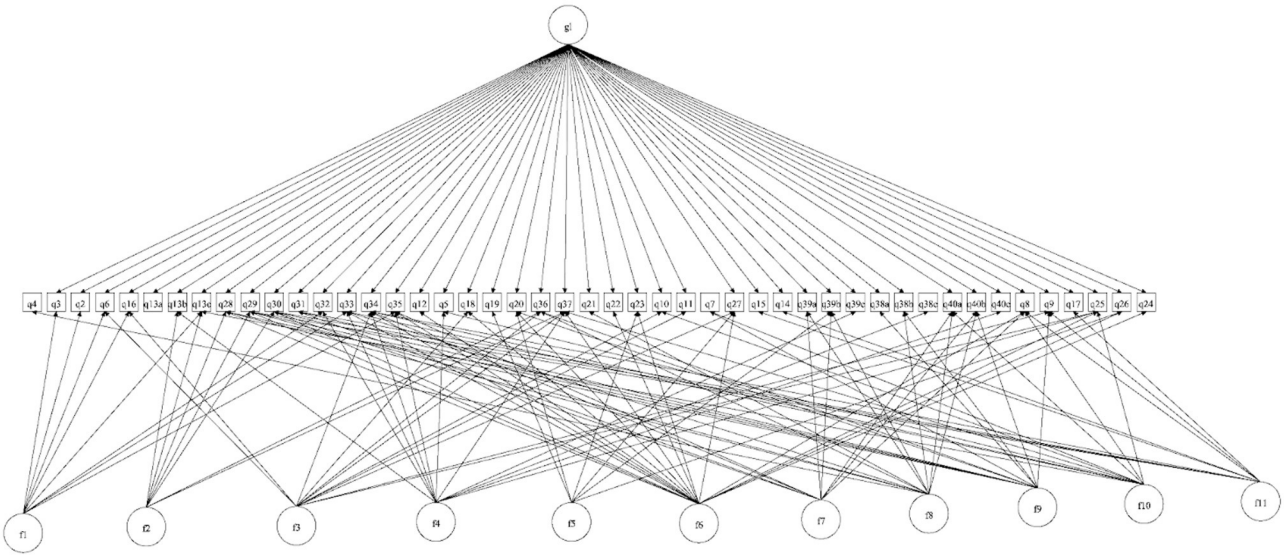

FIGURE 1
Schematic representation of the bifactor-ESEM model fitted in the current study.

the sensitivity and specificity of the scale in clinical population samples, in order to draw safe conclusions about the use of the tool in clinical practice.

Still, the development of SSLD addresses a gap in both theoretical research and clinical practice, and significantly contributes to early identification benefitting Greek Cypriot children who experience language difficulties. Early detection lays the foundation for appropriate intervention (e.g., Fey and Cleave, 2008; Gallagher and Chiat, 2009). Several studies have demonstrated that children that underwent early intervention display significant improvement in cognitive and academic performance, show less aggressive or disruptive behavior, as well as fewer neuro-developmental or neuro-psychiatric problems (Miniscalco et al., 2006; Vitrikas et al., 2017).

More studies need to be conducted to contribute to the advancement of knowledge on early screening of dialect speakers and non-monolingual population in general. Addressing linguistic diversity in language assessment is a necessity (Francois et al., 2023), and more tools that consider it should be developed so that non-monolingual speakers' language development is confidently assessed.

Data availability statement

The data that support the findings of this study are available from the corresponding author, AK, upon reasonable request.

Ethics statement

The studies involving humans were approved by Cyprus National Bioethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in

this study was provided by the participants' legal guardians/next of kin.

Author contributions

AK: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. GS: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. ET: Conceptualization, Formal analysis, Investigation, Resources, Validation, Writing – original draft, Writing – review & editing.

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