

# Which clinical signs are valid indicators for speech language disorder?

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## Introduction

- Problems in speech language development are common in children (Bishop et al. 2016 *PLoS ONE* 11(7) ).
- To measure speech language development, we need to identify clinical signs that reflect the underlying construct.
- The construct is under debate regarding unidimensionality versus multidimensionality (Tomblin & Zhang, 2006 *J Sp Lang Hear Res* 49).
- The aim of this study is to construct a scale with characteristics of speech language development and social interaction for children aged 1 to 6, and to evaluate its scalability, and associated with this its dimensionality.

## Methods

### Sample and procedure

- Population sample (n=1175; 603 boys and 572 girls equally distributed over 5 age groups) parents of children from 1-6 years of age
- 53-items via telephone conversation
- Administration by trained students
- Item Response Theory (IRT) analysis (Mokken) in R v3.2.3 Package Mokken

Mokken procedure

### Scalability

Assessment of dimensionality via Automatic item selection procedure  
Figure 1: ICCs ascending

### Monotonicity

Assessment if items are monotone positively related to the latent trait  
Figure 1: ICCs S-shaped

### Non intersection

Assessment if items do not intersect  
Backward selection of items  
Figure 1: ICC's do not intersect

### Remaining items

The 38 remaining items belonging to scale 1 have ItemH coefficients between 0,62 and 0,91, which indicates strong scalability. The total scale H = 0,82, which indicates a strong scale. The items have a mean score between 0,35 and 1. The mean score concerns the proportion of 'yes' answers on an item.

Table 1: Mean score and itemH for remaining items

Item	Remaining items	Mean	ItemH
1	els4 Does your child understand you when you say 'no'?	1.00	0.81
2	els6 Does your child say any 'words'? For example: 'mama', 'papa', 'cookie'? It doesn't have to be pronounced correctly.	0.99	0.84
3	els11 When you play with your child, with a ball for example, does your child have attention for you and the ball?	0.99	0.62
4	els2 Does your child understand tasks consisting of two words? For example: 'coat on' or 'look there'?	0.99	0.91
5	els18 Does your child understand 3 word sentences? For example: 'on the chair' or 'to the hallway'?	0.98	0.86
6	els19 Does your child understand when you ask him/her something? For example: 'Shall we read a book together'?	0.98	0.89
7	els3 Can your child point out something you ask them to? For example: 'where is your nose?' or 'where is the ball'?	0.98	0.90
8	els7 Can your child say about ten words in total?	0.94	0.87
9	els29 Do you understand about half of the things your child says?	0.93	0.83
10	els17 Is your child able to point 5 pictures in a book when they are verbally offered to him/her?	0.93	0.86
11	els26 Is your child able to point out 6 body parts on a doll/themselves? Where are the eyes, mouth, tummy, foot, hair, hand?	0.92	0.84
12	els68 Is your child able to clarify what he/she wants to say or ask?	0.90	0.68
13	els27 Does your child ask you when he/she wants to have some food, or wants to play with toys?	0.89	0.81
14	els22 Is your child able to combine two words? For example: 'daddy ball' or 'look cat'?	0.89	0.87
15	els33 Do you understand about 75% of what your child is telling you?	0.89	0.75
16	els37 Can your child name four or more pictures of animals? For example: 'dog', 'cat', 'horse', 'cow'	0.89	0.86
17	els25 Does your child say more than 30 words?	0.86	0.87
18	els28 Is your child able to talk with you in turns?	0.86	0.70
19	els69 Is your child able to initiate a conversation?	0.85	0.75
20	els24 Are the words in the sentences of your child mostly in the right place?	0.81	0.78
21	els44 Does your child ask questions about 'who', 'what', 'where', 'how'? For example: 'Where's my teddybear'?	0.80	0.84
22	els26 Is your child able to ask a question? For example: 'What's that?' or 'who's that'?	0.80	0.85
23	els21 Does your child call themselves 'me' or 'I'?	0.80	0.76
24	els43 Does your child ever spontaneously tell you a story? For example, about what they did that day.	0.79	0.78
25	els35 Does your child use words that say something about other words (adjectives)? For example, 'big' in 'a big house'.	0.78	0.83
26	els42 Does your child use four word sentences? For example: 'I put in bowl' or 'can I build blocks'?	0.77	0.88
27	els23 Is your child able to name a couple of colours correctly?	0.76	0.84
28	els57 Can your child retell a story with the help of pictures? For example when reading a book together.	0.75	0.82
29	els35 Does your child use words like 'we', 'he', and 'she' in a sentence? For example: 'he is really happy'	0.68	0.87
30	els67 Is your child able to express his/her thoughts verbally?	0.65	0.78
31	els34 Does your child make sentences with words like 'when' or 'and'? For example: 'when we have finished dinner, we are going to play with clay' or 'they put their coat on and they put their shoes on'	0.64	0.86
32	els54 Does your child ask questions beginning with 'why'?	0.64	0.85
33	els63 Does your child make very long sentences? For example: 'When I grow up, I want to be a cook.'	0.57	0.86
34	els39 Does your child use the proper plural form? For example feet instead of foots	0.57	0.81
35	els49 Can your child complete the following sentences: Not black but.... Not high but....	0.54	0.82
36	els66 Does your child make sentences with 'because'?	0.47	0.85
37	els40 Does your child use the correct form of the past? For example: 'went' instead of 'goes' or 'had' instead of 'have'?	0.35	0.80
38	els64 Does your child talk like an adult in terms of language?	0.35	0.78

Mokken procedure

### Scalability

Items removed: 7  
5 items were not scalable  
2 items belonging to scale 2

### Monotonicity

Items removed: 0

### Non intersection

Items removed: 8  
Crit values > 80

Item Characteristic Curves

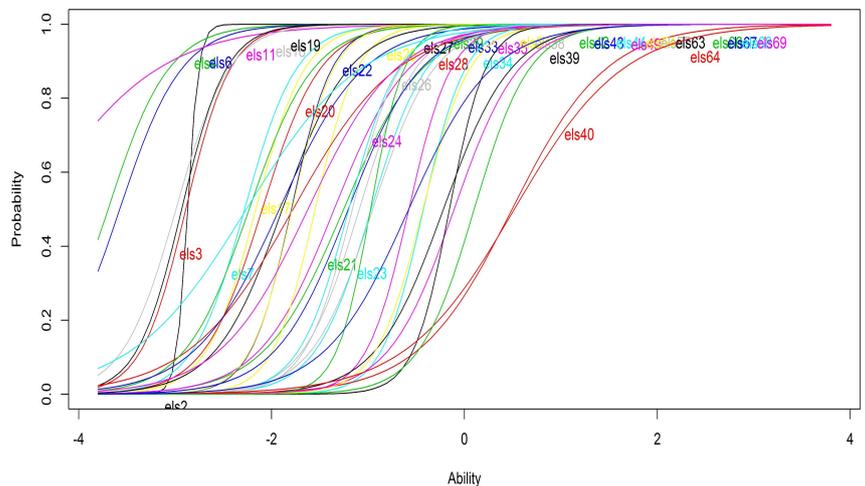


Figure 1. Item Characteristic Curves of the remaining 38 items.

Notes: The y-axis denotes the probability, this is the likelihood that a child scores a 'yes' on an item. The x-axis denotes to the ability, this is the latent trait value, in our case: speech language development.

## Discussion and Conclusions

- We constructed a unidimensional scale of 38 items to measure speech language development in children from 1 to 6 years of age.
- The latent trait 'speech language development' consists of items on speech (intelligibility) and language (semantics, syntax, and pragmatics). All items are related to the construct, and can contribute to the measurement of speech language development.
- Most items on interaction (13 out of 15) did not fit the unidimensional construct. Interaction can be a condition to develop language, moreover removed items may discriminate in younger children than our study sample.

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