

# Intervention plan in vocabulary, working memory, and syntactic awareness for adolescents and young adults with trisomy 21: Content development and validation

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## ABSTRACT

**Purpose:** to develop and validate the content of an intervention plan for adolescents and young adults with Trisomy 21, focusing on vocabulary, working memory, and syntactic awareness.

**Methods:** a methodological study with validation stages for the proposed intervention, which was assessed by ten judges. The content validity index was used to evaluate the content, quantitatively.

**Results:** most judges had a doctoral degree. All propositions reached the minimum score. The oral language intervention plan focusing on vocabulary, working memory, and syntactic awareness was designed for adolescents and young adults aged 13 to 25 years and 11 months. The proposal included fifteen 40-minute weekly sessions.

**Conclusion:** the study presented the process of developing and validating the Oral Language Therapy Plan, focusing on vocabulary, working memory, and syntactic awareness for people presented with trisomy 21, with the judges' agreement.

**Keywords:** Down Syndrome; Validation Study; Speech, Language and Hearing Sciences

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## INTRODUCTION

Trisomy 21 (T21), commonly known as Down syndrome (DS), is a genetic disorder in the 21<sup>st</sup> pair of chromosomes, being identified as an extra copy or excess of genetic material resulting from a failure in the cell division of the fertilized egg cell, presenting cognitive and physical deficits, which can vary considerably between individuals<sup>1</sup>. Its prevalence is 1:700 live births<sup>2</sup>.

People with T21 have peculiar characteristics, such as global developmental delay of oral and written language, muscular hypotonia, cardiac and pulmonary changes, and so forth. However, it is important to mention that the level of functional impairment may vary between these subjects<sup>3</sup>.

Thus, T21 can impair language due to neurological, sensory, auditory, and intellectual changes. Lexical competence is an extremely important and necessary skill for the other subsystems of oral language and a predictor for learning written language. Its development begins at 12 months and can be influenced by various factors (e.g., social interactions, language-rich environments, and so on), in a complex, multifaceted, nonlinear process<sup>4,5</sup>.

Lexical competence in people with T21 begins around 18 to 24 months, with greater loss in expressive vocabulary, in contrast with typically developing children<sup>6</sup>. This may happen due to hearing problems possibly associated with the syndrome, executive function difficulties, and phonological, pragmatic, semantic, and syntactic language delays – among which, the semantic level is the basis for acquiring other language subsystems<sup>7</sup>.

Besides the lexical acquisition challenges, people with T21 may also have difficulties in other essential cognitive skills. Studies have highlighted the importance of working memory (WM) in this context. People need WM (i.e., the ability to store and manipulate stimuli) to be able to develop complex activities such as reasoning, learning, and understanding and retain, process, manipulate, and understand them so that, finally, they can be evoked during a dialogue<sup>8</sup>. Authors point out that people with T21 have greater difficulty in the phonological component of WM<sup>6</sup>.

Syntactic awareness (SA) is another important linguistic skill that may be affected in individuals with T21. This skill involves understanding and being able to manipulate grammatical structures of the language, such as sentences, clauses, and their relationships. It may be challenging for individuals with T21 to identify

different syntactic elements, such as subject, verb, and object, and understand agreement and government relationships between words<sup>9</sup>.

Speech-language-hearing intervention plays a crucial role in maintenance, in relevantly addressing these difficulties, and in the quality of life of people with T21. When targeted at this audience, it aims to stimulate linguistic and communication skills, improving speech intelligibility and comprehensive and expressive vocabulary, and playing a fundamental role in maximizing the communication potential and understanding of people with T21<sup>10</sup>.

The skills chosen for an intervention plan aim to promote their greater academic and occupational autonomy, allowing gains in how they communicate and relate to others, bringing greater empowerment, and opening doors for this public to enter the job market<sup>11</sup>.

Given the above, the research question must be answered: “What content should be proposed in an intervention plan for adolescents and young people with T21?”.

This study hypothesized that the intervention plan for adolescents and young people with T21 will have content validated by judges, and structured to stimulate their language demands, WM, and SA.

This study will help set new goals for speech-language-hearing intervention for people with T21, promoting evidence-based practices. Few current studies have addressed T21 and language in adolescents and young people, which may hinder their clinical-educational management. Therefore, there is a need for studies in this area to reduce the complaints raised by family members, caregivers, teachers, and society in general, present in the social context of people with T21.

Thus, this research aimed to develop and validate the content of an intervention plan for adolescents and young adults with T21, focusing on vocabulary, WM, and SA.

## METHODS

This methodological study encompassed the validation stages of the intervention approach.

The research was approved by the Human Research Ethics Committee of the Health Sciences Department at the Federal University of Paraíba, Brazil, under protocol number 6.196.860 and CAEE 71203223.1.0000.5188. An informed consent form was applied, following the

recommendations in Resolution 466/12 of the National Research Ethics Commission (CONEP, in Portuguese).

The literature was reviewed to identify the skills with the greatest difficulties to be worked on and thus construct the intervention plan. The number of sessions and activities was evaluated by a group of judges to validate the intervention plan content.

The judges were selected through non-probability convenience sampling. The eligibility criteria were professional speech-language-hearing pathologists working on language with T21 for more than 5 years, having published or researched on the topic, and

carrying out speech-language-hearing interventions with the target audience. The literature recommends five to 10 judges<sup>12</sup>.

Firstly, 10 professionals were contacted via email with an invitation and the questionnaire, which began with an informed consent form and questions to evaluate the plan. Ten responses were obtained. The email contained information about the research study object, a brief explanation of the plan, and the reason why that professional had been chosen.

Table 1 contains the sociodemographic data of the judges in this research.

**Table 1.** Sociodemographic data of the judges

Identification	Sex	Education level	Years in the profession	Performs intervention
J1	Female	Specialization	8-9	Yes
J2	Female	Doctor's	More than 10	Yes
J3	Female	Master's	6-7	Yes
J4	Female	Specialization	8-9	Yes
J5	Female	Doctor's	More than 10	Yes
J6	Male	Doctor's	8-9	Yes
J7	Female	Master's	6-7	Yes
J8	Female	Master's	More than 10	Yes
J9	Female	Specialization	More than 10	Yes
J10	Female	Master's	6-7	Yes

Source: The author, 2023

It shows that the judges met all research eligibility requirements.

The questionnaire was carried out on Google Forms, and divided into two parts: sociodemographic data and analysis of the intervention plan. The first section aimed to understand the participants' academic level, years in the profession, whether they performed language interventions for people with T21, and whether they had taken improvement courses in the area.

The last section had nine propositions that the judges should analyze using a 4-point Likert scale (disagree, somewhat agree, agree, strongly agree). The propositions were described based on the literature<sup>13,14</sup> to understand whether the intervention had a different approach to the public in question, whether it stimulated the development of personal skills for greater autonomy, whether the procedure instructions

were adequate, whether the selected language skills were satisfactory, whether the program was suitable for the intended public, whether the number of sessions was appropriate, and whether the tasks were appropriately organized into difficulty levels. At the end, room was provided for the judges to add any information they deemed necessary.

The content validity index (CVI) was used to evaluate the content quantitatively. Its score is obtained by calculating the number of items marked 3 or 4 on the Likert scale divided by the total number of responses. This study used 0.78 as the minimum agreement (cutoff) value. Therefore, the minimum score to validate the content was 0.78. Items marked 1 or 2 on the Likert scale were reviewed<sup>12,15</sup>. The judges' suggestions on the form were analyzed qualitatively.

## RESULTS

The oral language intervention plan focusing on vocabulary, WM, and SA was designed for adolescents and young adults aged 13 years to 25 years and 11 months. The approach includes fifteen 40-minute weekly sessions.

The objectives were outlined with an acquisition hierarchy. The first five sessions focused on vocabulary development. During this period, intensive work was done to expand the patient's word repertoire, helping them acquire new terms and understand their meanings. Interactive materials, word association games, and categorization exercises were used to make vocabulary learning more effective.

The sixth to the tenth session focused on improving WM. This ability is essential for information processing and the basis for complex cognitive tasks. Exercises involving event repetition and sequencing were used to

strengthen their mind's ability to retain and manipulate information.

The last five sessions worked on SA, which helps understand the grammatical structures of sentences. Linguistic games, oral grammatical analysis exercises, and sentence construction practice were used to improve this skill.

The procedures used an average of three different semi-structured playful approaches per session, based on activities common to speech-language-hearing practices.

If the patient is unable to respond to the procedures in a session, the approach provides for adjusting the level of therapeutic support. In the following session, the procedures from the previous one should be resumed without support, allowing the patient to gradually challenge themselves and develop their skills.

The therapeutic plan is presented in Chart 1.

**Chart 1.** Oral language therapy plan focusing on vocabulary, working memory, and syntactic awareness for people with T21

Sessions	Objectives	Procedures
1 <sup>st</sup> session	To improve receptive vocabulary	<ul style="list-style-type: none"> <li>- Mime game: the participant uses gestures and facial expressions to convey a message.</li> <li>- Drawing a spoken word: the therapist says a word out loud, and the participant has to visually represent the word in a drawing.</li> <li>- The therapist reads a story or everyday news and, when a specific word appears, the participant must do a previously agreed action. For example, every time the therapist reads the word "dog", the participant has to clap their hands.</li> </ul>
2 <sup>nd</sup> session		<ul style="list-style-type: none"> <li>- Synonyms and antonyms game: the therapist asks the participant to identify synonyms and antonyms from a part of speech.</li> <li>- Guessing game: The therapist provides the participant with a clue or description of a word and asks them to guess the word.</li> <li>- Storytelling: The therapist asks the participant to tell a story using words that are new or unfamiliar. The therapist, then, asks them questions to check whether they understood the meaning of those words.</li> </ul>
3 <sup>rd</sup> session	To improve semantic categorization	<ul style="list-style-type: none"> <li>- Categorization of figures: the participant must separate the figures given by the therapist according to predetermined semantic categories (e.g., colors, foods, household objects).</li> <li>- Word storage according to semantic categories (each word is added – for example: participant says cow; therapist says cow, duck; then, participant says cow, duck, cat).</li> <li>- Organizing lists: a list of disorganized words is given, and the participant must organize them into groups.</li> </ul>
4 <sup>th</sup> session	To promote the comprehension of simple oral words and sentences	<ul style="list-style-type: none"> <li>- Concept association: the therapist presents the patient with a central word and asks them to list other words related to this central one. For example, if the central word is "school", the patient may list words such as "teacher, student, blackboard, study" and so on.</li> <li>- Understanding sentences through interpretation and digital game <a href="https://wordwall.net/pt/resource/3045088/compreens%C3%A3o-de-frases">https://wordwall.net/pt/resource/3045088/compreens%C3%A3o-de-frases</a>. The therapist reads the sentences, and the participant chooses the correct answer. If the digital resource is not available, the therapist asks oral questions about the patient's daily life for the patient to answer.</li> <li>- Understanding instructions: the therapist gives verbal instructions, and the participant must carry them out. For example: "Pick two objects that you can use to eat", "Find three objects that are red", and "Select three clothes that you wear in winter."</li> </ul>

Sessions	Objectives	Procedures
5 <sup>th</sup> session	To expand the expressive vocabulary	<ul style="list-style-type: none"> <li>- Changing the end of a story: the therapist chooses a story and reads it out loud. Then, they ask the participant to tell a new ending to the story, trying to be as detailed and creative as possible.</li> <li>- Theater: the therapist and the participant create dialogues between the characters, trying to expand vocabulary by using new words.</li> <li>- Logical-temporal sequence: the participant narrates the story in the logical sequence or the facts that happened in their day.</li> </ul>
6 <sup>th</sup> session		<ul style="list-style-type: none"> <li>- Puzzle games: the participant must remember the pieces they tried and the strategies they used to assemble a 24-piece puzzle on average, depending on their cognitive skills.</li> <li>- Ordering and sequencing: the therapist asks the participant to order a sequence of numbers or objects. Later, they will have to repeat the sequence without seeing the objects.</li> <li>- Lynx board game: the therapist gives 10 pieces to the participants, and they have 2 minutes to find the requested figures.</li> </ul>
7 <sup>th</sup> session	To stimulate the capacity to store and manipulate information	<ul style="list-style-type: none"> <li>- Discrimination and visual memory with objects/toys: the therapist places 5 objects for the participant to view for 30 seconds. Then, without the participant seeing it, the therapist removes one object and shows the other ones for the participant to say which object is missing.</li> <li>- Memory game: the therapist presents the participant with a memory game of at least 16 pairs to play.</li> <li>- Categories: A letter of the alphabet is randomly chosen for the participant to say a name, color, object, food, and animal.</li> </ul>
8 <sup>th</sup> session		<ul style="list-style-type: none"> <li>- Imitation game: The therapist asks the participant to repeat a pattern of sounds, words, or phrases. For example, the therapist says "monkey, giraffe, elephant" and asks the participant to repeat in the same order.</li> <li>- Going to the supermarket: the therapist creates a list with the participant to go to the "supermarket", then the participant will have to remember and pick up the items they had put on the list.</li> <li>- Music: the therapist plays music for the participant to listen to, then they play at least the chorus. The genre is at the discretion of the therapist according to the participant's musical taste. A slower pace is suggested.</li> </ul>
9 <sup>th</sup> session		<ul style="list-style-type: none"> <li>- Riddles: the therapist creates simple and fun riddles for the participant to figure out.</li> <li>- Treasure hunt: the therapist organizes a treasure hunt inside or outside the treatment room.</li> <li>- Building blocks or Lego: the therapist presents challenging pictures for the participant to build different objects with blocks, such as towers, bridges, or houses.</li> </ul>
10 <sup>th</sup> session	To stimulate the short-term memory	<ul style="list-style-type: none"> <li>- Auditory memory: The therapist asks the participant to listen to a series of numbers, words, or phrases and then repeat them in the correct order. Start with a list of 3 stimuli and gradually increase the amount of information as the participant progresses.</li> <li>- Stories in sequence: the therapist tells a short story to the participant and asks them to repeat it in the correct order.</li> <li>- Telephone game: the participant speaks a sentence that will be passed on to the others, one at a time. At the end, check if it is the same sentence as in the beginning.</li> </ul>
11 <sup>th</sup> session	To explore the parts of speech in semantic categories	<ul style="list-style-type: none"> <li>- Connecting ideas game and digital games: <a href="https://wordwall.net/pt/resource/3480886/categorias-sem%C3%A2nticas">https://wordwall.net/pt/resource/3480886/categorias-sem%C3%A2nticas</a>, <a href="https://wordwall.net/pt/resource/9042367/categorias-sem%C3%A2nticas">https://wordwall.net/pt/resource/9042367/categorias-sem%C3%A2nticas</a>, <a href="https://wordwall.net/pt/resource/17069031/roletas-categorias-sem%C3%A2nticas">https://wordwall.net/pt/resource/17069031/roletas-categorias-sem%C3%A2nticas</a>: the therapist stimulates and increases the lexical repertoire of nouns, adjectives, and verbs from the semantic categories that the participant has difficulty with or relates different semantic fields.</li> <li>- Game organizing sentences and booklet of structured sentences with images on Velcro: the therapist facilitates the combination of different meanings of words to form sentences.</li> </ul>
12 <sup>th</sup> session	To expand word categorization as nouns, adjectives, and verbs	<ul style="list-style-type: none"> <li>- Logical sequence game: the therapist uses sequences of 3 figures, representing names, qualities, and actions for the participant to orally structure sentences and report events.</li> <li>- "Who?", "What?", "How?", and "Where?" game: the therapist uses images and oral sentence formation.</li> </ul>

Sessions	Objectives	Procedures
13 <sup>th</sup> session	To maximize the perception and agreement of elements in syntactic organization	- Logical sequence game: the therapist uses sequences of images to produce grammatical oral statements relating to temporal, gender, and number logic. - Storybooks: as a resource to address aspects of the grammatical structure of the language, in narratives guided by the therapist, but with the participant's effective participation. Reading is not the goal, but rather, syntactic organization by linking scenes and images.
14 <sup>th</sup> session	To identify and correct ungrammatical sentences	- Digital games: <a href="https://wordwall.net/pt/resource/1550191/frases-agramaticais">https://wordwall.net/pt/resource/1550191/frases-agramaticais</a> , <a href="https://wordwall.net/pt/resource/33673593/ortografia/frases-agramaticais">https://wordwall.net/pt/resource/33673593/ortografia/frases-agramaticais</a> : the therapist reads the sentences in these games, and the participant identifies and make corrections so that they become grammatical. - List of grammatical and ungrammatical sentences: the therapist orally mediates grammatical and ungrammatical sentences, checking appropriate and inappropriate linguistic structures in the sentence, and the patient must correct them, if necessary.
15 <sup>th</sup> session	To dissociate grammatical and semantic incorrections	- List of sentences with grammatical and semantic errors: the therapist orally presents sentences with grammatical and semantic errors for the participant to manipulate and dissociate the grammatical error, without changing the semantic error. Example: Therapist: The balls is square. The patient should answer: The ball is square. - List of sentences with grammatical and semantic errors: the therapist orally presents sentences with grammatical and semantic errors for the participant to correct the semantic error, without changing the grammatical error. Example: Therapist: The balls is square. The patient should answer: The balls is round.

Source: The author, 2023

Table 2 shows each item's CVI. The total CVI was 0.85.

All propositions reached the minimum score. In the space allocated for suggestions, some judges highlighted what could be improved, part of which was accepted.

A judge suggested recording participants' responses and promoting parental guidance to continue activities at home. It was also requested to increase the number of sessions for greater generalization to the intended audience.

**Table 2.** Each item's content validity index

Item	CVI
The intervention has a different approach to individuals who need it most	1
The intervention stimulates the development of the participant's skills, aiming for their greater autonomy, awareness, and analytical in their daily lives regarding their lifestyles	1
The procedure instructions are adequate	1
The selected language skills are adequate	1
The program is adequate for the target public	1
The sessions are adequately divided for the target public	0.9
The number of sessions is adequate	0.8
The number of stimuli in each session is adequate	0.8
The tasks in the program are adequately organized into difficulty levels	1

Source: The author, 2023

Caption: CVI = content validity index

## DISCUSSION

This study's central purpose was to develop and validate the content of an intervention plan aimed at adolescents and young people with T21. The plan focused on vocabulary, WM, and SA – three essential cognitive elements. Through a thorough development and evaluation process, this study achieved the minimum score necessary for content validation.

In general, content development and validation are the first essential parts to continue the research. This stage checks whether each item is representative and relevant, which requires some steps: definition of the construct, development of the instrument, review by experts, content analysis, CVI calculation, evaluation, and review<sup>16</sup>.

The skills covered in the intervention plan are WM, vocabulary, and SA. The first one has four subsystems: phonological loop, visuospatial, central executive, and episodic buffer. Individuals with T21 have great difficulty in studies, mainly in the phonological loop, and better performance in the visuospatial subsystem<sup>17</sup>.

Barbosa<sup>6</sup> points out in her study the relationship between vocabulary and WM in T21. Individuals with better responses in the expressive lexical competence test also had good results in the memory test. Therefore, it demonstrates that vocabulary and WM are interconnected and mutually complementary.

SA is impaired in T21, which directly impacts learning to read and write. Hence, other skills are needed to perform well, such as WM. Its function is to enable individuals to understand the grammatical structures of sentences and how words relate to each other<sup>18</sup>.

Ten judges participated in this study, which is a good number, according to the literature<sup>12,16</sup>. All experts in this research met the eligibility criteria.

The CVI, which is widely used in health, measures the proportion of judges' agreement on a given topic, verifying both isolated items and the complete instrument. A minimum agreement rate of 0.78 is recommended, and for excellent agreement, 0.90 or more is expected<sup>19</sup>.

Many studies have addressed T21, but few refer to the intervention. Presenting strategies for early stimulation favors children's brain plasticity<sup>10</sup>. Speech-language-hearing therapy plays an essential role in this population's skill development and improvement, especially concerning communication. Proposing therapeutic strategies can help pathologists in clinical practice<sup>20</sup>.

The plan assessment questionnaire was based on literature research<sup>13,14</sup>, with some changes to adjust to the proposed plan.

Studies point out the difficulty people with T21 have in these skills and show that, if stimulated, they improve significantly in language and its subsystems<sup>6</sup>. Speech-language-hearing intervention in these skills can bring positive results in the construction and organization of verbal speech and written texts and help empower people with T21<sup>11</sup>.

The intervention plan proposed in this study is potentially adaptable to other conditions, with a promising perspective for expanding its positive impact. However, further studies are needed to evaluate the success of this approach in different audiences. Generalization of intervention strategies requires a comprehensive understanding of how contextual variables and individual characteristics can influence outcomes. Hence, to ensure the effectiveness and relevance of the plan in different scenarios, additional research must explore the adaptability and possible adjustments needed to meet the specific nuances of different groups of individuals.

Besides content validation, other forms of validation are essential to enrich the robustness and reliability of the results. Construct validity is a crucial point, requiring a more in-depth analysis of the theoretical relationships underlying the intervention plan. Clarity and conceptual coherence are fundamental to establishing construct validity, ensuring that the measures used actually measure what they are intended to assess. In parallel, criterion and predictive validity offer a practical approach to evaluating the effectiveness of the plan against established criteria and its ability to predict future outcomes<sup>21,22</sup>.

Thus, future investigations must deepen the analysis of the mentioned validities, contributing to a more comprehensive and solid understanding of the effects of the proposed intervention plan. Furthermore, new studies should be developed to expand the range of speech-language-hearing interventions with this audience. The next steps of this research are the other validities mentioned and the application of the plan to the target public. The limitations of the study include its wide age range to reach a suitable number of participants and reach the objectives assertively.

## CONCLUSION

This research presented the process of developing and validating the Oral Language Therapy

Plan, focusing on vocabulary, WM, and SA for people presented with T21. The content was valid according to the judges, allowing it to proceed to the next stages.

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### Authors' contributions:

PPS: study conceptualization and project, data acquisition, analysis, and interpretation.

ELA: data acquisition, analysis, and interpretation.

ILBL, GASA: critical review of relevant intellectual content.

ICD: study conceptualization and project, final approval of the version for publication.