

Research Article

Language Sample Analysis in Clinical Practice: Speech-Language Pathologists' Barriers, Facilitators, and Needs

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Purpose: Most speech-language pathologists (SLPs) working with children with developmental language disorder (DLD) do not perform language sample analysis (LSA) on a regular basis, although they do regard LSA as highly informative for goal setting and evaluating grammatical therapy. The primary aim of this study was to identify facilitators, barriers, and needs related to performing LSA by Dutch SLPs working with children with DLD. The secondary aim was to investigate whether a training would change the actual performance of LSA.

Method: A focus group with 11 SLPs working in Dutch speech-language pathology practices was conducted. Barriers, facilitators, and needs were identified using thematic analysis and categorized using the theoretical domain framework. To address the barriers, a training was developed using software program CLAN. Changes in barriers and use

of LSA were evaluated with a survey sent to participants before, directly after, and 3 months posttraining.

Results: The barriers reported in the focus group were SLPs' lack of knowledge and skills, time investment, negative beliefs about their capabilities, differences in beliefs about their professional role, and no reimbursement from health insurance companies. Posttraining survey results revealed that LSA was not performed more often in daily practice. Using CLAN was not the solution according to participating SLPs. Time investment remained a huge barrier.

Conclusions: A training in performing LSA did not resolve the time investment barrier experienced by SLPs. User-friendly software, developed in codesign with SLPs might provide a solution. For the short-term, shorter samples, preferably from narrative tasks, should be considered.

Developmental language disorder (DLD) is a common neurodevelopmental disorder (Bishop et al., 2016). Children with DLD experience difficulties in all language domains (Leonard, 2017). However, failure to acquire and/or efficiently use grammar has been proposed as a clinical marker of the disorder. Speech-language pathologists (SLPs) are the primary professionals involved in speech and language assessment and therapy for children with DLD. As such, they play a significant role in helping these children to master the rules of grammar in order to improve their communicative participation. To achieve this, SLPs want to choose functional grammatical intervention goals, for which detailed information about the child's grammatical development and daily language use is crucial. To date, SLPs

tend to rely on information from standardized language tests for goal setting (Overton & Wren, 2014; Pavelko et al., 2016). These standardized language tests appear to guide SLPs more in decision making than informal measures derived from language sample analysis (LSA, Fulcher-Rood et al., 2019). However, outcomes of standardized tests often only provide an indication whether grammatical skills are age-appropriate and give limited information about children's actual grammatical language production. Moreover, many grammatical phenomena are difficult or impossible to elicit in a standardized way (Ebert & Scott, 2014).

LSA is a more naturalistic and ecologically valid way to evaluate a child's language performance. LSA offers clinicians the opportunity to collect and analyze language samples that represent linguistic performance in a real-life situation, such as conversation, or in more structured communication tasks, such as narratives (Calder et al., 2017; Price et al., 2010). These types of language elicitation tasks reflect daily communication, which requires integration of all language domains (morphology, syntax, semantics, and pragmatics). Contrastively, standardized language tests mostly tap into separate domains and were never designed to set

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therapy goals or evaluate progress. Another advantage of LSA is the absence of a test–retest effect, making it possible to repeat LSA to measure progress of the child’s language performance. Furthermore, LSA offers a solution to assess language proficiency in children who cannot be tested reliably due to behavioral reasons such as anxiety or weak concentration.

Because of all these advantages, LSA is considered best practice (Heilmann, Miller, et al., 2010; Price et al., 2010) or even the gold standard to identify gaps in children’s use of grammar for setting therapy goals and to evaluate grammatical therapy (Heilmann, 2010; Overton & Wren, 2014). The question arises why SLPs do not use LSA regularly (Heilmann, 2010; Kemp & Klee, 1997; Overton & Wren, 2014; Pavelko et al., 2016) although they recognize its many advantages.

Challenges for SLPs to Perform LSA

The main challenge described in the literature is that LSA is too time consuming (Heilmann, 2010; Long, 2001; Pavelko et al., 2016; Westerveld & Claessen, 2014). A second challenge is that SLPs also need the knowledge and skills to perform LSA. SLPs not skilled in performing LSA feel overwhelmed and demotivated by the complexity of LSA. Therefore, it is important for SLPs to have these skills and knowledge, including understanding of morphosyntax (Long, 2001). Adequate training beyond the initial professional SLP training is necessary, as well as sufficient practice in transcribing and analyzing language samples (Heilmann, 2010; Schuele, 2010). A third challenge is the SLPs’ beliefs in their own capabilities and the accuracy and reliability of LSA for children with morphosyntactic problems (Heilmann, 2010).

Solutions to Reduce Time Investment in Performing LSA

Regarding the time issue, Long (2001) investigated the time needed for LSA done by hand and by computer. He concluded that LSA done by hand will not be regularly possible in most clinical schedules, because an extensive grammatical analysis of a linguistically more mature child would take up 2.5–5.5 hr. LSA is even more time consuming when therapists lack sufficient experience and skills. The majority of SLPs tend to take shortcuts, for example, they do not transcribe the language sample (Westerveld & Claessen, 2014), or they scan grammatical structures instead of counting them (Long, 2001). However, taking these shortcuts, especially for unexperienced SLPs, is difficult to apply in a valid way (Long, 2001).

Using LSA software could save time and bring language analysis within reach of clinician timetables. (Long, 2001; Overton & Wren, 2014). However, LSA software such as the commercially available package Systematic Analysis of Language Transcripts (SALT; Miller, 2010) and the freely available Child Language Data Exchange System (CHILDES) software program CLAN (MacWhinney, 2000) facilitate SLPs

but have not led to LSA performed regularly by most SLPs (Pavelko et al., 2016). Some studies have sought a solution in shortening the sample. For instance, Pavelko et al. (2020) investigated whether a 25- and 50-utterance sample yielded similar results using the “Sampling Utterances and Grammatical Analysis Revised” (SUGAR) method and elicitation protocol for conversational samples. They concluded that reliable language sample results can be obtained from 25-utterance samples for the measures mean length of utterance (MLU), total number of words (TNW), clauses per sentence, and words per sentence. However, there is debate whether SUGAR over- or underestimates children’s morphosyntactic skills (Guo et al., 2018). Wieggers (1996) also tested if reduction of sample size for LSA could help and showed that using 50 instead of 100 utterances with a Dutch version of Language Assessment Remediation and Screening Procedure (Crystal et al., 1976), GRAMAT (GRAMmaticale Analyse van Taalontwikkelingsstoornissen [Grammatical Analysis of Developmental Language Disorders]; Bol & Kuiken, 1988) led to almost similar results.

LSA in the Netherlands

Due to limited availability of Dutch LSA software, SLPs working in the Netherlands are even more disadvantaged. Several manual methods for LSA exist, and two of them are based on Language Assessment Remediation and Screening Procedure (Crystal et al., 1976), namely, Taal Analyse Remediëring en Screening Procedure (TARSP; Schlichting, 2017) and GRAMAT (Bol & Kuiken, 1988). Both methods are designed for young children with a language level up to 4 years. Another LSA method is Spontane Taal Analyse Procedure (STAP; Van Ierland, 1980), developed for linguistically more mature children between the ages 4 and 8 years. STAP offers a normed analysis of grammatical complexity and errors for children in this age group. In some cases, the CHILDES software program CLAN (MacWhinney, 2000) is used, for example, by linguists who work in a clinical setting and in Dutch child language research. All available methods are very time consuming because they have not been automated yet. In the Netherlands, most services for children with DLD are delivered in speech-language pathology practices (Gerrits et al., 2019). Other work settings for SLPs working with children are special day care centers, schools, hospitals, and rehabilitation centers. SLPs working in speech-language pathology practices usually treat a variety of clients with speech and language difficulties; children with DLD constitute a large part of their caseload. These children are generally referred by a general practitioner, audiological center, or ear, nose, and throat specialist. Speech-language pathology services delivered in speech-language pathology practices for children with DLD are financed through health insurance companies. However, SLPs only get compensated when the child is physically present. This means that language assessment using standardized tests is covered by health insurance but performing LSA is not.

This Study

Although the available resources for performing LSA in Dutch, and English-speaking countries differ, the situation is basically the same: LSA has added value but is not performed by SLPs on a regular basis. The aim of this study was to stimulate use of LSA in Dutch clinical speech-language pathology practice. We choose a behavioral change approach to thoroughly assess practitioners' needs and barriers and to select interventions that can resolve these. The behaviour change wheel (Michie et al., 2014), in combination with the theoretical domain framework (TDF; Cane et al., 2012) provides a systematic way of determining how change can be achieved (Michie et al., 2014). TDF can be used to further specify what needs to change using its 14 domains. The TDF is an integrative theoretical framework, developed for cross-disciplinary implementation and other behavior change research (Cane et al., 2012). It is a valid method for theoretically assessing implementation problems (Cane et al., 2012). A first step in changing behavior is to get insight in SLPs' barriers and facilitators. The three barriers found in the literature, time constraints, knowledge and skills, and beliefs about the accuracy and reliability of grammatical LSA, may hold for Dutch SLPs as well, with possibly an extra barrier that time-saving Dutch software packages for LSA are currently not available.

This leads to the following research questions: (a) What are the barriers, facilitators, and needs of Dutch SLPs in performing grammatical LSA with Dutch children with DLD aged 7–10 years? (b) Can a training using CLAN support SLPs in performing LSA?

Method and Results

Overall Design

This study followed the behavior change intervention design process of Michie et al. (2014), in combination with the TDF (Cane et al., 2012). The study consisted of three steps: The first step was to identify what needs to change. In order to do this, a focus group was conducted discussing the barriers and facilitators Dutch SLPs experience in conducting LSA for children with DLD aged 7–10 years. The second step was to develop a training based on identified intervention functions and behavior change techniques. The barriers were translated into intervention options; behavior change techniques were identified and executed in a 2-day training for SLPs. A clear infographic of the behaviour change wheel can be found on the following website: <http://www.behaviourchangewheel.com>. The third step was the evaluation of the targeted behavior. The LSA training was evaluated with an online survey before, directly after, and 3 months posttraining. To preserve participants' anonymity, we use pseudonyms in this article. The study was performed according to the Netherlands Code of Conduct for Research Integrity (2018). All participants gave their written informed consent. Data were anonymized and saved on a secured server. The following section describes the methodology and results of each step separately: (1) identification of what

needs to change, (2) development and execution of the training, and (3) evaluation of the targeted behavior.

Step 1. Identify What Needs to Change

We conducted a focus group study to identify what needs to change for SLPs to perform LSA in daily practice. In this section, we describe the participants of this focus group, the research team and reflexivity, data collection, analysis, and results, following the Consolidated Criteria for Reporting Qualitative Research (COREQ) 32-item checklist for interviews and focus groups (Tong et al., 2007).

Participants

The focus group consisted of 11 SLPs (see Table 1). The SLPs were recruited via our network and social media. All responding SLPs met both inclusion criteria that were defined: (a) working as an SLP in a speech-language pathology practice and (b) experience in working with children with DLD aged 7–10 years. The age range of 7–10 years was chosen because the existing methods for LSA in the Netherlands have been developed for younger children. TARSP can be used for children with a language level up to 4 years, and STAP was developed for children aged 4–8 years. Children with DLD in the age range of 7–10 years make up a large part of the caseload of the SLPs in speech-language pathology practices. In this age group, we see a combination of difficulties with grammatical complexity and a large variety of grammatical errors.

All participants were qualified SLPs; one also has a master's degree in linguistics, and two have a master's degree in clinical language, speech, and hearing Sciences. All SLPs worked at speech-language pathology practices in the Netherlands. Most participants expressed that they rarely perform LSA, two of them sometimes perform LSA, and only one performs LSA regularly.

Research Team and Reflexivity

The focus group was led by the first author, who is a Dutch SLP and clinical language, speech, and hearing scientist (MSc). The first author has experience and training in undertaking qualitative research. The second (MA) and third (PhD) authors, both SLPs and linguists, were present as observers and made field notes. The focus group was part of a bigger research project called "ZINnig," with the aim to improve care for children with severe grammatical problems. A relationship between the authors and participants was established prior to the focus group, since they were partners in this research project. The first author is not experienced in performing LSA, as opposed to the second and third authors.

Data Collection

The focus group was conducted at the authors' workplace, HU University of Applied Sciences Utrecht. The focus group lasted 2 hr with a short break. The first author used a topic guide. This topic guide (see Appendix) was developed based upon the existing literature about barriers and facilitators of LSA, such as Heilmann (2010), and consisted

Table 1. Characteristics of the participating speech-language pathologists.

Name of participant	Work experience (years)	Frequency performing LSA	Participated in focus group	Participated in training
Anne	11–15	Often	✓	X
Petra	41–45	Rarely	✓	X
Joyce	11–15	Rarely	✓	X
Nina	6–10	Rarely	✓	X
Nienke	21–25	Rarely	✓	X
Rosa	26–30	Rarely	✓	✓
Femke	21–25	Rarely	✓	✓
Karen	6–10	Rarely	✓	✓
Suzanne	31–35	Rarely	✓	✓
Maaïke	26–30	Sometimes	✓	✓
Merel	6–10	Sometimes	✓	✓
Rachel	36–40	Rarely	X	✓
Tess	11–15	Rarely	X	✓
Lise	1–5	Rarely	X	✓

Note. LSA = language sample analysis.

of two main topics: (a) challenging and facilitating factors and (b) SLPs' needs and future solutions. Field notes were taken. The focus group was audio- and video-recorded and transcribed verbatim.

Analysis

The first two authors independently analyzed the transcript looking for barriers and facilitators expressed by the participating SLPs. Next, they independently linked the identified barriers and facilitators to the COM-B components (capability, opportunity, and motivation; Michie et al., 2014) and to the 14 TDF domains (Cane et al., 2012). Some codes were easily linked to the TDF domain, such as “little knowledge about LSA.” Other codes were more challenging, such as “I would like to perform LSA, it is fun to do.” The authors discussed their analysis, and cases of doubt were discussed with the authors' research group, consisting of 14 speech-language pathology researchers. ATLAS.ti 8 Windows (ATLAS.ti Scientific Software Development GmbH, 2020) was used for data management.

Results Step 1: Identify What Needs to Change

SLPs shared information about facilitators referring to six domains and barriers referring to seven of the 14 domains of the TDF (see Table 2). In the next paragraphs, the facilitators and barriers are explained, illustrated, and supported by verbatim quotes from the SLPs during the focus group.

Before barriers and facilitating factors were discussed, SLPs were asked if they performed LSA and in what way. SLPs expressed that they did not perform protocolled LSA, but they did consider working on grammar with children with DLD to be important. For example, they do try to analyze morphosyntactic elements produced by the children during conversations and make notes of utterances along the way. Most of them also use storytelling tasks, such as the Frog Story (Mayer, 1969) and the Renfrew Bus Story

(Jansonius et al., 2014), to elicit (more) detailed information about grammatical development. Next to this general topic, SLPs were asked about their opinion about the added value of LSA, the reasons why they do or do not perform LSA, and their needs to be able or be willing to perform LSA in practice.

Knowledge and Skills

During the focus group, it appeared that SLPs were not sure about what LSA entails and how it should be performed. Femke, for example, wondered what an LSA entails.

What is a, let's call it an evidence based LSA? What criteria do I need to meet? I have given that up. I think that we all know the LSAs as we perform them... using the words and sentences that you get along the way, and that you analyze those. I think that we all do that. But really doing standardized LSA, as it should be done...And I also don't know anymore how it should be done, because I have thrown all that overboard. (Femke)

Maaïke questioned if narratives are a proper way of collecting language for LSA.

Working with the Frog Story or the Bus Story, is that also an LSA? That is semistructured. (Maaïke)

Also, according to Joyce, LSA is a structured way of collecting and analyzing language.

I do think that if you perform a real TARSP [specific Dutch LSA method] or a real STAP [specific Dutch LSA method], then you have a real LSA. Otherwise, you just collect a number of utterances. (Joyce)

Social Role

Another issue that came up during the focus group is that the SLPs differed in their beliefs about their professional

Table 2. Theoretical domain framework (TDF) domains, barriers, and facilitators.

TDF domains	Definition (Cane et al., 2012)	Expressed facilitators (F)	Expressed barriers (B)
Knowledge	An awareness of the existence of something	None	B1. Not enough knowledge about LSA, e.g., purpose, target groups, collecting and analyzing a sample, added value.
Skills	An ability or proficiency acquired through practice	None	B2. Lack of skills in collecting a language sample. B3. Lack of skills in performing LSA.
Social/professional role and identity	A coherent set of behaviors and displayed personal qualities of an individual in a social or work setting	F1. Performing LSA is the task of the SLP. F2. SLPs have to make their work quantifiable and standardized LSA can be used to do that.	B4. LSA is the task of a clinical linguist.
Beliefs about capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use	None	B5. Insecure about own skills and knowledge.
Optimism	The confidence that things will happen for the best or that desired goals will be attained	None	None
Beliefs about consequences	Acceptance of the truth, reality, or validity about outcomes of a behavior in a given situation	F3. The results of LSA give more and differentiated insight in grammar than standardized language tests and, because of that, clear guidelines for treatment. F4. LSA is of added value for specific target groups, e.g., ASD, performance anxiety, severe DLD, children with DLD who do not fail on standardized language tests. F5. The results of LSA give parents more insight in grammar. F6. LSA is a measurement moment and may provide insight in the child's progress.	B6. Doubts about added value of LSA relative to time. Investment, using standardized tests, and observing language intuitively. B7. LSA does not give enough information about spontaneous language in other situations.
Reinforcement	Increasing the probability of a response by arranging a dependent relationship or contingency between the response and a given stimulus	None	None
Intentions	A conscious decision to perform a behavior or a resolve to act in a certain way	F7. Willing to perform LSA when it fits with the reason why a child came to therapy. F8. Willing to perform LSA when it takes little time. F9. Performing LSA not as a standard procedure for all children, only in specific cases.	None
Goals	Mental representations of outcomes or end states that an individual wants to achieve	F10. I would like to perform LSA; it is fun to do. F11. I would like to perform LSA; it gives you much insight.	None
Memory, attention, and decision processes	The ability to retain information, focus selectively on aspects of the environment, and choose between two or more alternatives	None	None

(table continues)

Table 2. (Continued).

TDF domains	Definition (Cane et al., 2012)	Expressed facilitators (F)	Expressed barriers (B)
Environmental context and resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior	F12. Health insurance companies demand SLPs to make their therapy quantifiable. F13. Some parents are willing to record a language sample.	B8. Performing LSA takes too much time. B9. Performing LSA is not funded by health insurance, in contrast to standardized tests. B10. The usability of the available LSA methods in the Netherlands, such as TARSP and STAP, is limited timewise.
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviors	F14. SLPs adhere to evidence-based practice —to measure progress is important.	B11. Not aware of SLPs who perform LSA in daily practice.
Emotion	A complex reaction pattern, involving experiential, behavioral, and physiological elements, by which the individual attempts to deal with a personally significant matter or event	None	None
Behavioral regulation	Anything aimed at managing or changing objectively observed or measured actions	None	None

Note. LSA = language sample analysis; SLP = speech-language pathologist; ASD = autism spectrum disorder; DLD = developmental language disorder; TARSP = Taal Analyse Remediëring en Screening Procedure; STAP = Spontane Taal Analyse Procedure.

role. Most SLPs expressed that performing LSA is part of their professional role.

Mediator: Do you think that conducting an LSA belongs to the SLP's tasks?

I think that you should be able to do an LSA. (Merel)
It really belongs to the SLP profession. (Petra)

However, a few others expressed that a specialized professional, such as a clinical linguist, that is, an SLP with an additional master's degree in linguistics, often working in a clinical setting, such as an audiological center, should perform LSA as they have the resources to do it.

I have two children who did not have DLD, according to the CELF scores or whatsoever, but the LSA did indicate a DLD. Sure enough, in both cases, I had my doubts: "there is something [wrong], but what?" A clinical linguist conducted the LSA with these children. And then you think, well yes...Not that I will conduct LSA myself though, but I'll refer them. (Joyce)

Beliefs About Capabilities

All SLPs learned how to perform LSA during their initial speech-language pathology training, but most of them have never performed one in daily practice. Some expressed that they were not sure (anymore) about their own capabilities.

I have performed that thing [LSA] once during my SLP training. After that NEVER again...So that is a real barrier for me, thinking "well, do I know how to do it?" (Joyce)

Beliefs About Consequences

Some SLPs also mentioned facilitators, such as beliefs about added value of LSA. However, there was no consensus about the facilitators, but rather a discrepancy in the beliefs about the consequences of performing LSA and about the role of SLPs.

Most SLPs mentioned that LSA results in detailed information that is useful for setting treatment goals for (subgroups of) children with DLD and that it is not possible to get the same quality of information without LSA.

You can work more goal focused. More precisely, that you know where the gaps are. This is what the child can do, this is what the child cannot do. (Maaike)

However, some others expressed that they do collect enough information during assessment sessions with standardized language tests, such as the Clinical Evaluation of Language Fundamentals (CELF; (Kort et al., 2010), or in a more intuitive way through observations.

When the child comes to therapy because of pragmatic problems or not being able to have a conversation or something like that, then I'll perform a Renfrew Bus Story test. Otherwise, I'll just use the CELF. Also because of that reason [it takes too much time] you just mentioned. But maybe I would like to perform an LSA, in the ideal world, maybe, for that type of children. But I would differentiate therein. (Nina)

Intentions and Goals

A couple of SLPs expressed that they are willing to perform LSA when it fits with the child's therapy aim and that they like to do it.

Mediator: What if, in the ideal situation, money and time do not play a role, would you all perform LSA in practice?

I would love to do it. By the way, I really enjoy doing it. (Petra)

Environmental Context and Resources

According to all SLPs, due to time constraints, it is not feasible to perform LSA for a child with language problems. On top of that, the time invested is not compensated by health insurance companies.

I think it takes too much time. Actually, I don't have that time. If I see 45 clients a week, when am I going to do that for that single child? For all those children I see? (Nienke)

The health insurance companies don't support it...I would love to do it, but I don't know when. Timewise, it just isn't possible. And the health insurance says: "figure it out." (Petra)

Social Influences

SLPs feel that it is expected from them to work evidence based.

The SLP-world wants us to work evidence-based. Performing LSA fits within that picture. (Nienke)

However, according to Joyce, they don't know colleagues who perform LSA in practice.

I have never seen it [performed] during my internships, I have never seen it during my first work years. I have never heard of an SLP among my colleagues who performed it ever. (Joyce)

Next to the barriers and facilitators mentioned above, SLPs expressed a need for facilitating resources such as software to support transcription and analysis, accessible information about the grammatical development of children aged 7–10 years, and a training or e-learning on the application of LSA. Overall, according to the SLPs, performing LSA should be quick and practical.

Step 2. Development and Execution of a Training Based on Intervention Functions and Behavior Change Techniques

In Step 1, each barrier was categorized into one of the COM-B components and TDF domains. The next step was to link identified barriers to intervention functions and behavior change techniques using the behavior change technique taxonomy (Michie et al., 2014, p. 259). All authors were involved in this process. Table 3 illustrates this process. Per barrier and TDF component, the suggested intervention functions by Michie et al. (2014) were discussed

Table 3. Process link between barriers, intervention functions, and behavior change techniques (BCTs).

Barrier	COM-B component	TDF component	Intervention functions ^a	Chosen BCT
B1. Not enough knowledge about LSA, e.g., purpose, target groups, collecting and analyzing a sample, added value.	Psychological capability	Knowledge	Education	Instruction on how to perform a behavior
B5. Insecure about own skills and knowledge.	Reflective motivation	Beliefs about capabilities	Education , persuasion, modeling, enablement	Information about consequences of the behavior
B9. Performing LSA is not funded by health insurances, in contrast to assessment using standardized tests.	Physical opportunity	Environmental context and resources	Training, restriction, environmental restructuring, enablement	N/A

Note. TDF = theoretical domain framework; N/A = not applicable.

^aThe intervention function written in bold is the intervention function that was selected.

and judged using the APEASE criteria. APEASE stands for affordability, practicability, effectiveness and cost-effectiveness, acceptability, side effects/unwanted consequences, and equity. As illustrated in Table 3, we did not choose an intervention function for barrier B9; performing LSA is not funded by health insurances, because that barrier was not practical for the research group.

Our training goals, training method, selected intervention functions, and behavior change techniques are presented in Table 4. Based on the APEASE criteria, the research group selected the intervention functions education, training, and enablement. We strived to decrease the time investment for SLPs by increasing their knowledge and skills and by using the software program CLAN (MacWhinney, 2000). CLAN was chosen because of its open-source structure and because it was used already by some linguists working in Dutch child language assessment teams and in linguistic research. In order to achieve our training goals, we developed a 2-day LSA training.

The 2-Day LSA Training

Content of Training Day 1. The first training day focused on increasing the SLPs' knowledge about the grammatical development of children with and without DLD, how to perform LSA by using segmentation and parsing rules, and how to use the freely available software program CLAN for transcription and analysis (Aims 1–5). It must be noted that, to date, the functionality of CLAN for Dutch is restricted to using Codes for the Human Analysis of Transcripts (CHAT) as a transcription tool and to compute broad linguistic measures, such as MLU and type token ratio (TTR). More in-depth automated analyses, such as Index of Productive Syntax (Scarborough, 1990) and Developmental Sentence Score (Lee & Canter, 1971), as well as CLAN program KidEval (Ratner & MacWhinney, 2016) are not yet available. The LSA method that was used for the training was based on STAP (Van Ierland, 1980) that focuses both on grammatical complexity and grammatical errors. The knowledge part of the training was based on the results from a

literature search on grammatical development of Dutch-speaking typically developing (TD) children and children with DLD, aged 7–10 years. Furthermore, the general transcription rules, such as segmentation conventions, were practiced in the group. One of the SLPs provided a video recording of a child with DLD she was treating. This 40-utterance sample was representative of the grammatical difficulties of children with DLD in the age group 7–10 years. We chose to use a sample of 40 utterances, as this number is prescribed by TARSP, the LSA procedure Dutch SLPs are most familiar with. The third author is an experienced CLAN user and helped the participants with technical and transcription issues. After transcribing the sample in CHAT on the main tier, grammatical complexity and grammatical errors were identified and analyzed at sentence level and at verb phrase and noun phrase levels. In the CHAT file, these were noted on separate dependent syntax and error tiers. For the homework assignment, the SLPs were asked to perform LSA using CHAT with a 40-utterance sample from a child with DLD selected from their own caseload.

Results of Training Day 1. During Training Day 1, we experienced, based on verbal responses of the SLPs and a written evaluation directly after the training day, that SLPs hugely struggled with using the transcription tool CHAT in CLAN. Digital literacy of the participants turned out to be lower than we had estimated beforehand. Some of the participants already had problems installing and configuring the software correctly. The program is in English, and the participants had never used the program before. The participating SLPs found that CLAN and the CHAT interface were not intuitive and user-friendly enough. Therefore, it took much more time than expected for the SLPs to learn the basic skills of using CHAT and CLAN. We had to spend most of the time helping them to figure out the program itself and not, as we had originally intended, on analyzing the language samples. Most SLPs were demotivated after practicing with CHAT, because transcription and analysis turned out to be complicated and very time consuming. They expressed disappointment because they had hoped to learn how to perform LSA faster and more easily, but this was not the case.

Table 4. Language sample analysis (LSA) training: Goals related to barriers and intervention functions.

Goals	Barriers (B)	Intervention functions: BCTs
1. SLPs increase their knowledge and skills regarding collection of a language sample.	B1, B2, B5	Education - information about consequences of the behavior Training - instruction on how to perform a behavior. - behavioral practice/rehearsal - feedback on the behavior
2. SLPs expand their knowledge of grammatical development of typically developing children and children with DLD aged 7–10 years.	B1, B5	Education - information about consequences of the behavior - pros and cons
3. SLPs are familiar with the added value of LSA for children with grammatical problems.	B4, B6, B7	Education - pros and cons - information about consequences of the behavior
4. SLPs are aware of the added value of LSA compared to standardized language tests.	B4, B6, B7	Education - pros and cons - information about consequences of the behavior
5. SLPs are able to transcribe a language sample using CLAN.	B5, B8, B10	Training - demonstration of the behavior - instruction on how to perform a behavior - behavioral practice/rehearsal - feedback on the behavior
6. SLPs are able to perform LSA for children with DLD aged 7–10 years.	B5, B10	Training - demonstration of the behavior - instruction on how to perform a behavior - behavioral practice/rehearsal - feedback on the behavior Enablement - restructuring the physical environment
7. SLPs are able to set up relevant therapy goals using the results of the LSA.	B1, B3	Training - behavioral practice/rehearsal - instruction on how to perform a behavior - feedback on the behavior

Note. BCT = behavior change techniques; SLP = speech-language pathologist; DLD = developmental language disorder.

We expected that gaining more experience with the program by practicing at home would decrease the invested time. However, when conducting their home assignment, all SLPs kept struggling with CHAT and were not able to transcribe and analyze a language sample in the estimated time of 4 hr. After Training Day 1, we concluded that using CHAT and CLAN would not decrease the time investment of the SLPs. In addition, using CHAT even turned out to be an additional barrier to increase their knowledge and skills to perform LSA instead of being supportive. Therefore, we decided not to use CHAT anymore on Training Day 2.

Content of Training Day 2. To expand the knowledge and skills of SLPs regarding performing LSA, Training Day 2 focused on the analysis of samples by hand and how to select relevant therapy goals (Aims 6 and 7). The samples were from their own homework assignment or were provided by the third author. After practicing with the analysis of grammatical complexity and errors, we proceeded with

group discussions on what grammatical targets the SLPs would select on the basis of the analyzed samples.

Results of Training Day 2. The results of Training Day 2 were that the participants were glad that they did not have to use CLAN and CHAT again, and they could concentrate on the knowledge part of grammatical analysis and subsequent goal setting instead. Directly after Training Day 2, the participants filled in the survey that was also completed prior to the training. Results are elaborated in the paragraphs below.

Step 3. Evaluation of the Targeted Behavior

Data Collection

We evaluated the targeted behavior with an anonymous online survey that was sent to the SLPs participating in our study. The survey consisted of 13 items: eight statements with a 7-point Likert scale, three 6-point scale questions,

Table 5. Results of the survey per participant: eight statements with a 7-point Likert scale from *I totally disagree* (1) to *I totally agree* (7).

Statement 1	Participant	T0	T1	T2
LSA is of added value for all children with DLD.	Tess	5	6	5
	Lise	4	5	7
	Merel	7	7	7
	Femke	7	7	7
	Rachel	4	4	6
	Karen	4	5	5
	Rosa	5	4	4
	Suzanne	5	5	5
	Maiike	7	7	6
	Mean ^a	5.3	5.6	5.8
Statement 2	Participant	T0	T1	T2
LSA is of added value for all children with morphosyntactic problems.	Tess	5	5	5
	Lise	6	6	7
	Merel	7	7	7
	Femke	7	4	7
	Rachel	4	5	6
	Karen	6	6	5
	Rosa	7	7	4
	Suzanne	6	5	5
	Maiike	7	7	6
	Mean ^a	6.1	5.8	5.8
Statement 3	Participant	T0	T1	T2
LSA is of added value for all children with morphosyntactic problems that are difficult to measure with standardized tests.	Tess	6	6	7
	Lise	7	7	4
	Merel	7	7	7
	Femke	7	7	7
	Rachel	6	7	7
	Karen	7	7	7
	Rosa	7	7	7
	Suzanne	6	7	7
	Maiike	7	7	7
	Mean ^a	6.7	6.9	6.7
Statement 4	Participant	T0	T1	T2
LSA gives me practical guidelines for setting therapy goals focusing on morphosyntax.	Tess	6	6	5
	Lise	6	6	5
	Merel	7	7	7
	Femke	7	7	7
	Rachel	5	6	6
	Karen	6	6	6
	Rosa	7	7	7
	Suzanne	6	5	6
	Maiike	7	7	7
	Mean ^a	6.3	6.3	6.2
Statement 5	Participant	T0	T1	T2
The results of an LSA are in balance with the time I invest.	Tess	2	1	2
	Lise	3	2	1
	Merel	1	1	1
	Femke	1	7	1
	Rachel	3	3	4
	Karen	3	2	2
	Rosa	1	1	1
	Suzanne	1	1	1
	Maiike	2	3	3
	Mean ^a	1.8	2.3	1.8

(table continues)

Table 5. (Continued).

Statement 6	Participant	T0	T1	T2
I have enough skills to conduct an LSA.	Tess	3	6	4
	Lise	4	5	5
	Merel	2	6	5
	Femke	4	4	5
	Rachel	2	5	4
	Karen	2	5	3
	Rosa	7	5	6
	Suzanne	5	7	7
	Maiike	5	5	5
	Mean ^a	3.8	5.3	4.9
Statement 7	Participant	T0	T1	T2
I have enough knowledge to conduct an LSA.	Tess	5	4	5
	Lise	5	5	6
	Merel	3	7	7
	Femke	6	6	6
	Rachel	2	5	5
	Karen	2	5	4
	Rosa	6	6	6
	Suzanne	5	7	7
	Maiike	5	6	5
	Mean ^a	4.3	5.7	5.7
Statement 8	Participant	T0	T1	T2
The software program CHAT supports me in transcribing a language sample.	Tess	1	1	1
	Lise	1	1	1
	Merel	5	1	2
	Femke	4	1	1
	Rachel	1	4	5
	Karen	1	3	1
	Rosa	1	3	4
	Suzanne	1	1	1
	Maiike	2	3	3
	Mean ^a	1.9	2.0	2.1

Note. LSA = language sample analysis; DLD = developmental language disorder.

^aMeans are based on a small sample of nine participants.

and two open-ended questions. The items with a 7-point Likert scale focused on the identified barriers. The questions were posed as statements with an answering scale from *I totally disagree* (1) to *I totally agree* (7). The 6-point items focused on the targeted behavior, for instance, how often SLPs perform LSA with all children with DLD, children with specific grammatical problems, and children with grammatical problems that are not revealed when using standardized tests, respectively. The answering scale ranged from *never* (1) to *always* (6). The survey invitation was sent by e-mail and completed by all participants who attended both training days ($n = 9$) a week prior to Training Day 1 (T0), directly after Training Day 2 (T1), and 3 months after Training Day 2 (T2).

Results Step 3 of the Online Survey

Prior to the training, SLPs answered they performed LSA never to only sometimes. They were not familiar with using CLAN, and they stated that the time investment was not in balance with the added value of LSA. Their beliefs about their own capabilities varied; some of them did not have much confidence in their own knowledge and skills. However, they did believe that performing LSA was of added value for all

(sub)groups of children with DLD. After the training, SLPs' beliefs in their own capabilities increased on average. They remained positive about the added value of LSA. Their opinion about the balance between time investment and added value did not change, and they did not perform LSA more often. During the training, it appeared that CLAN did not support them, which was substantiated in the online evaluation. The results of the survey per participant are presented in Tables 5 and 6.

Discussion

In this study, we addressed the gap between reported advantages of using LSA in speech and language therapy for children and the actual use of this analysis method in clinical practice. A focus group was conducted to identify barriers, facilitators, and needs of SLPs about performing LSA, and a training in LSA with the CHILDES software program CLAN was developed, followed by an evaluation using a survey. Focus group results showed that most SLPs recognize the value of performing LSA for grammatical therapy goal setting. They agree with Westerveld (2011)

Table 6. Results of the survey per participant: three 6-point scale questions (1 = *never*, 2 = *hardly ever*, 3 = *sometimes*, 4 = *regularly*, 5 = *often*, 6 = *always*).

Question 1	Participant	T0	T1	T2
How often do you perform LSA with children with DLD in the age group 7–10 years?	Tess	2	2	2
	Lise	1	1	1
	Merel	1	3	3
	Femke	2	2	2
	Rachel	2	2	2
	Karen	1	2	2
	Rosa	1	1	1
	Suzanne	1	1	1
	Maaïke	3	3	3
	Mean ^a	1.6	1.9	1.9
Question 2	Participant	T0	T1	T2
How often do you perform LSA with children with morphosyntactic problems in the age group 7–10 years?	Tess	2	2	2
	Lise	1	1	1
	Merel	1	3	3
	Femke	2	2	2
	Rachel	2	2	2
	Karen	1	2	2
	Rosa	1	2	1
	Suzanne	1	1	1
	Maaïke	3	3	3
	Mean ^a	1.6	2.0	1.9
Question 3	Participant	T0	T1	T2
How often do you perform LSA with children with morphosyntactic problems who do not fail on standardized tests in the age group 7–10 years?	Tess	2	2	2
	Lise	1	1	1
	Merel	1	3	1
	Femke	2	2	2
	Rachel	2	2	^b
	Karen	2	2	2
	Rosa	1	1	1
	Suzanne	1	1	1
	Maaïke	3	4	3
	Mean ^a	1.7	2.0	1.6

Note. LSA = language sample analysis; DLD = developmental language disorder.

^aMeans are based on a small sample of nine participants. ^bMissing value.

that information derived from LSA can be used to confirm and complement standardized test results and provides a sound basis for assessment, intervention planning, and measurement of therapy outcomes.

Two of the identified barriers against performing LSA were Dutch SLPs' negative beliefs about their own knowledge and skills and the time investment needed for LSA. These barriers are also mentioned by Heilmann (2010) and Pavelko et al. (2016), suggesting that they are similar across countries and service delivery systems. Westerveld and Claessen (2014), Heilmann (2010), Long (2001), and Overton and Wren (2014) all suggest that these barriers can be overcome by using software that supports SLPs in performing LSA faster and also lowers the necessary level of skills and expertise needed for LSA. In our study, the SLPs also mentioned that supporting software could be a facilitator to perform LSA.

To address these two barriers, we combined behavioral change wheel techniques and the wishes of the SLPs and developed a training in language development and disorders, analysis of grammatical complexity and errors, and use of software program CLAN (MacWhinney, 2000). This turned

out not to be the perfect solution: The evaluation of the training revealed that participating SLPs did not perform LSA more often. Positive effects were some positive changes seen in beliefs about their knowledge and skills and about the added value of LSA. Especially, working with CLAN was too challenging for the SLPs. In their opinion, the CLAN/CHAT interface was not intuitive or user-friendly, and instead of being supportive, working with CHAT led to more frustration. Therefore, we abandoned the CLAN program on Training Day 2 and focused on manually analyzing the language samples and goal setting. However, the time investment needed for LSA was still considered too large and remained a barrier for use in clinical practice.

To summarize, although the behaviour change wheel intervention functions education, training, and enablement fitted the needs expressed by the SLPs, the behavioral change we aimed at, an increase in performing LSA, was not achieved. An important barrier that could not be lifted was the lack of reimbursement of the time spent on LSA by health insurance companies. This barrier can only be overcome via changes in governmental and/or insurance policies and requires long-

term efforts from our field, where SLP associations may play a pioneering role. Of course, reducing time needed for LSA will still be a facilitator here since it will reduce costs.

In the meantime, it may be worthwhile to invest in solutions to reduce the time investment other than using LSA software. Narrative tasks usually yield shorter samples than conversational samples and are very informative for the clinician (Calder et al., 2017; Zwitserlood, 2014). Narrative tasks can be taxing for children, because they have to describe actions and relations that demand more complex grammatical constructions, which might be avoided in a conversational sample. Narrative analysis therefore offers comprehensive and in-depth information regarding language functioning at the discourse level as well as at sentence, phrase, and word levels.

Conversational samples can also be shortened to deal with time constraints, although they are less informative compared to narrative samples. Heilmann, Nockerts, and Miller (2010) studied differences in sample length in minutes and found that short samples of TD children yielded reliable measures of productivity, lexical diversity, and utterance length. As already mentioned in the introduction, several studies have tried to reduce time for LSA (Owens & Pavelko, 2017; Pavelko et al., 2020; Wieggers, 1996). However, most of these studies concerned (young) TD children. Using shortened samples from (older) children with DLD may yield different results and could be less informative. It is also questionable whether the broad measures used in these studies are informative enough for goal setting. SLPs need in-depth information on grammatical complexity and errors to select appropriate therapy goals. Further research is needed comparing the reliability of reducing length of spontaneous language samples of children with DLD and preferably not only for broad language measures but also for more comprehensive measures, especially grammatical errors.

Obviously, using shorter samples saves time, but SLPs must be aware that collecting an unreliable sample may over- or underestimate a child's actual language level. Possibly, this issue may be resolved by additional probing, where the SLP offers probe tasks to the children to further examine grammatical constructions and errors.

In our study, the preferred solution from most SLPs in dealing with time constraints is to use shortcuts. They make notes of the child's utterances in real time instead of recording a sample. Or, when a sample is recorded, they just listen to the sample but do not transcribe or analyze it, a solution also mentioned in other studies (Pavelko et al., 2016; Westerveld & Claessen, 2014). However, the validity of these procedures is questionable, because sufficient knowledge of grammar and experience is needed to interpret the results (Long, 2001). There is some evidence that SLPs can rate grammaticality and utterance length in real time using story retell tasks (Castilla-Earls & Fulcher-Rood, 2018). However, utterance length and grammaticality only give a broad description of the language level and do not provide an in-depth grammatical analysis that can be used for therapy goal setting.

Although increasing use of LSA is also a solution for some barriers, as more practice will result in more skills and a decrease in time investment, the currently available solutions

are not sufficient for a wide and successful implementation of LSA. In general, SLPs have a positive attitude toward LSA, implying that investing in implementation of favorable new solutions is worthwhile. For instance, cutting-edge software, preferably developed in codesign with SLPs, that can be coupled with commonly used word processing software and the administration systems used by practitioners could be a way forward. The integration of speech recognition technology providing (semi-)automatic transcription, combined with an e-learning module, providing the knowledge needed for parsing easily at hand, would also be helpful. Furthermore, if the program could also guide goal setting by selecting useful grammatical therapy targets, it would make up a comprehensive solution for practitioners. Such an application would meet the wishes of the SLPs expressed in our focus group and their feedback on the LSA training. Finally, it would be a huge step forward when the software would generate a database of the grammatical development of (non-English-speaking) TD children and children with DLD. This database could strengthen diagnostics, goal setting, and treatment evaluation.

Apart from the barriers time constraints and lack of knowledge and skills identified in our study, there may well be other barriers why SLPs do not perform SLA, which were not addressed in our focus group. For example, we did not question SLPs' beliefs about the relevance of grammatical therapy for children with DLD. According to Bruinsma et al. (2020), SLPs tend to focus relatively less on grammar, suggesting that the importance of grammatical therapy seems to be undervalued. Solutions about facilitating SLPs in performing LSA should therefore not only be sought in making LSA more efficient. Possibly, their beliefs regarding the importance of grammatical therapy for children with DLD also need to be reconsidered.

Limitations of Our Study

The results of this article are based on a single focus group of 11 participants, a 2-day training on performing LSA, and a subsequent evaluation with nine participants, which constitutes a small sample. We cannot be certain that this group is representative of SLPs in general. However, our participant group consisted of SLPs who had a mix of beliefs about LSA. Most of them did not perform LSA in daily practice, which is in concordance with findings from the literature. Another limitation is that we could not change an important barrier, which is the lack of the reimbursement in daily practice.

Further Research

To address the reimbursement issue, it would be worthwhile to investigate cost-effectiveness in a study that compares outcomes of therapy based on goal setting using LSA or on norm-referenced tests. It would be very difficult to design such a study. If the outcomes would favor the use of LSA, that would make the case for reimbursing LSA by government or insurance companies much stronger.

Another line of research would be to compare the reliability of reducing length of spontaneous language samples of children with DLD and preferably not only for broad language measures, such as MLU and TNW, but also for more comprehensive measures, especially grammatical errors. In addition, further research focusing on SLPs' beliefs about the relevance of grammatical therapy can give more insights in their underlying motives to perform LSA or not.

Furthermore, concerning the linguistic knowledge necessary for LSA, currently, there is a lack of studies on milestones of grammatical development in older (Dutch-speaking) children, with and without DLD. More and easily accessible knowledge for practitioners would accommodate SLPs in grammatical goal setting for this age group.

Conclusions

SLPs agree that LSA is important to inform goal setting for grammatical therapy for children with DLD. At the same time, SLPs report that they do not perform LSA, mostly due to time constraints and need for more knowledge and skills. Dutch SLPs report similar barriers and needs. An LSA training using software tool CLAN was not sufficient to resolve these issues. Development of more user-friendly automated LSA tools, in cocreation with SLPs, is highly recommended.

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Appendix

Topic Guide Focus Group

Round 1: Experienced barriers and facilitating factors

Topics	Opening question
Orientation on LSA: Do SLPs see added value? How is LSA understood by SLPS? Do they believe LSA has added value? If so, for what diagnostic groups and ages of children? Barriers, e.g., time, knowledge, skills, funding. Facilitating factors, e.g., knowledge, skills.	How do you see language sample analysis?

Round 2: SLTs needs and solutions for performing LSA

Topics	Opening question
Requirements for performing LSA, such as knowledge, skills, funding, time Needs Solutions to cope with the barriers identified? Future: Does LSA have added value for you? If so, for which ages and diagnostic groups?	What do you need to be able to perform LSA?

Prompts used during the focus group:
How do others experience this?
What do others think about this?
Do you all agree?
If yes/no, could you explain why?
Could you please elaborate on this?
Is this true for every situation? Is this true for all cases?
