

The Differences in Differentiated Instruction for Students with an Auditory and/or
Communicative Impairment in Special and Regular Education: a Systematic Review and Expert
Appraisal

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Foreword

As I present this thesis, I would like to take a moment to express my heartfelt gratitude to those who have supported and guided me throughout this journey.

First and foremost, I extend my deepest thanks to Kyra Meutstege, Trynke Keuning, and my supervisor, Marieke van Geel, for their invaluable feedback and unwavering support. Their insightful guidance and practical suggestions have been instrumental in shaping the direction and quality of this research. The dedication and collaborative spirit of Kyra, Trynke and Marieke have made this journey both productive and enjoyable. Together, we have navigated challenges and celebrated milestones, making this thesis a true collaborative effort.

I would also like to express my gratitude to my parents, my brother, and my little sister. Their unwavering support, encouragement, and understanding have been a constant source of strength and motivation for me. I am grateful to my family and friends for their unwavering support and encouragement throughout this endeavour. Without their belief in my capabilities, this achievement would not have been possible.

Finally, I would like to acknowledge my own efforts, perseverance and self-belief for bringing me to this point. This journey has been filled with learning and growth, and I am proud of what I have accomplished.

Summary

Differentiated instruction (DI) is crucial for successful education, as it involves using diverse teaching methods to tailor material, techniques, and goals based on the unique learning needs of a diverse group of students. DI is seen as an important teaching skill, but it can be time-intensive and challenging to meet the diverse needs of students. While there is substantial research on DI in regular education, special education, which cater to students with auditory and/or communicative impairments and language-speech development disorders, have received limited attention in this regard. Special education places significant emphasis on fostering extensive collaboration among an interdisciplinary team, including teachers, teaching assistants, speech therapists, and remedial educators.

The aim of this study is to ascertain the extent to which principles derived from research in primary education are applied in theory and practice in primary education for students with an auditory and/or communicative impairment. The research employs a qualitative research design, including a systematic review and expert appraisal.

The implementation and impact of DI vary across special and regular primary education settings. While DI principles are valued for their ability to meet diverse learning needs, challenges persist in special education, particularly for students with auditory and/or communicative impairments. The five differentiation principles are present to varying degrees in both literature and practice. Professionals highlight the importance of these strategies and call for more emphasis on cognitive differentiation. Effective integration of DI relies on robust interprofessional collaboration among teachers, speech therapists, teaching assistants, and support staff. This collaboration is crucial for developing tailored instructional strategies that meet individual student needs. However, disparities between theoretical literature and practical application underscore the importance of cohesive teamwork and unified goals to enhance educational outcomes. Future research should fill literature gaps and assess the impact of collaborative training initiatives to enhance support for these students.

The Differences in Differentiated Instruction for Students with an Auditory and/or Communicative Impairment in Special and Regular Education: a Systematic Review and Expert Appraisal

Incorporating differentiated instruction (DI) is a vital aspect of successful education (Parsons et al., 2017). DI involves using diverse teaching methods to customise material, techniques, and goals based on the unique learning readiness and interests of a diverse group of students or individuals (Tomlinson, 1995). Implementing DI raises the probability of presenting a subject in a manner that resonates as meaningful, engaging, and suitable for each individual student (Tomlinson, 1999). This is because of the unique personal learning preferences and individual differences among children (Connor et al., 2011). The application of DI is seen as an important teaching skill (Van Geel et al., 2018). Ideally, all students can profit from the benefits of receiving DI. Engaging in DI can be quite time-intensive for teachers, requiring substantial effort in terms of planning, organisation, and coordination of individuals and groups within a large class setting (Joseph et al., 2013). Additionally, meeting these diverse needs and preferences of students, especially those who prefer independent work, is challenging.

DI has been thoroughly studied and demonstrated to be applicable across various contexts in regular education (Keuning et al., 2017; Keuning & Van Geel, 2021; Meutstege et al., 2023; Vreman, 2019; Vrielink, 2018). However, in the context of special education DI has not yet received the same attention (Bowen & Probst, 2023). Students with hearing or communication challenges have several educational pathways available. They may attend mainstream schools with the support of visiting specialists, or they can enrol in specialised institutions, where they receive targeted assistance alongside peers with similar needs (Kentalis, n.d.-a; Kentalis, n.d.-b).

Students in the Netherlands, who have auditory and/or communicative impairments or face challenges in language development are classified within a distinct category of special education, called ‘Cluster 2’ (Inspectie van het Onderwijs, 2021). Cluster 2, the target group, is the primary focus of this research. A significant difference between regular education and special education is that special education places emphasis on fostering collaboration among an interdisciplinary team. This team consists of teachers, teaching assistants, speech therapists, and remedial educators. Such collaborative endeavours are important in tailoring educational

approaches to meet the diverse and unique needs of students in special education (Bowen & Probst, 2023). Optimising the education for these students is therefore an interprofessional task. In an interprofessional approach, various professionals work together with shared responsibility and equality to develop and implement an approach that results in a greater overall impact (De Waal, 2018). Prior investigations about DI have primarily focused on the implementation of individual teacher-based differentiation (Bowen & Probst, 2023). Because of the interprofessional collaboration and a tailored educational approach, the theory of DI should probably be adjusted to the context of Cluster 2 education.

Quality improvement is needed in Dutch special education, particularly concerning effective instruction, and adapting to diverse student needs (Inspectie van het Onderwijs & Universiteit Twente, 2023). The internal audits within Kentalis (a specialised care organisation) indicate that teachers often feel uncertain about differentiation, and the collaboration among professionals in the field of differentiation is not always optimal. According to Inspectie van het Onderwijs and the University of Twente (2023), teachers in special education do not consistently and visibly address the educational needs of each individual student.

The aim of this study is to ascertain the extent to which principles derived from research in primary education can be applied to special education for students with an auditory and/or communicative impairment. This overview study will contribute to a broader knowledge base regarding educational support for students in special education and about interprofessional collaboration for differentiation. The results can be used as a groundwork for further improvements of materials and trainings of DI for professionals in special education schools. Via a systematic review, the characteristics for (interprofessional collaboration for) differentiation in special and regular primary schools, for students with an auditory and/or communicative impairment, will be analysed and compared to each other. This will provide a foundation of knowledge regarding DI in special and regular primary schools and the interprofessional collaboration for DI. The findings of the systematic review will be subjected to an expert appraisal.

Theoretical Framework

The Concept of Differentiated Instruction

At its core, differentiated instruction involves modifying classroom activities to offer students various ways to absorb information, comprehend concepts, and demonstrate their learning (Tomlinson, 2001). A cognitive task analysis conducted by Van Geel et al. (2018) shows that differentiation is a multifaceted process that unfolds across four chronological stages: 1) Planning a period and block, 2) Organising a lesson, 3) Executing the lesson, and 4) Assessing both the procedure and outcome post-lesson. The four phases are interdependent: with the information based on the evaluation in phase four, a teacher prepares the next lesson according to phase two. Subsequently, by using the preparation of the lesson in practice in phase three, a teacher can make sure to handle the differences between the students. In every one of these phases, various distinct skills related to differentiation can be identified.

Expanding on this foundational understanding, research by Smale-Jacobse et al. (2019) contextualizes the theoretical framework of DI within the broader concept of within-class differentiation. This presentation underscores the significance of addressing instructional diversity across various stages: prior to the lesson, during the lesson, and after the lesson. Moreover, as highlighted by Tomlinson (2001), teachers manage three key curricular components: content, process, and product. Content refers to the material and information that students are expected to learn. Process involves the methods and activities through which students understand and engage with this content. Finally, product pertains to the means by which students demonstrate their learning and comprehension.

Incorporating insights from Keuning and Van Geel (2021), five underlying principles consistently emerge, which are also closely interconnected. The five principles include working towards clear goals, continuous monitoring, providing challenges to each student, aligning instruction and processing methods, and promoting the development of self-regulation. When working with goals, it is crucial to align lesson aims with broader period goals. During instruction, teachers can prioritise actions that advance the lesson objective. Equally important is ensuring students understand what they are learning, why it matters, and the criteria for success. Furthermore, teachers need to consistently gather information on students' comprehension and

progress across all stages. In addition, teachers should hold high expectations for all students and demonstrate ambition in their goals, approaches, attitudes, and language. Teachers also need to adapt the level of abstraction, pace, difficulty, and/or amount of instruction and processing according to the identified variances and requirements of their students. Ultimately, successful differentiation involves encouraging students to contemplate their own requirements for achieving the goals (Keuning & Van Geel, 2021).

Given that DI is a complex concept, various authors have put forward different sets of components or dimensions to characterise it (Suprayogi & Valcke, 2016). Suprayogi and Valcke (2016) identified five dimensions that are commonly described by most authors. These dimensions could serve as the foundation for presenting a working definition of DI: an instructional methodology designed to address student diversity by (1) addressing individual differences among students; (2) employing tailored teaching strategies; (3) incorporating diverse learning activities; (4) monitoring the unique needs of each student; and (5) striving to achieve optimal learning outcomes.

The Benefits of Differentiated Instruction

DI offers the advantage of catering to the diverse needs of students with varying learning styles, including those with disabilities (De Jesus, 2012). DI brings about many different results in education and learning. This approach fosters creativity and facilitates deeper understanding of concepts, encouraging higher levels of thinking among students (De Jesus, 2012). Students who experienced differentiation based on their learning styles showed also improved reading achievement (Koeze, 2007). Furthermore, students expressed additional perspectives, noting increased motivation and enjoyment in classes attributed to the successful implementation of DI strategies (Melek & Mede, 2022). These DI-led sessions enhanced students' autonomy, enthusiasm, enjoyment, collaboration, and active engagement. Specifically, during DI activities, students showed more independence and accountability, accompanied by a sense of enjoyment in the learning process.

Characteristics of Education for Students with an Auditory and/or Communicative Impairment

Special education in the Netherlands is organised into four clusters, based on students' specific needs. Students with hearing and/or communication challenges have various educational options available to them. They can choose to attend a mainstream school while receiving support from specialists who visit the school, or they can opt for specialised education in so-called Cluster 2 schools, where they learn alongside peers who require also more focused assistance (Kentalis, n.d.-a; Kentalis, n.d.-b). Cluster 2 education is for students who are deaf, hard of hearing (DHH) or have a developmental language disorder (DLD) (Ministerie van Onderwijs, Cultuur en Wetenschap, 2021a). Students who have multiple communicative disabilities (MCD) are also included in Cluster 2 education (Kentalis, n.d.-c). The decision to either enroll in a mainstream school or to attend a Cluster 2 school for special education depends on the type and severity of the student's challenges and disabilities. Moreover, there are hybrid approaches possible, such as school-in-school arrangements where students attend a specialised school within a mainstream school's premises. Another option is a "medium setting" school, where the mainstream school has enhanced expertise in catering to the specific needs of these students. From now on, the term 'special education', will be used to describe education for students with an auditory and/or communicative impairment.

To be qualified for teaching in special education, following a regular teaching training program is deemed sufficient (Ministerie van Onderwijs, Cultuur en Wetenschap, 2021b). However, in practice, many teachers in Cluster 2 education additionally have followed a master in Educational Needs (Ministerie van Onderwijs, Cultuur en Wetenschap, 2021b), or a master Dutch Sign Language (Kentalis, n.d.-a).

Differentiated Instruction and Interprofessional Collaboration in Special Education

One main distinction that can be made between regular and special education is that students with conditions like deafness and a developmental disability often require specialised support throughout their educational journey. Therefore, special education works with interdisciplinary teams (Guardino & Cannon, 2022, cited in Bowen & Probst, 2023). This team should include special education teachers, teachers of the deaf and hard of hearing, and general

education teachers. These teachers collaborate to assess students' needs, establish high-quality educational objectives, and use appropriate curricula, implement suitable accommodations and modifications, and support the overall learning and growth of the students. Additionally, related services personnel, such as speech language pathologists, occupational therapists, and behaviour specialists, possess specialised knowledge and skills that differ from those of teachers. These professionals may either work directly with individual students or consult with team members, providing assistance during educational activities as needed (IRIS Center, n.d.). For instance, when dealing with students who have a DLD, teachers may partner with educational psychologists and speech therapists, while for DHH students, they could engage a sign language interpreter (Ndou & Omidire, 2022; Russell, 2021).

However, the internal audits within Kentalis indicate identified teacher uncertainty and suboptimal collaboration among professionals regarding DI. Additionally, newly qualified teachers have previously expressed feeling unprepared to teach students with additional support needs (Inspectie van het Onderwijs, 2023). It is known that DI represents a challenging undertaking that numerous educators have not completely mastered and feel inadequately prepared to manage (Van Geel et al., 2018). Kahmann et al. (2022) states that professional development programs can effectively improve teachers' implementation of DI, especially when delivered within the framework of a particular subject area. Nevertheless, it is notable that there are significant shortages of teachers, particularly in special education (Inspectie van het Onderwijs, 2024). These shortages are not expected to decrease anytime soon. It is concerning that primary schools serving challenging student populations are experiencing the most severe shortages, along with special education.

Most current research in special education focuses on DHH students. However, little is known about the ecosystem in which these students exist and what it might look like. According to Hartman et al. (2023), many early language and literacy programmes for DHH students have been adopted without adequate research. While some newer programmes have been more extensively researched, it is unclear whether any of them meet evidence-based standards. Without sound evidence, their effectiveness is uncertain. Consequently, teachers of the deaf and other professionals, with a deep understanding of both deafness and the science of learning, should utilise specialised instruction.

Research Questions

Literature suggests that differentiation in education is a crucial aspect for successful education. Although extensive research has been conducted on DI in regular education, there is a noticeable gap in knowledge about DI when it comes to special education, focusing on education for students with an auditory and/or communicative impairment. As it appears from literature that there are notable distinctions between regular and special education in both the learning needs of the students and the way these students are taught (for example a single teacher versus an interprofessional team), the critical question that emerges is:

“What are the characteristics of (interprofessional collaboration for) differentiation for students with an auditory and/or communicative impairment within special education schools?”

“To what extent are these characteristics for differentiation comparable to characteristics in regular education?”

For the comparison of characteristics of (interprofessional collaboration for) differentiation for students with auditory and/or communicative impairments in special education, the five principles of Keuning and Van Geel (2021) will be used as a framework.

Research Design

The current research is part of a broader study that examines primary and secondary education to DHH, DLD and/or MCD students (Meutstege et al., 2024). In this study, however, the specific focus will be on one aspect, namely primary education. This is due to the differing organisational structures of primary and secondary education. To analyse what characterises differentiation for students with an auditory and/or communicative impairment within special education schools, a qualitative research design was used. A systematic review was conducted to find an answer to the research question. Based on the theoretical investigation, a deeper understanding of the existing knowledge regarding DI in special education schools was acquired. With this information, the main research question was answered and a distinction between special education and regular education can be made. Additionally, the theoretical investigation gave insight into the factors that can either encourage or hinder effective interprofessional cooperation in special education schools. Finally, the outcomes of the systematic review were

checked by doing an expert appraisal via interviews. These experts are professionals in the field of a special education school. During the expert appraisal, these experts can tell the researchers if the findings from the systematic review are fitting to practise. Resulting in an answer to the question what the differences in DI in special primary education and regular education are.

Methods

Instrumentation and Procedure

In order to facilitate the organisation and execution of the systematic review, the practical manual of Petticrew and Roberts (2006) was utilised. Furthermore, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was employed to enhance the structure, clarity, and reliability of the process (Page et al., 2021). Appendix A contains the checklist that supported the systematic review process.

Literature Review

For the purposes of this systematic review, a comprehensive literature search was conducted to identify publications related to the differentiation of students with hearing impairments, MCD and DLD, both within the context of special education and regular general education. Additionally, the role of interprofessional collaboration in optimising education for students in this target group was investigated through a snowballing technique and an inquiry within the network of the researchers. In order to search the literature, the databases PubMed, Web of Science, and Scopus were employed. Furthermore, searches were conducted within specialised journal databases, including The Journal of Deaf Studies and Deaf Education. Furthermore, several other journals were already indexed in the Scopus database (for example Deafness & Education International and American Annals of the Deaf). Additionally, relevant literature was requested through the Siméa network. This organisation is dedicated to providing support and education for children who are deaf, deafblind, hard of hearing, or have DLD. The relevant literature from Siméa may include resources such as the Siméa guidelines for pedagogical and didactic practices tailored to different target groups. The search for literature was conducted via the formatted search matrix, as illustrated in Figure 1.

Figure 1*Search Matrix*

Nederlands								
<i>Leerling</i>	Doof	Slechthorend	Taal-spraak ontwikkelstoornis	TOS	Auditieve beperking	Auditief beperkt	Communicatief meervoudig beperkt	CMB
			Taal-ontwikkelingsstoornis	Taal-ontwikkelingsstoornis				
<i>Professionals</i>	Leerkracht	Onderwijsassistent	Leraar ondersteuner	Lerarenondersteuner	Leerkracht-ondersteuner	Logopedist	Intern begeleider	Orthopedagoog
	Leraar	Docent	Team	Interprofessioneel	Inter-professionele			Gedrags-specialist
<i>Differentiatie</i>	Differentiatie	Gedifferentieerde instructie	Adaptief onderwijs	Adaptieve instructie	Adaptief lesgeven	Inclusief onderwijs	Inclusieve instructie	Inclusief lesgeven
Engels								
<i>Student</i>	Deaf Deafness	Hard hearing	Hard-hearing	Developmental language disorder	DLD	Hearing impairment	Multiple communicative disabilities	MCD
<i>Professionals</i>	Teacher	Teaching assistant	Teachers' aide (TA)	Education assistant (EA)	Team teacher (TT)	Speech therapist	Academic coach	Educationalist
	Education generalist	Internal support coordinator	Support coordinator	Interprofessional				
<i>Differentiation</i>	Differentiation	Differentiated instruction	Adaptive instruction	Adaptive education	Adaptive teaching	Inclusive education	Inclusive instruction	Inclusive teaching
	Responsive teaching							

The network of involved researchers conducted a thorough examination of the search matrix to ensure that all potential concepts were included to minimise bias (Dwan et al., 2008). The literature search was conducted within abstracts, with the search query specifying a combination of at least one term from the 'students' category, at least one term from the 'professionals' category, and at least one term from the 'differentiation' category. An example of a search strategy is as follows:

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( TITLE-ABS-KEY ( ( "differentiation" ) OR ( "differentiated instruction" ) OR ( "adaptive instruction" ) OR ( "adaptive education" ) OR ( "adaptive teaching" ) OR ( "inclusive education" ) OR ( "inclusive instruction" ) OR ( "inclusive teaching" ) OR ( "responsive teaching" ) ) AND TITLE-ABS-KEY ( ( deaf ) OR ( deafness ) OR ( hard-hearing ) OR ( "hard hearing" ) OR ( "developmental language disorder" ) OR ( "DLD" ) OR ( "hearing impairment" ) OR ( "multiple communicative disabilities" ) OR ( "MCD" ) ) AND TITLE-ABS-KEY ( ( teacher ) OR ( "teaching assistant" ) OR ( "teacher's aide" ) OR ( ta ) OR ( "education assistant" ) OR ( ea ) OR ( "team teacher" ) OR ( tt ) OR ( "speech therapist" ) OR ( "academic coach" ) OR ( "educationalist" ) OR ( "education generalist" ) OR ( "internal support coordinator" ) OR ( "support coordinator" ) OR ( interprofessional ) ) ) AND PUBYEAR > 2013
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All the articles and other literature that were found were stored in an Excel document. The following (preliminary) inclusion criteria were formulated for the inclusion of publications in the overview study:

- Written in Dutch or English.
- Focused on education or support within the education of students with hearing impairments and/or DLD and/or MCD.
- Emphasis on supporting the (general) cognitive development of students.
- Targeted at supporting the development of students within the educational context (special education or mainstream education).
- Focused on students in primary school and secondary school (ages 4-18 years).
- Published from 2014 to 2023 (because the Dutch Law on Inclusive Education was introduced in 2014).

In order to ascertain whether a publication met all the inclusion criteria, the titles and abstracts were initially screened. During this screening, studies that did not meet the criteria were excluded from further analysis. This included medical studies on hearing impairments and studies with excessive language errors hindering proper interpretation. Publications that, based on the title and abstract/information, did not appear to be excluded were then thoroughly reviewed to determine if they met all the inclusion criteria. The reference manager 'Zotero' was employed to categorise the articles and other literature into two distinct groups: those that were excluded and those that were included. Subsequently, all articles that met the inclusion criteria were compiled into an Excel document. Finally, the articles that met the inclusion criteria were subjected to a series of checks, with each criterion being meticulously examined. Those that did not meet the requisite criteria were excluded.

1. Aimed at students in primary school and/or secondary school (ages 4-18 years).
2. Geared towards supporting the development of students within an educational setting (special education or mainstream education).
3. Tailored to education or support within the educational realm for students with auditory impairments and/or DLD and/or MCD.
4. The paper should focus on the skills, knowledge, or attitudes of a professional.
5. Concentration on aiding the (overall) cognitive growth of students.
6. The article should be an empirical study.

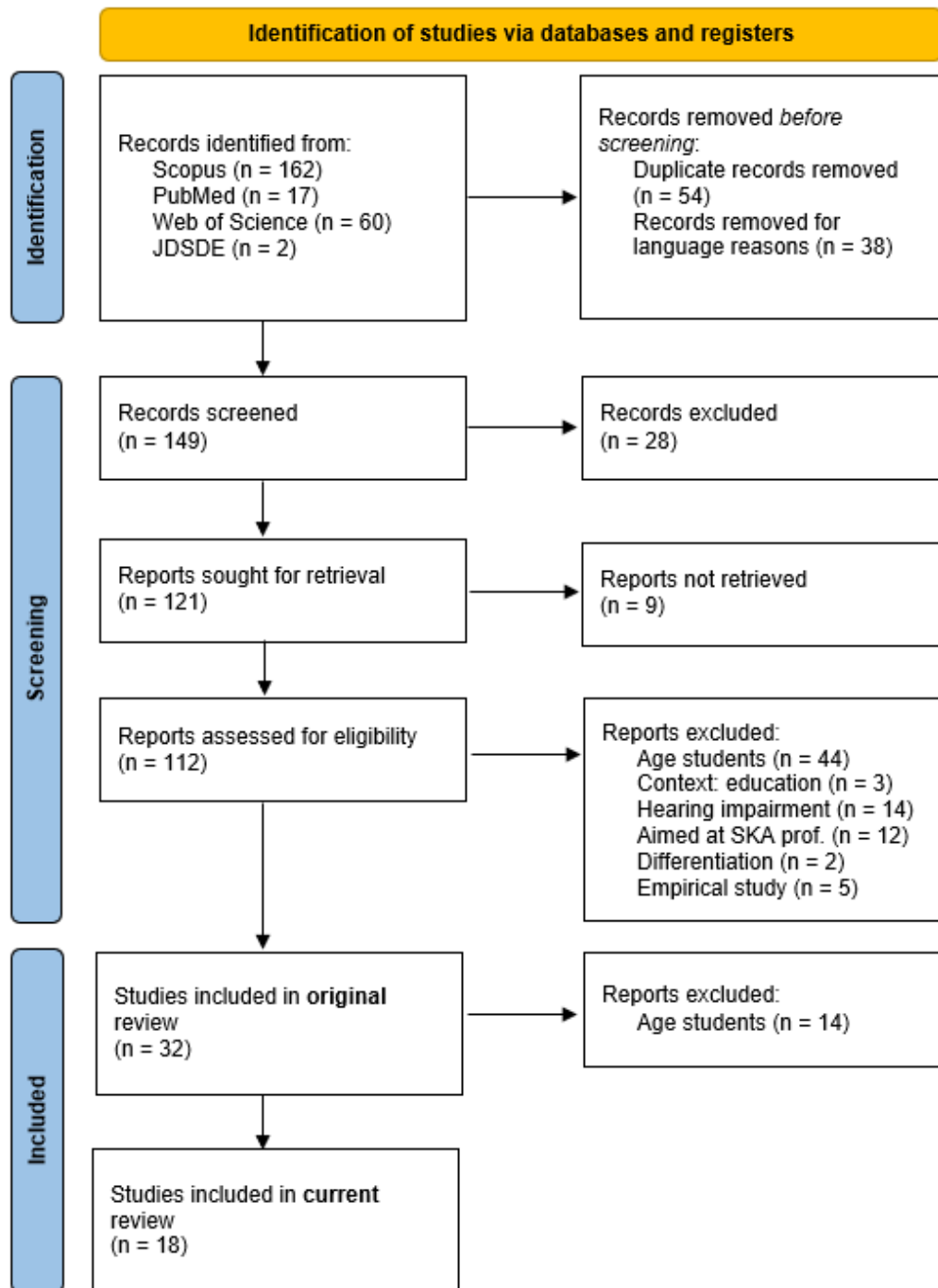
The aforementioned process of inclusion and exclusion was conducted for the purposes of the overarching study. Finally, the included articles were screened a second time, this time only on age, in order to identify those articles that were focused on students in primary school (ages 4-12 years). For a comprehensive overview of the methodology employed in screening and including the literature identified, please refer to the PRISMA in Figure 2.

In the Excel document, the exclusion points for each article based on the criteria were documented, resulting in a comprehensive overview of all eventually included articles. The inclusion process was conducted with a two-rater system. To maintain a systematic and rigorous approach to the quality of systematic reviews, it is essential to ensure transparency and clarity in the inclusion criteria (Belur et al., 2018). Firstly, ten randomly selected articles were discussed

collectively after each article had been reviewed individually, in order to enhance inter-rater reliability (Belur et al., 2018).

Figure 2

Prisma Flowchart (Page et al., 2021)



Expert Appraisal

The subsequent phase was an expert appraisal conducted in conjunction with teachers and experts in the field of special education. This expert appraisal occurred concurrently with the literature review. The expert appraisal comprised three distinct groups: the learning network, the focus groups, and the feedback group. All participants provided active and informed consent.

The Learning Network. The learning network is comprised of eight individuals, including a group of teachers and other professionals working in special education. The participants of the learning network were selected from a list of teachers and professionals engaged in special education schools, obtained from the University of Applied Sciences KPZ. The Learning Network was initially contacted via email, and the two sessions were conducted via 'Microsoft Teams'. Following each stage of data collection, theoretical exploration or practical investigation, a brief collective analysis was conducted in order to inform the subsequent data-gathering phase.

Focus Groups. Secondly, focus groups also include teachers and other professionals who are involved in special education. The participants in the focus groups were selected from a file of teachers and professionals working in the field of special education schools, retrieved from the University of Applied Sciences KPZ. The focus groups were contacted at the outset of the study via email, and the sessions were held at various locations. Due to logistical constraints, the focus groups were divided into three smaller groups of six individuals each. The focus groups were convened at Kentalis locations in Drachten, Utrecht, and Arnhem. In order to ensure that all relevant professionals were appropriately included in the focus groups, the participants were classified according to the guidelines set out by Van Assema et al. (1992). The relevant professionals included teachers, teaching assistants, education assistants, team teachers, speech therapists, academic coaches, and an educationalist. The participating professionals are presented in Table 1.

Table 1

Overview of the participants in the focus groups.

DLD		DHH		MCD	
Teachers	3	Teacher	1*	Internal supervisor	1
Internal supervisor	3	Speech therapist	1	Quality officer	1
Quality officer	2	Teacher Support Worker	1		
Behavioural expert	1	Behavioural expert	1		
Ambulatory attendant	2				

*The DHH teacher participated in both the focus group sessions held in Drachten and Arnhem.

In the focus groups, participants were requested to recall instances in which they had applied differentiation principles. The focus group interviews and analyses had a dual focus: one side examined the cognitive aspects of differentiation and interprofessional collaboration, while the other side explored the dynamics of interprofessional teamwork. Semi-structured group interviews were conducted for the focus groups. Some examples of questions are as follows: The following questions were posed in order to ascertain the participants' perspectives on the aforementioned topics: "How do you differentiate in special education schools?"; "How does interprofessional collaboration work with regard to DI in special education schools?". The discussions were recorded via a mobile device and, in addition to the researchers' notes, were subsequently summarised. The researchers then shared these summaries with the participants, requesting their feedback and validation on the conclusions drawn from the focus group sessions.

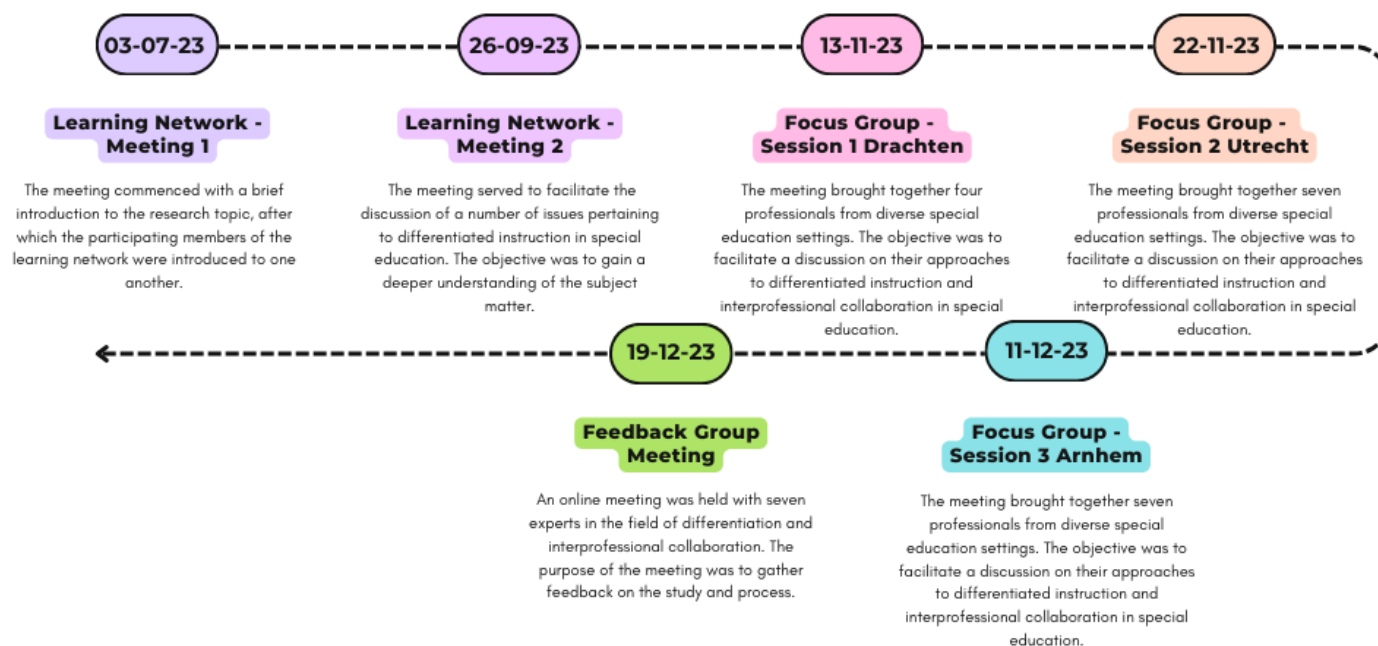
Feedback Group. Finally, the feedback group is comprised of seven subject matter experts. The group comprised experts with disparate perspectives on differentiation in special education and interprofessional collaboration in special education. The feedback group was subjected to questioning in order to increase the reliability factor (Khalilzadeh & Tasci, 2017). The feedback group was recruited from a variety of sources, including the network of researchers and consortium partners. The feedback group was contacted at the outset of the study via email, with the session conducted online via 'Microsoft Teams'. The findings from both the theoretical

analysis and the practical study were presented to the feedback group. One example of a question posed to the feedback group was as follows: "The results of the systematic review indicate that DI in special education schools exhibits distinctive characteristics compared to DI in regular schools." What are your opinions regarding this? The role of the feedback group was to validate and build upon the information collected in the theoretical and practical investigations.

A synopsis of the meetings and sessions held with the learning network, the focus groups, and the feedback group can be found in Figure 3, which presents the events in a chronological order.

Figure 3

Timeline of the different meetings and sessions with the different participating groups.



Data Analysis

The researchers employed a structured approach, entering related search terms into Atlas for the five principles, different types of professionals, their skills and knowledge, and interprofessional collaboration. The two raters divided the number of articles and coded the literature, using the highlighted related search terms in the text. The researchers then proceeded to read the results sections of the literature and make codings in the text based on the

aforementioned categories: the five principles for DI, the professionals, their skills and knowledge, and interprofessional collaboration. This method permitted the researchers to analyse and categorise the findings in a systematic manner, thereby facilitating a more comprehensive understanding of the interactions between these elements within the educational context. In the event that an article addressed multiple contexts, for instance, primary and secondary school, only the assigned codes for the primary school part were used in the analysis for the current study. The researchers individually coded each of the five articles and discussed them to identify areas of agreement between the coded text, thus enhancing inter-rater reliability (Belur et al., 2018). The raters continued to code and discuss discrepancies until 80% of the coded articles exhibited similar characteristics. The codex text was exported from Atlas to Excel, and a new Excel document was created for each principle. The five principles were subsequently subdivided into subthemes. For example, the principle of "adapting instructions and processing" was divided into descriptions of practices or interventions.

Following an initial round of exploratory analysis, the first findings were presented to the feedback group for verification. The results of the consultation with the feedback group were subsequently integrated into further analysis of the findings from the field study. Throughout the entire analysis process, the researchers convened on several occasions to discuss their insights and refine the coded texts. Furthermore, the recorded sessions of the focus group and the feedback group were transcribed using the software 'Amberscript'. The same raters analysed the transcriptions from the sessions using the same established principles as those employed in the analysis of the articles and other literature.

Results

The procedure of inclusion and exclusion has resulted in the inclusion of 18 studies in this literature review. Table 2 provides an overview of all the included studies and their characteristics.

Table 2*Overview of the included studies.*

Authors	Geographical setting	Participants	Type of disability	School context**
Akmeşe & Kayhan (2023)	Turkey	Teachers (in education) (n = 16)	DHH	R
Alasim (2020)	Saudi Arabia	Teachers (n = 120)	DHH	R + S
Borges & Nogueira (2019)	Brazil	Sign language interpreters (n = 2) *	DHH	R
Catalano et al. (2022)	USA	Teachers (n = 3), students (n = 19)	DHH	S
Chan et al. (2022)	Mauritius	Teachers (n = 2), students (n = 14), parents (n = 14)	DHH	S
Donne & Briley (2015)	USA	Speech therapists (n = 3), students (n = 7)	DHH	S
González-Reyes et al. (2021)	Chile	Students (n = 5)	DHH	R
Gupta (2022)	USA	Diagnosticians (n = 93)	DHH	S
Khairuddin & Miles (2019)	Malaysia	Teachers (n = 10), teaching assistants (n = 3), school leaders (n = 5), parents (n = 7)	DHH	R

Lederberg et al. (2022)	Canada	Teachers (n=8), students (n=32)	DHH	R
Musenyente et al. (2022)	Uganda	Teachers (n = 4), principals (n = 2)	DHH	R + S
Nikolarazi et al. (2021)	Greece	Teachers (n = 5), researchers (n = 2), students (n = 34) *	DHH	R + S
Oppong et al. (2023)	Ghana	Teachers (n = 15), clinicians (n = 9)	DHH	S
Phiri (2021)	Malawi	Teachers (n = 7)	DHH	R + S
Ralli et al. (2022)	Greece	Teachers (n = 122)	DLD	R
Tarjiah (2017)	Indonesia	Academics, teachers, and bureaucracy (numbers not specified)	DHH	R
Tuli et al. (2018)	India	Teachers (n = 71)	DHH	R
Wong et al. (2022)	Hong Kong	Teacher (n = 6), students (n = 12), parents (n = 11)	DHH	R

*This constitutes the segment of participants pertinent to this study. The overall participant count in the research was higher.

** R = regular education, S = special education.

As can be seen in the table, the origin of the studies is distributed (European, North American, South American, Asian, and African studies). There are a few (n = 6) studies from western

countries included (the United States of America, Canada, and Greece), and overall more studies from non-western countries ($n = 12$) included (for example Saudi Arabia, Brazil, and Mauritius).

It is evident that the studies encompass a diverse range of educational contexts. Some studies (Borges & Nogueira, 2019; Chan et al., 2022; Phiri, 2021; Tarjiah, 2017; Wong et al., 2022) are based on inclusive educational settings, where students with disabilities, for example DHH students, are integrated into general classrooms alongside their hearing peers. In such scenarios, it is typical to observe an educator conducting a class session in conjunction with an interpreter, whose role is to facilitate the understanding of the material for students experiencing hearing limitations, for example in the study of Wong et al. (2022).

Conversely, some studies are based on self-contained classrooms within regular education (Alasim, 2020; Catalano et al., 2022; Musenyente et al., 2022). In these self-contained classrooms, smaller educational environments are designed specifically for students with similar disabilities, such as DHH students. Furthermore, several studies (Donne & Briley, 2015; Gupta, 2022; Nikolarazi et al., 2021; Oppong et al., 2023; Ralli et al., 2022;) have examined special educational contexts that are solely dedicated to students with auditory and/or communicative impairments, such as schools for the Deaf.

The Five Principles of Differentiation in Special Primary Education

In this results section, a detailed analysis of the prevalence and applications of each principle identified in both literature and practice will be presented. The analysis will focus on the extent of evidence for the principles across the sources reviewed, highlighting findings and examples, while utilising the five principles for DI from Keuning and Van Geel (2021) as a foundation.

Work Goal-Oriented

Literature. According to Keuning and Van Geel (2021), ensuring the clarity of objectives is valuable. Understanding how lesson objectives align with overarching goals is important for making effective decisions during instruction. In a study conducted by Catalano et al. (2022) a teacher emphasised the importance of aligning instruction with the objectives

outlined in students' Individual Education Plans (IEPs), however, no information was provided regarding the content of these IEPs. The importance of aligning instructions to students' learning objectives is similarly evident in an example from the study of Lederberg et al. (2022). By integrating targeted vocabulary and encouraging repeated readings with engaging discussions, educators can effectively align their instructional efforts to their students' learning objectives. However, the importance of modifying content to align with learning objectives on student learning outcomes is not verified in literature.

Practitioner perspective. In the context of literature, the significance of modifying content to align it with learning objectives and student learning outcomes is not consistently evident. However, in practice, the essence of this approach is much clearer. In setting goals for students with DLD and DHH, teachers rely on core objectives and learning trajectories, whereas for MCD students, exit profiles (from UP1: engagement-focused day activities to UP4: supported work and employment) take precedence. Goals are frequently integrated into themes, with a preference for collaborative preparation involving teachers, speech therapists, and teaching assistants. A quality assurance officer emphasised that this approach is employed in order to ensure consistent alignment with the children's level of experience and their world of perception.

In the realm of special education schools, a diverse array of professionals can pursue varied goals. While teachers, speech therapists, care professionals, and physiotherapists each have distinct areas of focus, there is often collaboration to integrate these goals. For example, vocabulary lessons may align with speech therapy objectives, a practice deemed beneficial. In the field of DHH education, professionals engage in collaborative goal setting, with the objective of identifying and implementing differentiation strategies. These strategies are chosen every six months in partnership with speech therapists, and are evaluated in order to ascertain their efficacy.

Conversely, in mainstream education, it is common practice for ambulatory attendants to play a significant role, providing advice and collaborating with teachers to establish goals. This is particularly the case with regard to vocabulary and speech-language development. Subsequently, all formulated lesson objectives are disseminated to students, with a particular focus on visualisation, which is often facilitated through the use of visual aids such as drawings

or written notes on the board. An internal supervisor in primary education provided an illustrative example of the frequent use of drawing and/or writing on the whiteboard to facilitate the visualisation of word problems.

Monitor

Literature. Throughout the entirety of the educational process, it is imperative to continuously collect data on students' comprehension and advancement (Keuning & Van Geel, 2021). Professionals should employ a variety of monitoring techniques at different intervals to assess students' understanding, identify areas of difficulty, and recognise areas of strength. In the included literature, there is a paucity of discussion regarding teachers' monitoring of students' comprehension and advancement during the different phases (including the preparation period, preparation of the lesson, delivery of the lesson, and evaluation). Nevertheless, a study by Chan et al. (2022) indicated that a teacher may also be able to observe a student's feelings. In this study the difficulties DHH students encounter while learning French and the potential educational benefits of gamification were investigated. The study revealed that a student with a hearing aid became tired and distracted more rapidly. As a solution, the teacher recommended taking a break, after which the student showed significant improvement.

Furthermore, the study by Nikolarazi et al. (2021) demonstrates that teachers can utilise co-teaching to monitor their students when other professionals are teaching their students in class. In this context, a teacher monitored the DHH students during a museum visit. The teacher was thus able to provide support to both the DHH students and the museum staff in effective communication when necessary.

Practitioner Perspective. In practical settings, professionals also note that co-teaching is helpful for monitoring student comprehension. While one educator delivers the lesson, the other observes the students to evaluate their understanding of the material and determine if further instruction is necessary. For instance, a special education teacher for students with DLD has observed that their music teacher employs a range of executive function skills with the students, including waiting their turn. During these sessions, the teacher records and subsequently discusses their observations with the music teacher, which provides them with valuable insights into some specific skills of their students. However, while different professionals are monitoring

during co-teaching, the challenge lies in efficiently integrating these diverse perspectives. Long-term evaluation is typically ensured within the organisation of the year, with regular meetings held to track students' progress over an extended period. These meetings involve multiple professionals to obtain a comprehensive understanding of students' development.

Furthermore, the results of the various focus groups and theoretical exploration both indicated that monitoring student well-being is a feasible approach. The focus groups highlighted the importance of this as a prerequisite for effective learning. For example, a quality officer from MCD indicated that they initially assess the conditions of their students. The professional considers questions such as whether the student feels safe and whether they are ready to learn today. Moreover, there is an emphasis on observing the child's surroundings, as students with auditory and/or communicative impairments often have less developed empathy skills. Educational practitioners not only monitor the student but also their environment and the actions of others.

According to different professionals, the monitoring methods used for assessing understanding in students with auditory and/or communicative impairments differ significantly from those employed for monitoring other students in regular education. Particularly, students with DLD may struggle to gauge their own comprehension, necessitating extensive questioning from the professional. A teacher of children with DLD in special education emphasises the importance of asking clarifying questions. With DLD students, it is possible that only a word or two may be provided in response, therefore it is necessary to gauge their understanding from this limited input. In order to assist the student, it is advisable to ask questions such as, "How does this make sense to you? Do you understand that word in the full context?" These clarifying questions help to determine whether the student truly grasps the material.

Challenge All Students

Literature. A professional should maintain high expectations and ambition for all students, in both the objectives and methods, as well as in attitude and language (Keuning & Van Geel, 2021). It is the responsibility of the teacher to ensure that all students are able to learn and progress. The teacher should therefore communicate high, realistic expectations in a clear manner. The literature examined in this study does not explicitly discuss the notion of

challenging all students. In certain cases, it was deemed appropriate for students to repeat a class, particularly when they required additional time to acclimate to the school environment (Musenyente, 2022). Some educational institutions perceived the necessity for class repetition as an indication of failure, frequently associated with a student's inability to meet the established standards or "failure to meet expectations". This perception occasionally resulted in heightened pressure on students to achieve specific grades, particularly those with disabilities who were acutely aware of performance expectations (Musenyente, 2022).

Practitioner Perspective. All professionals are aware of the significance of maintaining high expectations. However, they also acknowledge the difficulty of avoiding the pitfall of setting lower expectations for students with disabilities. The challenge of addressing the needs of strong students persists, as they often receive minimal attention and lack opportunities for enrichment or deepening. The DHH teacher and teacher assistant recognise the importance of challenging both strong and weak students, but feel that more emphasis should be placed on promoting independent work, especially for stronger students. According to them, this is a challenging task, particularly in the highest level of primary school. It has been observed by practitioners that students who are more proficient in the subject matter are frequently overlooked. When these students achieve their goals with ease or have already met them, they are often set to work on their own. Opportunities for enrichment or deeper learning are seldom offered, in part because these students more often require remediation.

Adapt Instructions and Processing

Literature. It is recommended by Keuning and Van Geel (2021) that the level of abstraction, pace, difficulty, and amount of instruction and practice be tailored to the diverse needs and differences of the students. Various approaches to adapting instructions and processing have been identified in the included literature. One common type of adjustment is language modification. In order to prevent overloading students, it is of importance for both teachers and parents to utilise clear, concise sentences and distinct facial expressions when interacting with DHH students (Akmeşe & Kayhan, 2023). In order to facilitate the acquisition of oral communication skills among students with DLD, teachers actively promote the integration of oral communication and language development activities. Such activities, as exemplified by

language games and storytelling, are designed to enhance the language learning experience of DLD students (Ralli et al., 2022).

Furthermore, the integration of visual aids is frequently cited as a beneficial adjustment. Studies indicate that the use of visualisations, including videos, images, drawings, and dramatic presentations, can enhance comprehension and aid vocabulary retention. However, the impact of such techniques on students' performance may vary (Chan et al., 2022; González-Reyes et al., 2021; Nikolarazi et al., 2021). An illustrative example can be found in the study of Chan et al. (2022), in which the teacher read the passage aloud while also signing to the DHH students. Nevertheless, both the hearing and DHH students encountered difficulties in following up with the reading exercise. Consequently, the teacher proceeded to write the keywords and illustrate them with diagrams on the whiteboard.

In addition to language modifications and the use of visual aids, further adaptations are implemented to address the diverse learning needs of students. For instance, classroom seating arrangements are adjusted to accommodate students with disabilities, such as positioning students with hearing impairments nearer to the teacher to facilitate engagement and support (Musenyente, 2022). Furthermore, it is important to ensure that DHH students have unobstructed visibility of the teacher's face, as this is essential for effective lip-reading (Akmeşe & Kayhan, 2023).

Lastly, the utilisation of instructional groups, such as flexible instructional groups, offers increased opportunities to customise and adapt teaching methods according to individual students' goals defined in their IEPs (Catalano et al., 2022). Employing a diverse range of instructional methods tailored to the specific needs of DHH students could also foster their phonological awareness skills and early reading proficiency (Lederberg et al., 2022). For example, to illustrate the distinction between "sound" and "name," teachers may utilize farm animals. Students are taught the names of different farm animals (such as cow, pig, and horse) and the sounds they make (for example moo, oink, and neigh). Subsequently, the students are required to identify which sounds are similar. These exercises provide a foundation for subsequent lessons on the comparison of letters and sounds. Moreover, the study by Donne and Briley (2015) demonstrated the efficacy of tailored vocabulary instructions in addressing the

individual needs and readiness levels of students. In this study, students were provided with three levels of multimedia storybooks for each theme or week. Some students exhibited enhanced reading comprehension as a consequence of the DI instruction.

Practitioner Perspective. In the focus group sessions, various elements of modifying instruction and processing are emphasised. As in literature, the use of flexible instructional groups is seen as effective. Flexible instructional groups are primarily used for DHH and DLD students, whereas this is less common for MCD students due to their small group sizes. When forming instructional groups, consideration is given not only to cognitive performance but also to the level of guidance and support students need during processing. The typical format for instruction is a whole-class session, followed by independent work at varying levels, with personalised guidance from various professionals. The objective is to deliver meaningful and explicit instruction, supplemented with suitable aids, for students with auditory and/or communicative impairments. Additionally, to address the needs of weaker students, pre-teaching sessions are arranged by the speech therapist and teacher assistant, offering additional support before regular instruction commences. In these classes different professionals work together with small groups of students, segmented by their proficiency levels.

Furthermore, the teacher of the DHH students in special education indicated that alternating between different types of sign language, such as Dutch Sign Language and Dutch accompanied by gestures, is employed as a form of adjustment for DHH students. This necessitates a constant switching between the two modes, depending on the needs of the student.

Stimulate Self-Regulation

Literature. The effective differentiation of students involves facilitating their reflection on individual needs to attain academic goals (Keuning & Van Geel, 2021). This approach enables professionals to cultivate a learning environment where students are encouraged to undertake challenges and gather insights from their errors. The promotion of student self-regulation was not prominently emphasised in the literature. Nevertheless, the effects of differentiation through flexible instructional groups for DHH students were observed in the study conducted by Catalano et al. (2022). The implementation of differentiated instructional groups led to an enhanced sense of autonomy among students.

In select schools investigated by Musenyente (2022), an observed practice involved the integration of students from diverse academic levels into a unified group. These institutions advocated for peer assistance among students, facilitating the utilization of collective skills for the benefit of all individuals. As a result, the teacher's involvement in supporting the group was reduced, as students often provided mutual assistance.

Furthermore, Wong et al. (2022) observed that DHH students demonstrated increased initiative by seeking clarification and engaging in discussions. This improvement in classroom participation highlights the positive impact of fostering a supportive learning environment where students feel empowered to seek assistance and engage actively in their education.

Practitioner Perspective. Teachers in primary education are committed to fostering self-regulation in students with DLD, DHH, or MCD, acknowledging the inherent challenges associated with limited internal dialogue development. Teachers facilitate self-regulation by offering students tailored choices. Such choices may extend from relatively simple decisions, such as the completion of a task, to more complex ones, such as selecting between varying difficulty levels, which allows students to evaluate their own performance. For example, a teacher of students with DLD in special education allows her students to assess their dictation accuracy. Each lesson incorporates a structured evaluation period, which allows for the review of past performance and the formulation of future plans. This approach has been identified as a valuable and beneficial strategy for students with DLD. The objective of the lesson evaluations is to facilitate self-regulation, which enables students to develop self-awareness and organise information in their minds. While these abilities may present challenges for students with DLD, practice can enhance their proficiency over time. Alternetavely, a teacher of students with DHH in special education empowers her students to categorise their work as "still difficult" or "already known", to improve self-regulation. Similarly, an internal supervisor for DLD students mentioned that students are afforded the opportunity to make decisions regarding their participation in instruction, assignment choices, and weekly tasks.

Furthermore, the DSH teacher and the ambulatory service are aware of the challenges in expressing emotions and emphasise the importance of support, particularly during conflicts or

group interactions. Practical activities, such as the use of images, are employed to assist students in expressing their emotions.

Interprofessional Collaboration

Literature

Effective collaboration among a diverse range of professionals is essential in special education, a fact that has been underscored by various studies. In the study by Ralli et al. (2022), teachers noted their ability to collaborate with various specialists in order to address the diverse learning needs of their students. Borges and Nogueira (2019) also emphasise the significance of such collaboration. In the literature on interprofessional collaboration, the typical scenario involves a teacher working alongside one or more other professionals. Such professionals may include speech therapists, sign language interpreters, school leaders, educational psychologists, general specialists, or professionals from specific organisations (Ralli et al., 2022). A distinction can be made between interprofessional collaboration in regular education and in special education.

Collaboration in regular education can take various forms. According to Ralli et al. (2022), teachers indicated that effective collaboration includes regular contact with other specialists, guidance from these specialists, and dynamic partnerships where both teachers and specialists exchange information and jointly plan educational approaches. Teachers, principals, and other stakeholders in regular education should listen to sign language interpreters, as they share the language of the deaf community and actively engage in its culture (Borges & Nogueira, 2019). The literature, however, frequently addresses the collaboration, or lack thereof, between teachers and sign language interpreters. The degree of collaboration varies significantly. For instance, Borges and Nogueira (2019) reported that in some cases, teachers only verify the correctness of a DHH student's response, leaving further follow-up to the interpreter, who may lack the necessary knowledge of certain subject matter, such as mathematical concepts. In addition to the collaboration between teachers and sign language interpreters, the literature also discusses the cooperation between speech therapists and teachers in regular education. Alasim (2020) highlighted that speech therapists generally do not play a substantial role in regular

schools in enhancing the communication and language skills of DHH students. However, the presence of speech therapists is essential to support teachers in understanding the specific learning needs of DHH students, such as teaching the correct use of hearing aids (Alasim, 2020).

Another significant form of interprofessional collaboration occurs among teachers, often through co-teaching arrangements. In a study by Wong et al. (2022), a co-teaching model was examined in which a deaf teacher and a regular teacher collaborated to deliver lessons. As equal partners, they planned and conducted the lessons using sign language and spoken language, respectively. Initially, they received support from a hearing teacher proficient in sign language. The co-teaching model was found to enhance teacher professionalism, create a unique linguistic environment for both deaf and hearing teachers and students, and reinforce the identity of deaf students by having a deaf teacher in the classroom. As outlined by Alasim (2020), a co-teaching strategy in regular education is recommended for classes with a minimum of 20 students.

The collaboration with other educational institutions is a focus of special education schools (Oppong et al., 2023). One teacher posited that establishing connections with mainstream schools and other schools for the deaf through events such as sports, drama activities, and festivals significantly benefits children's social and communicative development with both deaf and hearing peers, thereby fostering their inclusion in the broader community. Furthermore, a teacher indicated that collaborations between special schools, facilitated through WhatsApp, text messages, and phone calls, allow educators to share resources and teaching strategies effectively (Oppong et al., 2023).

Practitioner Perspective

The distinction between professionals in regular and special education becomes more evident in the focus group sessions. Access to speech therapists differs between special and regular education settings, with special education often having on-site therapists, facilitating smoother communication and alignment between therapist and teacher. In regular education settings, the speech therapist is not in-house but works in a healthcare institution, meaning discussions need to be scheduled and the speech therapist has to be paid extra for these meetings. Therefore, the degree of coordination between teachers and speech therapists varies

considerably, directly affecting the teachers' capacity to integrate speech therapy objectives into their lessons.

In regular education, itinerant teachers are often employed. This support is tailored to the needs of the students and the requests of the teacher, taking various forms, such as individual guidance, co-teaching, or advising the teacher. An ambulant worker for DLD students provided an illustrative example of the work she does with a case study involving a student who experienced difficulties with synthesis tasks in a noisy classroom. Despite his ability to name and write letters, he found it challenging to identify the 'A' in 'cat'. She recommended the use of a special device to assist him in hearing himself and drew upon the guidance set out in the Literacy Master Plan. However, there is frequently a lack of clarity regarding the roles and responsibilities in the collaboration between ambulant workers and classroom teachers when it comes to aligning instructional approaches.

Furthermore, the focus group discussions highlight the pivotal role played by teaching assistants and teacher support workers in the implementation of differentiation strategies within the classroom. The deployment of teaching assistants may vary according to the specific location and student demographics. For instance, a teacher of DLD students in special education states that a teaching assistant frequently conducts targeted learning activities with small groups of students outside the classroom. However, the DHH teacher in special education notes that the prevailing mindset among teachers is to assign students requiring intensive support to a teacher support worker, which places a significant burden on them. Such a strategy effectively relinquishes responsibility for these students, despite the teacher's awareness of their specific needs. Consequently, it is possible that their progress may not be adequately tracked.

In the majority of cases, the primary responsibility for differentiation lies with the teacher, supported by professionals such as care support workers and occupational therapists who help establish the learning environment for children. According to a quality officer from MCD, the CvL (Committee for Pupil Care) plays an important role. This committee includes a remedial educationalist, a behavioural expert, a speech therapist, a principal, an internal supervisor, and, when possible, a doctor, and is primarily concerned with identifying potential improvements for children, especially those needing extensive care. While literature often

emphasizes the role of interpreters, focus group sessions reveal that legal constraints limit interpreters' involvement in the educational process to a multidisciplinary rather than an interprofessional capacity.

Discussion and Limitations

The field of special education has not received the same degree of attention as general education settings with regard to Differentiated Instruction (DI), which has been predominantly focused upon teacher-driven differentiation (Bowen & Probst, 2023). Furthermore, there is a lack of understanding of the educational environment for Deaf and Hard of Hearing (DHH) students and its implications. The implementation of early language and literacy programmes for students with hearing impairments has frequently occurred without sufficient empirical evidence, and while more recent programmes have been subjected to greater evaluation, their adherence to evidence-based standards remains uncertain (Hartman et al., 2023).

This study compares literature on DI in special and regular primary education for students with auditory and/or communicative impairments, with the actual practice of DI in these different settings. The analysis of various DI principles, as outlined by Keuning and Van Geel (2021), and the examination of their implementation by educational professionals in different settings provides a foundation for understanding DI practices in special education.

Discussion

Theoretical and practical investigations have indicated that the principles of differentiation can be applied to the education of students with auditory and/or communicative impairments. However, the extent to which these principles are addressed and put into practice varies. In practice, challenges when applying the different principles were highlighted by the different professionals. This is in line with the study of Dixon et al. (2014), in which is mentioned that educating a class with students of varying abilities presents a challenging and intricate task for current educators.

Literature emphasises the theoretical importance of aligning instruction with students' IEPs, however it often lacks practical details and verification of impact on student outcomes.

This is in line with the study of Poppes et al. (2002), in which is mentioned that staff members need the skill to set technically sound and contextually appropriate goals to ensure a high-quality education through IEPs. Goals should meet criteria such as being reasonable, clear, measurable, and achievable. In contrast, practice demonstrates effective goal-oriented strategies through collaborative efforts among diverse professionals, integration of thematic goals, and regular evaluation, particularly in special education settings. However, in an educational report for the Netherlands in 2024 (Inspectie van het Onderwijs, 2024), it is noted that setting goals remains an area for improvement among professionals.

While academic literature provides limited discussion on comprehensive methods for monitoring students' comprehension and progress, practical settings demonstrate nuanced approaches. According to Etscheidt (2006), progress monitoring is substantial for assessing the effectiveness of a child's IEP. Additionally, in the Individuals with Disabilities Education Act (IDEA) is included that a student's IEP must incorporate a strategy for progress monitoring (Wolfe & Harriott, 1998). Professionals in special education employ strategies like co-teaching, targeted questioning, and environmental observations to assess and support student understanding and well-being. A difference can be observed between special and regular education, where in regular education the focus of monitoring students is more cognitive-oriented.

Furthermore, the literature addresses little the importance of challenging all students, often focusing on the necessity of class repetition for those needing additional time to acclimate (Musenyente, 2022). Research of Fitzpatrick and Knowlton (2007) indicates that educators who set high expectations for all students, including those with disabilities, create learning environments that more effectively equip them for postsecondary education and future employment prospects. In practice, however, educators emphasise the importance of maintaining high expectations and providing opportunities for both strong and weak students to engage in independent and enriched learning. Although, practitioners acknowledge the challenge of balancing high expectations while avoiding lower ones for students with disabilities. Lindeman and Magiera (2014) emphasise that practice of having high expectations through co-teaching could positively influences students' overall development and success in various aspects of their educational journey.

Additionally, literature identifies various approaches to adapting instruction and processing, such as language modifications and visual aids, it often lacks detailed practical application and impact on student performance. In practice, educators employ a range of tailored strategies, including flexible instructional groups, pre-teaching sessions, and sign language adjustments, to meet the diverse needs of special education students. The various mentioned ways to adapt instructions and processing are also confirmed in other literature. Equipping both teachers and DHH students with such strategies to adapt is seen as pivotal in fostering their development as independent learners capable of recognizing and addressing their own learning requirements (Cockcroft et al., 2010). Ultimately, these efforts aim to empower students to become self-sufficient in managing their learning needs effectively.

Lastly, while the promotion of self-regulation is not prominently emphasised in the literature, practical approaches in special education reveal strategies for fostering student autonomy. Practitioners' insights highlight the benefits of differentiated instructional groups, peer assistance, and tailored choices, which enhance self-regulation and classroom participation among students with auditory and/or communicative impairments. In the study of Cawthon (2001) it was observed that teachers in inclusive classrooms tended to communicate less with deaf students compared to their hearing peers. Moreover, they were more inclined to pose closed (yes/no) questions rather than open-ended ones. These challenges often stem from mainstream teachers their unfamiliarity with deaf children, sign language interpreters, and assistive listening devices (Marschark & Knoors, 2012). When teachers do not actively involve deaf students in ongoing communication and classroom discussions, they overlook opportunities to enhance visual attention, focused information processing, and the development of self-regulation skills valuable for effective learning.

The characteristics of interprofessional collaboration in special education highlight a significant disparity between literature and practice. While the literature emphasizes the theoretical benefits of collaboration among teachers, speech therapists, and interpreters, it often lacks detailed practical insights and applications, especially in the context of special education. The practitioners indicated that effective collaboration can be facilitated by fostering regular, dynamic partnerships amongst a diverse range of professionals, including teachers, speech therapists and teaching assistants. These professionals work together to address the complex

needs of students with auditory and/or communicative impairments by integrating therapy objectives, conducting targeted activities, and coordinating through structured committees. Unlike the literature, which frequently discusses the roles of specific professionals like interpreters, practical settings reveal that legal and logistical constraints can limit their involvement, emphasizing the need for tailored, context-specific collaboration strategies to enhance educational outcomes for students with special needs. It should therefore be acknowledged that insights from countries with differing legislation and practices may not directly translate to the Dutch context due to the aforementioned legal constraints.

Furhtermore, different professionals in the focus group highlight the problem of having multiple adults in one classroom. Can students still think independently? In the study of Giangreco et al. (1991), parents of students with dual sensory impairments expressed frustration with the large number of professionals involved in their child's education. Despite recognizing good intentions, parents felt overwhelmed and confused by the constant presence of different experts. Another concern was the lack of cohesion among team members, leading to a disjointed approach to addressing the child's needs. Parents felt their child was seen as a collection of disabilities rather than a whole person, with specialists lacking expertise beyond their focus area. This highlights the need for improved communication and coordination among professionals to provide effective support for students and their families.

Additionally, a distinction can be made between the needs for training for teachers in special education and regular primary education contexts. In regular primary education, there is a greater demand for knowledge and skills to address the specific support needs of DLD and DHH students, with a focus on foundational adjustments. Conversely, in the context of special education, there is a stronger emphasis on expertise in managing cognitive differences. This is likely because teachers in these settings already possess the specialised knowledge and skills required to support students and their impairments.

Limitations

The study on differentiation principles in specific educational settings aims to offer valuable insights. However, it is subject to several notable limitations that could affect how the findings should be interpreted and applied more broadly.

A limitation of this study is the specific search for literature using the term 'differentiation'. As a result, the prominence of the five principles in the literature found may be diminished. The principle of 'adapting instructions' appeared more frequently in the literature, possibly due to the inclusion of 'adapt' as one of the search terms. This focused search approach might have restricted the overview of broader principles and practices relevant to supporting students with auditory and/or communicative impairments in special education. Therefore, this could result in a biased representation of available literature and potentially skewed conclusions. A broader search strategy, incorporating a wider range of terms, could have provided a more comprehensive understanding of the five principles for effective differentiation in special education. Additionally, it is important to highlight that the research specifically targeted differentiation and analysed the literature especially by using the five principles of DI. Another challenge lies in the overlap between the differentiation principles themselves. At times, statements could align with multiple principles, making it more difficult to categorise and analyse the findings and potentially leading to differences in interpretation.

Furthermore, the fact that different individuals conducted the coding of the literature could have affected the reliability of the results. This variability in interpretation could introduce errors in the coding process, despite efforts to ensure consistency. While interpreting the results, it is important to recognize that the personal subjectivity and judgment of individual coders can influence systematic reviews (Belur et al., 2018). Moreover, the varying sizes of the research samples analysed need to be considered. Some studies may hold more weight due to their size, sample size, and methodological quality, potentially influencing the overall conclusions drawn. For example, studies that examine multiple students or teachers provide more reliable data than those that focus on a single individual.

The constraints of the outlined study are further highlighted by the few offerings of literature concerning DLD and even more noticeably, MCD. The scarcity of available data on these specific learning needs makes it extremely difficult to draw robust conclusions regarding the efficacy of DI in teaching students with DLD or MCD. Furthermore, studies about inclusive education in regular education and special education were included. Additionally, also studies about a combination of regular and special education were included. In the studies in regular education, less emphasis has been placed on DI within these educational practices. This suggests

that the research primarily focuses on incorporating students with auditory and/or communicative impairments into mainstream classroom settings, but places less importance on the necessity and practice of differentiation to cater to the diverse needs of all learners.

Conclusion

The concept of differentiation has been extensively researched and to some extent applied in the field of regular education (Keuning et al., 2017; Keuning & Van Geel, 2021; Meutstege et al., 2023; Smale-Jacobse et al., 2019; Tomlinson, 2001; Vreman, 2019; Vrielink, 2018). A distinction can be made with regard to the types of these studies. The first type of study investigates the conditions for and effects of differentiation (e.g., Smale-Jacobse et al., 2019; Tomlinson, 2001). The second type of study analyses the practices of expert teachers through task analyses (Keuning et al., 2017; Keuning & Van Geel, 2021; Meutstege et al., 2023; Vreman, 2019; Vrielink, 2018). However, special education remained understudied in this regard. The aim of this research is to bridge that gap and shed light on differentiation practices in special education for students with auditory and/or communicative impairments. Overall, this study expands the knowledge of educational support in special and regular primary education and interprofessional collaboration for differentiation. By examining both contexts, the research provides a comprehensive understanding of differentiation practices, highlights the benefits of inclusive education, and informs effective interprofessional collaboration strategies that are adaptable across different educational settings. It has the potential to benefit students with diverse support needs in both settings, laying the groundwork for future research and tailored support tools.

The study demonstrates that differentiation in special primary education for students with auditory and/or communicative impairments (MCD, DHH and DLD) focuses not only on cognitive differences but also on providing access to education through necessary adjustments. The initial research question focused on the characteristics of differentiation for students with auditory and/or communication impairments, both within the context of primary special education and within regular primary schools. All five differentiation principles – goal-oriented work, monitoring, instructional and processing adjustments, and promoting self-regulation – are present to varying degrees in both the literature and practice. Professionals recognise the

importance of these foundational differentiation strategies, yet also advocate for greater emphasis on cognitive differentiation. Close cooperation between teachers and other professionals, for example speech therapists, teaching assistants, and ambulant workers, can help to successfully implement differentiation strategies. Effective interprofessional collaboration can significantly enhance the success of differentiation in special education. Nevertheless, in practice, the difficulties of this interprofessional collaboration are evident.

The conclusions and limitations highlight the necessity for further research into the practices of DI in special education for students with auditory and/or communicative impairments. This is required in order to gain a more comprehensive understanding of the effectiveness and challenges of inclusive educational practices. Understanding how collaborative training initiatives can enhance teachers' confidence in differentiation and improve interprofessional collaboration in schools would be valuable. By addressing these areas in future research, educators, policymakers, and other stakeholders can gain a deeper understanding of how to effectively support students with auditory and/or communicative impairments in special educational settings.

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* These articles are included in the literature review.

Appendix A

PRISMA: a guideline for reporting systematic reviews

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of	

Section and Topic	Item #	Checklist item	Location where item is reported
		automation tools used in the process.	
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	
Certainty	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	
Study characteristics	17	Cite each included study and present its characteristics.	
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	

Section and Topic	Item #	Checklist item	Location where item is reported
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	
	23b	Discuss any limitations of the evidence included in the review.	
	23c	Discuss any limitations of the review processes used.	
	23d	Discuss implications of the results for practice, policy, and future research.	
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	
Competing interests	26	Declare any competing interests of review authors.	
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	

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