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Published in:
Teaching and Teacher Education

DOI:
[10.1016/j.tate.2016.02.008](https://doi.org/10.1016/j.tate.2016.02.008)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2016

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Haakma, I., Janssen, M., & Minnaert, A. (2016). A literature review on how need-supportive behavior influences motivation in students with sensory loss. *Teaching and Teacher Education*, 57, 1-13.
<https://doi.org/10.1016/j.tate.2016.02.008>

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Review

A literature review on how need-supportive behavior influences motivation in students with sensory loss

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H I G H L I G H T S

- Need-support is important in the education of students with sensory loss.
- Structure is the most studied dimension of need-support.
- All studies on structure provide examples of need-supportive teaching.
- Fewer studies address teachers' autonomy support and involvement.
- For autonomy and involvement also examples of need-thwarting are reported.

A R T I C L E I N F O

Article history:

Received 26 June 2015

Received in revised form

18 February 2016

Accepted 23 February 2016

Available online 19 March 2016

Keywords:

Self-determination theory

Need-supportive teaching

Psychological needs

Motivation

Engagement

Sensory impairments

A B S T R A C T

This review examines the literature on the effects of need-supportive teaching on motivation, engagement, and educational outcomes of students with visual or hearing impairments or deafblindness. We searched literature for evidence relating to dimensions of need-supportive teaching, namely providing structure, autonomy support, and involvement, as described in Self-Determination Theory. Of the 19 studies reviewed, most addressed how teachers provide structure. The literature revealed that, in general, teachers provide structure in their lessons, and this has a positive impact on students' motivation, engagement, and educational outcomes. Fewer studies and inconsistent results were found concerning teachers' provision of autonomy support and involvement.

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1. Introduction

Motivation is important for high-quality learning, conceptual understanding, enhanced personal growth, and adjustment (Deci, Vallerand, Pelletier, & Ryan, 1991). Research has shown the impact teacher-student interaction has on students' motivation for school (e.g., Ryan, Stiller, & Lynch, 1994; Stroet, Opdenakker, & Minnaert, 2013; Tucker et al., 2002). Creating teacher-student interactions that have a positive impact on students' motivation is therefore a central element of a teacher's daily work. Studying teacher-student interactions, particularly in students with sensory loss, is important in order to support their development.

In addition, the study of teacher-student interactions is important due to the prevalence of students with sensory loss. According to an estimate of the World Health Organization (WHO, 2014), 32 million children worldwide have hearing loss, and 19 million children are visually impaired. An estimate of the number of children with deafblindness is not provided by the WHO. There are estimates that there are 10,000 children with deafblindness in the United States (The National Consortium on Deaf-Blindness, 2008) and 4000 in the United Kingdom (Sense, 2016).

Sensory impairments can hinder a student's ability to learn through observation, imitation, and exploration. This consequently has an impact on their motivation to learn. Teachers play a crucial role in fostering students' intrinsic motivation to learn. They can help the student to overcome the restrictions imposed by sensory impairments, to encounter and make sense of the world, and to make the most of every learning opportunity. The role of teachers interacting with students with sensory loss is the focus of this

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study. The objective of the present research is to explore the literature on teacher-student interactions regarding students with sensory loss. This study hopes to provide grounded and practice-oriented recommendations for teachers' professionalization, training, and educational practice.

Interacting with students can be challenging, in particular when dealing with students with sensory loss, because students with hearing impairment, visual impairment, or both encounter difficulties in various domains. Sensory loss can have an impact on communication, orientation in the environment, and information (Rødbrøe & Janssen, 2006). Moreover, students with sensory loss can experience difficulties in understanding what they do see or hear. They might experience difficulties in learning from the events around them. Their learning is limited to what their instructors and carers provide (Aitken, 2000). Since sight and hearing are important for creating and maintaining interpersonal relationships (Rødbrøe & Janssen, 2006), sensory impairments can hinder positive teacher-student interactions. Therefore, the teacher-student relationship is tremendously important, perhaps more so for these students. The development of a warm, secure, and trusting relationship between teacher and student is the cornerstone for educating students with sensory impairments (Clark, 2000).

As previously mentioned, research has shown the impact that teacher-student interaction has on student motivation, so teachers must understand how to best elicit behavior suited to create positive interactions that have a positive impact on student motivation. The literature lacks an overview of those teaching behaviors that support the motivation of students with sensory impairments. Moreover, we found no studies that explicitly use a theoretical framework geared to the motivational processes of students with hearing and/or visual impairment. Research on students without sensory impairments does provide such a framework. Much has been published about motivation in regular education settings; Self-Determination Theory is currently a well-established model (SDT; Deci & Ryan, 1985, 2000).

1.1. Theoretical background

According to SDT, humans are intrinsically motivated to undertake activities that are interesting, optimally challenging, and spontaneously satisfying (Ryan & Deci, 2000). SDT also claims that this process promotes development (Niemic et al., 2006). SDT is a comprehensive theory that addresses the influence of the (social) context on intrinsic motivation. The theory states that people's basic psychological needs for competence, autonomy, and relatedness must be met. Contexts that support people in being competent, autonomous and related to others promote intentional motivated action (Deci et al., 1991). On the other hand, contexts that thwart these basic psychological needs are assumed to diminish motivation.

1.2. Need-supportive teaching

Fig. 1 presents an overview of SDT, as applied in an educational setting (adapted from Appleton, Christenson, & Furlong, 2008). The figure shows that SDT views students' motivation as dependent on the social context in the classroom. In the educational setting, the theory assigns a primary role to teachers in providing support for students' needs. The extent to which students perceive teachers' behavior as focused on fulfilling their needs influences how motivated they will be for a learning task.

Teachers can support student competence, autonomy, and relatedness (column 2), by providing structure, autonomy support, and involvement (column 1). Table 1 shows examples of need-supportive teaching behaviors. These are based on the literature

study by Stroet et al. (2013) which focused on the teaching of students without impairments. It provides an overview of the components of the three dimensions of need support on the basis of prior theorizing in the tradition of SDT. Some extra components were added, derived from the SDT literature.

As Fig. 1 shows, need-supportive teacher-student interactions lead to certain actions (column 3) and outcomes (column 4). Students can be disengaged or engaged in learning. Engagement can be seen as the outward manifestation of student motivation (Skinner, Kindermann, & Furrer, 2009). It refers to the intensity and emotional quality of students' involvement in initiating and carrying out learning tasks (Connell & Wellborn, 1991).

For people to be active engaged they need to feel that their basic psychological needs are being met. Peoples' engagement in an activity varies as a function of the degree to which they experience need satisfaction. In order to maintain the intrinsic motivation to engage in activities, students' needs must be satisfied (Deci & Ryan, 2000). Student motivation and engagement lead to desired educational outcomes such as academic achievement, well-being and personal growth.

The concept of needs is extremely useful because it provides a way of understanding why some behaviors enhance motivation, whereas others do not (Deci & Ryan, 2008). Need-supporting behavior has a positive influence on motivation, need-thwarting behavior does not, since it is by definition need-thwarting, hence demotivating. By considering whether a particular contextual factor is likely to support satisfaction of basic psychological needs, it is possible to predict the effects of that factor on outcomes such as motivation, behavior, performance affect, and well-being (Deci & Ryan, 2008; Deci et al., 1991). In this way, the theory provides both theoretical and practical insights.

1.2.1. Structure

Teachers can enhance students' feelings of competence by providing structure. The need for competence refers to the feeling that one is competent in interacting with the environment (Deci, Ryan, & Williams, 1996). Competence also involves understanding how to attain an outcome and being efficacious in performing the actions needed to attain a goal (Deci et al., 1991). Providing structure helps students attain this feeling (Jang, Reeve, & Deci, 2010; Skinner & Belmont, 1993). According to Jang et al. (2010), structure-providing teacher behavior includes framing students' learning activities using explicit directions and guidance. Examples of structured teacher behaviors are listed in Table 1. The opposite of a structured teaching style is a chaotic or laissez-faire teaching style, in which teachers give confusing or contradictory information (Jang et al., 2010).

1.2.2. Autonomy support

A second dimension of need-supportive teaching is autonomy support. The need for autonomy refers to the experience of one's own behavior as self-initiated and volitional (Deci, 1975; Niemic & Ryan, 2009). A person's actions should be considered to be personally interesting or valuable (White, 1959). Teachers can fulfill students' needs for autonomy by behaving in an autonomy-supportive manner (see Table 1). The opposite of autonomy-supportive behavior is autonomy-suppressive behavior, in which teachers are controlling (Belmont, Skinner, Wellborn, & Connell, 1992), pressuring, coercive, evaluative, or intrusive (Assor, Kaplan, & Roth, 2002). Moreover, autonomy-suppressive teachers force meaningless and uninteresting activities on students (Assor et al., 2002), and rely on incentives, consequences, directives, and deadlines (Jang et al., 2010).

Fig. 1. Theoretical framework.

1.2.3. Involvement

Involvement is associated with the need for relatedness, which refers to a feeling of belonging, to secure and satisfying connecting with others, and to being accepted by others (Baumeister & Leary, 1995; Ryan & Deci, 2000). Attachment theories have shown that humans are born with an interest in and responsiveness towards others. Contact with other people feels comforting and safe, which gives children the freedom to explore and engage constructively in activities and interactions with others (Bowlby, 1979). The opposite is rejection or neglect (Skinner & Belmont, 1993).

1.3. Need-supportive teaching in students with sensory loss

The examples of need support, described in Table 1, are derived from research in educational settings for students without sensory loss. There appears to be no overview of the literature that studies whether need-supportive strategies are similar for teaching students with sensory impairments.

We expect that students with sensory loss, as with students without sensory loss, will benefit from need-supportive teaching. However, the content of that need-supportive teaching might be different.

Children without sensory loss learn by exploring the environment. Exploring is one way children learn about objects and learn how to solve problems. Children are naturally interested in everything and everyone. They want to try things out for themselves.

For children with sensory loss, learning by exploration is seriously impeded. Without the ability to notice interesting things in the environment or without hearing interesting sounds, the motivation to explore is not triggered.

In addition to learning through exploration, children also learn by imitating others. When it is not possible to observe other people or listen to them, imitating them becomes difficult. This is another factor that hinders a student's natural motivation to learn.

To overcome these difficulties involving exploration and imitation, students with sensory loss depend on their teachers' skills to create opportunities to learn. When students do not explore the environment themselves, the teacher needs to bring the environment to the child. Therefore, the teachers' role is not only to create a safe and accessible environment but also bring this to the child in a manner that fits the student's need.

The application of the general principles of need-supportive teaching, as provided by SDT, need to be carefully adjusted to the individual students' preferences and abilities. For instance, while a

Table 1
Need-supportive teacher behaviors.

Structure	Autonomy support	Involvement
<p>Teachers should:</p> <ul style="list-style-type: none"> - Clearly communicate expectations (Skinner & Belmont, 1993) - Respond consistently, predictably, and contingently (Skinner & Belmont, 1993) - Adjust teaching strategies to the level of the student (Skinner & Belmont, 1993) - Mark the boundaries of activities (Jang et al., 2010) - Coordinate the transition between activities (Jang et al., 2010) - Offer instrumental help and support (Skinner & Belmont, 1993) - Provide explicit step-by-step directions and guidance (Jang et al., 2010; Skinner & Belmont, 1993) - Scaffold students towards successfully achieving a learning task (Jang et al., 2010) - Offer constructive feedback (Ryan, 1982) 	<p>Teachers should:</p> <ul style="list-style-type: none"> - Identify and nurture the student's inner motivational resources: Needs, interests, and preferences (Jang et al., 2010; Reeve, Jang, Carrell, Jeon, & Barch, 2004; Skinner & Belmont, 1993) - Provide optimal challenges (Jang et al., 2010; Reeve, 2006) - Provide choices, options, or possibilities for personal initiatives (Assor et al., 2002) - Provide meaningful rationales for learning activities, and communicate value and relevance (Assor et al., 2002; Jang et al., 2010; Reeve, 2006) - Avoid external regulators such as incentives, consequences, rewards, directives, deadlines, and assignments (Reeve, 2006) - Use non-controlling informational language (Reeve, 2006) - Not intrude on students when they are working (Assor et al., 2002) - Acknowledge and accept students' expressions of negative affect (Assor et al., 2002; Reeve, 2006) 	<p>Teachers should:</p> <ul style="list-style-type: none"> - Express affection (Skinner & Belmont, 1993) - Enjoy interactions with students (Skinner & Belmont, 1993) - Take time for the student (Skinner & Belmont, 1993) - Convey warmth and care (LaGuardia, Ryan, Couchman, & Deci, 2000; Ryan et al., 1994) - Be attuned to the student (Skinner & Belmont, 1993) - Be Responsive: Display timely and appropriate responsiveness to the initiations, signals, and needs of the student (La Guardia et al., 2000) - Dedicate resources to the student (Skinner & Belmont, 1993) - Encourage exploration (La Guardia et al., 2000) - Provide non-contingent positive regard (La Guardia et al., 2000)

teacher of students without sensory loss can provide need-supportive teaching by instructing students from a distance and by giving instructions to a full class of students, a teacher of students with sensory loss might give instruction in a more individualized manner. This means that teachers of students with sensory loss need to be extremely creative and flexible.

All in all, our expectation would be that the SDT can provide really valuable insights into need-supportive teaching for students with hearing and/or visual loss. However, teachers will need to adjust the content of need-support to the characteristics of this specific target group. SDT research and research on students with sensory loss is lacking in an overview of the literature in this regard. Therefore, the aim of this study was to address this gap in the literature.

1.4. Study purpose

The purpose of this study is to review the empirical evidence on the effects that need-supportive teaching has on the motivation, engagement, and educational outcomes (e.g. learning, achievement, and development) of students with hearing impairment, visual impairment, and deafblindness. Our central goal was to examine prior literature using the SDT framework in order to identify to what degree the three basic needs have been studied in these three target groups. With this study we aim to: 1) explore whether and in what way teachers of students with sensory loss express need-supportive behavior; 2) determine whether teachers' need-supportive behavior influences these students' engagement and outcomes; 3) provide grounded and practice-oriented recommendations for teachers' professionalization, training, and educational practice; and 4) provide ideas and input for teacher-training programs.

2. Method

2.1. Preliminary selection

To select relevant studies, we conducted a search of a collection of 30 databases, including ERIC and PsycINFO, in June 2014, using EBSCOHOST. The search was limited to papers published in peer-reviewed journals between 1995 and 2014. Four levels of search terms were formulated and combined (see [Appendix](#)). After deleting duplicates, 509 references remained.

2.2. Criteria-based selection

Next, we formulated four selection criteria. Papers were selected if they: 1) included teachers of students with sensory impairments as participants; 2) included students with mild to severe hearing and/or visual impairments as participants; 3) explored an aspect of need-supportive teaching; and, if possible, 4) explored the effects on student engagement and/or educational outcomes.

No exclusion criteria were formulated with regard to the following: a) possible additional disabilities in students; b) teachers' roles (we included studies in which "regular" teachers, support teachers, specialist teachers, or itinerant teachers participated); c) educational setting (mainstream and special educational settings were both included); d) educational level; and e) type of research design (qualitative and quantitative studies were both included).

Finally, 19 studies met the aforementioned selection criteria. Two important reasons why the other studies did not fit the inclusion criteria were that they focused on medical aspects of sensory impairments, or on language and literacy development.

2.3. Study indicators

We gathered background information about the 19 studies in three ways. First, we screened them for sample information (2nd column in [Table 2](#)). This included: 1) the type of impairment participants had; 2) the country in which the study was conducted; 3) the sample size (how many students or teachers participated); and 4) the type of educational setting (mainstream or special setting).

Second, we gathered information about the research design (3rd column in [Table 2](#)). This included: 1) the type of data (qualitative or quantitative) and 2) the methodology used (e.g., questionnaires, interviews, or classroom observations).

Third, we categorized the studies using the following components of the framework: 1) teachers' provision of structure; 2) teachers' autonomy support; 3) teacher's involvement; 4) student engagement; and 5) student outcomes (see [Tables 3–5](#)). We identified which of the five components were described in the studies, and also specified whether the study results were positive or negative.

2.4. Reliability

First, two raters independently reviewed the papers for information about sample information and research design (columns 2 and 3 in [Table 2](#)). A third rater executed a final check on the correctness of this information.

Second, two raters independently identified whether the papers provided information on any of the five components of the framework and whether this information was positive (coded as plus) or negative (coded as minus). Results that were not clear-cut, or that included both positive and negative findings, were coded as plus/minus (see [Tables 3–5](#)).

Of the 35 codes provided by the first rater, five were coded differently by the second rater. Of these five different codes, one rater coded plus/minus four times, while the other rater coded either plus or minus. The two raters decided together which code was the most suitable.

3. Results

The review found that most of the studies (17 of the 19) focused on students with hearing impairments. Most of the studies (9) were conducted in mainstream educational settings, followed by special education (7), or in both settings (3). In terms of their research designs, most of the studies used a quantitative approach. They used various methods for data collection: the three most commonly used methods were questionnaires, observations, and interviews.

3.1. Structure

Thirteen studies examined an aspect of teachers' provision of structure (see [Table 3](#)). In one study, students with visual loss participated ([Brown, Packer, & Passmore, 2013](#)); the other 12 studies addressed deaf or hard-of-hearing (DHH) students. The studies by [Brown et al. \(2013\)](#), [Mahon \(2009\)](#), [Woolsey, Harrison and Gardner \(2004\)](#), and [Marlatt \(2004b\)](#) additionally explored an aspect of involvement or autonomy support. Since the findings of Mahon (see [Table 2](#)) were interlinked with teachers' provision of structure, these findings will be described in this section.

Providing structure includes adjusting teaching strategies to the level of the student. Often students with sensory loss are included in mainstream education settings. This requires that teachers differentiate their teaching strategies and adjust their teaching to students with or without sensory loss. Three studies addressed this issue.

Table 2
Overview of studies included.

Study	Sample information 1) Type of impairment 2) Country 3) Sample size 4) Educational setting	Research design 1) Type of data 2) Methodology 3) Intervention content	Aim	Results
Angelides and Aravi (2007)	1) DHH 2) Cyprus 3) 9 teachers 4) ME: Secondary school	1) Qualitative 2) Interviews, observations	To explore teachers' use of differentiating and adjusting strategies when integrating students into mainstream education.	Integration of students led teachers to collaborate more. Teachers developed more inclusive practices, such as differentiating the curriculum, using simplified texts and handouts, using an overhead projector, and using examples to make lessons more easily understandable. This not only had a positive influence on the students but also on the hearing students.
Antia and Kreimeyer (1996)	1) DHH 2) United States 3) 91 hearing students, 45 DHH students 4) ME: Preschool and primary school	1) Quantitative 2) Speech recordings, questionnaires, observations 3) Intervention 1: Teachers designed activities to promote peer interaction. They used modeling and prompting strategies to encourage students to use specific social skills during activities. Intervention 2: students and students with normal hearing were provided with opportunities to interact with each other. Teacher mediation was not included.	To compare the effects of two interventions related to social interaction and acceptance between students and their peers, and between students and their normally hearing peers who did or did not participate in the intervention.	The first intervention produced an increase in the frequency of positive interactions between students and their peers, which was still maintained four weeks after the intervention. By contrast, the second intervention did not increase interaction. This indicates that familiarity alone is not sufficient to increase interaction; teacher mediation is necessary. Neither intervention resulted in increased interaction between students and their peers with normal hearing. This may have been caused by a lack of motivation on the part of children with normal hearing to communicate with children, with other students with normal hearing available.
Beal-Alvarez and Easterbrooks (2013)	1) DHH 2) United States 3) 10 students 4) SE: Primary school	1) Quantitative 2) Language tests, narrative retelling 3) Teachers delivered an intervention to their students, which included, among others, watching videos of stories in American Sign Language, in which classifiers were used. Students received teacher mediation, which included teachers using prompting and modeling strategies to teach the classifiers. Students had to imitate the teachers and were given feedback. After each viewing of the stories, students engaged in an individual video recorded narrative retelling with a researcher.	To evaluate an intervention aimed at increasing students' use of classifiers. (Classifiers are part of American Sign Language and refer to the meaning of a word.)	Most students increased their classifier use after receiving teacher mediation that included prompting and modeling strategies. Some students needed more scaffolding of their skills than others. Younger students needed more teacher mediation than older students.
Borders, Barnett, and Bauer (2010)	1) DHH 2) United States 3) 5 students, 5 teachers 4) ME: Primary school	1) Quantitative 2) Observations	To study the participation of students with mild-to-moderate deafness in inclusive educational settings.	The results indicated that the responses of students to practice and prompt opportunities were similar to those of their hearing peers. Students required higher levels of prompting to follow classroom directions than hearing students did. Prompting could be visual (using an object or picture to assist with a classroom directive), physical (using an object), or hand-over-hand (assisting a student with writing by holding the student's hand). Students were less accurate at following class-wide prompts (i.e., directions for the entire class on how to perform a task) than personal prompts (i.e., addressed to an individual student). The engagement levels of students were similar to those of hearing students.
Brown, Packer, and Passmore (2013)	1) Visual impairments 2) Australia 3) 20 students 4) ME: Kindergarten and primary schools	1) Quantitative 2) Questionnaires	To explore the classroom environment that students with visual impairments typically experience in regular early education.	All teachers reported that they provided a good overall level of curriculum individualization for their students with visual impairments. This included 65% who reported an excellent quality, which referred to situations where specific strategies were embedded in

(continued on next page)

Table 2 (continued)

Study	Sample information 1) Type of impairment 2) Country 3) Sample size 4) Educational setting	Research design 1) Type of data 2) Methodology 3) Intervention content	Aim	Results
				daily activities to teach individual student objectives, and where the strategies were changed in response to the students' progress. Teacher and staff involvement was less than adequate. At the start of the year, 35% of the students received an appropriate level of involvement from classroom teachers, staff, and volunteers. The scores improved over the year: 80% of the students later experienced a good level of adult involvement.
Foster and Cue (2009)	1) DHH 2) United States 3) Survey study: 270 teachers; focus groups and interviews: 8 teachers; observations: 2 teachers 4) ME: Preschool to high school	1) Quantitative and qualitative 2) Surveys, interviews, focus groups, observations	To examine the roles and responsibilities of itinerant specialist teachers. Itinerant teachers are specialists who work with students with specific impairments.	Most of these teachers' time was spent working with students individually. Within this timeframe, they supported students' self-advocacy, taught them coping skills and skills for functioning independently, or taught them how to use their hearing aids or an interpreter.
Howell and Luckner (2003)	1) DHH 2) United States 3) 2 teachers, 1 student 4) ME: Secondary school	1) Qualitative 2) Action research	To examine teachers' strategies for developing literacy skills.	Teachers' instruction strategies (e.g., summarization, using modeling skills, and providing feedback) resulted in positive student outcomes (e.g., becoming more comfortable with reading textbooks, increased comprehension, higher grades, more confidence, and more enjoyment). The results indicate that teachers' use of these strategies can help students improve their ability to succeed in class, and thereby build a foundation for lifelong learning.
Jarvis (2003)	1) DHH 2) United Kingdom 3) 61 deaf pupils, 22 hearing pupils 4) ME: Primary and secondary schools	1) Qualitative 2) Interviews, focus group discussions	To examine the views of students about the support they receive in school.	Some of the students seemed to be helped by the in-class support they received. They were able to make decisions about how much support they needed and took the initiative to ask for help. Other students felt that they were over-supported at times. They mentioned that the support teachers constantly asked if they could help, asked them questions all the time, or took their work and checked it without asking.
Liu, Chou, Liu, and Yang (2006)	1) DHH 2) Taiwan 3) 1 teacher, 7 students 4) ME: Junior high school	1) Quantitative 2) Interviews, observations, questionnaires 3) The teachers used tablets with scaffolding tools that divided complicated mathematical problems into simple steps and provided examples and feedback.	To investigate whether technology could enhance mathematics learning and teaching activities.	The students demonstrated more response to the teacher, less distraction, and fewer mistakes solving mathematical problems, when using the tablet. Therefore, this study shows that using technology to support the teacher's provision of structure can be helpful.
Mahon (2009)	1) DHH 2) United Kingdom 3) 1 teacher, 1 student 4) SE: Primary school with a unit for students	1) Qualitative 2) Observations	To describe the interaction between a congenitally deaf student and his teacher.	The results show the effectiveness of one-to-one sessions with the student for language learning/teaching. The combination of structure and involvement seemed to have a positive influence on the student's language development. Providing structure in a sensitive, responsive, and natural manner seemed to positively influence the student. The student made progress in his language development.
Marlatt (2004a)	1) DHH 2) United States 3) 163 teachers (50 pre-service education students; 57 novice teachers; 56 teachers with more than 5 years of teaching experience)	1) Quantitative 2) Questionnaires	To compare the adherence to classroom rules of practice by pre-service, novice, and experienced teachers of DHH students.	No significant differences were found between the pre-service, novice, and experienced teachers. This included, teachers' efforts to provide students with highly structured lessons, to maintain an orderly classroom, to keep the lesson pace appropriate to the

Table 2 (continued)

Study	Sample information 1) Type of impairment 2) Country 3) Sample size 4) Educational setting	Research design 1) Type of data 2) Methodology 3) Intervention content	Aim	Results
Marlatt (2004b)	4) SE: Most common specialization areas were elementary education (36.8%) and early education (29.4%) 1) DHH 2) United States 3) 163 teachers (115 hearing teachers and 48 deaf teachers)	1) Quantitative 2) Questionnaires	To compare the adherence to classroom rules of practice by deaf and hearing teachers of students.	students' level, to check for comprehension, and to use examples and demonstrations. All the teachers' mean scores were positive. Results indicated that deaf teachers tended to view students as equals but were more likely to emphasize control over classroom behavior than hearing teachers. Hearing teachers tended to stress efforts to engage students in subject matter by providing variety and relating it to life experiences.
Powell, Hyde, and Punch (2014)	4) SE: Most common specialization areas were elementary education (36.8%) and early education (29.4%) 1) DHH 2) New Zealand 3) 64 students 4) ME: Post-secondary institutions	1) Qualitative and quantitative 2) Questionnaires, interviews	To investigate the experiences of students in post-secondary educational settings.	Students experienced barriers related to the amount of group work, the teachers' delivery styles and chaotic teaching styles, insufficient lighting, or poor acoustics. Disability support staff often lacked the knowledge necessary to understand or assess students' needs. There were also positive comments about teachers who tried to make their teaching more accessible and made an effort to ensure all students were provided with the opportunity to learn. In the inclusive setting, three of the four students increased their verbal comments and play turns in both interventions, although some of the changes were slight. In the classroom for students, two of the four students showed improvements in both interventions.
Raver, Bobzien, Richels, Hester, and Anthony (2014)	1) DHH 2) United States 3) 4 students 4) ME+ SE: Preschool	1) Quantitative 2) Observations 3) Students were told a social story from a storybook about how to be good friends. After the story, the teacher gave a social prompt, asking the students to play together like good friends, as described in the book. They were then given time to play. The second intervention also included a social story followed by playtime. This time a verbal prompt was given during playtime. Directions and reinforcements were also provided during play.	To compare the effects of two interventions for students in two settings: a preschool for deaf students and an inclusive regular preschool.	In the inclusive setting, three of the four students increased their verbal comments and play turns in both interventions, although some of the changes were slight. In the classroom for students, two of the four students showed improvements in both interventions.
Smith and Landreth (2004)	1) DHH 2) United States 3) 24 teachers, 24 students 4) SE	1) Quantitative and qualitative 2) Observations, questionnaires 3) Filial therapy is a special kind of play therapy aimed at forging closer and happier relationships between an adult and a student. The primary objectives of this therapy were to assist teachers in acquiring play therapy skills, enhance relationships, and help students reduce problem behaviors and emotional distress.	To examine the effectiveness of filial therapy with teachers of students.	The study revealed that the teachers in the experimental group significantly improved their ability to communicate acceptance and empathy, and they developed more non-directive involvement with their students. The students in the experimental group exhibited significantly fewer overall behavioral problems, including fewer withdrawal and internalizing behaviors compared to the non-treatment control group.
Teller and Harney (2005)	1) DHH 2) United States and Canada 3) 19 directors of programs for DHH students 4) SE	1) Quantitative 2) Questionnaires	To survey the views of directors of programs for students about the skills teacher education programs need to be teaching.	A large majority of the directors reported that teachers employed rewards and punishments to motivate students to learn, rather than finding ways to make learning more personally meaningful and relevant in and of itself. Only a few directors indicated that their teachers used strategies to make learning meaningful without resorting to extrinsic rewards. The survey revealed that programs for deaf students were highly behaviorist (i.e., you do this and you will get that) in the way they induced students to learn and in how they managed student behavior.
Vervloed, Van Dijk, Knoors, and Van Dijk (2006)	1) Deafblindness 2) The Netherlands 3) 1 teacher, 1 student 4) SE	1) Quantitative 2) Observations	To analyze the interaction between a teacher and a deafblind boy.	A sequential analysis of the interactions observed in the 16 h of video recordings found that the teacher only reacted to 41% of the student's initiatives. The

(continued on next page)

Table 2 (continued)

Study	Sample information 1) Type of impairment 2) Country 3) Sample size 4) Educational setting	Research design 1) Type of data 2) Methodology 3) Intervention content	Aim	Results
Woolsey, Harrison and Gardner (2004)	1) DHH 2) United States 3) 9 students, 29 teachers 4) ME + SE: Secondary schools (3 settings: public school, residential school for the deaf, residential treatment center)	1) Quantitative 2) Observations	To examine instructional arrangements, teaching behavior, and the level of academic response among deaf middle school students in three different settings: a public school, a residential school for the deaf, and a residential treatment center for both deaf and hearing students with severe emotional/behavioral disorders.	teacher and student interacted only 2% of the time. Instructional behaviors were similar across teachers in the three settings. Teachers spent most of their time teaching, which included academic talk, questions, commands, and prompts. In all settings, students engaged approximately half of the time in academic responding (e.g., reading and writing). Students in every setting were exposed to teachers with neutral affects at least 90% of the time. Teachers' disapproval was more common (2–5%) than their approval (0–4%). The students engaged most in academic responding at levels similar to those of both hearing and deaf peers.
Woolsey, Herring, and Satterfield (2009)	1) DHH 2) United States 3) 30 students, 17 teachers 4) ME + SE: Primary schools	1) Quantitative 2) Observations	To investigate social studies instruction in programs for students.	One finding was that teachers showed more positive affect towards low-achieving students. Teachers responded more often with a neutral affect to the high-performing students. Lower-achieving students also received more teacher attention. This attention was not negative; rather, it was assistive.

ME = mainstream education; SE = special education.

Powell, Hyde, and Punch (2014) found examples of need-supportive and need-suppressive teaching behavior in their study on the experiences of DHH students included in a post-secondary education setting. The studies by Brown et al. (2013), and Angelides and Aravi (2007) found that teachers who taught DHH students within regular education settings did adjust their teaching to successfully include DHH students.

Marlatt compared the provision of structure used in the teaching strategies of pre-service, novice, and experienced teachers (2004a), along with deaf and hearing teachers of DHH students (2004b). No significant differences were found between the pre-service, novice, and experienced teachers. Both the deaf and hearing teachers provided structure.

Woolsey et al. (2004) found no large differences between teachers' behavior in three educational settings: public school, a residential school for the deaf, and a residential treatment center for both deaf and hearing students with severe emotional/behavioral disorders. All teachers were generally engaged in teaching that included elements of providing structure. In all the settings, students showed engagement levels similar to other students with and without impairments.

A study by Borders, Barnett, and Bauer (2010) addressed the influence of teachers' structure on student engagement. They assessed teachers' use of prompts, student response to the prompts, and student engagement. Results indicate that the DHH students and their hearing peers showed a similar response to practice and prompt opportunities. DHH students showed more accuracy with individual prompting than with class-wide prompts. The engagement levels of DHH students were similar to those of hearing students.

Four studies (Beal-Alvarez & Easterbrooks, 2013; Howell & Luckner, 2003; Liu et al., 2006; Mahon, 2009) addressed both elements of teachers' provision of structure as well as positive academic outcomes. These studies found that teachers' provision of structure – mostly in the form of explicit directions, scaffolding,

prompts, modeling, and feedback – could be associated with positive academic outcomes such as language development (Beal-Alvarez & Easterbrooks, 2013; Howell & Luckner, 2003; Mahon, 2009) or mathematical abilities (Liu et al., 2006).

In addition to studies that addressed the effects of teachers' provision of structure on academic outcomes, some looked at its effects on social outcomes. Studies by Antia and Kreimeyer (1996), and Raver et al. (2014) found that teachers' use of structure provision can also have a positive impact on social outcomes. The study by Antia and Kreimeyer (1996) showed that teachers' use of modeling and prompting strategies to teach students social skills (e.g., sharing materials, assisting peers, or dealing with peer requests appropriately) can lead to more interactions between DHH peers. In addition, Raver et al. (2014) showed that the use of teacher support in the form of social prompts enhanced DHH students' communication and social skills.

3.2. Autonomy support

Four studies focused on an aspect of autonomy-supportive teaching (see Table 4). DHH students participated in all the studies.

A study by Teller and Harney (2005) found that teachers of DHH students used far more strategies based on extrinsic means than on inner resources. A large majority of the program directors interviewed reported that teachers employed rewards and punishments to motivate students to learn rather than finding ways to make learning more personally meaningful and relevant in and of itself. Examples of autonomy-suppressive teaching behavior were also brought forward in the study by Jarvis (2003). Some students commented that they felt over-supported by their support teachers, who provided help even when the students did not ask for it. Other students were able to ask for in-class support, when they felt they needed it.

Positive findings with regard to teachers' autonomy support were brought out in the study by Foster and Cue (2009). It revealed

Table 3

Overview of studies on teachers' provision of structure.

Study	Findings related to				
	Teachers' structure	Teachers' autonomy support	Teachers' involvement	Student engagement	Student outcomes
Angelides and Aravi (2007)	+				+
Antia and Kreimeyer (1996)	+				+/-
Beal-Alvarez and Easterbrooks (2013)	+				+
Borders et al. (2010)	+			+	
Brown et al. (2013)	+		+/-		
Howell and Luckner (2003)	+				+
Liu et al. (2006)	+			+	+
Mahon (2009)	+		+		+
Marlatt (2004a)	+				
Marlatt (2004b)	+	+/-			
Powell et al. (2014)	+/-				
Raver et al. (2014)	+				+/-
Woolsey, Harrison and Gardner (2004)	+		-	+	

Table 4

Overview of studies on teachers' autonomy support.

Study	Findings related to				
	Teachers' structure	Teachers' autonomy support	Teachers' involvement	Student engagement	Student outcomes
Foster and Cue (2009)		+			
Jarvis (2003)		+/-			
Marlatt (2004b)	+	+/-			
Teller and Harney (2005)		-			

that itinerant teachers not only supported students' autonomy in the classroom but also focused on teaching students to become more autonomous in a more general regard. This could include teaching students to self-advocate, teaching them coping skills and skills for independent functioning, or teaching them how to use their hearing aids or an interpreter.

The study by Marlatt (2004b) showed differences between teachers who are themselves deaf and teachers who are hearing. Deaf teachers tend to view their students more as equals and tend to emphasize classroom control more than hearing teachers, whereas hearing teachers tend to place greater emphasis on generating student interest in the subject matter by providing variety and relating subject matter to everyday life experiences.

3.3. Involvement

Six studies explored an aspect of teacher involvement (see Table 5). One of them was already mentioned in the section on structure (Mahon, 2009). Three studies focus on DHH students. The study by Vervloed et al. (2006) focuses on a student with deafblindness, and in the study by Brown et al. (2013) students with visual loss participated.

The findings of a study by Vervloed et al. (2006) were negative with regard to teachers' involvement. Not only did a teacher and a student with deafblindness interact only a very small percentage of the time, but the teacher also only reacted to the student's initiatives less than half of the time.

Table 5

Overview of studies on teachers' involvement.

Study	Findings related to				
	Teachers' structure	Teachers' autonomy support	Teachers' involvement	Student engagement	Student outcomes
Brown et al. (2013)	+		+/-		
Smith and Landreth (2004)			+		+
Vervloed et al. (2006)			-		
Woolsey, Harrison and Gardner (2004)	+		-	+	
Woolsey et al. (2009)			+/-		

Two studies investigated teachers' affect towards their DHH students. Woolsey et al. (2004) revealed that students were exposed to teachers with neutral affect most of the time. Teachers' disapproval was more common than approval. Second, the study by Woolsey, Herring, and Satterfield (2009) showed that, overall, teachers responded with neutral affect towards high-performing students and with more positive affect towards low-achieving students.

Brown et al. (2013) indicated that teacher involvement was less than adequate at the start of the year, although it did improve over the year. Finally, a study by Smith and Landreth (2004) indicated positive outcomes of teachers' involvement. Close teacher–student relationships were found to lead to reduced levels of problematic behaviors and emotional distress in DHH students.

4. Discussion

This literature review has focused on the role that the social context (i.e., teacher behavior) plays in the motivation of students with a hearing or, visual impairment, or deafblindness. Our central goal was to examine prior literature using the SDT framework in order to identify to what degree the three basic needs have been studied in these three target groups. Four aims were formulated. We will discuss the findings in line with these four aims and, in addition, provide ideas for future research and practice.

4.1. Research question 1

First, we wanted to know whether and in what way teachers of students with sensory loss exhibited need-supportive behavior. Teachers can support students' need for competence by providing structure. All the studies on teachers' provision of structure provided examples of need-supportive teaching. Table 1 described the strategies that teachers in regular education settings can use to support students' need for competence. This literature study showed that teachers of students with sensory loss also applied these strategies in their teaching. For instance, Table 1 states that teachers can provide structure by adjusting teaching strategies to the level of the student. The study by Brown et al. (2013) showed that, teachers of students with a visual impairment, applied strategies for curriculum individualization.

Furthermore, examples of adjusted teaching were found with regard to DHH students. For instance, Angelides and Aravi (2007) described a situation where using simplified texts and handouts had a positive effect on all students, including hearing classmates. Curriculum individualization and simplifying texts are both good examples of tailoring teaching strategies to individual student levels.

It is also important to create a well-adjusted classroom environment. The study by Powell et al., (2014) indicated insufficient lighting and poor acoustics in the classrooms of DHH students. According to Powell, it is important that staff have the knowledge necessary to understand or assess DHH students' needs.

Providing explicit step-by-step directions and guidance, using scaffolding, and offering feedback are other components of structure provision, as described in Table 1. This literature study showed that using scaffolding, prompting, modeling, and feedback can enhance language development (Beal-Alvarez & Easterbrooks, 2013; Howell & Luckner, 2003) and positive social interactions (Antia & Kreimeyer, 1996) in DHH students. Borders et al. (2010) provided examples of prompting for DHH students. Prompting can be visual (using an object or picture), physical (using an object), and hand-over-hand (assisting a student with writing by holding the student's hand).

In contrast to the many studies we found, which dealt with teachers' provision of structure, we only found a few studies dealing with teachers' autonomy support and involvement. Moreover, in contrast to the positive findings with regard to teachers' provision of structure, the studies related to autonomy support and involvement showed more mixed results.

Literature mentions examples of autonomy-supportive behaviors and autonomy-suppressive behaviors. Examples of autonomy-suppressive behavior are, for instance, offering too much support, and relying on rewards and punishments to motivate students, rather than making the learning task interesting in itself. Using controlling instead of non-controlling language is also a component of autonomy-suppressive teaching.

In our study, examples of autonomy-suppressive teaching behaviors were provided, for instance, by Marlatt (2004b), and Teller and Harney (2005). The study by Marlatt (2004b) showed that hearing teachers interacted differently than deaf teachers, to the children's benefit perhaps. Hearing teachers tended to stress efforts to engage students in the subject matter through providing variety and relating it to life experience. The study by Teller and Harney (2005) showed that teachers often employed rewards and punishments to motivate students to learn rather than finding ways to make learning more personally meaningful and relevant in and of itself.

In Table 1, providing choices, options, or possibilities for personal initiatives are described; these are all important for providing autonomy support in regular education settings. Students with

sensory loss of course also want to be able to make their own choices. They need, for instance, to be able to determine the amount of support they receive. The study by Jarvis (2003) showed that students sometimes felt over-supported. Support teachers displayed such negative behavior towards the students as constantly asking if they could help, continually distracting students by asking questions, and interfering without asking.

To encourage students' autonomy, it is important to support their self-advocacy, to teach them coping skills, and to teach them how to function independently. For DHH students, this can, for instance, include teaching them how to use their hearing aids or to ask for an interpreter (Foster & Cue, 2009).

Just as in the studies on teachers' provision of autonomy support, the results for teachers' involvement were negative as well as positive. Examples of involvement, such as expressing affection, conveying care, being attuned to the student, and being responsive were reported. There were also examples of need-suppressive behavior; these included being unresponsive to students and lacking positive affect. The results of this literature study indicate that teachers of students with deafblindness interact little with their students. Moreover, these teachers are not always responsive to the student's initiatives (Vervloed et al., 2006), even though close teacher–student relationships would seem to have a positive effect on students (Smith & Landreth, 2004).

The results also indicate possible linkages between needs. For instance, the study by Mahon (2009) pointed out that providing structure in a sensitive, responsive, and natural manner seems to positively influence students' language development.

In sum, our answer to the question of whether and in what way teachers of students with sensory loss exhibit need-supportive behavior would be that teachers do support their students' need for competence, but they don't always support their students' need for autonomy and relatedness. Moreover, the same need-supportive teaching strategies designed for students without sensory loss can be used, although the content will need to be adjusted to the individual student and his/her sensory loss (see also 4.3).

4.2. Research question 2

A second aim of this study was to explore whether need-supportive behavior influences the engagement and outcomes of students with sensory loss. There were only a few studies that addressed this issue. These studies showed that provision of structure would seem to be associated with positive levels of student engagement and educational outcomes in terms of sign language, reading, mathematics, and social skills. The effect that autonomy support has on students' engagement or outcomes was not explored. With regard to involvement, the findings showed that this can lead to positive outcomes, such as reduced levels of problematic behaviors and emotional distress in DHH students.

4.3. Research question 3

A third aim of this study was to provide grounded and practice-oriented recommendations for teachers' professionalization, training, and educational practice. In Table 1, we have provided an overview of the strategies teachers can use. These strategies are based on SDT research conducted in regular educational settings. The results of our literature study indicate that these need-supporting strategies are also applicable to students with sensory loss. However, the content of the need support has to be adjusted to the individual student. To give an example: adjusting teaching strategies in this target group might require that teachers use enlarged text, braille prints, sign language (interpreters), or that subtitles be added to videos. This is in line with Reeve (2006), who

states that there is no one prescribed set of techniques and strategies that teachers must use; rather, need-supportive teaching should be adjusted to each individual student.

4.4. Research question 4

A fourth aim was to provide ideas and input for teacher-training programs. The results showed that teachers already provided a lot of structure in their teaching. However, the results for involvement and autonomy support were not overwhelmingly positive. Therefore, in teacher-training programs more attention should be paid to teacher behaviors. Teacher-training programs should focus on supporting students' self-advocacy and coping skills, along with skills for functioning independently.

Previous research pointed out the importance of autonomy-supportive teaching for students with sensory loss. For example, Luckner and Sebald (2013) asserted that including components of self-determination in the curriculum helped students take charge of their learning and their lives. Moreover, being able to self-advocate builds a sense of self-efficacy and pride (Bruce & Parker, 2012). According to Kusurkar, Croiset, and Ten Cate (2011), it is not difficult to engage in autonomy-supportive teaching behavior, and it can be learned through practice and self-reflection about teaching practices. The literature also shows examples of enhancing self-determination in students with disabilities (Wehmeyer, Palmer, Agran, Mithaug, & Martin, 2000).

Moreover, teacher-training programs should focus on how teachers can broaden their level of involvement, for instance, by correctly identifying and interpreting the signals of students, and then being responsive to them. Previous research has demonstrated the positive impact that relationships have on students' academic achievement; yet teachers are given little instruction or support as to how to develop interpersonal relationships with students (Newberry, 2010).

Furthermore, previous research has shown that teachers can be trained to identify and express need-supportive behavior in their everyday educational practice. Previous studies indicated positive results with regard to enhancing teachers' need support through coaching teachers. A study by McLachlan and Hagger (2010) showed that even a brief intervention resulted in significant increases in autonomy-supportive behaviors on the part of teachers.

To answer the fourth research question, we would recommend that teacher-training programs focus on need-supportive teaching.

studies focused on DHH students only. Another limitation is the wide variation in research designs found in the studies we included. There were not only single-subject case-study designs and small-group designs among the studies but also large-group design studies. Moreover, both quantitative and qualitative studies were included. Given the variety of methodologies used in the included studies, our main aim was to conduct a descriptive review, as opposed to a meta-analysis. Since not all of the studies reported effect sizes, it was impossible to conduct a meta-analysis.

4.6. Future research

These findings lead to four recommendations for future research. First, there is a need for more research about students with visual impairments and deafblindness. Second, there is a need for more theory-driven research in order to explore teachers' involvement and autonomy support. Third, there is a need for more research on the causal relationship between need-supportive teaching, and student engagement and outcomes. Fourth, in future research an intervention aimed at enhancing need-supportive behavior in teachers of students with sensory loss should be developed and implemented.

5. Conclusion

Drawing on SDT, this study examined the interplay between teachers' need support, and students' motivation and engagement. Although all the included studies were conducted from a perspective other than SDT, we found aspects of the theory in each of them. This study provides substantial evidence that the SDT framework is applicable and useful in the education of students with sensory loss. Finally, it provides concrete points of departure for future research and practice.

Acknowledgements

The authors wish to thank Roos Dijkstra for her contribution to the coding process.

Appendix. Search terms

Levels	Search terms
1. Sensory impairments	Deaf* or hearing impairment or hard-of-hearing or blind* or visual impairment or deaf-blind* or sensory impair*
2. Teachers' provision of need-support	Teachers' structure: structure or feedback or scaffolding or expectations or chaos or guidance or direction; teachers' autonomy support: autonom* or control or choice or relevance; teachers' involvement: involv* or relation or support or interaction or communication or attunement or affection
3. Students' needs	Competence or relatedness or autonomy or self-determination; (student motivation or engagement): engage* or motivat* or attention or concentration or effort or performance or persistence or participat*; (student outcomes): learn* or development or well-being or achievement or identity or regulat* or emotion
4. Context	Education OR teach* OR teacher behav*.

*denotes use of word as a root word.

Based on the results of this literature study, our suggestion would be that teacher-training programs increase their focus on how to support students' needs for autonomy and relatedness, since teachers seem to provide the least support for both these needs.

4.5. Limitations

One limitation of this study is the lack of research on students with visual impairments and deafblindness. The vast majority of

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