

## University of Groningen

### A good read

ten Brug, Annet

**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:*

2015

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

*Citation for published version (APA):*

ten Brug, A. (2015). A good read: A study into the use and effects of multi-sensory storytelling; a storytelling method for persons with profound intellectual and multiple disabilities. [S.l.]: [S.n.]

**Copyright**

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

**Take-down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

## Chapter 6 Learn and apply.

Using multi-sensory storytelling to gather knowledge about preferences and abilities of children with profound intellectual and multiple disabilities – three case studies.

Published as:

Ten Brug, A., Van der Putten, A. A., & Vlaskamp, C. (2013). Learn and apply: Using multi-sensory storytelling to gather knowledge about preferences and abilities of children with profound intellectual and multiple disabilities—three case studies. *Journal of Intellectual Disabilities*, 17(4), 339–360.

## 6.1 Introduction

People with profound intellectual and multiple disabilities (PIMD) are characterised by their pervasive needs for support. They have a developmental age below 24 months, combined with a severe or profound motor disability and in addition, sensory disabilities and general health problems (Nakken & Vlaskamp, 2007). They form a very heterogeneous group with major differences in their intellectual, motor, and sensory abilities, as well as their preferences (Nakken & Vlaskamp, 2007). Given the heterogeneity of this target group and the severity of their disabilities, professionals like teachers and therapists must possess detailed and extensive knowledge about the preferences and abilities of each person with PIMD in order to offer appropriate activities (Vlaskamp & Cuppen-Fonteine, 2007; Vlaskamp et al., 2007). Earlier research shows direct support professionals and teachers involved in the support of these children (either in centres for special education or day care centres) display an on-going need to increase their knowledge about individual abilities and preferences in order to attune support to the needs and wishes of the person with PIMD ( Van der Putten, Vlaskamp, & Poppes, 2009; Vlaskamp & Van der Putten, 2009). They want to know about sensory problems or abilities and their consequences for the support they offer. For example, which colours can the person differentiate between? Does it make a difference whether lights in the room are on or off? When presenting an activity, knowledge about the context is also important, such as the influence of ambient noise. The motor abilities of a person with PIMD also have consequences. If we present an object, is he/she able to reach it, grab it, maybe even hold and

manipulate it? Does its size matter? Without this knowledge about preferences and abilities, the full potential of a person with PIMD could go unexploited (Vlaskamp, 2003); direct support persons and teachers therefore attach great importance to knowledge resulting in activities that enable full engagement with the environment (Vlaskamp et al., 2007).

However, reliable and valid instruments for assessing these abilities and preferences in children with PIMD are lacking (Vlaskamp, 2005). As a result, structured methods are often used, for example, presenting stimuli in a systematic way and then observing behaviour (Cannella, O'Reilly, & Lancioni, 2005; Van der Putten, Vlaskamp, & Schuivens, 2011). In such a procedure, professional staff has to rely greatly on observation. The disadvantage of this as a source of information is that observations are only snapshots, and the question arises whether full capabilities are being shown at a particular moment. In addition, because of the limitations in the ability to communicate, reliable interpretation is difficult. Communicative signs are often described as unintentional, ambiguous, and/or inconsistent; therefore interpretation depends strongly on the communication partner (Grove, Bunning, Porter, & Olsson, 1999). In addition to problems with gathering information and interpreting it, abilities and preferences do not remain static; not only may they change over time but even between situations and environments. Something once enjoyable might be considered annoying at a later time (Kennedy & Haring, 1993; Watson, Umansky, Marcy, & Repacholi, 1996). New abilities can also be acquired (Van der Putten, Vlaskamp, & Nakken, 2005), while existing abilities may disappear over time (Evenhuis et al., 2001; Robertson et al., 2000).

## Learn and apply

As previously described, it is important for teachers to understand the needs of their pupils. This requires an optimally knowledge about contextual, motor, and sensory preferences/abilities. One can imagine that, in addition to existing methods, teachers would be well served if they could gather knowledge in a more casual way, for instance, during offering all kinds of activities. Such activities would have to be fully adapted to current knowledge of individuals to be certain they show their full potential (Vlaskamp et al., 2007). Also, there should be repetition so that there is no question of a snapshot. Multi-sensory storytelling (MSST) is an activity that would seem eminently suitable because of the one-on-one situation, its repetitive character, and the use of individualized sensory stimuli. These multi-sensory stories are personalized, and are shaped according to predefined guidelines by the developers of MSST (Fuller, 1990; Lambe & Hogg, 2011; Ten Brug et al., 2012); a story generally consists of six to sixteen sentences, spread over 6-8 pages, each page being supported by sensory stimuli. An MSST book has a customized starting instruction, so the storyteller knows exactly how the story must be told and how the stimuli should be offered to the listener. Therefore, MSST allows the teacher (as storyteller) to systematically assess reactions in terms of preferences and abilities. MSST also allows patterns in the reaction to be distinguished. In addition, it allows the teacher to notice recurring, subtle communicative behaviours, which otherwise might be overlooked (Iacono, Carter, & Hook, 1998).

Theoretically, MSST appears to be an ideal activity as an “assessment procedure” for acquiring more knowledge about preferences and abilities. However, no research has yet been conducted into this

subject. Is any new knowledge is indeed gained from reading stories? And, if so, what types of knowledge do teachers gather (contextual, motor, and sensory abilities, preferences). Furthermore, we question to what extent teachers use and apply the knowledge gathered while working with MSST in practice.

## **6.2 Method and materials**

### **6.2.1 Participants and setting**

The study took place in a Centre for Special Education (CSE). These centres provide all kinds of educational and support services for students with disabilities up to 18 years of age. At CSE's, planned and purposeful attention is paid to the development of the students. Interdisciplinary cooperation between teachers and therapists (such as physical therapists, occupational therapists, or speech therapists) and close cooperation with the medical profession is a characteristic of the CSE. At the participating CSE, there are eight classes for children with intellectual disabilities, including two classes especially for children with PIMD. Each class consists of seven children aged between 9 and 17. The teachers participating in this study were selected based on the following criteria:

- A degree in upper vocational education and training in a relevant discipline.
- Sufficient time to participate in the study.
- Works at least three days a week (or six half-day shifts).

Teachers who met these criteria, volunteered to participate after being informed by their supervisor. Three teachers participated in this

## Learn and apply

study. Based on the following criteria the children with PIMD were selected by the teachers:

- (a) The child has PIMD according to the description of Nakken and Vlaskamp (2007), meaning a profound intellectual disability (IQ below 25, or a developmental age below two years) and a profound or severe motor disability.
- (b) The child visits the centre at least three days a week (or six half-day shifts).
- (c) The teacher expected the child to enjoy the storytelling activity.
- (d) Written informed consent obtained by the parents for their child to participate in MSST as well as in the current study.

Due to the nature of this research, it was important that the child and the teacher knew each other straight off. For practical purposes, the child and the teacher needed to be together in the same group on a regular basis. Therefore, the following last two inclusion criteria were:

- (a) The child and teacher have known each other for at least a year.
- (b) The child and the teacher are in the same group at least two days a week (or four half-day shifts).

Finally, three dyads consisting of a teacher and a child with PIMD participated. The children's and teachers' characteristics are presented in Table 1. To ensure the anonymity of the teachers and the children, fictional names are used.

*Table 1*  
*Characteristics of the participating dyads*

		Amber (teacher) and Aden	Brit (teacher) and Bob	Carol (teacher) and Catrin
Teacher	Age (years)	26	26	49
	Gender	Female	Female	Female
	Working experience with persons with PIMD (in years)	6	3	8
	Working with the particular child (in years)	2	1	3
Child	Age (in years)	13	9	17
	Gender	Male	Male	Female
	Developmental age <sup>1</sup>	6.5 month	2-3 months	6.5 month
	Health problems	Epilepsy, problems drinking.	Epilepsy, constipation, hypertonia in whole body. Uses drip-feed combined with blended food administered orally.	Epilepsy (grand mal), regurgitating.
	Additional motor disabilities		No trunk balance.	



## Learn and apply

Sensory impairments	Cerebral visual impairment (CVI). Possible auditory disability.	Cerebral visual impairment (CVI), loss in the left and upper range of vision. Hypersensitive for loud sounds.	
Medication	Anti-epileptics	Anti-epileptics and medicines against constipation.	Anti-epileptics
Communication	Verbal and tactile communication. He grumbles when discomforted. When he is happy, he shows it with sounds and frequent body movements.	Reacts to verbal communication with facial expressions, body language, sounds, and smiles (pleasure or tension).	Makes no contact with her environment, has plain facial expressions. Cries when discomforted, makes high "ee-ee" sounds when happy.

---

<sup>1</sup>Developmental age is measured by the Bayley scales of infant development (second Dutch edition) (Van der Meulen, Ruiters, Spelberg, & Smrkovsky, 2002).

### 6.2.2 Intervention

In MSST, a short story is read out supported by multiple sensory stimuli (Fuller, 1990; Lambe & Hogg, 2011; Ten Brug et al., 2012). According to the general guidelines of MSST, stories consist of 6 to 16 (short) sentences, supported by 6 to 8 stimuli. Each one or two sentences are linked to one stimulus. The stimuli can target different senses; the

selection depends on the assumed preferences and abilities. The subject, text, and stimuli should thus be fully attuned to the child's preferences and abilities. Moreover, every story has a personalized "starting instruction" intended for the storyteller. In it, detailed information is given about how to read the book to the child concerned (e.g., read it in a quiet room, switch on the lights, speak clearly and slowly, etc.). The stimuli used are presented on large neutral (e.g. white) boards, which provide a contrast to make them more visible. MSST books should be read multiple times in exactly the same way; this repetition enables listeners to get used to their personal stories (Ten Brug et al., accepted) .

### **6.2.3 Data and instruments**

Inventory for attuning activities and situations to the abilities and Preferences of persons with Profound intellectual and multiple disabilities (IPP). The knowledge teachers do dispose of the sensory, motor, and contextual preferences and abilities was measured with the (adapted) version of the "Inventory for attuning activities and situations to the abilities and preferences of persons with profound intellectual and multiple disabilities" (IPP) (Tadema et al., 2005). This is an instrument that asks for the immediate available knowledge of the teacher: the knowledge they use on a day to day basis, the knowledge that is in their hands and minds. The IPP inventories what teachers actually know and/or find they need to know, about the sensory, motor, and contextual abilities and/or preferences. It consists of 40 items divided into ten domains, five domains (22 items) of which are related to sensory preferences and abilities (the domains: visual, auditory, tactile and olfactory abilities, sensory preferences). Two domains, with a total of

## Learn and apply

seven items, are related to motor skills (gross and fine motor skills). The remaining three domains (11 items) concern contextual preferences and abilities (where, how, and when) (Vlaskamp et al., 2007).

For the purpose of this study, some small adjustments were made to the IPP. The differences between the IPP and the adjusted version (IPP-A) are: (1) the IPP-A just focusses on current knowledge, omitting the section about what teachers feel they need to know; (2) IPP-A only inventories knowledge relevant for MSST, omitting 13 items (items related to preferable group size for an activity and children's need for variations in activities (Tadema et al., 2005; Ten Brug, Van der Putten, & Vlaskamp, 2010).

Finally, the IPP-A consists of 27 items divided into three categories and eight domains (see Table 2). Of these, 12 items are related to contextual preferences and abilities, another 12 to sensory and motor preferences and abilities, and 3 items to motor ones. Contextual domains are the storyteller, the client, the setting, and the way stimuli are presented. Sensory domains are vision, hearing, touch, and smell. Motor abilities and preferences are involved if the listener is able to grab, grasp, or hold an object, and under what conditions (see Table 2).

All IPP-A items have the same format, meaning that they are formulated as questions: “*Should you, during storytelling, take ..... into account?*” Answers can be multiple choice (with possible answers adapted to the item), but the teacher can also provide more details. An example of an item in “the storyteller” domain is: “*Should you, during storytelling, take the volume of your voice into account?*” Possible answers are (a) preferably speak loudly; (b) preferably speak softly; (c) preferably speak

Table 2

*Domains and items of the IPP-A*

Category	Domain	Items
Contextual preferences and abilities	The storyteller	Voice pitch, speech volume, field of view, distance of stimuli.
	The client	Suitable time, posture, focus time, holding focus.
	The setting	Suitable space, place in space, background noise, lighting.
Motor preferences and abilities	Motor skills	Can the listener grab, grasp or hold an object, and under what conditions?
Sensory preferences and abilities	Vision	Importance of colour and size, preference for visual stimuli.
	Hearing	Volume and preferences for hearing stimuli.
	Touch	Aversions, hyposensitivity, hypersensitivity, preferences for tactile stimuli.
	Smell	Recognition, aversions, hypersensitivity, preferences for olfactory stimuli.

normally; and (d) don't know/unknown. If it is clear that an item has been taken into account, it can be considered "answered" and scored as "positive." If it is unknown whether an item (e.g., pitch of voice) has to be reckoned with while reading a story, this item is considered "unanswered" and is scored as "negative." Teachers' knowledge about preferences and abilities is reflected in the number of positively scored items.

*Manual for making and reading an MSST book.*

Learn and apply

The teachers used the manual, based on the guidelines by PAMIS (Lambe & Hogg, 2011) to put together their MSST book. It provides a structure for making an MSST book, and starts with the choice of a title and subject. Guidelines and their rationale are also discussed in it.

*Expectations and experiences.*

Before reading, and after the 10<sup>th</sup> and 20<sup>th</sup> reading sessions, teachers were asked about their experiences while reading, and their expectations for future sessions. The expectations and experiences were explored with regard to: (1) the rationale behind the text and stimuli chosen, and any changes made; (2) the listeners' reaction to the story and individual stimuli; and (3) the knowledge of the preferences and abilities that the teacher gains during reading. Teachers were finally asked whether they wanted to make changes in their MSST book based on their reading experiences.

#### **6.2.4 Design**

The IPP-A was filled in before the storytelling started (T1), and then after 10 (T2) and 20 (T3) reading sessions (see Table 3).

During these three measurements, the teachers were also asked about their experiences and expectations. At T1 and T2, the teachers were asked to formulate expectations. At T2 and T3, the teachers were asked for their experiences and whether they wanted to make changes in the story or in the stimuli in the book.

Table 3

<i>Design</i>					
Week	0	1-4	5	6-9	10
Reading-session (intervention)		1-9	10	11-19	20
Measurement	T <sub>1</sub>		T <sub>2</sub>		T <sub>3</sub>
Information collected:					
* Knowledge about the preferences and abilities of the child	X		X		X
* Applying knowledge			X		X
* Expectations about listeners' preferences and abilities	X		X		
* Experiences with the listeners' preferences and abilities			X		X

T<sub>1</sub> = first measurement before storytelling  
T<sub>2</sub>, T<sub>3</sub> = second and third measurements during storytelling

### 6.2.5 Procedure

In the Netherlands, especially in the case of a non-invasive study like this, ethical approval is obtained from the facility where the study takes place. An independent ethics committee is consulted when a study has high personal impact for the participants, like for instance the administration of drugs or other invasive actions. . Before the study started, a research proposal was presented for approval to the CSE, and the CSE informed parents and legal guardians who gave their informed consent. After selection of the participants, a two hour workshop was given to the three teachers on using MSST. During this workshop, the teachers were informed about the theory behind MSST, and were introduced into the practical conditions a multi-sensory story had to meet. The teachers were told how to make and read a story, and

Learn and apply

examples of MSST books were presented. The IPP-A was filled in by the teachers before the workshop, and was used by the teachers to fully adjust their book to the children's preferences and abilities. When they had any questions about the instrument, they could contact the research assistant who was regularly present at the day-care centre. Materials needed to complete the book (such as the A3 sized white backgrounds) were provided by the researcher.

### **6.2.6 Analysis**

In this study, data were processed in a descriptive manner and the results displayed per child- teacher dyad.

Per measurement, the number and percentages of positively scored items of the IPP-A per domain were counted for each dyad. Information about the changes in knowledge came from the number of answers changed between two measurements. This was done for all items and also for the eight domains; the three measurements were analysed separately.

Subsequently, the knowledge of the teachers was analysed by using the data of the IPP-A. The IPP-A was described per item over the three measurements. This description started with the knowledge about the contextual, motor, and sensory abilities and preferences that the three teachers had prior to reading the MSST book (T1). A description was also given of the books written. Thereafter, the successive moments of measurement were compared, and the new facts gathered from T1 to T2 and from T2 to T3 discussed. To analyse the nature of the changes in

knowledge, the changes in items between two measurements were categorized in the following five categories:

- (1) Stays known: Knowledge about this item was present during the earlier and later measurements; there are no changes in knowledge.
- (2) Becomes known: This item was answered in the later measurement, but was unknown in the earlier measurement.
- (3) Knowledge adjusted: This item was answered in both the earlier as well as the later measurements, but the answers on this item differed between the two measurements.
- (4) Becomes unknown: This item was answered in the earlier measurement but marked as unknown in the later measurement.
- (5) Stays unknown: This item was marked as unknown during both the earlier as well as the later measurements.

Using this system, changes between T1 and T2, T2 and T3, and T1 and T3 were classified per storytelling dyad and presented in figures. The changes were shown for the total 27 items of the IPP-A, but also separately for the contextual and sensory domain items. Finally, the adjustments the teacher made in the book at T2 and T3 were analysed per dyad. After describing these adjustments, the desired changes in the book in response to the teacher's new knowledge were described, and placed alongside the changes actually made by the teacher. Similarly, the convergence and divergence between the additional information provided by the teachers and the information from the IPP-A were described.



## 6.3 Results

### 6.3.1 Dyad A: Aden and Amber

#### *Before the first reading session (week 0/T1)*

At T1, 18 of the 21 items (77.8%) were answered as positive and marked as “known.” The other 22.2% were scored as negative (unknown). Almost all items about the contextual preferences and abilities were scored as positive (11 out of 12: 91.6%), while all three items about motor abilities and preferences were answered. As for sensory preferences and abilities, seven out of twelve items were answered, leaving 41.7% of the items unanswered; these were mainly related to knowledge concerning Aden’s abilities or preferences concerning smell. Table 4 provides a summary of the unanswered items and changes in knowledge at T1, T2, and T3. A description of the answers to items at T1 is given below.

Distinguishing between the three categories, almost all contextual preferences and abilities items ( $n=11$ , 91.7%) were answered, and all motor abilities items were filled in. Over half ( $n = 7$ , 58.3%) of the sensory domain items were answered.

At T1, Amber indicated that Aden preferred a voice with a normal pitch and volume. Stimuli were preferably presented at close range (under 40 cm) and in the middle of his visual field; Aden can only grab and hold small stimuli. Aden being more alert in the morning, the storytelling sessions ideally took place early in the morning. He needed 5-10 seconds to direct his attention, and was able to focus it for about 10. He preferred to sit in his wheelchair in a small room with little ambient

Table 4

*Number of answered items of the IPP-A, and changes in knowledge for Aden and Amber*

Domain	T1	T2		T3	
	N (%) Answered items	N (%) Items changed T1 to T2	N (%) Answered items	N (%) Items changed T1 to T2	N (%) Answered items
Contextual	11 (91.7)	6 (50.0)	12 (100.0)	2 (16.7)	12 (100.0)
- Storyteller	4 (100.0)	1 (25.0)	4 (100.0)	1 (25.0)	4 (100.0)
- Client	4 (100.0)	2 (50.0)	4 (100.0)	1 (25.0)	4 (100.0)
- Setting	3 (75.0)	3 (75.0)	4 (100.0)	-	4 (100.0)
Motor	3 (100.0)	-	3 (100.0)	3 (100.0)	3 (100.0)
Sensory	7 (58.3)	9 (75.0)	8 (66.7)	10 (83.3)	8 (66.7)
- Visual	1 (50.0)	1 (50.0)	2 (100.0)	1 (50.0)	2 (100.0)
- Auditory	2 (100.0)	-	2 (100.0)	1 (50.0)	2 (100.0)
- Tactile	4 (100.0)	4 (100.0)	-	4 (100.0)	4 (100.0)
- Olfactory	-	4 (100.0)	4 (100.0)	4 (100.0)	-
Total	21 (77.8)	15 (55.6)	23 (85.2)	15 (55.6)	23 (85.2)

IPP = the Inventory for tuning activities and situations to the abilities and Preferences of persons with Profound intellectual and multiple disabilities

T1 = first measurement before storytelling

T2, T3 = second and third measurements during storytelling

noise and regular lighting (fluorescent lamps and daylight, like in his group). An ideal room for storytelling would be a small hallway.

Concerning his sensory preferences and abilities, he prefers auditory and tactile stimulation, especially liking loud and high-pitched noises, and physical contact. Aden has no tactile aversions, and is not hypersensitive or hyposensitive to tactile stimulation.

## Learn and apply

Aden's book was called "A day together with Aden," and consisted of eight stimuli and eighteen sentences. Amber wanted to make a book that was close to Aden's own experiences. The reference stimulus was a stuffed-toy butterfly, chosen because the name of Aden's group home was Butterfly. Aden's story starts with a honking toy bus; then the doorbell (triangle) rings and Aden is at the door. It is raining outside (the sound of rain from a rainmaker), so Aden is asked to come inside quickly. The day starts with a cookie, illustrated by the sound of a crackling packet of cookies, and Aden is complimented for his nice perfume (he gets to smell the scent of male perfume). Then the daily schedule is discussed, with listening to music suggested first (using a CD disk as stimulus). But then the story says "I know what we are going to do... We are going to make music!" Here Amber chose a small tambourine as stimulus. Then at the end of the story, the day ends (an egg timer goes off), and Aden returns home. Amber used eight stimuli and eighteen sentences, necessary for a well-rounded story. Most of the stimuli were chosen by Amber because she knew Aden would respond well. The honking toy bus and the egg timer were chosen because Amber wanted to know Aden's reaction to low and high-pitched sounds. The perfume and tambourine were chosen because these were not often used in other activities.

Amber expected Aden to react neutrally to the reference stimulus. She thought Aden would laugh and react with a lot of body movement, especially to the honking bus, but also to the rainmaker and tambourine, and laugh but respond calmly and alertly to the triangle, the packet of cookies, and egg timer. The packet of cookies perhaps would prove as interesting as the other stimuli. Amber found it difficult to predict Aden's

reaction to the perfume. She thought Aden would laugh and follow the movements of the CD disk with his eyes.

Amber expected to learn about Aden's reaction to low-pitched noises and olfactory stimuli; she also wanted to know whether olfactory stimuli would prove interesting. Amber also expected to gain more information about the timing and the types of reactions, and whether Aden would be able to cope with stimuli that addressed multiple senses (e.g., the rainmaker is an auditory stimulus, but also a tactile one).

### *Week 5/session 10 (T2)*

After ten reading sessions, Amber still found it difficult to assess Aden's reaction to the perfume; she did not know whether he was responding to the smell or something else. Aden reacted as Amber expected to the rainmaker, tambourine, cookies, and egg timer. At times the honking bus scared him slightly, but he also would laugh at it. Amber expected Aden to react calmly to the triangle, but instead he made body movements. The reaction to the CD disk was less pronounced than Amber expected.

During T2, 23 out of the 27 items (85.2%) of the IPP-A were answered, all items regarding motor and contextual preferences and abilities. Amber answered eight out of the twelve (66.7%) items about sensory preferences and abilities. Changes were made in 15 out of the 27 items (55.6%) from T1 to T2. Six items of the contextual preferences and abilities were changed, and nine items concerning the sensory preferences and abilities (see Table 4). Categorizing the changes in items between T1 and T2, by far the most items ( $n = 12$ ) remain "known" between measurements (see Figure 1(a)).

Learn and apply

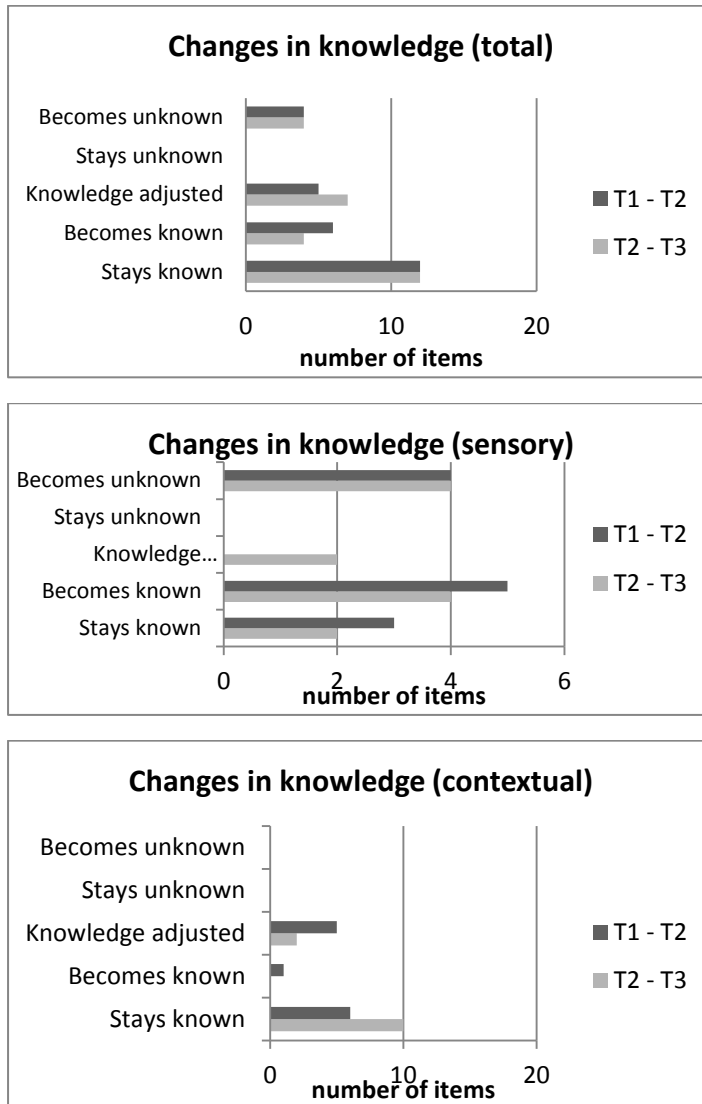


Figure 1(a) to (c). Changes in knowledge between T1 and T2, and T2 and T3 for Aden and Amber<sup>1</sup>

<sup>1</sup> Total being the sum of contextual, sensory and motor preferences and abilities

Many items ( $n = 5$ ) in the sensory category became known from T1 to T2; there were also four items unanswered during T2 which were known at T1 (see Figure 1(b)). The contextual preferences and abilities were mostly adjusted ( $n = 5$ ) or remained known ( $n = 6$ ) (see Figure 1(c)).

Five items were adjusted from T1 to T2. A preference for a normal voice at T1 changed to preferring a high voice. Reaction time rose from 5-10 seconds to 10-30 seconds. In addition, the amount of time Aden could focus his attention rose from under 10 seconds to 30-60 seconds. A little environmental noise changed to complete silence. At T1, Amber indicated the lights should be on, at T3 Amber that they should be bright. Three items concerning tactile preferences and abilities were marked as unknown during T2, while at T1 Amber indicated Aden preferred physical contact and that the three other items were “not important.” With the items relating to the olfactory sense, a reversal occurred; these items were marked as unknown during T1 but as not important during T2. At T2, Amber knew Aden preferred sitting next to the window and that he could distinguish colour; these two items were unknown during T1.

For the next ten reading sessions, Amber expected some of Aden’s reactions to the stimuli to change. She thought Aden would stop being scared of the honking toy bus and that Aden would show that he recognized the tick-tack sound of the egg timer. Amber hoped that Aden would show a clearer reaction to the perfume so that she would be able to evaluate what he thought of it. Amber herself stated that she learned that low-pitched stimuli could also grab Aden’s attention. At the end of the first five weeks, Amber decided to stop using the white backgrounds

Learn and apply

for the stimuli, because they distracted Aden and they were not user-friendly. Other adjustments in the subject, sentences and stimuli were not made because the story works fine according to Amber.

*Week 10/session 20 (T3)*

After ten weeks of storytelling Aden's reaction to the toy bus with its honking, the cookies, the CD, and the tambourine were as Amber had expected. Aden started making sounds along with the triangle and started holding the rainmaker instead of just listening to it. When spraying on the perfume, Aden laughed and shook his head; while sniffing the perfume, he would sometimes laugh but other times showed no reaction. Aden showed no clear recognition of the egg timer, but he looked as if he were concentrating, and he laughed when it went off.

At T3, 23 items (85.5%) were again answered, again including all items about contextual and motor preferences and abilities. For a second time, fifteen (55.6%) items were changed, consisting of 10 items (83.3%) in the sensory category, three items (100%) in the motor category, and two items (16.7%) concerning contextual preferences and abilities (see Table 4). Most items remained known from T2 to T3 ( $n = 12$ ), or knowledge was adjusted during the two measurements ( $n = 7$ ). Four items were unknown and became known in T3; four other items were known and became unknown (see Figure 1(a)). The types of changes between T2 and T3 in the sensory category varied. Changes concerning the motor and contextual abilities, and preferences, all involved adjustments to existing knowledge.

Between T2 and T3, changes again occurred in all olfactory items (they all became unknown) and all tactile items (all became known).

Eight items were adjusted; the reaction time went from 10-30 seconds to 5-10 seconds, and Amber indicated during at T2 that Aden preferred a high-pitched voice. At T3, however, Amber stated a normal voice was perfect. Amber specified that Aden used both his left and right hand for reaching, grabbing, and holding. Aden could also use large objects (T3), not just small ones (T2). As for his vision, Amber indicated that Aden could distinguish size as well as colour (T3), not just colour (T2). During T2, Amber mentioned that Aden had a preference for high-pitched sounds and, during T3, she specifically mentioned a high whistle tone.

After the last storytelling session, Amber indicated she now knew that Aden seemed to have a preference for olfactory stimuli because of his positive reaction to the perfume. She did not make any changes to the MSST book.

### **6.3.2 Dyad B: Bob and Brit**

#### *Before the first reading session (week 0/T1)*

The first time (T1) Brit filled in the items about Bob's preferences and abilities, 18 items (66.6%) were answered (known). The remaining 9 (33.3%) items went unanswered and therefore were considered unknown (see Table 5).

At T1, it became clear from the IPP-A that the story should be told with a high-pitched voice and at a normal volume and stimuli presented at close visual range. Bob preferred to sit in his wheelchair during storytelling. Focusing takes him 0-5 seconds, and once focused he can sustain this for up to 10. He prefers a small room (e.g., the group space), sitting by a wall with light from his right. He prefers a quieter



## Learn and apply

environment, and ideally not seated near other children or a door. Bob cannot grab or grasp, but can hold small objects. With regard to his sensory preferences and abilities, information is available about vision, hearing, and touch. Because Bob is visually impaired, he is mainly presented large objects, contrasting colours, and bright lights.

Concerning auditory stimulation, Bob likes soft, high-pitched sounds or music; loud noises can startle him. Finally, he has a preference for smooth, solid, and liquid tactile stimuli.

Table 5

*Number of answered items in the IPP-A, and changes in knowledge for Bob and Brit*

Domain	T1	T2		T3	
	N (%) Answered items	N (%) Items changed T1 to T2	N (%) Answered items	N (%) Items changed T1 to T2	N (%) Answered items
Contextual	11 (91.7)	4 (25.0)	12 (100.0)	2 (16.7)	11 (91.6)
- Storyteller	4 (100.0)	-	4 (100.0)	2 (50.0)	3 (75.0)
- Client	3 (75.0)	2 (50.0)	4 (100.0)	-	4 (100.0)
- Setting	4 (100.0)	2 (50.0)	4 (100.0)	-	4 (100.0)
Motor	3 (100.0)	-	3 (100.0)	-	3 (100.0)
Sensory	4 (33.3)	4 (33.3)	3 (25.0)	2 (16.7)	3 (25.0)
- Visual	1 (50.0)	1 (50.0)	1 (50.0)	1 (50.0)	-
- Auditory	2 (100.0)	1 (50.0)	1 (50.0)	-	1 (50.0)
- Tactile	1 (25.0)	2 (50.0)	1 (25.0)	1 (25.0)	2 (50.0)
- Olfactory	-	-	-	-	-
Total	18 (66.7)	8 (29.6)	18 (66.7)	3 (11.1)	17 (63.0)

IPP = the Inventory for tuning activities and situations to the abilities and Preferences of persons with Profound intellectual and multiple disabilities

T1 = first measurement before storytelling

T2, T3 = second and third measurements during storytelling

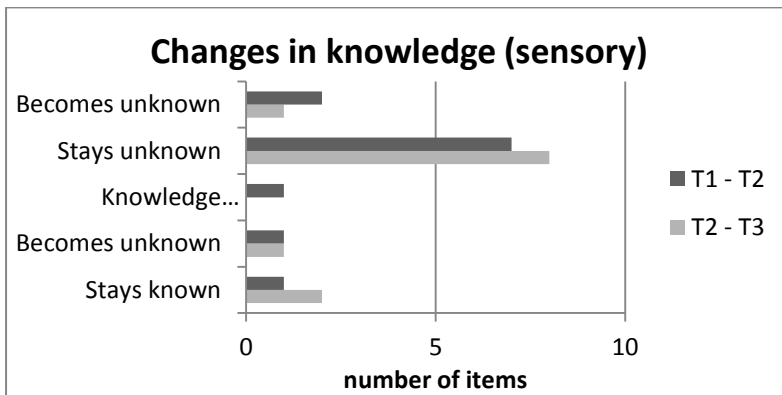
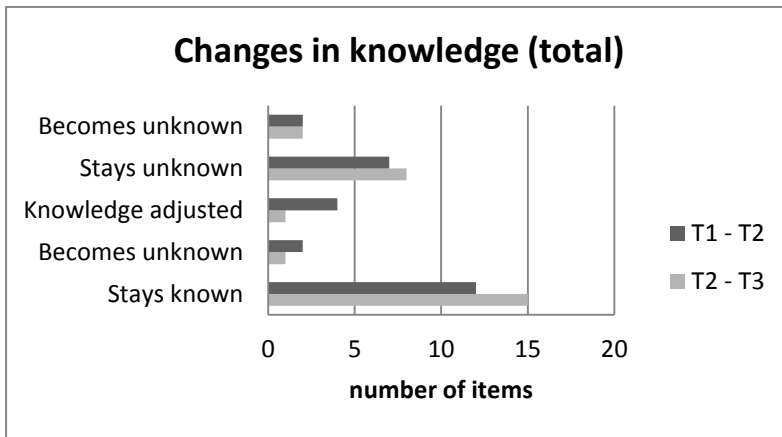
Brit chose ‘taking a stroll’ as subject for Bob’s book; the story takes place on a windy day in fall. Before going outside, Bob puts on his scarf. During his walk, he meets a pig, feels tree leaves, and feels the sun on his face. It is nice and warm when Bob returns home. The six stimuli chosen by Brit are (in order of appearance): a scarf, a paper fan, a toy pig with sound, leaves, a bright white light, and a lavender-scented cherry pit bag. Brit chose this subject because it let her use stimuli focused on hearing and feeling. In selecting the stimuli, Brit varied the type of stimuli into account, using tactile, auditory, visual, and olfactory stimuli. She expected were Bob to react with some tension – but smiling – to the first three tactile stimuli (scarf, paper fan, leaves). She suspected that the pig might sometimes be a little too exciting or even scary and that Bob would track the white lights. The lavender-scented bag was a bit of a guess; Brit did not have any information about Bob’s reaction to smell. She suspected he would not respond to the scent, but smile while touching the bag. Brit expected to learn more about how Bob wanted his story to be told (e.g., use of voice), to gain more knowledge about his response to stimuli, and insight into his sensory preferences. She was specifically interested in whether she might later describe Bob as “more capable than she previously thought.”

*Week 5/session 10 (T2)*

At T2, according to Brit, Bob anticipated the toy pig. Before the pig sound was presented, Bob would sit up, laugh, and turn his head towards the pig. He showed the least engagement with the cherry-pit bag, enjoying touching it, but uninterested in the scent. Bob acted a bit tense towards the scarf, paper fan, leaves, and light. But he seemed interested in everything and relaxed at times after a stimulus was presented.

## Learn and apply

Again, 18 items (66.7%) of the IPP-A were answered, including all items concerning contextual and motor preferences and abilities. In the sensory domain, three items (25%) were answered. Most changes (n = 4) from T1 to T2 involved adjustments in existing knowledge. Between the two measurements, most answers remained unchanged (n = 19) (see Figure 2(a) to (c)).



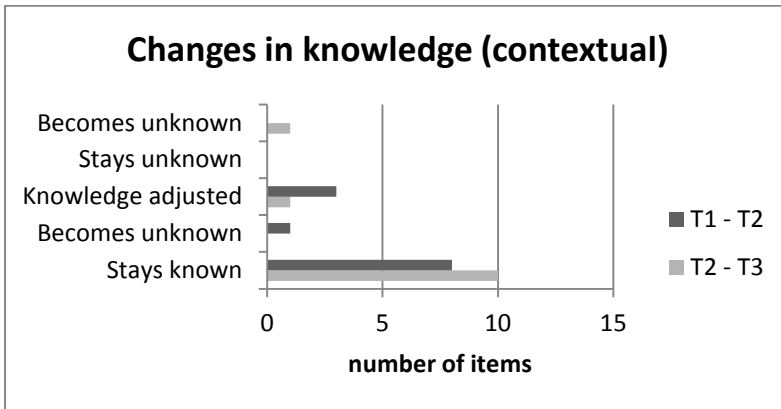


Figure 2(a) to (c). Changes in knowledge between T1 and T2, and T2 and T3 for Bob and Brit

When differentiating between the categories “contextual,” “motor,” and “sensory abilities and preferences,” there were no changes in the motor category. Sensory abilities and preferences showed a whimsical pattern; most items remained unanswered ( $n = 7$ ), but there was a variety in other observed changes between the two measurements (see Figure 2(b)). A clearer pattern was found for contextual preferences and abilities (see Figure 2(c)); most items remained known ( $n = 8$ ) or were adjusted ( $n = 3$ ) between the two measurements. One item previously answered was answered during T2.

Looking at the changed items in more detail, the two items initially unanswered were those on whether to take alertness and hyposensitivity for tactile stimuli into account. Brit stated that Bob was more alert in the mornings and that he was not hyposensitive to tactile stimuli. Two items were answered during T1 but marked as unknown during T2; those concerning Bob’s preference for sounds and for tactile stimuli. Finally, the answers to four items were modified. Instead of a focus time of 0-5

## Learn and apply

seconds (T1), according to Brit, in T2 Bob needed 5-10 seconds to focus. As to the ideal amount of ambient sound, she now indicated that a completely silent environment was ideal. Lights needed to be dimmed (T2) instead of coming from the right (T1). Although Brit initially indicated that Bob preferred large objects in contrasting colours and with lights, after ten reading sessions, she filled in that Bob had no visual preferences.

Brit also confirmed that she had learned new things about Bob's preferences, for example, that he did not like too much light and that sounds were at times a little too exciting, but she thought he could get used to them. When Bob was interested in a stimulus, Brit noticed that he turned his head towards it. Brit decided to make no changes in the MSST book as a result of her new knowledge. The subject of the story did not change because otherwise Bob would not have the chance to get to know his story, the number of sentences, and the stimuli were not changed by Brit because they are good as they are. She expected no big changes in Bob's reaction to the stimuli in the next five weeks, only less excitement with the scarf, paper fan, and light.

### *Week 10/session 20 (T3)*

After the 20<sup>th</sup> reading session, Bob's favourite stimuli were the light and the pig. Bob was still a bit jumpy towards the leaves, turning his head away. Bob also was slightly defensive towards the scarf. He turned his head towards the light, pig, and fan, and occasionally towards the scarf and cherry-pit bag. Bob still anticipated the toy pig.

At T3, 17 items were answered by Brit, answering one item less about contextual preferences and abilities compared to T2 (see Table 5).

Between T2 and T3, four questions (14.8%) were answered differently, varying per category. Concerning sensory preferences and abilities, most items (n = 8) remained unanswered (see Figure 2(b)). All items were again answered for the motor abilities, almost all (n = 10) for contextual preferences and abilities (see Figure 2(c)). Looking at the difference between all 27 items, a very erratic pattern again emerged (see Figure 2(a)).

During T1 and T2, Brit indicated that a normal speech volume was most suitable; during T3, Brit specified a soft to normal voice. Brit indicated in T2 that stimuli should be presented in Bob's right field of vision; in T3, Brit marked the field of vision item as unknown. The visual preferential stimulus changed from "no visual preferential stimulus" (T2) to "unknown" (T3). With respect to tactile stimuli, Brit added that Bob had an aversion to solid and raw materials.

Brit decided not to make any changes in the MSST book, the stimuli and sentences are good the way they are, changing the subject of the story would be confusing for Bob. Besides the fact that Brit did not feel that she had learned any new things about Bob, another reason not to make any changes was that she expected these would be confusing for Bob.

### **6.3.3 Dyad C: Catrin and Carol**

#### *Before the first reading session (week 0/T1)*

Carol was able to answer 19 items (70.4%) about Catrin's preferences and abilities at T1. Nine items involved contextual preferences and

## Learn and apply

abilities (75%), and three motor abilities (100%); Carol answered seven items about sensory preferences and abilities (58.3%) (see Table 6).

Table 6

*Number of answered items of the IPP-A, and changes in knowledge for Carol and Catrin*

Domain	T1	T2		T3	
	N (%) Answered items	N (%) Items changed T1 to T2	N (%) Answered items	N (%) Items changed T1 to T2	N (%) Answered items
Contextual	9 (75.0)	5 (41.7)	10 (83.3)	4 (33.3)	12 (100.0)
- Storyteller	2 (50.0)	1 (25.0)	3 (75.0)	1 (25.0)	4 (100.0)
- Client	4 (100.0)	1 (25.0)	4 (100.0)	1 (25.0)	4 (100.0)
- Setting	3 (75.0)	3 (75.0)	3 (75.0)	2 (50.0)	4 (100.0)
Motor	3 (100.0)	3 (100.0)	3 (100.0)	1 (33.3)	3 (100.0)
Sensory	7 (58.3)	6 (50.0)	2 (16.7)	5 (41.7)	5 (41.7)
- Visual	1 (50.0)	1 (50.0)	1 (50.0)	1 (50.0)	1 (50.0)
- Auditory	1 (50.0)	-	1 (50.0)	2 (100.0)	2 (100.0)
- Tactile	2 (50.0)	2 (50.0)	-	2 (50.0)	2 (50.0)
- Olfactory	3 (75.0)	3 (75.0)	-	-	-
Total	19 (70.4)	14 (51.9)	15 (55.6)	9 (33.3)	20 (74.1)

IPP = the Inventory for tuning activities and situations to the abilities and Preferences of persons with Profound intellectual and multiple disabilities

T<sub>1</sub> = first measurement before storytelling

T<sub>2</sub>, T<sub>3</sub> = second and third measurements during storytelling

It was important for Catrin to be offered stimuli in the middle of her visual field that remained over 40 cm away. She needed a maximum of 5 seconds to focus her attention, and she could be attentive for a period of

10-30 seconds. The best time to read the story to Catrin was in the morning; she preferred sitting in a chair or wheelchair somewhere quiet. Because she preferred brightly lit rooms, ideally she sat near the window. If objects were offered at close range, Catrin could hold, grab, and grasp them. Carol indicated that Catrin preferred visual and auditory stimuli, specifically soothing music. Catrin did not like the feeling of reclining and preferred solid, tactile materials. Regarding olfactory stimuli, Catrin had no specific aversions, hyper or hyposensitive.

Carol made a book for Catrin about a magic mirror. The reference stimulus was a stuffed-toy butterfly, symbolizing the “magical world” behind the mirror. The story started with Catrin looking in the mirror (stimulus), ending up in a flowery garden (smell of flowers). She sees a cottage and knocks on the door (sound of knocking on the table top). Catrin sees sunlight shining through the cottage windows (small lights), and bright colours and glitter all around her (shimmering bright-coloured fabrics), and... she sees a magic mirror hanging in the cottage. When she looks into it, she ends up back in her own room.

While making up the story, Carol first thought about which stimuli she could use and created the story around them, making a book with six stimuli and twelve sentences. The mirror was chosen because Carol wanted to encourage Catrin to focus; the flowery scents, knocking sound, and shimmering bright-coloured fabrics were selected because Carol wanted to know how Catrin would react to them. Carol expected to learn about the type of stimuli catching Catrin’s attention while reading the MSST book; Carol also supposed that she would learn more about whether Catrin’s preferred sense was visual or auditory.



Learn and apply

Carol expected Catrin to focus on the mirror, and briefly respond to the knocking sound and lights. Carol predicted Catrin would not respond to the shimmering fabrics and had no idea how she would respond to the flowery scent.

*Week 5/session 10 (T2)*

After five weeks, Catrin would focus on the mirror, but not for long. Catrin would briefly smell the flowers, and after a quick look reacted somewhat uneasily to the knocking. She paid little attention to the lights, while the shimmering fabrics were more popular; Catrin focused on them making soft, agitated sounds.

At T2, Carol could answer 15 items (55.6%). Ten were items about Catrin's contextual preferences and abilities; all the motor abilities items were answered, and two (16.7%) about Catrin's sensory preferences and abilities. Between T1 and T2, fourteen items changed: five from contextual preferences and abilities, all the motor category items, and six about sensory abilities and preferences (see Table 6).

From T1 to T2, most items remained known ( $n = 10$ ); six items answered during T1, went unanswered at T2; three items were adjusted (see Figure 3(a)).

The types of changes in items and the three categories differed. All items regarding motor abilities and preferences were adjusted; most of the items in the sensory category remained or changed to unknown ( $n = 10$ ). Most contextual items remained answered (known) ( $n = 6$ ) (see Figure 3(b) and (c)).

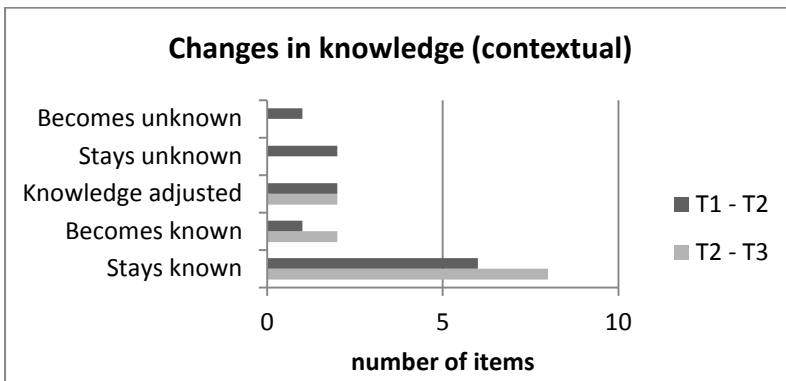
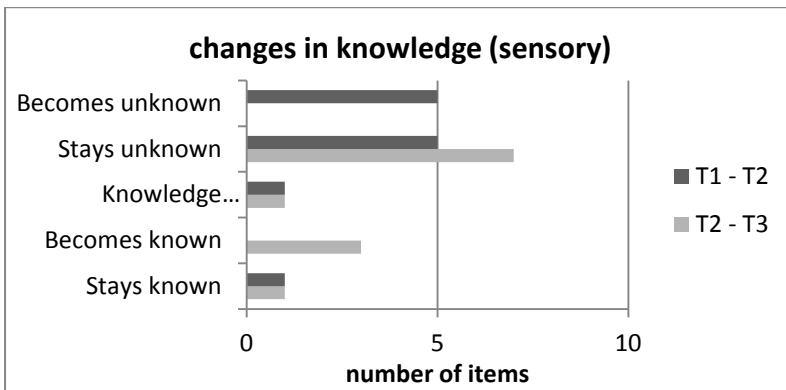
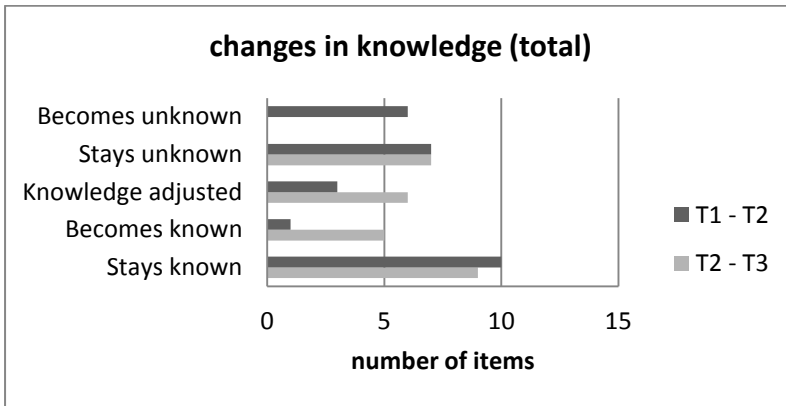


Figure 3 (a) to (c). Changes in knowledge between T1 and T2, T2 and T3, and T1 and T3 for Carol and Catrin

## Learn and apply

The first change concerned Carol's volume; unknown at first, while at T2 Carol said it should be normal. At T2, Catrin could be attentive for under 10 seconds (instead of 10-30 seconds). Regarding the ideal setting, Carol changed her answer on some items; the ideal room size was marked as unknown (instead of big). Catrin should sit at the window (T2) instead of near the wall (T1). The ideal lighting was marked unknown (T2) instead of bright (1). Concerning Catrin's motor abilities, two things were specified at T2: Catrin could only grab, grasp, and hold big objects (instead of small and big objects), and Catrin grasped and held objects with her right hand (T2) instead of with both (T1). Regarding the senses, Catrin preferred glittering colours at T2, instead of visual stimuli in general at T1. In addition, aversions and preferences for tactile stimuli were filled in at T1 but marked as unknown at T2. The items regarding aversion, and olfactory hyper and hyposensitivity were marked as "known but not important" at T1, but marked as unknown at T2.

Carol indicated she now knew that Catrin was easily distracted by environmental noise. Carol also noticed that Catrin really seemed to react to the flowery scent; therefore, olfactory stimuli seemed to interest Catrin. Carol expected no change in reaction to lighting for the next ten reading sessions, but did expect Catrin to respond differently to the other stimuli. Carol thought Catrin could focus a little longer on the mirror and the flowery scent. She believed the uneasy reaction to the knocking sound would dissipate, and that Catrin might engage more actively with the shimmering fabric and the mirror (e.g., holding or grabbing them instead of just looking).

Carol decided to make a change in the text of her MSST book. Initially Carol used very short sentences, which made it awkward to read. To make it more fluent, Carol decided to lengthen some. The number of sentences, however, was not adjusted. Carol gave no specific reason for the fact that there were no further adaptations in the story.

*Week 10/session 20 (T3)*

Catrin's reaction to the mirror and the knocking sound did not change during the last ten storytelling sessions. Catrin did respond more nervously to the lights but paid more attention to the flowery scent and shimmering fabric.

At T3, Carol answered twenty items. These included all items about Catrin's contextual and motor preferences and abilities, along with five (41.7%) in the sensory category. When comparing the IPP-A between T2 and T3, 10 items were filled in differently. These items were mostly ( $n = 5$ ) items involving sensory preferences and abilities; one was in the motor category, and four involved contextual preferences and abilities.

From the T2 to T3, there was no clear pattern in the differences between the items; nine items remained known, seven items unknown, six were adjusted, and five went from unknown to known (see Figure 3(a)). One item was adjusted in the motor category, and two regarding contextual preferences and abilities; the other items remained answered (see Figure 3(c)). Concerning sensory preferences and abilities, there was a bit more change: four items became unknown, four known, two were adjusted, and two remained known (see Figure 3(b)).

## Learn and apply

The ideal pitch was unknown at T2, and was changed to a normal pitch at T3. At T2, Carol indicated that Catrin needed 0-5 seconds to focus her attention; at T3, Carol stated this was 10-30. Information about the lights was at first not available, at T3 it was known it should come from above, not from the side. There was also a change in knowledge regarding motor abilities: Catrin now also hold small objects (T3), not just big ones (T2). Catrin's visual preferences changed from preferring glittering colours to bright ones. Catrin preferred soft noises (previously unknown), and a preference for calm music (T2) changed to one for auditory stimuli in general (T3). Hypersensitivity and preferences for tactile stimuli were unknown at T2; at T3, Carol indicated that Catrin was hypersensitive when you touched her face, and preferred smooth stimuli.

After the twenty reading sessions, Carol indicated that she had learned a few things about Catrin; olfactory stimuli now seemed to be a definite interest, presenting opportunities for new activities. Carol also learned that Catrin needed ample time to react and benefitted from a quiet environment. While reading, Carol also discovered that Catrin reacted uneasily to loud noises.

Looking at these three cases, some final remarks can be made. Most knowledge about the contextual preferences was gained from T1 to T2, while most information about sensory preferences and abilities was collected during the subsequent reading sessions (see Table 7 for a summary of the three cases).

Table 7

*Number of answered items of the IPP-A, and changes in knowledge for all three dyads*

	T1	T2		T3	
	N (%) Answered items	N (%) Items changed T1 to T2	N (%) Answered items	N (%) Items changed T2 to T3	N (%) Answered items
Contextual	31 (86.1)	15 (41.6)	34 (94.4)	8 (22.2)	35 (97.2)
- Storyteller	10 (83.3)	2 (16.7)	11 (91.6)	4 (33.3)	11 (91.6)
- Client	11 (91.6)	5 (41.6)	12 (100.0)	2 (16.7)	12 (100.0)
- Setting	10 (83.3)	8 (66.7)	11 (91.6)	2 (16.7)	12 (100.0)
Motor	9 (100.0)	3 (33.3)	9 (100.0)	4 (44.4)	9 (100.0)
Sensory	18 (50.0)	19 (52.8)	13 (36.1)	27 (75.0)	16 (44.4)
- Visual	3 (50.0)	3 (50.0)	4 (66.7)	3 (50.0)	3 (50.0)
- Auditory	4 (66.7)	1 (16.7)	4 (66.7)	3 (50.0)	5 (83.3)
- Tactile	7 (58.3)	8 (66.7)	1 (8.3)	7 (58.3)	8 (66.7)
- Olfactory	3 (25.0)	7 (58.3)	-	4 (33.3)	-
Total	58 (71.6)	37 (45.7)	56 (69.1)	27 (33.3)	60 (74.1)

IPP = the Inventory for tuning activities and situations to the abilities and Preferences of persons with Profound intellectual and multiple disabilities

T1 = first measurement before storytelling

T2, T3 = second and third measurements during storytelling

For motor abilities, all items were scored as positive at T1, but remained positive at both T2 and T3. All three teachers were able to answer more items about contextual preferences at T3, as compared to T1. In contrast to contextual preferences, no additional items

Learn and apply

concerning sensory abilities and preferences were answered as positive at T3.

## 6.4 Conclusion

The aim of this study was to describe the knowledge teachers have available about the contextual, motor, and sensory abilities and preferences of a child with PIMD, and to specifically focus on changes when applying this knowledge during storytelling with MSST. In all three cases, changes in the teachers' knowledge were observed; most changes in knowledge were seen between the first two measurements. However, teachers seem insufficiently aware of their new knowledge and do not apply it in practice. Changes in knowledge were predominantly related to contextual preferences. There was no increase in the number of positively answered items in the sensory or motor domains. However, in these domains teachers answered multiple items differently. Furthermore, teachers confirmed that they had learned new things about the children but that this new knowledge rarely led to adapting the MSST book.

At T1, the teachers expected to gain new knowledge during storytelling. The expected new knowledge mainly involved new insights into sensory preferences. Brit wondered if she might be underestimating Bob's capabilities in general, she thought Bob's full capabilities might emerge during storytelling. At T2 and T3, all three mainly reported new knowledge about the responses to stimuli used in the book and had thus gathered new knowledge about the sensory preferences. Only Carol stated that she had also gathered new knowledge about Catrin's contextual preferences and abilities.

Finally, the changes made by the teachers in the MSST book were described. No changes were made in the starting instructions of the MSST books. Brit and Amber both decided after five weeks to stop using the white backgrounds. Carol adjusted the text of the MSST book by making the sentences a little longer. All three teachers indicated that they removed the white background in order to make storytelling easier.

## 6.5 Discussion

Despite these positive results, these must nevertheless be treated with caution. When interpreting the results, one should take into account that the three teachers volunteered to participate in this study; therefore, they might be more motivated to learn more about the children's preferences and abilities. Furthermore, because no recordings were made of all storytelling sessions, we could not analyse to what extent the teachers did change the way of storytelling. We do know, however, that gained knowledge was not processed in the MSST text, starting instructions, or in the choice of stimuli. Another concern arises from the continuous switching by Amber and Carol between the answer options, *known, but not important* and *unknown*. This suggests that it is difficult for a teacher to distinguish between these two options. This could be overcome by giving clear and specific instructions regarding this point. Moreover, when choosing the answer, *known, but not important*, teachers can be asked to clarify what is already known and why they believe it is not important. When using the IPP-A in future research, we have to take this into account. Also, the IPP has its focus on the currently available knowledge of teachers; knowledge that they use on a day-to-day basis. This type of knowledge will overlap with information in the personal files, but these



## Learn and apply

files will probably consist of additional knowledge on the client, the knowledge measured in the IPP-A was not compared to the available knowledge in client files. After all if additional information is indeed available, it is not known or used by the teachers in their daily routine. Finally, due to the study design, the results cannot be generalized. However, this design allows for detailed information, and has great clinical value. Nevertheless, quantitative research on a larger scale would be of added value.

Reviewing the knowledge gained, there seems to be a trend applicable to all three dyads. Knowledge which is relevant to the storytelling itself, but also to other settings, mostly involves contextual and motor preferences and abilities. Most new information about the context was gained during the first ten reading sessions. At T3, there is a rather complete picture of the preferred context of activities for all three children. Regarding motor abilities and preferences, knowledge was gained during the full period of storytelling. New facts concern refinements or additions to the initial knowledge. Knowledge about motor abilities might provide these children with more opportunity to relate to their environment (Van der Putten et al., 2011). For example, it is easier to engage with an object when size and presentation are suitable. More knowledge might also aid children's communication; when interest is indicated by reaching, teachers need to be aware whether or not a child has a dominant hand. With respect to motor and contextual abilities/preferences, teachers might use a multi-sensory story in order to increase their knowledge in an enjoyable way. Sensory abilities and preferences seem to be a different story. Although some new knowledge was gained by all three teachers, many items regarding the

senses remained unanswered. Answers at times also changed from *known, but not important* to *unknown*. Although such a change may not have direct implications for practice, the importance of, for example, knowledge about the functioning of tactile and olfactory senses is often ignored (Vlaskamp et al., 2007) or underestimated (Hewett, 2007; Vlaskamp et al., 2007). Therefore, it is questionable whether the answer, *this is not important*, is always justified.

It is surprising that the gained knowledge reported by teachers does not completely correspond to the results of the IPP-A. The teachers emphasize new facts about the sensory abilities and preferences, which is what they expected to learn. However, these changes are not reflected in the IPP-A. It is possible that realization of lack of knowledge about sensory preferences and abilities at T1 resulted in a focus on these senses during subsequent measurements. One thing that was remarkable was that all teachers used one or more stimuli to explore the children's responses. We did not explicitly encourage them to choose these "new" stimuli. Once again, this could be due to gaps in knowledge becoming apparent at the first measurement, which made them realize that they needed to know more about sensory preferences and abilities. In all three dyads, knowledge by the teachers about the children's preferences and abilities regarding touch, but also regarding the olfactory sense, seems to be lacking. This gap in knowledge is a cause for concern; two of the three children have visual as well as auditory impairments. For them, at least, touch and smell are vital senses in, for example, the representation of the meaning of an object. Additionally, tactile problems such as hyper- or hyposensitivity can be related to the prevalence of behavioural problems

## Learn and apply

such as stereotypical movements or self- injurious behaviour (Poppes, Van der Putten, & Vlaskamp, 2010).

This study shows that teachers tend to leave the MSST book unchanged or make adjustments that are not in accordance with their newly gained knowledge. This is a concern because gathering and even more important applying this new knowledge is of great value for the child with PIMD. Participating in personally adjusted activities provides better opportunities to be actively involved in those activities and to learn about their environment (Munde et al., 2009). Besides, new knowledge can also be valuable in the daily living situation of the child. For example information about the ideal size and colour of a drinking cup, and the amount of support a child needs while drinking can be implemented in practice immediately. Because this study shows gathered knowledge is not applied into practise, we recommend the use of an instrument like the IPP-A in the classroom routine as an aid to make knowledge about children's preferences and possibilities more visible and therefore easier to apply. Earlier research showed that persons with PIMD could benefit from reading an MSST book (Ten Brug et al., 2012; Young et al., 2011). This study, with its focus on the teacher, suggests that dyads will profit from reading an MSST book. Despite possible differences in the competence of the teachers, in all three cases similar patterns are found. The three teachers in this study increased their knowledge, or realized what they did not know, which is also of great value.