Fostering the tactile working memory through creative activities: A single case-study of a child with congenital deafblindness

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Master Deafblindness

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Summary

Title: Fostering tactile working memory through creative activities

Problem definition: There is a growing interest in researching the expansive uses of the bodily-tactile modality to enhance bodily-tactile experiences and to develop cognitive functions in individuals with congenital deafblindness (CDB). However, there is a limited number of empirical studies on how diverse educational activities are used to enhance the bodily-tactile modality.

Research question: *How can creative activities be used to develop tactile working memory skills with a child who is congenitally deafblind?*

Method: This study was a quantitative effect study using a single-subject design with a baseline, intervention, and follow-up phase. The Tactile Working Memory Scale (TWMS) was administered during the baseline and follow-up phase with a 10 year old pupil with CDB. The teacher was observed during the baseline, intervention and follow-up phase using video-recordings, and received feedback and coaching on implementing learning strategies enhancing the bodily-tactile modality in a pupil with CDB.

Results: The results showed changes in the pupil's bodily-tactile cognition when the teacher adapted the learning environment while also implementing perceptual- and social cognitive learning strategies into the painting sessions. This study also showed that coaching and guidance to the participating teacher was an important element to achieving the results.

Conclusion: The TWMS captured significant changes in pupil's bodily-tactile cognitive abilities in the post-intervention assessment where the environment was optimized and the teacher was implementing learning strategies in a bodily-tactile manner. Future research is needed to develop more effective and easy-to-follow intervention plans for creative activities in individuals with CDB.

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Foreword

> "…we need a philosophy that sees aesthetics as not just about art, beauty, and taste, but rather as about how human beings experience and make meaning. Aesthetics concerns all of the things that go into meaning form, expression, communication, qualities, emotion, feeling, value, purpose, and more"
>
> -Mark Johnson, 2007 p.212

Introduction

The Nordic definition of deafblindness states that "Deafblindness is a combined vision and hearing impairment of such severity that it is hard for the impaired senses to compensate for each other. Thus, deafblindness is a distinct disability." (Nordic Welfare Centre, 2024, p.5). The definition goes on to explain that the condition can have a severe effect in many aspects of an individual's life, such as social life, communication, access to information, orientation, independence, and being able to navigate the environment in a safe manner (Nordic Welfare Centre, 2024, pp.6-7). It is however important to note that people with deafblindness are a heterogenic group, the severity of sensory impairment, onset of sensory impairment, number and severity of additional disabilities, and cognitive, social and communicative functioning all play a role in how much affect it will have on the person's life. (Dammeyer, 2014; Nordic Welfare Centre, 2024)

The term congenital deafblindness covers a spectrum of combinations of varying degrees of vision and hearing loss. People who are congenitally deafblind are either born deaf and blind or become deaf and blind early in life. There are some disagreements of how early the onset of deafblindness needs to be for it to be considered congenital (Larsen & Damen, 2014). However, most researchers agree that people with congenital deafblindness have acquired dual sensory impairment before the development of language, this is also known as pre-lingual deafblindness. (Dammeyer, 2014)

Some individuals with congenital deafblindness (CDB) can develop symbolic communication and language; however, according to Dammeyer in most cases, communication abilities remain at a pre-symbolic/lingual level (Dammeyer, 2014). Typically developing children develop their communication skills mostly by observing and interacting with those around them, which becomes a challenge for a child with CDB (Damen et al., 2020, pp.14-15) since they cannot rely on sight or hearing to observe their environment.

Children with CDB rely on their tactile sense to develop an understanding of how they can relate to the world and for their communication with others (Nicholas, 2020).

The tactile sense is the most important modality for obtaining information for those with deafblindness (Nordic Welfare Centre, 2024). The information received through touch is, however, limited (Miles, 2008), resulting in fragmented experiences and information (Nicholas et al., 2019a). Nevertheless, this is not to state that the bodily-tactile modality is of any less quality than other modalities. Evidence shows that people with CDB can become very skilled in using tactile modality as a source of information and can learn tactile language (Nicholas et al 2019a). There is even evidence that suggests that individuals with CDB can perform complex cognitive tasks using active touch, such as forming autobiographical memories (Gibson & Nicholas, 2018).

People with CDB use tactile sense in multiple ways, that is, to learn skills, develop language and process information. To understand how tactile sense relates to working memory, a concept called the bodily-tactile modality, needs to be understood. Working memory can be described as a "mental workspace that keeps track and works with information, according to the needs of the moment." (Nicholas, et al., 2019a) Working memory is also vitally important to perform various cognitive abilities such as understanding complex topics, planning, and learning new skills. For learners with CDB, touch becomes an important sense for learning. In fact, the leading intervention approaches in congenital deafblind education focuses on using the bodily-tactile modality in various learning and social situations (Nicholas, et al., 2019a). These factors support the theory that people with CDB develop their working memory mainly through the bodily-tactile modality.

The development of tactile working memory skills is, however, only possible when the environment is available to them. According to Nicholas et al. (2019) the social environment needs to adjust to become more bodily-tactile available so that a person with CDB can use and develop their tactile working memory skills. For intervention purposes, it is important to assess the tactile working memory functions of a person with CDB. The tactile working memory functions of a person with CDB can be better understood by analyzing interactive context, instead of focusing solely on the individual with CDB (Nicholas et al., 2019a).

Tactile Working Memory Scale (TWMS) was developed to better understand the cognitive functions of a person with DB. TWMS itself is an assessment instrument which aims to enable the identification and promotion of working memory in the bodily-tactile

modality of individuals with CDB. TWMS is an itemized rating scale for assessing working memory in the bodily-tactile modality, identified by patterns of observable behaviour in everyday occurrences and during interpersonal interactions (Nicholas et al., 2019a).

Previous research in the Master in Deafblindness Track at the University of Groningen (Somers, 2021) examined whether cognitive strategies performed by a teacher during outdoor activities enhanced the tactile working memory functions of a pupil with CDB. The case study showed that by using the TWMS, Somers was able to capture a positive development in the child's tactile working memory during outdoor activities (Somers, 2021). It has previously been demonstrated that engaging individuals with CDB in stimulating and meaningful learning situations and activities in outdoor education has positive effects on the cognitive and communicative development in individuals with CDB.

Research by Gibson and Nicholas (2018) suggests that outdoor activities contribute to the development of people with CDB due to three factors. Firstly, activities in an outdoor environment are authentic and meaningful, it is a space where memorable experiences are made. Secondly, the activities are experienced through the bodily-tactile modality. Lastly, the activities are interactive because of the shared nature of the activities, meaning there is someone who shares the same experiences. Previous research shows the possibilities of cognitive and social development in the bodily tactile modality when the correct intervention strategies are in place.

Both the TWMS and the three different aspects of outdoor activities that benefit cognitive development with people with CDB (Gibson & Nicholas, 2018), provide intervention strategies that can be used to make the environment more bodily-tactile accessible and as a tool for the individual with CDB to develop their tactile working memory. Although these case studies focused on outdoor activities, the proposed theories and interventions could arguably be recreated in various other educational settings.

Research on how bodily-tactile modality could be used to develop the cognitive functions in individuals with CDB is an exciting development in the field of deafblindness. However, during my research, I have found a limited number of empirical studies that focused on using various educational activities to enhance the tactile working memory in pupils with CDB. Furthermore, to my knowledge, no research has been conducted on the effectiveness of using creative activities to enhance tactile working memory in pupils with CDB.

The focus of this study is therefore to see how a creative activity can be used to develop the tactile working memory in a pupil with CDB. This study also aims to measure the effectiveness of the TWMS when analyzing creative activities with a pupil that is congenitally deafblind. The definition of a creative activity includes many different types of creative expressions. However, in this study a creative activity will refer to projects that involve making things with one's hands. Simple creative projects are a common activity done in both mainstream and specialized schools around the world. In Norway, where this study takes place in, art classes are included in the core curriculum, which applies to all primary and secondary schools and training in the country (Utdanningsdirektoratet, u.d). The core curriculum states that creative learning processes are a necessary part of children's development, and that educators must stimulate the curiosity and creative power of their pupils, and that pupils must be allowed to use their creative energy throughout their entire schooling (Utdanningsdirektoratet, u.d).

However, mainstream methods and expectations in art classes are not easily imitated when teaching pupils with CDB. The Diamanten school in Norway specializes in teaching pupils with CDB and has been creating a local curriculum that is more fitting for pupils with CDB. In this local curriculum, a section regarding creative arts lessons can be found. The local curriculum states that it is important for pupils with deafblindness to have varied experiences using their hands, and that arts and crafts activities can give pupils the experience of creating something, to participate in a "building process", and a sense of accomplishment (Diamanten Skole, 2022).

The idea that art is an important subject in both mainstream and specialized schooling can be supported by the idea that art and aesthetics are a naturalistic part of the human experience. Dissanayake (2000) defines four parameters of 'Naturalistic Aesthetics'. In this context, the term naturalistic means that the parameters are culture-independent and human universal (Reid, 2019). Reid (2019) adds to this by stating that individuals with CDB, following Dissanayake's perception, have the same fundamental drives, instincts, and developmental parameters as everyone else. Furthermore, he stated that research on communication and communicative development has already shown that individuals with CDB share the same baseline fundamentals as other individuals. This notion suggests the same could be applied to naturalistic aesthetics.

I, the author, follow the belief that artistic activities should be fun, engaging and accessible for everyone. This, in combination with my personal love for creating art and having a background in art school, is the reason why I have been highly motivated to research how artistic subjects are taught to pupils with CDB, and more importantly, how these subjects could be made more accessible and fun for the pupils. Due to these factors, the research question for this thesis is: '*How can creative activities be used to develop tactile working memory skills with a child who is congenitally deafblind?'* The goal of this research was to create an opportunity for a pupil with CDB to better engage in creative activities where he can simultaneously express himself, develop his tactile working memory skills and have positive experiences with his teacher. In other words, the project aimed to turn art lessons into a more engaging and fun creative outlet and as a learning tool.

Method

Design

The project included an effect study using a single-subject design in a dynamic assessment format and combined quantitative and qualitative methods. Single-subject based research is a common approach in the field of deafblindness, it is recognized that single-subject-design methodology is a valid approach to evidence gathering and analyzing for practice (Parker et al., 2007). Individuals with CDB form a small and very heterogeneous target group, which means that evidence-based research with randomized group designs to establish lines of evidence will become challenging and may not give accurate results (Parker et al., 2007). This supports that one can implement evidence-based practices based on the results of single-subject research.

Lebeer (2013 p.12) defines dynamic assessment as "an interactive approach to conducting assessments within the domains of psychology, speech/language, or education that focuses on the ability of the learner to respond to intervention". The principle is based on the socio-constructive theory of intelligence and the concept of "zone of proximal development" developed by Lev Vygotsky. This concept designates developmental functions that are not yet completely autonomous but can be achieved with some help. In Vygotsky's socio-constructive theory of intelligence, higher-order cognitive development is "constructed" by the child interacting with his social and cultural environment and with the help of others. (Lebeer et al., 2013 p.12) In other words, the child could show heightened cognitive potential

when the physical and social environment is adjusted in a way that makes learning more accessible to them.

The dynamic assessment format in this research was conducted in three phases: Baseline assessment, intervention, and re-assessment/post-intervention phase. By using this approach, standard test measures could be applied in the baseline and in the post-intervention phases. Additionally, specific instructions and coaching were given during the intervention phase of this research.

The tactile working memory of the participant with CDB was measured with the TWMS during the baseline and post-intervention phases. The teacher was observed during the baseline, intervention and post-intervention phases by means of real-time observations and video-recordings. The teacher also received coaching and feedback throughout the different phases of the research. This research falls in line with the dynamic assessment approach by combining both observations and measurements.

Participants

The participants in this study were Mark (pseudonym), a 10-year-old boy with CDB, one of his teachers, and an internal expert group in the TWMS. The ethics committee of the Pedagogical and Educational Sciences at the University of Groningen accepted the study as a student project. The selection of the participant was based on the following criteria: a) visual and hearing disability according to the International Classification of Functioning, Disability and Health criteria (World Medical Organization, 2001) from birth or acquired within the first year, b) spontaneous use of bodily-tactile modality to obtain information, c) pre-existing interest in creative art sessions. Both Mark's parents and the teacher received an informational brochure on the research (Appendix A), then signed and delivered a consent form to the researcher before the research began (Appendix B).

Mark is diagnosed with Wolf-Hirschhorn syndrome (WHS) and has been identified with congenital deafblindness by the National Multidisciplinary Team for the Diagnosis and Identification of Deafblindness (NTT) in 2023. The main features of WHS include delayed growth and development, intellectual disability that ranges from mild to severe, seizures, and motor skills such as sitting, standing, and walking being significantly delayed. (MedlinePlus, 2023). Individuals with WHS generally have excellent social skills but usually struggle with language and communication (Cleveland Clinic, 2022). Mark has had a cochlear implant in

his right ear since 2015 and uses a hearing aid in his left ear. He has moderate to severe visual impairment, exotropia, low contrast sensitivity, and visual perceptual motor deficit. Mark always wears glasses with filtered prescription lenses. He attends a specialized school for children with congenital deafblindness and is currently in 4th grade. He is dependent on communication partners using both tactile and verbal communication. Mark is very sociable and shows great interest in his family, teachers, and other pupils at the school. Mark also has a great interest in creative activities. His individual education plan (IEP) includes specific learning goals centered around creative activities. Mark was invited to participate in this research due to meeting the criteria mentioned above. This research focused on a highly motivating and useful activity that could be used as a communication topic between him and his teachers.

The teacher in this study is a 25-year-old woman who has worked at the school since August 2024. She is relatively new to Mark’s team. This teacher was invited to participate in this research in an email that included an informational brochure on the research and what participation in the research would entail. The teacher gave a positive response to the email and signed a consent form before the start of this research. This teacher has prior experience in working with individuals with deafblindness but is relatively new to working as an educator for pupils with CDB. She has a bachelor's degree in special pedagogy, a master's degree in special pedagogy with specialization in audio pedagogy and 5 years' part-time experience in a bilingual workplace (Norwegian sign language and Norwegian) where she worked with individuals with deafblindness. She has in addition taken a one-year study in Norwegian sign language. This, combined with her general enthusiasm and knowledge about art and creative activities, made her a solid candidate for this research.

An internal expert group in TWMS was also asked to participate in this research. The expert group consists of four members, which I, the author, am a member of. The other three members have completed a TWMS counseling course and have received certifications in TWMS counseling. The members were asked in a meeting if they had interest in lending support to this research. Their role during this research was to review and assess the TWMS that I conducted. The expert group also helped in creating the intervention plan and gave expert advice on how I could coach the teacher. Lastly, the expert group supported and gave me expert opinions in the final analysis of the post-intervention results.

Setting

This study was conducted at a school for children with deafblindness owned by a Norwegian state-run organization that provides services for pupils who have rights to special education. Mark and his teacher were filmed during creative art lessons at school over the span of 6 months. The sessions were filmed in the school's art room instead of Mark's classroom. This was done to create a unique space for Mark to be creative in, which follows the statement on aesthetic- intention and context. It is argued that aesthetic- intention and context are important factors for an optimal aesthetic experience. This means that both the artistic expression and the context in which it is experienced must be "made special" (Larsen et al., 2011, p.11). The context for where artistic expression was experienced in this study was the school's art room to elicit a 'special' environment and context.

The sessions focused on creative activities that were fun and motivating for Mark. It has been suggested that playfulness can be encouraged by finding spaces and places that enhance creativity (Reid & Smith, 2020, p.31). Reid (2019) states that entering an 'aesthetic space' is to engage creatively with the senses and the process of meaning making. Within this framework, playfulness and safety are paramount, and the focus is on sharing the world together declaratively, rather than viewing the other in terms of a functional, imperative agent of practical needs (Reid, 2019, p.40). 'Aesthetic space' can be used to describe "an intersubjective space, between two or more brains", "A space explored through the senses, and as a space of imagination and creativity. (Reid & Smith, 2020, pp.26-27)

The materials chosen for the painting sessions were selected based on which items could be tactilely interesting to Mark. Encouraging children with deafblindness to explore objects during play, especially objects that are just out of reach, is a crucial way to get Mark interested in and engaged with the activity (Reid & Smith, 2020, p.31). With this approach, the materials used in the painting session had to be tactilely recognizable for Mark to show interest in exploring and using them.

The aim of this setting was to create conditions where Mark could use his tactile modality freely and actively, while also creating a 'special' environment that would encourage a playful and creative space for Mark and his teacher. By having a structured setting also created an optimal opportunity for me to observe and assess Mark's tactile cognition.

In order to obtain reliable data and to be able to compare the collected data with each other, it is important that the measurement moments and settings are as similar as possible (Robson, 2016). Therefore, to obtain reliable data, the creative art sessions were restricted to a singular type of activity. Mark and his teacher participated in a tactile painting activity during the baseline, intervention and follow-up phase with various materials, some of which were familiar to Mark, and some that were new. In total four recorded sessions were conducted. For a complete overview of the activities, see Table 1.

Table 1

Overview of the painting activities in Baseline, Intervention, and Post-intervention phase

Video Recording	**Materials used**	**Intervention/changes**
Baseline 1	Crayons and watercolors. Painting using hands	Getting used to the set up. Establishing steps and procedures to be followed in baseline 2
Baseline 2	Crayons and watercolors. Painting using hands	Repeating the previous session. Same steps and procedures were followed
Baseline 3	Watercolors (painted with hands). Putty paint (painted with a sponge)	Taping down the paper. Changing materials. Introducing new tools
Intervention		See Appendix C
Post intervention	Watercolor and tactile paint. Painting using both hands and a paintbrush. Tilted worktable	Perceptual learning strategies, social cognitive learning strategies. Optimized environment: tilted table, structured placement of items

Intervention

The intervention was carried out collaboratively by me, the TWMS expert group, and the teacher. In total, the teacher participated in five meetings throughout the research (Appendix D). I, the author, have a certification in video analysis and giving feedback, and have received training in applying the TWMS and creating interventions since becoming a member of this expert group.

There were two coaching sessions in the baseline phase where I gave direct feedback about the activity itself, communication with Mark, and how the teacher could implement the findings from the video-feedback sessions into practice. During the coaching sessions, the teacher was also encouraged to reflect on their work and to evaluate the findings. More information on what was discussed during the coaching sessions and the meetings can be found in Appendix D.

The implementation consisted of meetings and debriefings with the teacher, coaching the teacher and giving video feedback. Training was given at the start of the intervention in a meeting. I presented the results from the baseline, then presented the intervention manual (Appendix C) and addressed the definitions and gave examples on two of the groups of learning strategies.

Instruments, coding and variables

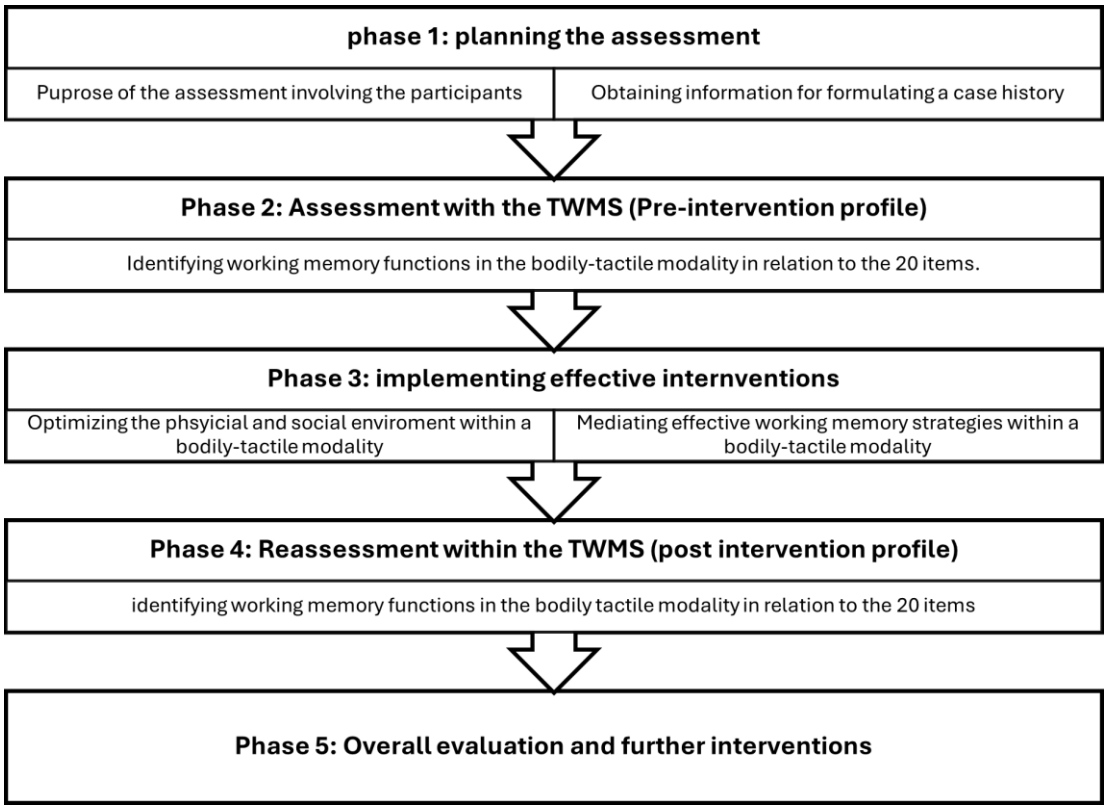
TWMS

TWMS is a rating scale that contains 20 items within three theoretically derived domains that measure the different processes of tactile working memory: Encode, Maintain, and Manipulate bodily-tactile information during everyday occurrences (activities/tasks) and during interpersonal interactions. The first domain is Encode, corresponding to the ability to detect and initially interpret bodily-tactile information (e.g., uses active touch and motion to direct focus of attention towards an object of interest). The second domain is Maintain corresponding to the ability to temporarily retain bodily-tactile information (e.g., uses active touch and motion in a purposeful manner to recognize objects in the vicinity). The third domain is Manipulate, corresponding to the ability to actively control attention (e.g., maintains bodily-tactile information in the present and holds on to the information long enough to use it). The items could be scored as either present, emerging, absent, or not applicable (Nicholas et al., 2019a). For a full overview of the 20 items in the TWMS, see appendix E.

Table 2 outlines the framework for how the TWMS assessment procedure is conducted. The model describes five distinct phases: Planning, assessment, intervention, reassessment, and overall evaluation. This case study followed the five phases of the framework model. The overall evaluation of the TWMS was done with the dynamic assessment approach, by comparing the pre-intervention profile (referred to as the baseline profile in this study) and the post-intervention profile (Nicholas et al., 2019a, P.110).

Table 2

Framework of the TWMS assessment procedure



Phase 1 of the assessment procedure was done by involving Mark and his teacher in a painting activity that I observed and analyzed. After the observation, video recordings were analyzed according to the items of the TWMS to create the baseline profile (phase 2). The TWMS baseline profile was created by me, with feedback and recommendations from the TWMS expert group. The baseline profile of the TWMS (see Figure 1) was presented to the teacher in a meeting. During this meeting, two major intervention strategies were discussed: (1) how the social and physical environment should be optimized for the bodily-tactile modality, and (2) how to mediate effective learning strategies in the bodily-tactile modality. This meeting was the starting point for phase 3.

Phase 4 was done 2 months after the intervention phase began. I created a post-intervention profile by analyzing the video recordings of the follow-up session. The expert group had a meeting where we discussed the findings and the results of the TWMS by comparing the baseline profile with the post-intervention profile.

Lastly, the findings from the post-intervention profile were compared to Mark's baseline profile. These findings were used to evaluate the effectiveness of the intervention and to evaluate the results from this study.

Video-analysis

The use of video recordings as a tool in analyzing is a common practice in human interaction studies. Videoclips enable the study of social interaction in a detailed matter (Hansen, 1991). This method also opens the possibility to share and analyze the video with other individuals in the pupil's network. Video recordings allow for an interaction partner to become aware of actions and expressions from the person with CDB that might otherwise have been overlooked in the moment.

The use of video recordings involves several ethical considerations such as consent, storing of data, distribution, anonymization and sensitivity in how the person who is being recorded is presented. In the school where this research was conducted, video recordings of interactions between pupils and teachers are routinely used in various contexts, such as team meetings, network meetings, documenting learning progress, and in teaching assessments.

Video-analysis enabled a more detailed discovery of Mark's communicative expressions and tactile working memory, which was important when making TWMS assessments and in creating an effective intervention plan. Video analysis was used to capture the subtle cues of Mark's tactile working memory that might have passed unnoticed from direct observations, as well as to better observe how the teacher reacted to Mark's tactile cues. The recordings of the video observations allowed for repeated viewing and analysis of the same activity/interaction, this method was helpful in assessing and describing the tactile cues that were relevant to the TWMS items.

A total of four video recordings were made. The lengths of the sessions varied slightly, with each recording lasting between 35-55 minutes. Each recording started at the beginning of the activity and ended when the activity ended (see Table 1 for an overview of the activities).

I was present during the painting sessions to make direct observations. I then rewatched and analyzed the recording of each session. The recordings enabled me to create TWMS profiles and further analyze both the teacher's learning strategies and communicative approaches, as well as analyzing actions and cues from Mark which could be indicators of his cognitive abilities. This approach gave insight into which methods could be used in future sessions, and on which areas the coaching sessions would focus on.

Supervision and coaching

To implement interventions and evaluate the results of this research, a dynamic assessment approach was implemented in the form of coaching and feedback to the teacher. Dynamic assessment approach suggests that a person with CDB could show greater performance levels in an activity when an interaction partner who can support them facilitates social interactions and mediates individualized working memory strategies during activities. (Nicholas et al., 2019a, p.48). Therefore, coaching the teacher on how art sessions could be taught in a more bodily-tactile way became a valuable part in this research.

The teacher and I worked closely together during this research, where I acted as a coach for the teacher. I made direct observations, recorded and then analyzed the painting sessions. The observation notes and video recordings were used as tools for me to coach the teacher. The coaching sessions aimed to give the teacher a better insight into how Mark was using his bodily-tactile modality, how he interacted with the teacher and the painting process, and how the teacher interacted with and responded to Mark. By rewatching the videos together, it became easier for the teacher to understand the feedback and guidance given in the coaching sessions. For a complete overview of the timeline on how coaching and meetings were linked with the painting sessions, see Appendix D (The appendix also details the tasks and discussion points of each participant).

In total, the teacher received three coaching sessions in the baseline and intervention phases. In addition to the coaching sessions, we held three separate meetings: an initial introduction meeting, an intervention meeting, and a post-intervention meeting. After the post-intervention meeting, I was asked to present the findings to Mark's teaching team and to other staff at the school. The teacher attended the presentation as a supportive presenter, where she shared what she had learned from this project: Both what she had learned about Mark, and which skills and insights she had gained from this study.

Data-analysis

TWMS

The data collected from the TWMS was analyzed by comparing the pre-intervention profile with the post-intervention profile of the TWMS. After completion of the pre-intervention profile in the baseline phase, I and the other TWMS expert group members discussed which items should be focused on, and which methods could be used to see if Mark has an enhanced bodily-tactile working memory after the intervention period. Examining the results from the baseline profile with the post-intervention profile would show whether the intended change had been achieved by the intervention strategies.

Each item was scored by using a numerical rating system, on a scale of 1-4. 1 being 'not applicable', 2 being 'Absent', 3 as 'Emerging', and 4 meaning 'Present'. For a full overview of the item names, number and descriptions, see Appendix E.

The baseline profile

The baseline profile for Mark was created from data I had collected from three painting sessions. The data consisted of notes written during my direct observations and recordings of each session. These observation methods were used to capture Mark's behaviours that were relevant to his tactile working memory. Mark's engagement with the painting process and interactions with the teacher in the bodily-tactile modality were assessed by using the TWMS assessment form (Nicholas, 2019b). The video recordings enabled me to do multiple viewings of the sessions, which allowed me to conduct a detailed analysis of Mark's bodily-tactile behavioural cues that were relevant to the TWMS. These recordings were also used when presenting my findings to the TWMS expert group.

After filling out the TWMS scoring sheet for each session, the responses for each item on the TWMS were then plotted into a graph to create a visual portrayal of Mark's tactile working memory. Figure 1 shows the results of three painting sessions; those results were then used to create a singular baseline scale that took the highest scores from all the sessions combined (Figure 2).

Figure 1

Compiled data of the three baseline sessions

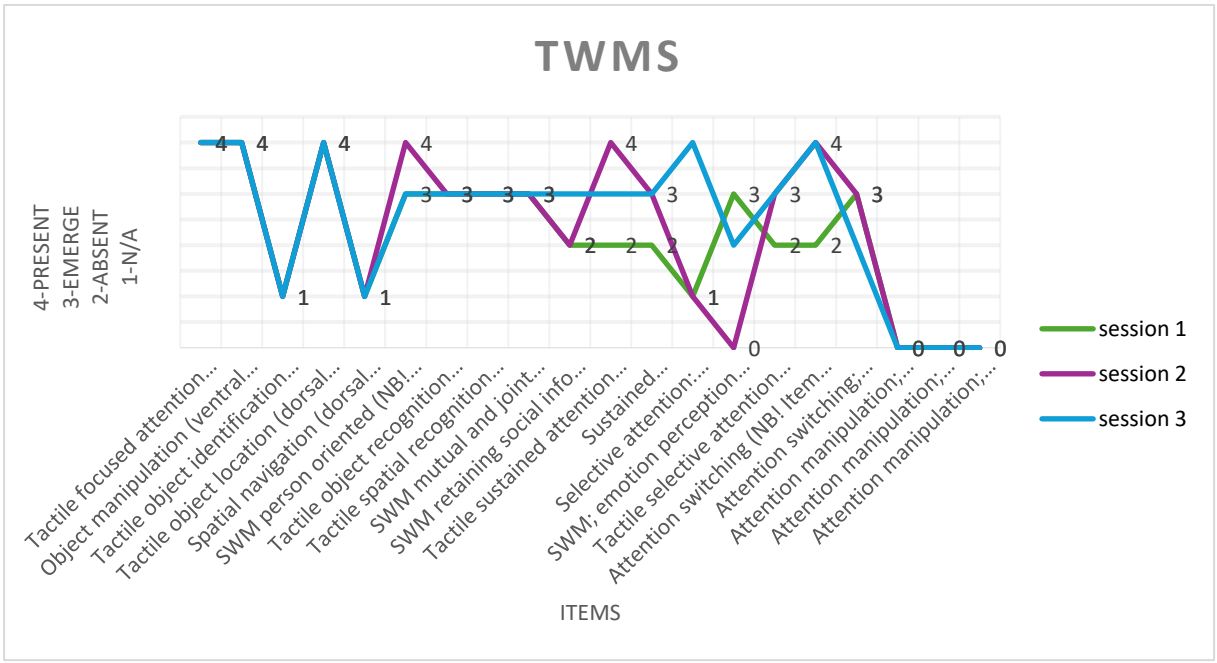
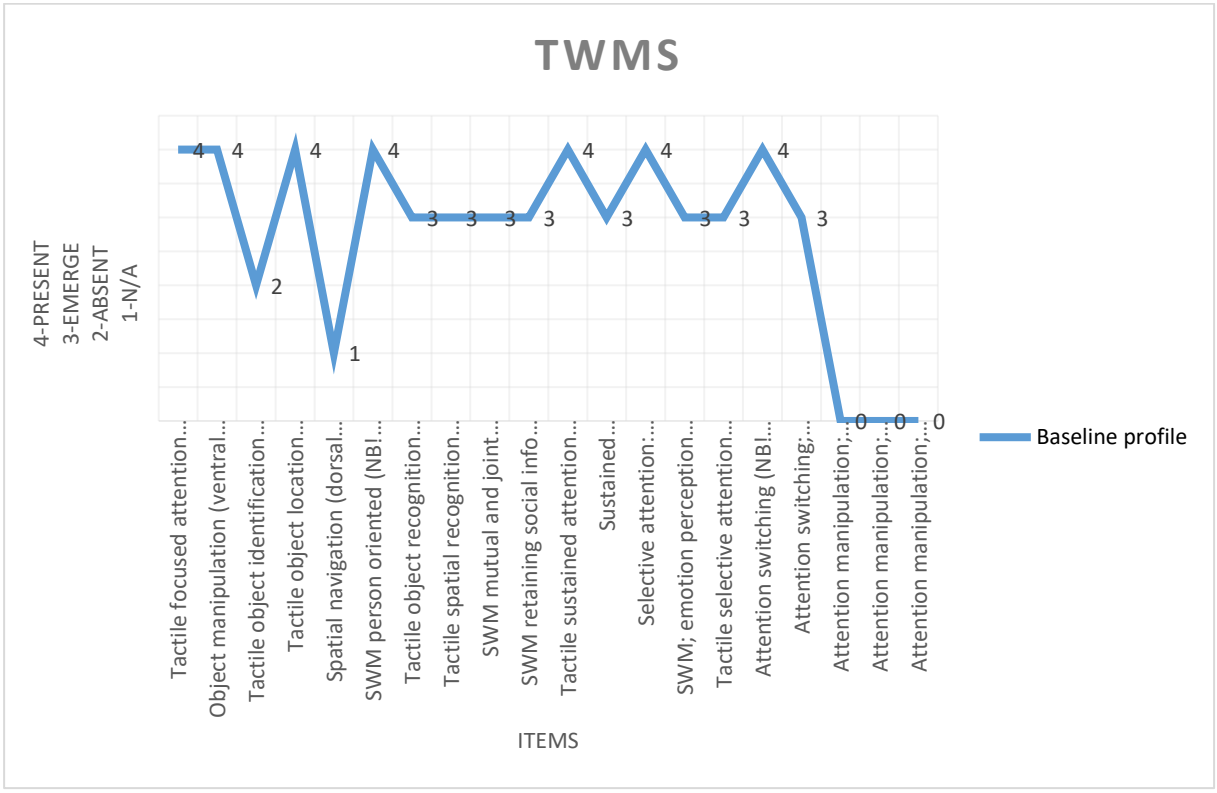


Figure 2

Complete TWMS baseline profile of Mark



The baseline profile illustrated that Mark's scores varied from item to item, but that he had several bodily-tactile behavioural cues that were clearly observable from the TWMS baseline assessment.

In the ENCODE domain, 4 of 6 items were rated with a "present" score, this showed that Mark was clearly displaying behaviours of Tactile focused attention, object manipulation, tactile object location and person oriented social working memory (Items 1, 2, 5 and 8). However, tactile object identification (item 3) was scored as "Absent", and spatial navigation (Item 6) was given the score "not applicable".

In the MAINTAIN domain, 2 of 7 items were scored as "present, and 5 of 7 items were marked as "emerging". Mark was clearly showing behaviours of Tactile sustained attention (item 12) and selective attention when an unfamiliar feature is introduced to the activity (Item 16). He was otherwise assessed to partly display behaviours related to the social working memory items 10 and 11, as well as partly displaying tactile object recognition, tactile spatial recognition and having a partly sustained attention on the interaction (items 4,7 and 15)

Lastly, in the MANIPULATION domain, 1 of 7 items was given the score "present" and 3 of 7 items were given the score "emerging". This indicated that Mark showed partial behavioural cues related to emotional perception, tactile selective attention, and being able to switch his attention from one topic to another (items 9,13 and 17). It is important to note that items related to attention manipulation (items 18,19 and 20) were not assessed or observed during this research and could therefore not be scored.

The overall evaluation of Mark's baseline profile showed that Mark was able to adequately display behavioural cues in the bodily-tactile modality in some of the TWMS items. However, this profile also showed areas that would need specific attention, namely his tactile object manipulation (item 3).

The intervention phase

The TWMS baseline profile of Mark (Figure 2) was used to create an intervention plan that focused on enhancing specific bodily-tactile behaviours. The baseline profile, combined with my observations, showed some key areas that needed to be prioritized. The intervention focused on items that were scored as "absent" or "emerging". The intervention took into consideration that the cause of items being scored as "absent" or "emerging" could have been

due to the physical and/or social environment not being adequately optimized for Mark. Therefore, the aim of the intervention was to see if optimizing the physical and social environment, while also implementing effective bodily-tactile learning strategies would increase Mark's tactile working memory potential. This approach follows in line with the dynamic assessment approach, which focuses on both the individual and their social- and physical environment.

Video recordings showed moments of Mark's physical environment not being adequately optimized. I observed that the teacher moved items around the table during the activity, making it difficult for Mark to relocate those objects. I further noted that Mark occasionally showed attempts to relocate objects by placing his hand on the table to feel around the area where the object used to be located.

In addition, based on the results from Mark's TWMS baseline profile, the intervention focused on implementing learning strategies that were aimed at enhancing specific items in the TWMS to assess if Mark was able to showcase those skills when the environment and learning strategies were optimized. The intervention implemented learning strategies that were aimed at items related to object specific skills, social working memory items, and attention-based items (Nicholas, 2022). For a full overview of the items and descriptions, see Appendix E.

After evaluating the findings from the baseline phase and creating an intervention plan that was customized to fit into the painting activity, I invited the teacher to participate in an informational meeting. The teacher received feedback from the baseline sessions and was encouraged to give her own feedback on the painting sessions as well as the study itself. The baseline profile was presented and discussed, during which I showed video clips of Mark demonstrating specific bodily-tactile skills that were of particular interest. The recordings were also used to show the teacher how specific items in the TWMS presented themselves in Mark. This allowed the teacher to get a better understanding of what items on the scale meant. The teacher noted that Mark uses his vision more actively than she had previously believed, and that although Mark was not always engaged in a bodily-tactile manner, he was still focused on the activity and their interaction.

The teacher received an intervention plan that included both learning strategies and suggestions on optimizing the social- and physical environment in the bodily-tactile modality during the meeting (Appendix C) and received coaching on implementing perceptual and

social cognitive learning strategies in a bodily-tactile manner (Nicholas, 2022). The teacher was instructed to encourage Mark to systematically use his tactile modality to explore and to create unique tactile experiences for Mark during the painting activity by using materials that would be easy for Mark to identify and use, such as by using sponges, textured paints, glue, and other unique tactile materials to paint and explore with.

Regarding Mark's tactile attentional abilities, the intervention focused on improving his tactile selective attention and attentional switching by implementing learning strategies that were aimed at enhancing those cognitive skills. Mark was on occasion observed to direct his attention to his teacher during the activity. He let his teacher guide his hands to manipulate the paints and would sometimes put his own hand on top of his teacher to show mutual attention to the activity. I, together with the expert group noted an instance where Mark possibly mimicked the "side to side" drawing motion that he and his teacher had been doing. From these instances, we hypothesized that Mark could have been processing the interaction he had with his teacher and was showing attempts at mutual exploration and attention.

However, due to the sporadic nature of these instances in the baseline recordings, paired with the fact that the teacher was the one to initiate each step in the painting process, the teacher was further coached in implementing learning strategies that would give Mark more opportunities to initiate and to be given more time to process information during the activity.

The post intervention profile

Approximately 2 months after the informational meeting with the teacher in the intervention phase, Mark was re-assessed with the TWMS. The scores of the TWMS were plotted to a graph to create Mark's post-intervention profile (Figure 3). After completion of the post-intervention profile, I discussed with the TWMS expert group if Mark showed enhanced bodily-tactile working memory capacity after the intervention period.

The analysis examined whether the intended changes had been achieved. For analyzing the extent to which changes had occurred in Mark's tactile working memory since the intervention, the data from the baseline and post-intervention were put into a singular graph and the data patterns from the baseline and post-intervention were compared using visual inspection (Figure 4).

Figure 3

Post-intervention TWMS profile of Mark

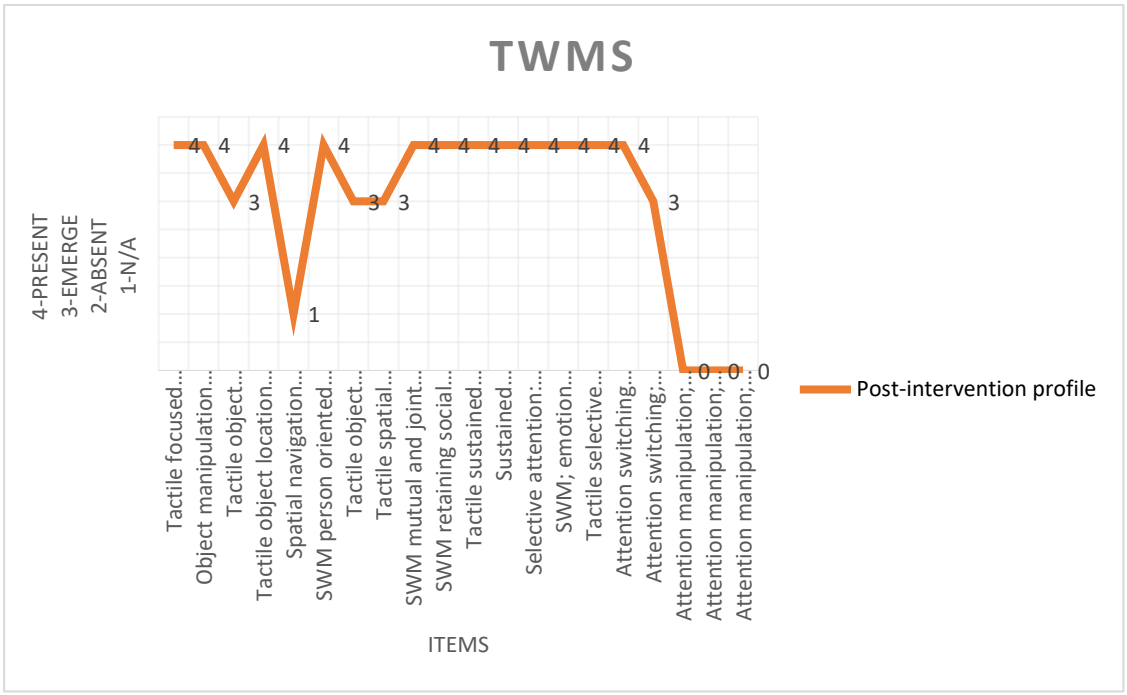
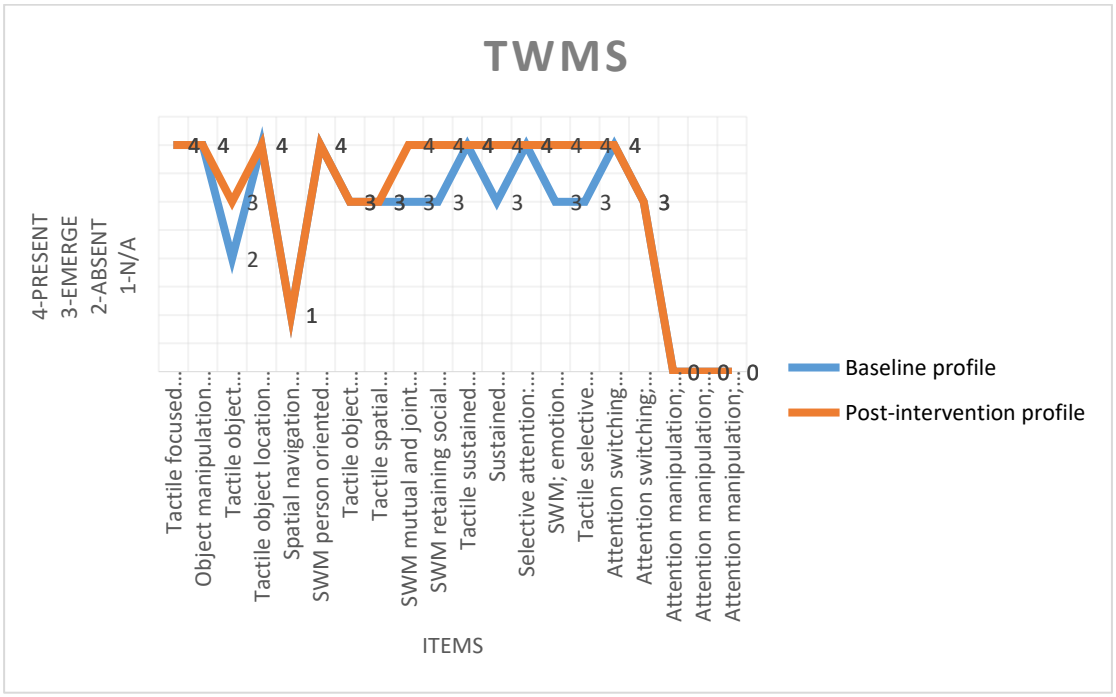


Figure 4

Baseline and post intervention TWMS profile of Mark



Comparing the baseline profile with the post-intervention profile showed some significant changes. The TWMS items scores showed clear observable behavioural cues on almost all of the items in the post-intervention profile, apart from 4 items that were scored as "emerging" (Items 3, 4, 7 and 17), all other items (with the exception of items 18, 19 and 20 as they were not assessed during this study) were given the score "present". When comparing the baseline profile with the post-intervention profile (Figure 4) we can see a significant change. These results suggest that the intervention plan had a positive impact on Mark's tactile working memory, and his ability to engage in a painting activity and to interact with his teacher in the bodily-tactile modality had significantly increased.

Results

For this chapter the results of the collaborative research and coaching will be discussed, as well as the results of creating an effective intervention plan that takes into account the nature and purpose of the activity it is created for. The second part of this chapter will further detail the results found by using the TWMS as an assessment procedure, the results presented in the previous chapter will be further explored in this chapter.

General results and effects of Coaching

According to Nicholas et. Al (2019a) The interaction partner plays an important role in adapting the learning environment, providing possibilities for shared exploration and supporting tactile perceptual strategies, such as providing time, opportunity and supporting active exploration procedures to systematically explore (Nicholas et al, 2019a, p. 67). This perspective follows the dynamic assessment approach, where the environment plays a big role in the child's learning potential and development. In this instance, the teacher played an important role in creating an environment that allowed Mark to display and develop his tactile working memory. Combining the results from the coaching given to the teacher with the results of the TWMS assisted in making a clear conclusion to this study.

The coaching sessions focused on enhancing the skills of the teacher and on which adjustments the teacher could implement into her own practice. Through feedback and coaching given after each session, the teacher became more aware of the strategies she was implementing and how Mark responded to those strategies. It became clear that the teacher benefited from the coaching sessions that were given in the baseline phase of the research and

was becoming more attuned to Mark's cues and interaction attempts by the end of the baseline phase. The teacher expressed in a post-intervention meeting that the coaching sessions paired with our informational meeting in the intervention phase gave her a better understanding of Mark's communication methods, his tactile modality, and his potential. (For a full report on the meeting, see Appendix F.)

The results of the intervention were assessed in a post-intervention observation of the painting session. This observation showed that the teacher had followed the feedback and instructions she had received in the intervention meeting. During this reassessment, I was able to observe that Mark had been given more time to explore the items and tools that were being used during the art sessions. Additionally, the teacher was actively engaged during mutual exploration and would enthusiastically communicate with Mark about what they were exploring or doing. Combining mutual exploration with fun and playful commentary from the teacher repeatedly elicited a positive response from Mark. Which in turn showed improvements in his engagement and focus on the activity.

The teacher also implemented changes in the environment that would optimize the space for tactile engagement in the post-intervention session. During the meeting with the teacher after the baseline session, a point about making the paper and materials more accessible to Mark was discussed. The teacher noted that due to Mark's limited mobility, he was having difficulties with painting on a horizontal surface. After receiving this feedback, I created a tilted worktable that was used in the intervention and post-intervention phases. This adjustment was made as a result of the coaching session. The teacher observed that Mark was not able to paint on the upper areas of the paper when the paper was taped down (Appendix D). However, when using the tilted worktable in the post-intervention session, I observed that Mark was not only able to paint on the entire area of the paper, but he also showed more interest in exploring and painting on the paper. This adjustment to his physical environment allowed him to use his bodily-tactile modality more effectively

I also observed that the teacher applied learning strategies on spatial cognition, where the teacher and Mark would locate, pick up and put down the objects together. This allowed Mark to better familiarize himself with the location of objects and could better relocate them by using his tactile modality. This appeared to have a great effect on Mark, I observed that Mark would relocate specific objects on his own during the post-intervention session.

After analyzing the post-intervention session with Mark, I had a final meeting with the teacher and Mark's mother (Appendix F). During the first half of the meeting, the teacher was given overall feedback on the research and the results and was asked to give feedback on the coaching she received, as well as to share her personal experience of this research. The teacher noted that the results of the coaching done in this study allowed her to form ideas in how she could form a better connection with Mark during the study. She stated that not only did the painting sessions become easier to teach after she started implementing the intervention plan, but that being able to establish a positive relationship with Mark became one of the most important factors during her participation.

In the latter half of the meeting, the results of the intervention and the changes in the TWMS were presented. Mark's mother was informed about the intervention strategies that had been implemented. Additionally, I presented an overview of the tactile working memory skills Mark had been developing or mastering as a result of the intervention. Sections of the post-intervention video were shown in the meeting, during which everyone was allowed to comment on the video and ask questions. I received positive feedback on the research from both the teacher and Mark's mother. His mother emphasized that she was very happy to see that the research was based around an activity that Mark has a big interest in. She further noted that she saw that creative activities had the potential to further help him in developing his communication and tactile working memory skills. Mark's mom concluded by expressing her interest in recreating the painting sessions at home with Mark, I gave her some ideas on how she could start doing this type of activity at home and which materials she could use.

Tactile Working Memory Scale (TWMS): general results and effect

The TWMS assessment is based on a transactional approach where the development of tactile working memory is understood as a dynamic process between internal mental processes and physical/social environmental interactions. By optimizing the physical and social environment and by mediating individualized learning strategies within a bodily-tactile modality, Mark was able to enhance his tactile working memory performance. A major outcome of this dynamic assessment is that increased experience and effective use of strategies within the bodily-tactile modality could have helped him to keep track and efficiently process cognitive and social cognitive information, during ongoing tasks/activities and interpersonal interactions (Nicholas et al., 2019a, pp. 116-117). The TWMS assessment

gave a clear indication of how Mark used the bodily-tactile modality to retain information, thereby providing insights into his emerging tactile working memory capabilities.

The post-intervention assessment showed how Mark was able to use his bodily-tactile modality to relocate objects after placing them down, how he used both of his hands in a purposeful manner to explore two objects, how he retained social working memory functions while exploring objects and participating in the painting process with his teacher.

Furthermore, when the teacher implemented perceptual- and social learning strategies in the bodily-tactile manner, Mark was able to sustain his attention on the painting activity for a prolonged time, he showed increase in taking initiatives during the activity (by for example initiating the painting movements on the paper, and to pick out the colors), he was also seen to be more independent in the activity, he would explore and relocate both the materials and the painting on his own. He was now also more engaged with his teacher and was able to switch his focus between the task and the social interactions without becoming distracted from participating in the task.

In this way, the overall suggestion is that the TWMS was able to capture the progression of Mark's tactile working memory skills, in addition to spot key areas in his tactile working memory functions that were either absent or emerging, which allowed for an intervention that would directly address those items. To evaluate if the changes in Mark's TWMS profile showed meaningful improvements in Mark's bodily-tactile cognition, the baseline profile and the post-intervention profile were compared and evaluated. Comparing the profiles showed some significant improvements in Mark's tactile memory functions during the painting activities. It can be noted that item 3 proceeded from "absent" to emerging, and that items 9, 10,11, 13 and 15 went from "emerging" to "present". These results show that Mark improved in six items in his tactile working memory, and it can therefore be concluded that Mark had a meaningful change in his tactile working memory after the intervention period.

The teacher followed the instructions that were given in the intervention manual. Observing the post-intervention session, I observed that the physical and social environment was optimized and that the learning strategies were being implemented. The teacher adapted the environment by engaging actively in shared tactile exploration, Mark was given more time to process information and to respond (in forms of picking colors- he was encouraged to explore and make choices). Additionally, he was encouraged to initiate the painting

sequences. The teacher gave Mark ample time and opportunity to familiarize himself with new objects when they were introduced and used in the art sessions. As well as giving him pause to process and answer. The teacher actively talked about and explored the new items with Mark before using them in the art session.

By having items in a specific area while they were in use and allowing Mark to place the items down on the table with the teacher allowed Mark to show that he recognized where the objects were located. One example was when they were picking out a color to paint with, and Mark placed his hand on the color they had chosen, which they both placed back on the table after they had picked it up to explore it. Mark was observed locating the object repeatedly on his own accord.

Although Mark showed significant improvement in his tactile working memory as a result of this study, it is crucial to note that these results could arguably only be achieved due to the intervention and the teacher being a strong communication partner to Mark. For Mark to maintain the tactile working memory skills that he achieved because of this study, his physical and social environment must continue to be optimized, as well as continuing to implement learning strategies in the bodily-tactile modality. The teacher should continue to support Mark in creative activities and work on transferring the tactile working memory skills he displayed in the painting sessions to other situations or activities.

Conclusion and discussion

Conclusion

This study was a single-case qualitative study that used quantitative measures to create an assessment and to track the tactile cognition in a child with CDB. The participants were a teacher and a pupil duo at a school for pupils with CDB. This research was influenced by the supervision of the TWMS expert group members at the school. This research is an example of a semi-structured assessment in a practice context of the tactile cognitive functioning and development of a pupil with CDB. As a qualitative, interpretative study, the structure of the assessment and the actions of the participating teacher changed and developed as the assessments led to new perspectives on Mark’s bodily-tactile cognitive abilities.

To gain a better understanding of Mark’s cognitive potential, I created a tactile painting project that he and a teacher would participate in. The purpose of using art sessions

in this research was to expand Mark's positive association in creative art sessions and to give him opportunities to explore, create and have fun with learning. This project, in turn employed a general perspective on creative activities being defined as fun, explorative and highly interactive. This perspective, in combination with using a dedicated area where this perspective is applied to aided in creating a unique setting for Mark.

The art room is a place where Mark is encouraged to freely explore with his hands and to be more tactilely engaged than in many other areas. It created a space where he was allowed to freely explore materials, share fun experiences and activities with his teacher, and most importantly, to be allowed to have fun and be messy. Previous research has shown that engaging individuals with CDB in activities that are fun and playful can be an encouraging approach to being more engaged in social interaction and allowing for a more tactile engagement from both partners. (Reid & Smith, 2020)

This case study showed that by using a space and situation that Mark showed interest in, it allowed for greater learning potential. It became easier to implement interventions that focused on developing Mark's tactile working memory in a situation where he felt comfortable and positively stimulated in.

This study aimed to gain insight into the possibilities of improving Mark's tactile working memory by optimizing the physical and social environment while using teacher-mediated cognitive learning strategies within a bodily-tactile modality during creative arts activities. This study aimed to answer the research question:

> *How can creative activities be used with a child that is congenitally deafblind to develop their tactile working memory skills?*

This single-case study aimed to explore the potential of using art lessons to explore and assess the potential of Mark's bodily-tactile working memory. This research showed that Mark was able to use various skills in the bodily-tactile modality during the painting sessions and had significant improvement in his tactile working memory when the environment was optimized and the teacher implemented learning strategies in a bodily-tactile manner.

By applying the TWMS to assess the bodily-tactile skills in Mark, I was able to determine that Mark showed a range of cognitive skills in the bodily-tactile modality in the baseline assessments. The results from the TWMS profile of Mark, alongside the meetings

and the coaching given to the teacher in the baseline phase, gave me a clear insight into how Mark's tactile working memory could develop further.

We saw that the TWMS captured significant changes in Mark's bodily-tactile cognitive abilities in the post-intervention assessment. From reviewing and analyzing the video recordings of the post-intervention session, I observed that the teacher continued to apply learning strategies and had optimized Mark's physical and social environment that had been selected in the intervention. These results established that the intervention had been effective in improving Mark's tactile working memory skills.

This study had some limitations: The first limitation is that the intervention did not include any cognitive learning strategies. The focus on the intervention was optimizing the physical and social environment with simultaneous implementation of perceptual- and social cognitive learning strategies. I concluded that for the teacher to implement all of these aspects successfully, the cognitive learning strategies had to be excluded. The intervention needed to have a clear aim and structure that focused on enhancing tactile working memory skills that were already emerging or had the potential of being more easily assessed. The disadvantage of this exclusion is that it was not possible to determine if the intervention influenced Mark's cognitive, attention manipulation and metacognitive development.

The second limitation was that the long-term effect of the intervention could not be measured. Due to time restrictions, only one post-intervention session was observed and analyzed. Therefore, it is possible that the data collected did not show the complete results of the intervention. However, the post-intervention profile indicated that meaningful change in Mark's cognitive abilities in the bodily-tactile manner had indeed occurred.

Discussion

This study opened discussions related to the effects of implementing the TWMS into practical settings, its limits and possibilities to be apploed as a resource to create effective interventions and in assessing individuals with congenital deafblindness. The TWMS gave insight into skills that were either already emerging or present in Mark, which aided in establishing a direction for the intervention. TWMS had its limitations when making a full evaluation of the effectiveness of the intervention. To show the full picture of how Mark engages and learns in art classes, we must consider how Mark uses other modalities in combination with his tactile modality. The results from the observations suggested that Mark

was sometimes combining visual modality with tactile modality, as well as combining his auditory- and tactile modality. I was unable to determine whether he was combining those three modalities at the same time. However, the observation from the post-intervention showed that when the environment was optimized for his bodily-tactile modality, he was able to combine his other modalities more effectively.

Discussion relating to Mark's epilepsy became an important factor when reviewing and concluding the reliability of his tactile working memory functions. Although this topic is out of scope for this research, it was a topic that I felt was important to mention. It was apparent that during times of high epileptic activity, his performance levels went down, although not completely (Figure 1- session 1). The observations done through video analysis and the results of the TWMS showed that although he was affected by the seizures, Mark still tried to use his tactile modality to participate in the activity, and to seek out his teacher to the best of his abilities. This discovery showed that although Mark has residual hearing and vision, the tactile sense was his strongest and most valuable modality. It became evident that Mark relies on his tactile modality to communicate, access information, and to learn, therefore his educational environment must be optimized for bodily-tactile methods of learning.

Another discussion point of this study is that when implementing interventions to elicit change in the bodily-tactile cognition, the communication partners (in this case, the teacher) must receive adequate information and resources to be able to better support the individual with CDB. When the teacher was asked to evaluate the early stages of this study, she explained that before receiving coaching and guidance, she had moments of uncertainty and felt like she was unsure of how to engage Mark in social interactions and in the activity itself (See Appendix F). Though, after our initial coaching and guidance meeting, she expressed that by watching the sessions together while receiving feedback and coaching, she could more easily reflect on her own work as well as get a better understanding of Mark's communicative methods and attempts. It can be difficult for communication partners/teachers that are unexperienced in teaching pupils with CDB to engage them in an activity that is optimized in a bodily-tactile way. Recording the session and reviewing the footage with someone who knows the person and/or has experience in video analysis can be a positive learning experience for a new communication partner/teacher.

Individuals with CDB are reliant on having skilled communication partners around them for them to access information, learn and communicate about the world around them.

Therefore, teachers working with children with CDB could benefit from coaching and guidance sessions that focus on intervention methods that focus on adapting their teachings to make them more accessible to a person with CDB. In this way, the teacher is given tools that could not only improve the learning environment, but also help the pupil develop their tactile working memory and build a better connection with their physical and social environment.

Lastly, this research aimed to challenge the idea about how creative art lessons at schools can be used with pupils with CDB. In the Introduction chapter, I gave a brief insight into how creative arts classes are generally conducted in schools. However, by looking at art and creative lessons as an area where pupils could more freely explore and experiment with materials and subjects that are of interest to them, then it could be argued that creative arts could be used not only to create products and to refine their creative skills, but also to stimulate their senses and to develop essential cognitive skills.

From personal experience when talking to other teachers, the idea of participating in art classes with pupils that have CDB can be intimidating due to a feeling of not being creatively skilled enough in order to teach their pupils, or that they feel as if the activities are not easily accessible for their pupils. Therefore, by lowering the bar to what constitutes a creative arts activity, teachers could possibly be more willing to participate in creative activities pupils with CDB.

As shown in this single-case study, the effects of the painting sessions proved to be a positive experience for Mark, his teacher and his mother, who became inspired to do similar painting activities with Mark at home. This was not an activity where he was expected only to paint a picture in order to create a finished product, but rather a place for him to engage in a unique and fun activity where he was free to explore, play and have a positive experience with his teacher, which resulted in them strengthening their bond. The teacher went from being uncertain about the activity to being excited for their painting sessions as she realized that they both seemed to share the joy of painting together. This positive outlook from the teacher is mirrored by Mark’s continued enthusiasm for the activity; he not only showed that he now understands the routine and expectations, but that he has developed a positive relationship to the teacher and this activity.

Recommendations

Recommendations can be made for further research on the use of learning strategies by teachers to enhance the tactile working memory of individuals with CDB. Namely, how teachers can use creative art activities together with pupils with CDB as a building block for further tactile learning. In Mark's case, it would be insightful to see if he has started to use the skills he has developed from the painting sessions in other contexts and areas of his life, or to explore ideas and strategies needed for him to transfer those skills into other areas.

The teacher participating in this case study was quite new to both teaching children with CDB and to Mark, meaning she had not built an established relationship with Mark, and was still unfamiliar with some of his communication approaches. Recommendations can be made to repeat this activity with someone who already has a strongly established relationship with Mark to see how he would use his bodily-tactile cognitive skills with that individual. It is recommended to use video recordings of multiple teachers working with a variety of children with CDB to show the relationship between what is observed (behaviour) and which strategy the behaviour belongs to the different learning strategies (Gibson et al., 2020).

Further recommendation is that the teacher continues to work with Mark in this activity from a scaffolding perspective to examine the potential of Mark developing his cognitive and metacognitive abilities in a bodily-tactile manner. As well as further develop the communicative relationship between Mark and the teacher.

Further research could be done on the validity of the observation instrument used to measure Mark's cognitive skills and abilities. It is important to gain insight into how Mark's other modalities manifest themselves in a concrete manner (Nicholas, 2024). Especially since individuals with deafblindness form a very heterogeneous target group, and the ways they can use and develop their multimodality may vary. This study used the TWMS to assess and evaluate the changes in Mark's bodily-tactile cognition; however, due to the limitations of the TWMS, it was not able to evaluate how Mark was using and developing his other senses. This study mentions that Mark was using his other modalities during the painting session, however, the findings were limited due to them being out of scope for this study.

Lastly, the topic of Mark's epilepsy and how it could affect his cognition, his ability to participate in an activity, and his ability to engage in a bodily-tactile manner became a topic that I would be interested in exploring in the future. Further research into how epilepsy can affect individuals with CDB is recommended.

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Appendix

Appendix A. Informational brochure

INFORMATION SHEET

Master thesis: Fostering the tactile working memory through creative activities

Dear,

……..

Thank you for your interest in participating in this research. You are receiving this brochure because your child/family member (of whom you are the legal representative) could be eligible to participate in the Master thesis "**Fostering the tactile working memory through creative activities".** This letter explains what the research entails and how the research will be conducted. Please take time to read the following information carefully. If any information is not clear kindly ask questions using the contact details of the researcher provided at the end of this letter.

WHAT THIS STUDY IS ABOUT?

This research is a case study that aims to gain insight in how a child that is congenitally deafblind can showcase their tactile working memory skills through creative art activities, and how the activity could enable them to improve their use of the bodily-tactile modality in everyday situations. This research aims to analyze the learning strategies that will be implemented by the teacher during art lessons, and to document and analyze the improvements of the tactile modalities in the pupil.

The participants in the study will be one pupil with CDB that attends a school for children with congenital deafblindness and a teacher who works at the same school. The educator is not required to have prior experience with teaching and guiding art lessons to those with CDB.

Your child was nominated as a possible candidate to participate in this study based on their interest in creative activities.

WHAT DOES PARTICIPATION INVOLVE?

Your child will participate in creative activity sessions together with a teacher from the school your child attends. The focus is on using the tactile senses to learn and create a product that is meaningful and enjoyable to your child. The creative project will focus on exploring, learning, and having fun together in art classes. Additionally, the themes and materials that will be used will be selected based on things your child has shown interest in from previous art lessons as well as new materials that could be interesting to them. These activities will take place in a familiar learning environment and in a natural learning situation at Diamanten Skole.

1. We will collect some information about your child: Their age, gender, cause and nature of the limitations, their tactile exploration and learning possibilities. This information will be stored pseudonymously (with a fictitious name). This information is necessary to process, interpret and describe the research results as reliably as possible.
2. Your child will participate in creative art classes with their teacher. This will be an activity that suits your child, such as finger painting, sculpting or other related crafting activities. The researcher will discuss with you, and the teachers that work with your child, which activity you think might be fun and interesting for your child to work on.
3. During a period of 10 weeks, your child will participate in a personalized and structured art lessons given by the teacher, with the aid of the researcher. The art classes will be recorded by the researcher, who will be present during the art sessions.
4. After a few creative art sessions, we will make a baseline of your child's tactile working memory and create an intervention-based learning plan based on the findings from the tactile working memory scale. This will be done by the researcher in a collaboration with the Tactile Working Memory Scale expert team at the school.

DO YOU HAVE TO PARTICIPATE?

Participation in the study is voluntary. However, permission is required from both you as a legal representative and the teacher. Therefore, read this information sheet carefully. Ask any questions you may have, for example because you do not understand something. Only then should you decide whether you want your child to participate. If you decide you do not want your child to participate, you do not have to explain why, and this will not have any negative consequences for you or your child. This right applies at any time, so also after you have agreed to participate in the study.

ARE THERE ANY RISKS IN PARTICIPATING?

If your child participates, you have the right to access, rectify, and delete any personal data that has been collected at any time. This can be done by sending an email to the researcher involved. If you have given permission for your child to participate, you may withdraw this permission at any time during the study. Any data about you/your child will then be deleted.

The researchers will write a Master thesis about the study. Only pseudonymized data and fictitious names will be used in the thesis and in the presentation given at the University of Groningen. However, due to the small target group, some data can sometimes be recognizable to acquaintances.

ARE THERE ANY BENEFITS IN PARTICIPATING?

You will not receive any additional compensation for the research. However participation in this research may contribute to further knowledge on how communication partners/teachers/ families can stimulate and encourage the tactile working memory development in children with congenital deafblindness. Additionally participating may further help other educators who work with pupils who are deafblind create a learning environment that is more bodily-tactile focused.

- However, your child and the teacher will receive a small gift as a thank you for participating.

HOW WILL INFORMATION YOU PROVIDE BE RECORDED, STORED AND PROTECTED?

- How we handle personal data and video images is specified in the Data Management Plan. We act in accordance with the GDPR (General Data Protection Regulation).
- The collected data is processed pseudonymously (under a fictitious name) by the researcher and stored in a secure place. Both through the University of Groningen, and in a hard drive which is stored in a secured and locked place at Diamanten Skole. Only the researcher can access this data.
- The videos are also stored on a secure hard drive and are analysed by the researcher and internal work groups at Diamanten Skole. This analysis is also stored securely and will be pseudonymised before publication of the thesis.

- The data (consent forms, recordings, interview transcripts) will be retained on the Y-drive of the University of Groningen server for 10 years, in correspondence with the university GDPR legislation.

WHAT WILL HAPPEN TO THE RESULTS OF THE STUDY?

The anonymized data will be used to write a master's thesis based on the results of the study. In addition, the anonymized data and findings from this study will be used in a presentation at the University of Groningen. The results may also be used for future presentations or publications given/written by the researcher.

INFORMED CONSENT FORM

If you decide you want your child to participate in this research, we ask that you sign the informed consent form provided to you by the researcher.

WHO SHOULD YOU CONTACT FOR FURTHER INFORMATION?

If you have questions related to the research, such as: consent forms, insight into the information we have stored about you/your child , or if you want to withdraw consent in participating in this research, you can always contact the researcher (Hjördís Jenný Önnudóttir Hansen) through email HJOHa@statped.no. You may also reach out to the master thesis supervisors: Dr. S. Damen (s.damen@rug.nl) and Dr. J. Gibson (joseph.william.gibson@statped.no)

INFORMED CONSENT FORM

Title study:

Name participant:

Assessment

- I have read the information sheet and was able to ask any additional question to the researcher.
- I understand I may ask questions about the study at any time.
- I understand I have the right to withdraw from the study at any time without giving a reason.
- I understand that at any time I can refuse to answer any question without any consequences.
- I understand that I will not benefit directly from participating in this research.

Confidentiality and Data Use

- I understand that none of my individual information will be disclosed to anyone outside the study team and my name will not be published.
- I understand that the information provided will be used only for this research and publications directly related to this research project.
- I understand that data (consent forms, recordings, interview transcripts) will be retained on the Y-drive of the University of Groningen server for 5 years, in correspondence with the university GDPR legislation.

Future involvement

- I wish to receive a copy of the scientific output of the project.
- I consent to be re-contacted for participating in future studies.

Having read and understood all the above, I agree to participate in the research study: yes / no

Date

Signature

To be filled in by the researcher

- I declare that I have thoroughly informed the research participant about the research study and answered any remaining questions to the best of my knowledge.
- I agree that this person participates in the research study.

Date

Signature

Appendix B. Consent forms (English/Norwegian)

1) English

INFORMED CONSENT

I, the undersigned, hereby declare

.....

I agree that my child participates in a study conducted by Hjördís Jenný Önnudóttir Hansen (HJOHa@statped.no) under the supervision of Dr. S. Damen (s.damen@rug.nl) and Dr. J. Gibson (joseph.william.gibson@statped.no).

1. Participation in the Master Thesis "Fostering tactile learning through creative activities" is completely voluntary. Cooperation may be terminated at any time. The researcher is responsible for secure and privacy-sensitive data storage.
2. The aim of this research is to gain insight into the emergence and development of the bodily tactile exploration and learning done through creative activities. The activity will focus on stimulating the bodily-tactile sensory system and allowing for a more tactile focused communication and learning between a pupil and their educator. Participation in this study will provide more insight into how a pupil with congenital deafblindness can be stimulated by communication partners/educators by using creative activities as a learning arena.
3. The study is an intervention in which the participants will work on creating a tactile book once per week for 10 weeks, which will be recorded on video. These videos will be analyzed and encoded. A personalized plan will be made for the intervention phase after recording and analyzing the way the pupil uses their tactile working memory during crafting sessions. The teacher will receive coaching and guidance from the researcher on how to implement the personalized intervention plan into their teaching sessions.
4. Participants have the right to opt out of the study at any time.
5. The data obtained from this research will be treated confidentially and therefore cannot be disclosed in an individually identifiable manner. The data will be a pseudonymized and coded report of the findings, and the original data will only be available to the researcher(s).
6. All data is stored in a secure environment of the University of Groningen, and in a secured environment of Diamanten Skole.
7. The pseudonymised data will be used to write a Master Thesis about the study and the results, additionally the pseudonymised data and findings from this study will be used in a presentation at the University of Groningen.
8. If you have any questions, you can always contact the researcher (Hjördís Jenný Önnudóttir Hansen).

Date:	Researcher's signature:

Date:	Participant's signature:

2) Norwegian

INFORMERT SAMTYKKE

Undertegnede erklærer herved

.....

Jeg som foreldre/foresatte godtar at barnet mitt deltar i en forsknings-studie utført av Hjördís Jenný Önnudóttir Hansen (HJOHa@statped.no) under veiledning av Dr. S. Damen (s.damen@rug.nl) og Dr. J. Gibson (joseph.william.gibson@statped.no) som en del av Mastergradsoppgave i døvblindhets pedagogikk : Fostering the tactile working memory through creative activities.

9. Deltakelse i masteroppgaven «Fostering the tactile working memory through creative activities» (På norsk: forsterke taktil arbeidshukommelse gjennom kreative aktiviteter) er helt frivillig, og du kan når som helst trekke ditt samtykke tilbake ved å kontakte forskeren (Hjördís Jenný Önnudóttir Hansen).
10. Målet med studiet er å få innsikt i hvordan en lærer kan støtte den taktile arbeidshukommelsen hos en elev med medfødt døvblindhet gjennom formings aktiviteter. Aktivitetene vil fokusere på å stimulere den kroppslig-taktile sansen og gi mulighet for en mer taktilt fokusert kommunikasjon og læring. Deltakelse i denne studien vil gi mer innsikt i hvordan en elev med medfødt døvblindhet kan utvikle sin taktile arbeidshukommelse i praktisk-estetiske fag. Studiet vil også gi mer innsikt i hvordan kommunikasjonspartnere/lærere bedre kan tilrettelegge for

undervisning i praktisk-estetiske fag på skolen for å gjøre dem mer tilgjengelig for elever med medfødt døvblindhet.

11. Studien inkluderer en intervensjon der deltakerne skal jobbe med å lage taktil fokuserte kunstverk en gang i uken i 10 uker. Øktene vil bli tatt opp på video, analysert og kodet av forskeren i samarbeid med 2 arbeidsgrupper (Videoanalyse og Tactile Working Memory Scale) på Diamanten Skole. Det vil bli laget en personlig plan for intervensjonsfasen etter at grunn-kartlegging av elevens taktile arbeidshukommelse (TWMS) i formingsøkter har blitt etablert. Læreren vil få veiledning fra forskeren om hvordan den personlige intervensjonsplanen kan gjennomføres i undervisningen.
12. Forskeren er ansvarlig for å oppholde sikker datalagring av personvernsensitiv informasjon.
13. Samtykket om deltagelse er frivillig, og du/dere kan når som helst trekke samtykket tilbake.
14. Du kan be om innsyn i studiet og de opplysningene som er lagret om deg/ditt barn.
15. Du kan be om sletting og/eller retting av opplysninger som dere som foreldre/foresatte mener er uriktige eller gir et skjevt bilde av deres barn.
16. Dataene som blir innhentet fra denne forskningen vil bli behandlet konfidensielt og kan derfor ikke avsløres på en individuelt identifiserbar måte. Forsker vil lage en anonymisert og kodet rapport om funnene, og de originale dataene vil kun være tilgjengelige for forskeren(e).
17. Alle data lagres i et sikkert miljø ved Universitetet i Groningen, og i et sikret miljø på Diamanten Skole.
18. De anonymiserte dataene vil bli brukt til å skrive en masteroppgave med utgangspunkt i resultatene fra studiet. I tillegg vil de anonymiserte dataene og funnene fra denne studien bli brukt i en presentasjon ved University of Groningen.
19. Hvis du har spørsmål knyttet til studiet, eller ønsker å vite mer om samtykket, kan du alltid kontakte forskeren (Hjördís Jenný Önnudóttir Hansen).

Dato:	Forskerens signatur:

Dato:	Foreldres/foresattes signatur:

Appendix C. Personalized intervention plan

Optimizing the physical and social environment

The teacher is encouraged to optimize the learning environment within a bodily-tactile modality.

- By encouraging Mark to systematically use his tactile modality to explore and by creating unique tactile experiences for Mark.
    - Some examples of how to implement this is by using materials that would be easy for Mark to identify and use through his bodily-tactile modality; such as by using modeling paste, sand-paint, glue, or other unique tactile materials to paint and explore.
- Engage in a shared tactile exploration of objects/materials
- Follow Mark's initiatives during tactile exploration
- Allowing sufficient time for Mark to process the information during tactile exploration
- Give clear instructions and allow sufficient time for Mark to notice and understand what is expected of him, and to give him time to formulate a response/to initiate further exploration or to act

Perceptual learning strategies

Mark scored "absent" on item 3 (tactile object identification) in all of the pre-intervention sessions. The intervention phase will therefore implement some perceptual learning strategies in hopes of seeing changes in his tactile objective identification.

Taken from the Checklist of earning strategies that support tactile working memory (suggested learning strategy for item 3):

The interaction partner provides opportunities and supports the person to sequentially touch and compare things that are similar and contrast things that are different (tactual matching/differentiating)

- guiding the person to tactually match similar shaped or textured objects (i.e., sorting materials based on their tactual similarities)

- guiding the person to tactually discriminate between different shaped or textured objects (i.e., sorting materials based on their tactual differences)

This learning strategy was adapted to fit into the art sessions. This could be done by (for example):

- exploring the similarities and differences between two paintbrushes/sponges/textured paper etc. (big and small brushes-hard and soft bristles- having two sponges: making one wet and the other dry)
- Having two boxes: one for paints, the other for tools. Letting Mark explore both boxes to differentiate between the tactile features of the paints and the tools

The second Perceptual learning strategy that will be implemented is to give Mark opportunities to gather information about the spatial placement of an object in the immediate vicinity (for these sessions, all items will be on the table that Mark works on)

Mark scored "present" on item 5 (tactile object location) and "emerging" on item 7 (Tactile special recognition). Even though these items are present or are emerging, Mark shows great curiosity in the items that are close to/within his reach. Therefore, the intervention includes a learning strategy that would give Mark greater potential in developing his spatial navigation skills in the bodily-tactile modality.

This perceptual learning strategy could be implemented by:

- Encouraging and guiding Mark to reach out and locate an object that is (nearly) out of reach by for example, using tactual search movements such as a swiping movement towards the object (Mark already uses swiping motions actively- but keeps his hands close to his body when exploring- encouraging him to extend his exploration "bubble")
- Having the items placed in certain areas on the table (for example: paints on his left, tools on his right. Placed in specific boxes that could be easily identifiable for him.
- Keeping said items in the same area during the entirety of the art session, so that Mark could more easily reach for things he might be interested in using.
- Grabbing an item from a specific spot and placing it back together to the same spot once that item has been used.

Social learning strategies

Mark scored “emerging” on item 10 in all pre-intervention sessions (mutual joint attention). This item was given the score “emerging” due to him sporadically directing his attention to his teacher during the activity, he lets his teacher guide his hands to manipulate the paints, and he sometimes brings his own hand on top of his teacher to show mutual attention to the activity. In the first session, he also (possibly) mimics the “side to side” drawing motions him and his teacher did on the paper-possibly a way for him to process the interaction they did together.

The teacher is already very engaging in the pre-intervention phase. For example, the teacher follows Mark’s focus on the “banging” action he does in session 3. The teacher attempts to shift his focus from banging on the table, by instead having him bang on the paper while using the watercolors and the sponge. Mark showed signs of finding this interaction amusing and is seen laughing to himself afterwards.

The three sessions show different levels of social focus. In the first sessions he shows limited to no interest in the social interactions, while in the second and third sessions he uses his bodily-tactile modality to show some social engagement and understanding. Therefor the social learning strategies will be mainly about him being able to stay focused on an interaction for a prolonged time, and to be able to switch from one theme to another.

Supporting the person to stay focused on the interaction for a prolonged time when a novel feature is introduced or when switching from one theme to another The interaction partner supports the person to sustain the flow of information, during the social interaction. This learning strategy is aimed at items 15, 16, and 17. Mark scored “emerging” on items 15 and 17 overall, and scored “present” on item 16 in the third session where a new item was introduced (sponges in a box). Suggestions for implementing this learning strategy is:

- encouraging the person to stay focused on the interaction for a prolonged time (sustained social interaction)
- engaging the person to contribute actively to the ongoing interaction
- providing attention breaks when necessary
- motivating the person to sustain the flow of attention and remain on the ongoing social interaction, when a new topic/content is introduced
- guiding the person to switch attention back to the original social interaction when attention is drawn to another (attentional switching)

- guiding the person to move the focus of attention from one theme/feature to another during the ongoing social interaction

This learning strategy can be implemented in the art sessions by:

- Giving Mark ample time and opportunity to familiarize himself with new objects when they are introduced and used in the art sessions. As well as give him pause to process and answer
- Talking about and exploring items related to the new theme/feature before using them in the art sessions
- When switching from one object to another, the teacher informs Mark that they are done with x object and they put the “old “ item away in a dedicated “used” box together before grabbing the “new” items from the “unused” box.

Appendix D Collaboration with the teacher.

Observations and summary of the content of the coaching sessions and the results of the coaching during the painting sessions.

Timeline	The researcher (author)	The teacher	Observations on Mark	Notes/Results
Initial meeting	• Introducing the research • Gathered information about the situation: the relationship between mark and the teacher, the teacher's previous experiences with Mark, and with teaching art • Suggested a painting activity	• Shared her experiences • Evaluated the relationship between her and Mark • Gave suggestions about Mark's interests and his tactile skills	Not present	• Co-created an activity • Mark's interests and suggested skill levels were taken into consideration
1st baseline	• Physically present for direct observation • Recorded the session • Took observation notes	• Shared in a painting activity with Mark • Was asked to teach Mark as she normally would	• Shared in a painting activity with the teacher • Had high epileptic activities • Participated to the best of his abilities • Was observed to show some levels of tactile working memory skills (Figure 1, session 1)	• This was a new activity for the teacher to participate in • Mark's seizure effected the teacher's confidence in the activity
Coaching	• Shared personal observations from the session • Noted Mark's seizure levels • Gave feedback to the teacher	• Asked to give personal evaluation of her teaching, Mark's tactile engagement, and his overall participation • Addressed concerns regarding Mark's engagement and enjoyment	Not present	Agreed on repeating the activity with the same structure and content to evaluate if Mark's seizures were affecting his participation and overall interest in the activity
2nd baseline	• Physically present for direct observation • Recorded the session • Took observation notes	• Repeated the painting activity with the same steps from previous session	• No seizures were observed during the session • More tactile engagement on the activity and socially • Appeared to enjoy the activity- very focused on the activity itself, not so much on the teacher	We agreed that there were big changes in the quality of Mark's tactile engagement, and that he appeared to really enjoy today's session.

Coaching	• Shared observations and gave feedback • Shared some of the tactile modalities Mark was actively using based on the TWMS profile of session 1 (see Figure 1, session 1). • Showed video recordings of the two sessions	• Asked to give personal evaluation on her teaching and the painting session. • Requested feedback on how she could improve the sessions based on Mark's reactions and engagement • Shared personal ideas for future sessions	Not present	Cooperated in making a plan on how to adjust the activity. Came to a shared agreement to: • switch out the crayons with a different material. • Introduce one tool he can use to paint with • Tape down the paper
3rd baseline	• Physically present for direct observation • Filming the session • Took observation notes • Prepared the room before the session	• Shared in a painting activity with Mark • Introduced a new tool (sponge) and material (putty paint) • Showed Mark the taped down paper	• Actively used his tactile modality throughout the session • Occupied with his own tactile movements and exploration during the first half. • Little to no seizures • Showed curiosity to the new material and paper • Was more focused on social interactions with the teacher.	Appears as though that Mark is starting to form a connection with the teacher and the activity. • Has started to form an understanding to the routines and expectations • Still needs more optimized environment and support
Intervention meeting and coaching	• Shared the TWMS baseline profile (Figure 1 and 2). Detailing items of interest and explaining what those items and results mean • Showed video recordings from the sessions where Mark was using his tactile modality as a visual aid to the TWMS items • Gave video examples of how Mark interacts with her and the activity to give her a better understanding on how Mark interacts and communicates. • Presented an intervention with personalized examples on how she can implement the chosen learning strategies into the painting sessions (Appendix C)	• Gave feedback on the TWMS results • Was encouraged to ask questions about the scale, results, and its meaning. • Evaluated the results from the scale and to comment on the findings • Went over the intervention plan together with the researcher (Appendix C) • Received coaching and guidance on how to implement learning strategies and how to optimize the environment • Gave ideas on how to incorporate the strategies	Not present. Discussed our observations on Mark throughout the baseline phase: Mark's general interest and motivation were discussed. • The teacher noted that taping down the paper was ineffective as it was difficult for Mark to reach the top corners of the paper. • Shared agreement on a new solution to optimize the physical environment- using a tilted worktable instead of taping the paper down • Discussed which materials could be fun for Mark to use in future sessions	The outcome of the meeting was a cooperative intervention plan that both parties agreed on (Appendix C). • The teacher was encouraged to try out the intervention and report back to the researcher if certain strategies were difficult to perform/not suitable for the activity. • The researcher would create a tilted worktable for Mark to use. • Agreed to a timeslot for a post-intervention observation

Post-intervention	• Physically present for direct observation • Filming the session • Took observation notes • Prepared the room before the session	• Shared in a painting activity with Mark • Independently implemented the learning strategies during the session • Optimized the physical and social environment • Showed more confidence in her own teaching- and was more aware of Mark's responses and engagement • Used a playful approach to the session and was highly engaged with Mark in the tactile-modality • Spending more time on each section of the activity than in the previous sessions* *When analyzing the video recordings I was able to see that the teacher was spending more time on each step in the activity. Previous sessions were recorded to be 35-40 minutes long. This session was 1 hour long.	• Shared in a painting activity with his teacher • Was a very active participant during the session. • Showed great enthusiasm to the activity • He was able to respond and initiate actions more frequently and with more intent • Appears to have built a stronger relationship with the teacher Some of the skills Mark showed were: • Tactile spatial recognition, mapping out and locating objects • Long term memory (understanding the routine) • Social cognition and partner recognition • Active independent tactile exploration • Using both hands to explore and manipulate objects with	The post intervention session showed that when both the physical and the learning strategies were optimized and personalized to Mark's suggested tactile skill levels in addition to his general interests, he was able to show a wider range in his tactile working memory skills. • Evident that the teacher and Mark had built a stronger relationship throughout the project. • The teacher is better able to recognize how Mark communicates and engages himself in the activity. Initial observation indicated that intervention strategies were being implemented. Observed that it had a positive effect on the painting sessions. (Further video analysis needed to confirm my observations)
Post-intervention meeting	• Shared the results from the research • Presented the new TWMS profile (Figure 3) and showed his TWMS development (Figure 4) • Detailed Mark's improvements- giving visualized examples through video recordings • Gave suggestions on the activity's continued potential	• Shared her own experiences and reflection of her own work and of the research itself • Gave feedback on the intervention, the coaching session, and the project itself • Partook in the discussion about the post-intervention profile- giving her own views on the results. • Shared what she had learned from the experience	Mark's mother was present for the meeting. • Gave feedback and shared her personal view on the research and the results • Was very grateful that Mark's enthusiasm for creative activities was taken into consideration throughout the research. • Positively encouraged to see Mark's progression over time • Highlighted the importance of optimizing his environment, and for his teachers to actively engage with Mark in a bodily-tactile matter.	This was the final meeting for this intervention. The teacher felt encouraged to continue to paint with Mark after the experiences she's had with this research. Expressed that she felt more confident in carrying these sessions out more independently. Although this was the last formal meeting in this research, the researcher and teacher shared interest in continuing their cooperative work with Mark. (For the complete report of the meeting, see Appendix F.)

Appendix E. Overview of the TWMS items

Items		**As described in the scale profiles**
1	Uses active touch and motion to direct focus of attention towards an object of interest	Tactile focused attention
2	Uses active touch and motion in systematic exploration of an object of interest	Object manipulation (ventral stream function)
3	Uses active touch and motion to identify similarities or differences among objects	Tactile object identification Similarities/differences; classifying/categorizing (ventral stream function)
4	Uses active touch and motion in a purposeful manner to recognize objects in the vicinity	Tactile object recognition: retaining task-relevant information (ventral stream function)
5	Uses active touch and motion to identify an object in the immediate surrounding	Tactile object location (dorsal stream function)
6	Uses active touch and motion to locate a place when navigating within an environment	Tactile spatial reasoning: Spatial navigation
7	Uses active touch and motion in a purposeful manner to recognize spatial relations among objects and locations	Tactile spatial recognition: Retaining task-relevant information (dorsal stream function)
8	Uses active touch and body movements to intentionally explore and interact with the interaction partner during close bodily contact	Social working memory: person oriented
9	Uses active touch and motion to capture the emotionally triggered bodily-signals or reactions of the partner	Social working memory: emotion perception
10	Uses active touch and motion to explore an object together with the interaction partner while displaying behaviours of social attention	Social working memory: mutual and joint attention

11	Uses active touch and motion in a purposeful manner to recognize the partner, during the interaction	Social working memory: retaining social information
12	Uses active touch and motion to stay focused on a specific task or activity for a prolonged time	Tactile sustained attention
13	Uses active touch and motion to pay attention on the relevant details of a task or activity while filtering out distractions/ignoring interruptions	Tactile selective attention
14	Uses active touch and motion to shift the focus of attention back and forth between different tasks or activities	Attentional switching
15	Stays focused on the interaction for a prolonged time	Sustained attention: interaction-time
16	Stays focused on the interaction when an unfamiliar/novel feature is introduced	Selective attention: interaction-novel condition
17	Stays focused on the interaction when an unfamiliar/novel feature is introduced	Attentional switching: interaction-topic change
18	Maintains information to specific episodes from the past in the present, especially when partner-guided long-term working memory strategies are provided	Attention-manipulation: initiating long-term working memory strategies
19	Maintains information in the present and holds on to the information long enough to use it, especially when partner-guided maintenance cognitive strategies are provided	Attention manipulation: initiating maintenance cognitive strategies
20	Maintains information in the present and actively monitors or makes changes within his/her own learning, when partner-guided metacognitive strategies are provided	Attention manipulation: initiating metacognitive strategies

Appendix F. Report from the final meeting with the teacher and Mark's Mother

Post intervention meeting with the teacher and Mark's mother. 5.3.2025

The first part of the meeting was between me and the teacher.

- I asked for feedback on the project, the teacher's experiences throughout, and how they felt about the intervention and its effectiveness.
- The teacher voiced that she had an overall positive experience in participating in this research, the activity itself was fun and new for her, and that she gained a lot of new knowledge about conducting in creative activities as well as feeling like she and Mark built a strong and positive relationship from it
- She noted that she was unexperienced in teaching art related subjects, and the first session was very improvised on the spot- additionally she didn't know Mark that well, so she didn't always recognize when Mark had seizures or that he had a lot of epileptic activity that day.
- She expressed that after our first meeting after the research began, that she felt more confident in her work- and that it motivated her and gave her ideas in ways she could better conduct the sessions with Mark. In that meeting we discussed the topics related to Mark's epilepsy, the positive things I saw in her teaching methods, and gave her feedback and ideas on what she could focus more on moving forward. -> this topic brings up the thought on how important positive constructive feedback to teachers is. As a coach, it was important for me to hear that being able to give feedback in an open discussion, where I could present her with concrete examples from the video recordings, was a good method of conducting these one-on-one coaching meetings
- When asked how she felt the intervention approaches she was given worked, she responded that they were easy to follow and implement into her lessons, and brought up a specific examples that she felt helped improve the lessons. Namely the tilted table, and that when she gave Mark more time and opportunities to be an active participant in the sessions, he appeared to be more focused and engaged for longer periods of time. She also noted that she felt that Mark was more social and secure in her

Mark's mother joined us for the second half of this meeting.

- I started with presenting the work we had done so far, briefly share our experiences and what we have observed with Mark and his progression.
- I presented the pre- and post intervention TWMS and talked about the points that we saw change in. we discussed in detail on how Mark was now actively trying to use both of his hands during the sessions, and was using bodily tactile modality to socialize and gather information.
- I presented some photo examples taken from the post-intervention video, and the mom commented on the physical accommodations that were visible in the photos, namely that Mark could easily rest his elbows on the table, which gave him better support, and that the tilted table was positioned in a way that made the painting easily accessible to him. As well as using tactile paints- which I informed the mother that Mark seemed to really enjoy examining and using. I gave her some ideas on how she could recreate such an activity at home if they were interested (mixing paint with grainy materials)
- I informed them about some of the other measures we had made to optimize the environment, and that it was clear that those measures had a positive impact on the sessions.
- The mom agreed and commented on how important it is for his social and physical environment to be optimized for him, and that the felt that the interventions we had put in place for that were well suited for him.
- I informed them of some of the changes we had seen over time. That from this research we could see that Mark has great long term memory skills, he has shown improvement in motor functions (starting to use two hands actively. Painting and exploring in a more purposeful way), and that he is taking more initiative in the sessions. The mom was very happy to hear about these results and we discussed specific incidents where we could clearly see that those skills were developing.
- We discussed how important it was to give Mark ample time to process information- and the teacher noted that she felt Mark was more engaged now that she was more aware of giving him time.
- At the end of the meeting, we looked at the first part of the post-intervention video, where Mark and the teacher were preparing themselves to start the activity (putting on the coats and discussing what they were going to be doing today). In this clip we could see that Mark completely understands the situation and had specific expectations of

what was to come. Mark's Mom was very happy to see how engaged he was- and noted that he was clearly following along and was enjoying the interaction.

Personal reflections after the meeting:

- The feedback from my coaching approach was very informative and important to my work. Being able to reflect on the process together with my participant was a good way to get a sense of how the overall experience of the research and the topic I decided on worked.
- Having both Mark's mom and the teacher present to be able to discuss my findings and my interpretations of those findings was very helpful. Both the teacher and I have been directly involved during the entire process, so having an outside perspective from someone close to Mark helped me gain a stronger belief in my findings.
- Mark's mom agreed on both the intervention approaches of the teacher and the ways we optimized the environment, and she could clearly see the effectiveness of those interventions. She also agreed that Mark was very engaged and showed great enthusiasm in the activity, and was overall very happy during this session.
- She also expressed that she was very happy that I chose an activity that Mark clearly loved doing, and that she was happy to see how we were using these sessions as a learning tool for him. Interest based learning is something I've learned about while taking higher education in special education. Being able to use this method in practice gives me better understanding of how this method works and how I can use it in my future work.
- Knowing that Mark seemed to really enjoy these sessions and was gaining something valuable from it was also a great feedback- due to his limited communication, it can be hard to determine how willing he is to participate in an activity. From my own reflection, and after talking to his mom and teacher, I feel like we can say that Mark showed clear signs of wanting to participate.