A CASE STUDY OF TACK TILES® LITERACY INSTRUCTION FOR A STUDENT WITH MULTIPLE DISABILITIES INCLUDING CONGENITAL BLINDNESS

JESSICIA A. KLENK

Northeast Indiana Special Education Cooperative

LISA A. PUFPAFF

Ball State University

Author Note

Jessica A. Klenk, Northeast Indiana Special Education Cooperative; Lisa A. Pufpaff, Department of Special Education, Ball State University.

Correspondence concerning this article should be addressed to Lisa A Pufpaff, Department of Special Education, Teachers College, Room 710, Ball State University, 2000 W. University Ave., Muncie, IN 47306-0002. Email: lapufpaff@bsu.edu

ABSTRACT

Research on literacy instruction for students with multiple disabilities is limited. Empirical research on braille instruction for students with multiple disabilities that include congenital blindness is virtually nonexistent. This case study offers initial insight into possible methods of early braille literacy instruction for a student with multiple disabilities including congenital blindness and autism. The use of Tack Tiles® during an intervention program in a one-on-one format resulted in increased early literacy skills for the targeted student. Educational implications address the potential challenge of tactual readiness for braille instruction for students with multiple disabilities.

Key words: multiple disabilities, literacy instruction, braille, tactual defensiveness

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The purpose for using research-based practices in the classroom is to ensure that students are provided with instruction that is both effective and efficient in assisting them to acquire needed skills. There is a dearth of research on successful literacy instructional methods for students who have multiple disabilities including congenital blindness (Parker & Pogrund, 2009), especially in the area of braille instruction (Durando & Wormsley, 2009). Braille is a complicated code that requires time and effort on the part of educational team members to ensure efficient use in instructional situations. The effort needed for successful braille skills acquisition among students with multiple disabilities requires an even greater effort from service providers. Some may question whether this work is worth the effort. Regardless of student ability, all students have the right to access curriculum that is comparative to their same-age peers. It is the responsibility of the educational team to determine how to present this information in such a way that the student gains skills towards greater levels of independence in accessing both educational and other life experiences. Research has demonstrated that braille instruction allows students to have access to educational and leisure materials that they would not have otherwise (MacComiskey, 1996). Students who learn braille literacy skills are also more likely to be engaged in the same educational activities as their typically developing peers (Cooper & Nichols, 2007; Swenson, 2008).

Providing braille instruction to students who have multiple disabilities that include congenital blindness requires an individualized approach (Durando & Wormsley, 2009). The combination of both a sensory impairment and additional disabilities compounds the challenges to learning braille and requires the expertise of many professionals. Few teachers of students with visual impairments (TVI) have received training in providing braille instruction to this population of students. Durando (2008) reported the results of a descriptive survey regarding the literacy instruction of students who have multiple disabilities from the perspective of TVIs who had these students on their caseloads. Survey questions addressed factors teachers used to determine when to teach literacy skills and what types of literacy skills to teach. Of those surveyed, more than half believed that learning braille was too difficult for this population and indicated the students' cognitive skill level as the most common factor in making instructional decisions. Teachers were also asked to indicate the skills most often targeted for instruction. The top three were listening skills, letter identification, and communication. Reading braille was

ranked much lower. The majority (92%) of teachers expressed interest in obtaining further training and information on instructional practices for this population.

McKenzie (2009) recently provided a similar picture of current literacy practices among students who have deaf-blindness and students who have multiple disabilities including significant vision impairment. Through classroom observation, as well as review of individualized education programs (IEP) and student records, McKenzie found that, although early braille activities were observed in 71% of the classrooms, activities were typically not age-appropriate. There was a lack of research-based literacy activities observed and braille instruction, when offered, occurred for only a short period of the day. There was a lack of emphasis on literacy in IEPs. Classrooms lacked adequate amounts of large print or braille labels in the environment. Additionally, a very small percentage of students had a learning media assessment on file; an assessment that determines what mediums of learning the student will use (e.g., braille, large print, audio).

A survey from the American Printing House for the Blind (2006) revealed that of school-aged students who are legally blind, 34% are considered nonreaders. Durando (2008) clarified the definition of a nonreader as someone without reading potential and not considered to be currently gaining skills toward literacy through instruction. Durando reasoned that students with multiple disabilities may lack literacy skills due to limited access to appropriate instruction whether for lack of research-based instructional methods or lack of believed potential. Although there is little research evidence to guide the selection of instructional methods and materials, there are a variety of potentially appropriate strategies for teaching braille skills to students who have multiple disabilities.

INSTRUCTIONAL APPROACHES TO TEACHING BRAILLE

Braille is considered the official medium of reading for individuals who cannot reliably use print as their primary reading tool. It is a tactually based symbol set that corresponds to the Roman alphabet using a cell of 6 raised dots in a 2 by 3 pattern. Particular dots in the cell are raised or left flat, depending on the symbol represented by that cell. Braille has three common forms (Samuels, 2008). Uncontracted braille, previously known as Grade 1 braille, consists of the Roman alphabet and punctuation, while contracted braille, previously known as Grade 2 braille, includes an additional 189 contractions that represent whole words, parts of words, and short form words. Grade 3 braille has over 300 additional contractions and shorthand words in which specific vowels are omitted and spacing between words is eliminated. Grade 3

braille is typically used for personal note taking by individuals engaged in higher levels of academic work .

Uncontracted Braille

A majority of braille readers learn and use contracted braille as their official medium of literacy throughout their education. The complexity of contracted braille can be a barrier for students with intellectual impairment or a learning disability due to the extensive number of symbols and rules to learn. It has been suggested that students who are blind in conjunction with other disabilities be taught uncontracted braille, that is, only the alphabet and punctuation symbols (Wormsley & D'Andrea, 1997). A single study to date has demonstrated the potential for this strategy (Stauffer, 2008). A 15-year old male with congenital blindness in conjunction with "diffuse developmental delays" was taught to type on an electric typewriter with braille key tops. Results indicated that following six months of keyboarding instruction, the participant identified all braille alphabet letters with 92% accuracy. Therefore, although recognition of braille letters was not taught explicitly, the participant demonstrated the ability to recognize individual braille letters incidentally following instruction in keyboarding.

The use of uncontracted braille among students with multiple disabilities would likely provide added interactions in braille as peers, parents, and general education teachers are more likely to learn braille if they are only required to know the alphabet and punctuation. Others have suggested initially teaching literacy skills with uncontracted braille and then switching to contracted braille (Day, McDonnell, & O'Neill, 2008; Farnsworth, 2007; Troughton, 1992). It is cautioned, though, that students with intellectual impairment might have difficulties with the transition to contracted braille (Wormsley, 2004). Limited reading materials are available in uncontracted braille, so additional preparation time would be required of the TVI to produce instructional materials.

Modified Braille: Moon, Jumbo, and Spaced

Moon is a simple tactual symbol system that is commonly used in England for older persons with late onset blindness who have struggled to learn braille (McCall & McLinden, 2001; Wormsley & D'Andrea, 1997). Its tactual design more closely resembles print letters and includes Grade 1 Moon with only the alphabet and punctuation, like uncontracted braille, and Grade 2 Moon, similar to contracted braille, but with a much smaller number of contractions. A long-term project in England has demonstrated the potential of Moon to contribute to the literacy development of students with visual impairment and additional disabilities (McCall & McLinden, 2007). Through a research project at

the University of Birmingham that began in 1992, Moon has been emphasized as an option for teaching functional tactile literacy to students with multiple disabilities that include significant visual impairment. McCall and McLinden (2007) recently conducted a survey of teachers in the United Kingdom who were using Moon to identify teachers' motivations for implementing Moon and corresponding student outcomes. Results revealed that teachers felt the use of Moon contributed to students' increased pleasure in literacy activities, increased self-esteem, and motivation to engage in literacy activities. Teachers also indicated that through the acquisition of early literacy skills, students were more likely to be included in a broader range of curricular activities, had increased social interaction with peers, and had increased levels of independence through choice making and communication. Teachers commented that the use of Moon increased expectations for student learning and provided students "an outlet to display and build on skills that would previously have lain dormant" (p. 608).

McCall and McLinden (2001) suggested that the simplicity of each letter in Moon allows for greater tactual discrimination, making this a potential alternative to braille for students with multiple disabilities that include blindness. Continued research is needed to determine the effectiveness of Moon in teaching literacy skills. The primary concern is its lack of presence in the student's environment and the small number of resources presently available for producing Moon (McCall & McLinden, 2007).

Another option is jumbo braille, which follows the same rules as standard-sized braille except with a larger cell and dots. Spaced braille works similarly with the same sized dots as standard braille but spaced further apart in a larger cell (Wormsley & D'Andrea, 1997). These formats are often used for individuals who lack the tactual sensitivity to read regular braille.

Tack Tiles®

Tack Tiles® is a set of jumbo and spaced braille symbols fashioned out of Lego®-like blocks that can be individually built onto a frame to form words. This set is commercially advertised for both typically developing emergent braille readers and for individuals with multiple disabilities that include visual impairment who would benefit from additional and/or alternate forms of braille instruction for successful acquisition of literacy skills. The creator of Tack Tiles® reported using the tool to teach his son, who has multiple disabilities, to read braille (Murphy, 1999). There is some expressed opinion that *extended* instruction with a larger braille cell may not transfer well to regular braille (Wormsley, 2004) and jumbo and spaced braille are not found in the student's environment, with few resources and materials available in these formats. Murphy (2002) stressed that Tack Tiles® is not intended to replace

traditional braille or traditional braille instruction but is intended to be used alongside both as an extra bridge for learning.

Despite the potential effectiveness of Tack Tiles®, there is no research on its use. Initial instruction with larger braille cells is a typical practice, with Tack Tiles® included among the available alternatives (Wormsley & D'Andrea, 1997). The intent is for students to recognize the placement of dots in individual symbols. Tack Tiles® affords this opportunity in its larger size blocks, along with being able to "write" by placing the symbol tiles on the frame side by side.

In addition to use with emergent braille readers, Tack Tiles® may be a successful tool for use in braille instruction with persons with tactile defensiveness as tactual readiness is a critical skill for success in learning braille (MacComiskey, 1996). Tactile defensiveness occurs when an individual has an aversion to certain types of tactual stimulation (Downing & Chen, 2003). This behavior is more closely linked with the characteristics of autism, as it is under consideration as part of the diagnostic classification (Boyd et al., 2010). Tactile defensiveness can greatly impede student learning given that access to the environment and learning materials for students who are blind occurs mostly through tactile interaction.

There is an urgent need for research on viable methods for teaching literacy to students who have multiple disabilities that include significant vision impairment (Durando & Wormsley, 2009). Tack Tiles®, an instructional braille tool marketed specifically for individuals with multiple disabilities, has not yet been systematically explored. Therefore, the purpose of this study was to examine the potential effectiveness of Tack Tiles® to enhance the acquisition of braille skills for a student who was congenitally blind, diagnosed with autism, and demonstrated tactile defensiveness. The student had experienced only minimal success with traditional braille instruction resulting partly from tactile defensiveness and his reluctance to physically interact with braille materials. Marketing information about Tack Tiles® suggested they would be well suited for use with this student.

METHOD

Participant

Tanner (pseudonym) was a 10-year-old fourth-grade student who received services in a self-contained classroom with eight other students with autism. Tanner had congenital blindness resulting from retinopathy of prematurity, with light perception only in both eyes. Tanner was diagnosed with autism at the age of nine. A review of Tanner's educational file revealed that no formal assessments

had been completed. Numerous references were made to Tanner being "untestable." His classroom teacher and TVI reported that Tanner enjoyed music, singing, taking walks, and playing with the wheels of his skateboard. They also related that he responded positively to and sought verbal praise.

Tanner was the only student in his class who was blind. Tanner communicated primarily through speech; he accurately repeated phrases and communicated many needs and wants appropriately in one- to three-word phrases. He responded to practiced social overtures appropriately and could follow one- or two-step familiar directions. He exhibited blindisms that included head bobbing, eye poking, and tactual defensiveness with braille, squishy foods, art materials, and occasionally with unfamiliar objects. He exhibited this defensiveness through vocal objections, stiffening his body, pulling his hands away from objects, and occasionally head-butting or kicking.

The TVI had provided an hour of braille instruction twice a week for approximately three years. Tanner's braille instruction for the last two years had been based on a functional literacy approach (Durando & Wormsley, 2009) with whole-word instruction, focusing on the correct tracking and recognition of five highly motivating words: *Tanner, skateboard, mom, lunch,* and *music*. Instruction also included the identification of letters A-F with the use of braille letter cards. Brailler lessons involved the typing of rows of individual letters as well as Tanner's name. Braille instruction early in Tanner's education included the use of an egg carton and tennis balls to teach dot location in a braille cell, as well as hand-over-hand tracking of lines read aloud in story books, and the encouragement of tactual interaction using various textures and objects.

During the three years of braille instruction, Tanner showed little progress. He did not learn to identify parts of the braille cell and often threw or dropped the tennis balls rather than interact with them. At the beginning of this study, Tanner's behaviors related to tactual defensiveness no longer included kicking or head-butting, but he still often stiffened his arms, pulled away, and vocalized to communicate his reluctance to engage with objects. During braille instruction, he rarely tracked a line of braille independently. When asked to name letters and words, Tanner typically stated one of the letters or words that he had been working on for the past two years, but was usually incorrect, demonstrating that he did not understand the braille representation of the letters/words that he had been taught.

Procedures

Tanner's special education teacher and TVI expressed their beliefs that Tanner was capable of making more literacy progress than he had demonstrated

the last three years. Given that his previous instruction was limited to whole word instruction and lines of repeating letters, it was a concern that he may not have made the connection that words are made of individual letters. Therefore, it was hypothesized that Tanner might make more progress with a greater focus on individual letters. When considering his tactual defensiveness, Tack Tiles® were chosen as a format for braille letter instruction. The addition of Tack Tiles® to Tanner's curriculum occurred over a four-month period, with the first author providing an hour of instruction twice a week.

During this project, Tanner's literacy curriculum continued to be modeled after the Individualized Meaning-Centered Approach (also referred to as the Functional Approach) that was designed specifically for students with significant visual impairment along with additional disabilities (Durando & Wormsley, 2009). Durando and Wormsley recommend a highly individualized approach to early braille instruction beginning with sight words individualized to the student, then moving on to letter recognition, phonemic awareness, and phonics while simultaneously addressing proper hand and finger usage and writing. The purpose for introducing Tack Tiles® into the curriculum was to determine their benefit in assisting Tanner to overcome his tactile resistance to engaging with paper braille.

Braille instruction focused on understanding that words are composed of individual letters. Instruction addressed recognition of the first four letters of the alphabet and the letters in Tanner's first name (i.e., a, b, c, d, l, o, r, t, y). The first four letters of the alphabet were addressed in order to match the instruction being provided by the TVI. The letters in Tanner's name were addressed as they were highly familiar letters that Tanner had ample exposure to over the years. This selection of highly familiar letters was used to increase Tanner's opportunity for success during instruction and to continue the instructional skills that had been targeted prior to introduction of Tack Tiles®.

Tanner was taught to name each braille letter encountered. Letter names were the focus of instruction using the tiles because letter naming and spelling had been the primary literacy skills taught to Tanner over the previous year. The goal of using Tack Tiles® was not to replace Tanner's current literacy instruction, but to supplement his instruction to determine if the tiles would contribute to improved success with skills currently being taught.

As the Tack Tiles® were a new curricular tool for Tanner, a one-week introductory period was provided to expose Tanner to the new materials and to teach him how to place the tiles into and remove them from the frame board. This training included finding the rounded top left corner of each tile, using a pincher grasp to hold the letter tile while using his other hand to find where the tile should go, pushing the tile into the frame, and using the pincher grasp to pull the tile off the frame.

The system of least prompts was used during instruction, a method typically implemented with students with multiple disabilities that shapes instruction around the abilities of the student (Bennett, Gast, Wolery, & Schuster, 1986). When using this method, students are provided with the instructional cue and then given an opportunity to complete the task independently. If the student does not act independently within a pre-set pause time, a series of gradually more supportive prompts are provided until the student performs the required response with a pre-set pause between each prompt.

The prompts used with Tanner consisted of a non-specific verbal prompt (e.g., "Tanner, where is the letter?"), then a specific verbal prompt (e.g., "Put your hand on the letter."), a gestural prompt that was usually a slight nudge of his elbow in the direction of the materials, followed by a partial physical prompt such as redirecting his hands to the materials, and, finally, a hand over hand prompt such as guiding his hands to touch the letter. Each prompt was combined with the instructional cue (e.g., "What letter?"). A three-second pause was provided between each level of prompt.

Baseline

Baseline data were collected during the second week of the project. During baseline, a letter tile was placed on the frame and the instructional cue provided (i.e., "What letter?"). If Tanner did not respond, the instructor implemented the response prompt hierarchy described above providing a 3-sec pause between each prompt. Three trials with each of the letters A-D were conducted during each of two sessions. During each trial the letters were presented in random order. Data were collected on the level of prompt required for Tanner to touch the letter tile and the correctness of his letter names spoken. During all 24 trials of baseline, Tanner required a partial physical or hand over hand prompt to touch the letter tile and he achieved zero correct letter names. On the other hand, Tanner demonstrated little resistance to touching the letter tiles during baseline.

No baseline data were collected on Tanner's ability to recognize paper braille letters or to recognize the letters in his name using Tack Tiles® as observation of Tanner prior to beginning this project revealed that he did not have these skills. The instructor felt it best not to frustrate Tanner by asking him to engage in skills that he was known not to possess.

Instruction

Each instructional session consisted of three parts. During the first part, Tanner was taught to identify the letters A-D using Tack Tiles®. Then Tanner was taught to identify the letters A-D with paper braille. Finally, Tanner was taught to identify the letters in his name using Tack Tiles®.

When teaching identification of letters A-D, four trials were conducted with each letter consecutively before moving to the next letter. The presentation order of letters was randomized for each session. The first trial with each letter was a model with the following three trials being instruction. Corrective feedback was provided during all trials. Data were collected on the level of prompt required for Tanner to touch the letter and the correctness of the letter name spoken by Tanner for three trials per letter for a total of 12 trials per session.

Each session began with the instructor placing a Tack Tiles® letter on the frame board. The instructor then said, "What letter?" while simultaneously guiding Tanner's hand to the letter and stating the letter name (e.g., "A. You say A."). If Tanner did not respond or responded incorrectly, the process was repeated. No data were collected on the first trial with each letter.

The instructor then placed another tile of the same letter one space to the right of the first tile and provided the instructional cue, "What letter?" The prompt hierarchy was implemented as described above. Data were collected on the level of prompt needed for Tanner to touch the letter tile. If Tanner provided the correct letter name, he was praised (e.g., "Yes, A, good!) and the process was repeated two more times with the same letter. If Tanner stated an incorrect letter name, he was provided with the correct name and the instructor paused for Tanner to imitate the letter name. This continued until three instructional trials with the letter were completed.

The entire process was then repeated with the next letter until all four letters had been completed. After all four letters had been completed with the Tack Tiles®, the process was repeated with paper braille letters, presenting the letters in the same order that they had been presented with the letter tiles.

During the final stage of each instructional session, the instructor placed the tiles representing the letters in Tanner's name on the frame. Again, the first trial was a model with the instructional cue, "What word?" Tanner's hand was guided to the first letter of his name. The instructor stated each letter of his name while guiding his hand across each letter and pausing slightly for Tanner to imitate the letter name. After the last letter, the instructor paused for 3 sec, said, "What word?" then immediately said Tanner's name for him to repeat. If Tanner did not respond or responded incorrectly, the instructor repeated the process.

Only one instructional trial with his name was completed during each session. Given this occurred at the end of each instructional session, Tanner typically demonstrated fatigue and, sometimes, frustration. Therefore, he was only encouraged to read his name one time per session. During the instructional trial, the prompt hierarchy was implemented for each letter, but the instructional cue was only provided once at the beginning of each trial. The instructor then documented the highest (i.e., most intrusive) level of prompt

required for Tanner to keep his hand on the letter tiles and track them from the first letter to the last letter of his name. Once Tanner was touching the first letter tile, the instructor paused for 3 sec for Tanner to say the letter name. If he did not respond or responded incorrectly, the instructor simply said, "T" and paused 3 sec for Tanner to imitate. This process continued across all letters of his name. After Tanner said the last letter in his name, the instructor paused for 3 sec for Tanner to say his name aloud. If he responded correctly, positive feedback was provided (e.g., "Yes! Tanner."). If he did not respond or began to respond incorrectly, the instructor quickly said his name aloud for him to imitate.

RESULTS

Tanner demonstrated progressive improvement during the instructional tasks using Tack Tiles®. Unfortunately, the instructional sessions with Tanner were much fewer than anticipated at the outset of this study. The sessions were originally set to run from January through May with two sessions per week. Inclement winter weather resulted in numerous disruptions to the school schedule during the early part of the study. Tanner experienced sporadic school absences due to illness and family issues toward the end of the study. Therefore, only the data representing consecutive sessions are presented here as being most representative of Tanner's performance in the absence of disruptions to his school attendance.

As can be seen in Figure 1 and Figure 2, the level of prompt required for Tanner to touch the tiles during instruction with letters A-D steadily decreased in intensity across the instructional sessions. A general trend was evident, with Tanner requiring less physical assistance to touch the letters during the final three instructional sessions. More importantly, Tanner demonstrated increasing accuracy with letter names across sessions. During the first session, he named 2 of 12 letters correctly (17% accuracy) but steadily improved to a high of 83% accuracy during the fifth session.

In comparison to Tanner's progress while using Tack Tiles®, he demonstrated greater inconsistencies in performance when using paper braille. Figure 3 and Figure 4 reveal he generally needed less supportive prompts to touch the paper braille letters while at the same time he made little progress in correctly identifying the letters. During the first instructional session he correctly identified the letter A during all three trials, but never correctly identified A again across the remaining sessions. Then during the final session he correctly identified the letter C during two of three trials whereas he had not identified C correctly during any previous sessions. This inconsistency in letter identification seemed

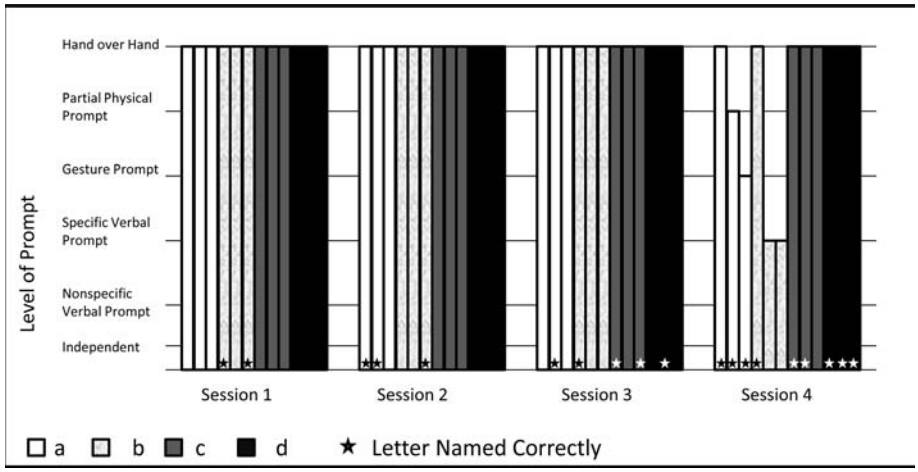

Figure 1. Level of prompt required to touch Tack Tiles® letters during instruction with letters A-D across Sessions 1-4. The star indicates trials in which the letter was named correctly.

to indicate that he was not making the connection between the paper braille letters and their names.

As can be seen in Figure 5, Tanner made progress in spelling his name using Tack Tiles®. During the first two sessions, he required hand over hand

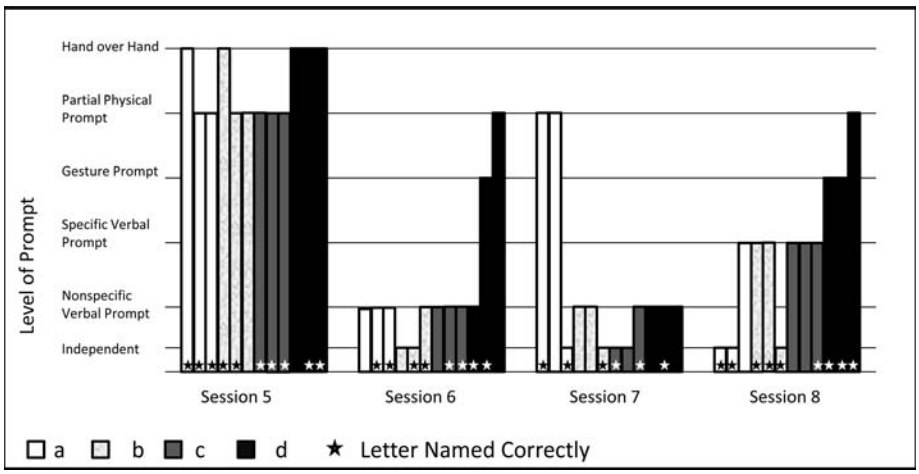

Figure 2. Level of prompt required to touch Tack Tiles® letters during instruction with letters A-D across Sessions 5-8. The star indicates trials in which the letter was named correctly.

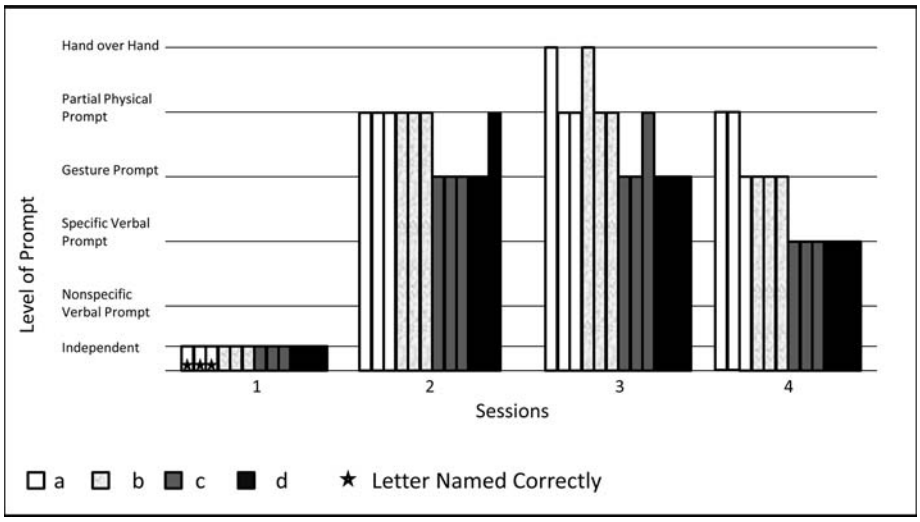

Figure 3. Level of prompt required to touch paper braille letters during instruction with letters A-D across Sessions 1-4. The star indicates trails in which the letter was named correctly.

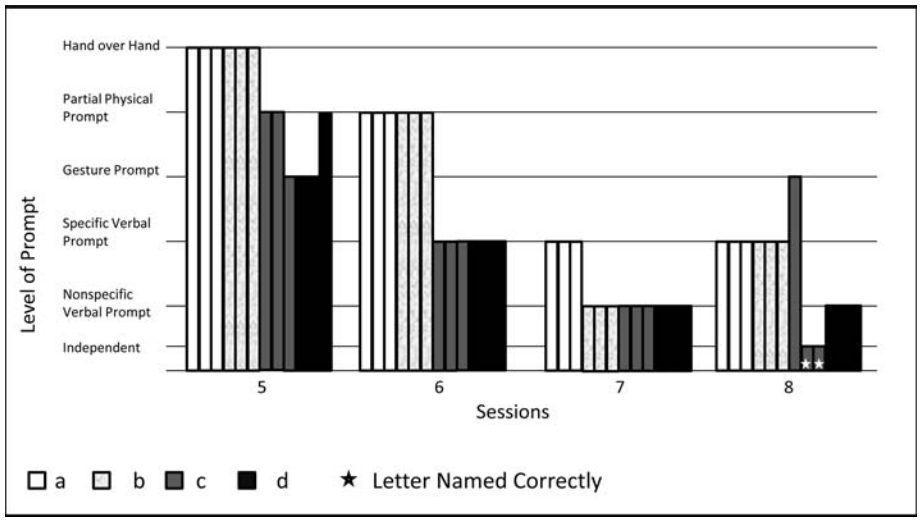

Figure 4. Level of prompt required to touch paper braille letters during instruction with letters A-D across Sessions 5-8. The star indicates trails in which the letter was named correctly.

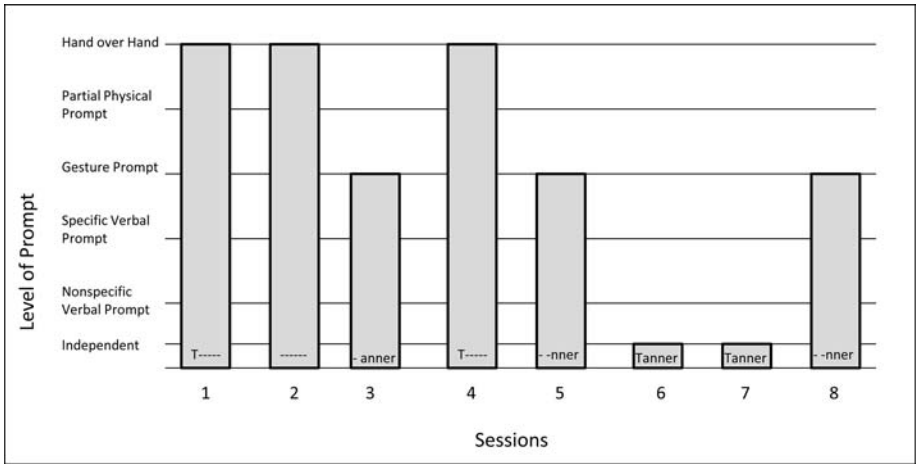

Figure 5. Maximum level of prompt (per session) required to track letters of his name using Tack Tiles®. Letters represent those he stated independently while dashes represent those for which he required a spoken model.

assistance to track the letters of his name. During the sixth and seventh sessions, Tanner independently tracked all the letters of his name. Tanner also made progress stating the letters of his name in conjunction with touching each tile although his progress was inconsistent. During the initial session, he independently stated the first letter of his name, but required a model for the remaining letters. During the second session, he required a model for all letters of his name, but during the third session, he required a model for the initial letter of his name and then independently stated the remaining letters. During the sixth and seventh sessions, Tanner not only independently tracked the tiles, but also independently stated each letter name.

DISCUSSION

During Tanner's initial introduction to Tack Tiles®, he did not demonstrate avoidance behaviors and, in fact, continued to feel the bumps of the braille letter tiles and the frame in between instructional prompts and after the sessions were completed. The only instances of Tanner stiffening his arms or pulling away from the tiles were during the first session and during a later session when he appeared to be getting a cold. In comparison with Tanner's continued reluctance to touch paper braille after three years of instruction, Tanner demonstrated more consistent progress during the short instructional

period with Tack Tiles®. Therefore, it appeared Tack Tiles® did, in fact, benefit in assisting Tanner to overcome his tactile resistance to engaging with braille. Tanner's increased willingness to interact with the tiles over paper braille may demonstrate an increase in his motivation for actively participating in the academic instruction presented with this tool. His observed interest in the tiles and frame board may reflect its resemblance to the popular toy Legos® and/or the tactile difference between the large, smooth plastic bumps on the blocks and the small pointy dots of paper braille.

Tanner's performance with identification of letter names during instruction with Tack Tiles®, compared to his performance when using paper braille, provides a clear indication that the letter tiles were assisting him to make the connection between braille and letter names as well as to tactually differentiate among braille letters. Instructional sessions with Tack Tiles® and paper braille were identical, yet Tack Tiles® trials occurred first during each session. Therefore, it could be presumed that there would be carryover of learning letter names from the Tack Tiles® trials to the paper braille trials. Since this did not occur, it can be concluded that Tanner's improved performance with letter identification resulted from use of Tack Tiles®.

An additional example of Tanner's greater attention to academic instruction when using the Tack Tiles® was observed during instruction of individual letters in his name. Prior to instruction in identifying the letters in his name, Tanner had demonstrated the ability to rotely spell his name aloud. This skill assisted instruction, as he willingly verbalized these letters while the instructor guided his hands over the tiles in a one-to-one correspondence with each letter. This had not been done with Tanner in the past, as tracking with whole words was done in a smooth manner over the word, without stopping over individual letters. After the first two sessions, the instructor was able to decrease the amount of physical support, allowing him to take initiative to move his fingers with one-to-one correspondence while identifying the letters in his name.

Considering Tanner's engagement with Tack Tiles® and previous tactual defensiveness with paper braille, Tack Tiles® may be a successful fit for him to continue gaining braille literacy skills. There are, however, cautions for the use of this tool for Tanner and other students. As Wormsley (2004) suggested, larger braille materials like Tack Tiles® may not transfer well to paper braille. Attention to this potential problem was addressed in this study by the continued use of paper braille alongside the tiles during instruction on letter names. Another potential difficulty with this product is in the placing and removing of letter tiles by students with fine motor difficulties. A potential solution for this is using a mat surface instead of the frame board for placement. There is a design flaw with the product in the curving of the top left side of the tiles

rather than the conventional practice to curve or cut the top right corner of a card or individual page of braille (Wormsley, 2004). This may confuse students when using curricular materials with the right side cut.

EDUCATIONAL IMPLICATIONS

The determination of how to teach braille to a student with congenital blindness and additional disabilities depends on a variety of factors related to the specific characteristics of the student. There is no evidence to date that the presence of intellectual impairment will preclude acquisition of braille skills, but a specialized instructional program should be built for the student to fit particular needs. Student rate of acquisition, level of skill proficiency, and potential functional uses will all vary depending upon the needs, abilities, and environment of the student. Whatever the instructional program, it is important for the use of braille to be frequently demonstrated and modeled, with its exposure and instruction being tied to functional activities (Wormsley & D'Andrea, 1997). Instruction should be meaningful to the student and motivating by building on student interests (Swenson, 2008). The focus is on using literacy in the student's daily interactions to show the importance of learning how to recognize and use symbols. It is theorized that once connections begin to be made, the student will be motivated to progress further with skills acquisition. All gains will serve to provide a greater level of independence in interacting with the world around the student. It thus changes the question from whether to teach literacy skills, to where to start.

There are inherent limitations to the potential for generalization from a case study. First, this intervention study was short in duration with only eight instructional sessions. Yet in those eight sessions, Tanner demonstrated clear progress in his ability to identify letters. Second, Tanner's unique combination of disabilities represent a very small population of school-age children who will each have a different profile of strengths and needs, minimizing the ability to generalize these results to a wider population of children. Conversely, the purpose of this study was to determine the feasibility of using Tack Tiles® to assist a child in overcoming his tactile resistance to engaging with braille materials. The results presented here clearly demonstrate Tanner's increased willingness to engage with Tack Tiles® over paper braille, confirming the need for continued research in this area.

Recommendations for Tanner's instructional program emphasize continued, but more intense, focus on the individual letters of his name in the same fashion as done with letters A-D in this study. Attention should again be

drawn to the dot positions of braille letters on the letter blocks when providing instruction with the letters of his name. Further instruction would include forming other words as he learns new letters. More attention can be placed on making the connection between Tack Tiles® and paper braille by continuing to use the letter and word cards. The next step also includes his Perkins Brailler with Tack Tiles® instruction. At this point, a greater focus should also be placed on noting what Tanner is producing when he is typing certain keys on the brailler.

The use of Tack Tiles® deserves further consideration as an evidence-based practice. Future research could include a survey of instructor opinions and examples of other instructional uses, the ability of proficient braille users to tactually discriminate letters and words formed with the Tack Tiles®, the transferability of braille skills with Tack Tiles® to braille on paper, and its use with individuals with late onset blindness who have difficulty reading regular braille or other individuals with tactual defensiveness. In considering Tanner's tactual defensiveness and improved interaction with the larger braille blocks, a potential barrier to progress in braille instruction for Tanner might have been his lack of tactual readiness. Tactual readiness is an essential part of braille instruction, yet is often difficult to determine (MacComiskey, 1996; Steinman, LeJeune, & Kimbrough, 2006). Further research in this area may provide important guidance for effective instruction in this vital early skill, especially for individuals with tactual defensiveness, physical disabilities, or other barriers to tactual discrimination.

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