

## SENSORY PROCESSING PREDICTORS OF CHALLENGING BEHAVIOR

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## **Abstract**

Previous research has demonstrated that sensory processing is a temperamental trait that can contribute to challenging behavior. Research linking sensory processing to behavior has primarily focused on diagnostic groups, such as autism. Protective factors, such as resiliency, can support children in managing their behavior. While previous research has suggested that relational aspects of the environment can influence protective factors, little research has addressed the contribution of the sensory environment. We aim to determine the contribution of sensory processing (using the Sensory Profile 2) to challenging behavior and protective factors (using the BASC-2) in a sample of 51 children ages 6-11 from the general population. Results indicate that certain sensory processing patterns do predict challenging behaviors and protective factors.

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## **Executive Summary**

My dissertation project is aimed at understanding how a person's context affects participation. The American Occupational Therapy Foundation (2014) defines participation as engagement in meaningful, every-day activities as “a result of choice, motivation, and meaning” (p. S4). Given this definition, self-determination, which is a personal characteristic describing the level in which a person makes decisions and directs action based on his or her goals, is integral to participation. Context can support or inhibit successful participation.

Bronfenbrenner's (1977) ecological model of human development described four layers of context: the microsystem (groups that directly impact the person, such as family, school and peers), mesosystem (relationships between microsystems, such as the relationship between family and school), exosystem (influences on the person in which the person does not play an active role, such as government policy), and macrosystem (culture in which the person lives). Each layer affects development in different ways. Bronfenbrenner's model has been applied to participation through theories such as the Ecology of Human Performance, which considers participation as the dynamic interaction between the person, context, and activity (Dunn, Brown, & McGuigan, 1994). I investigated different aspects of context using these models throughout my dissertation.

The first manuscript, “Contextual Aspects of Self-determination”, provides a conceptual basis for how self-determination is supported by context. I first summarize Causal Agency Theory, which describes a process in which a person acts or directs action in a manner that accomplishes his goals. Then, I discuss how the physical and socio/cultural environments (components of Bronfenbrenner's microsystem) support self-determination – and as a result, participation. Fi-

nally, I consider measurement tools professionals can use to assess environmental supports and barriers to inform practice.

The second manuscript, “Role of Occupational Therapy in Promoting Self-determination Through Consumer-Directed Supports,” considers how self-determination can be supported from a policy level (Dean, Dunn, & Tomchek, 2015). In Bronfenbrenner’s view of context, this is considered the exosystem (Bronfenbrenner, 1977). This section describes a system of supports called consumer directed supports. This system of support gives people with disabilities the option of purchasing their own supports based on their needs and goals. People who use consumer directed services can hire, train, and fire caregivers without going through an agency that provides those services. I discuss how occupational therapists can support people with disabilities who use consumer direct supports.

The third manuscript, “Sensory Processing: A Piece of the Learning-Related Behaviors Puzzle” considers a micro-level contextual issue (Dean, Dunn, Little, & Tomchek, In Preparation). Sensory processing is a construct that describes how a person responds to their sensory environment. This section explores how sensory processing is related to school participation through learning-related behaviors, such as attention, learning, self-control, and cognition. Different aspects of sensory processing are related to learning-related behaviors. I discuss how school professionals can use sensory processing to determine additional ways of supporting students to participate in the classroom

Finally, the culminating manuscript is titled “Sensory Processing Predictors of Challenging Behavior”. Challenging behavior can interfere with participation, and I am interested in understanding how people’s response to the sensory environment contribute to challenging behav-



ior. I found that certain sensory processing patterns do predict challenging behaviors as well as protective factors, such as resiliency.

Through my dissertation process, I have developed a broad understanding of how context influences participation. Additionally, I have developed a deep understanding of how personal characteristics, such as sensory processing, can support or inhibit successful participation. As I begin my research career, this knowledge will provide a foundation to delve deeper into contextual supports of participation.

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## **Background**

Sensory Processing is a construct that describes the interface between a person's neurological function and the environment. Interactions between the environment and person are at the heart of modern conceptualizations of health, and can affect participation (WHO, 2007). This research seeks to understand how the interaction between a child and sensory environment (i.e. sensory processing) can predict behavioral patterns.

## **Introduction**

### **Sensory Processing**

Dunn's Sensory Processing Framework (DSPF) theorizes sensory processing as two continua of responses to environmental stimuli (Dunn, 2014). People respond differently to sensory information based on how soon they detect (threshold) and how they manage (self-regulation) sensory stimuli. According to DSPF, threshold ranges from high (e.g. slow to detect) to low (quick to detect), and self-regulation ranges from passive (reacts to stimuli as they happen) to active (plans reaction to stimuli). These two continua interact to create four sensory processing patterns: registration (high threshold and passive self-regulation), seeking (high threshold and active self-regulation), sensitivity (low threshold and passive self-regulation), and avoiding (low threshold and active self-regulation). In personality research, sensory processing has been shown to be related to, yet distinct from emotion and self-regulation (Gouze, Lavigne, Hopkins, Bryant, & Lebailly, 2012)

Psychology literature has investigated sensory processing related to temperament. Researchers hypothesized sensory processing sensitivity (SPS) as a temperament or personality trait (Aron & Aron, 1997; Aron, Aron, & Jagiellowicz, 2012). In this model, researchers view sensory processing sensitivity as a continuum of responsiveness to environmental stimuli.

Responses from more sensitive people are driven by strong emotional reactions and include being more sensitive to subtle stimuli, pausing to observe in novel situations, and using complex self-regulation strategies for planning responses and learning from situations. SPS is similar to DSPF. Both consider sensory processing as an innate biological function that allows a person to make sense of their environment.

The difference in the SPS and DSPF models is the relationship of neurological threshold. While SPS considers threshold and response to be along the same continuum (i.e. more responsive also means lower threshold), DSPF considers threshold and responsiveness as separate continuum. That is, a person may notice (or not) sensory stimuli quickly, but may react in a passive or active manner. Other research has challenged Aron & Aron's (1997) unidimensional model of sensory processing and suggested multiple factors (Evans & Rothbart, 2008; Smolewska, McCabe, & Woody, 2006) The multiple factor models are interesting because each factor in those models were related to different behavioral and personality constructs. Considering sensory processing as an innate biological trait has allowed researchers to consider the evolutionary benefit of sensory processing (Wolf, van Doorn, & Weissing, 2008, 2011). Society needs responsive people who notice subtle changes in the environment and other people. If there is a threat, someone needs to notice the threat early and respond. However, society also needs consistency and predictability. When no threat is present, people who act consistently and predictably support others in society to do the same. The range of sensory processing observed through research suggests the adaptability of the species as a collective.

### **Sensory Processing and Challenging Behavior**

While there are advantages to variability within groups to responses to environmental stimuli, responses over time can lead to challenging behavior. Researchers have found

relationships between sensory processing and both behavioral and personality constructs that relate to internalizing (responding internally) and externalizing (responding outwardly) behaviors. Children who are more sensitive to environmental stimuli also display higher levels of stress (Bakker & Moulding, 2012; Benham, 2006), anxiety (Hofmann & Bitran, 2007; Kinnealey, Koenig, & Smith, 2011; Lane, Reynolds, & Dumenci, 2012; Mazurek, Vasa, Kalb, Kanne, Rosenberg, Keefer et al., 2013), externalizing behaviors (Ben-Sasson, Carter, & Briggs-Gowan, 2009), internalizing behaviors (Ben-Sasson, Carter, & Briggs-Gowan, 2009; Ben-Sasson, Cermak, Orsmond, Tager-Flusberg, Kadlec, & Carter, 2008), and symptoms of ill health (Benham, 2006). Sensitive children have also displayed lower levels of adaptive social behaviors (Ben-Sasson, Carter, & Briggs-Gowan, 2009; Watson, Patten, Baranek, Poe, Boyd, Freuler et al., 2011). Evans, Nelson, and Porter (2012) differentiated between children who react more to sensory stimuli and children who are more aware of novel stimuli. Children who react more to sensory stimuli demonstrated more difficulty with social behaviors, while children who were more aware of novel stimuli showed more prosocial behaviors.

Autism researchers have investigated behaviors associated with externalizing behaviors. For example, O'Donnell, Deitz, Kartin, Nalty, and Dawson (2012) found that challenging behavior, but not adaptive behavior was related to sensory processing. O'Donnell and colleague's findings related to adaptive behavior is different from other studies that have found a relationship between adaptive behavior and sensory processing (i.e. Chuang, et al. (2012); Watson, et al., (2011)). O'Donnell and colleagues used the Vineland, which has not been related to sensory processing in other work (Dunn, 2014). Additionally, Chuang et al's (2012) study of children with autism found that students who were more sensitive to sensory input showed a higher intensity of reaction to sensory stimuli.

Related to externalizing behaviors, the term reactive aggression has been used to distinguish challenging behavior that has been linked to environmental causes from socially caused behavior. Reactive aggression has been related to self-regulation (White, Jarrett, & Ollendick, 2013). Additionally, children who display a higher frequency of reactive aggression tend to perceive threats in their environment where other children do not (Crick & Dodge, 1996). The threats that this research studied were social in nature. Using a sensory processing frame of reference, we might interpret children who display reactive aggression behaviors as quick to detect (low threshold) sensory input and actively trying to control that input (active self-regulation). This pattern would match the Avoiding sensory processing pattern. Given this, we would expect children who demonstrate a higher frequency of avoiding behaviors to also demonstrate a higher frequency of externalizing behaviors.

### **Protective Factors**

The term “protective factors” in research is used to mean different things, including interaction effects between attributes (people with an attribute may be unaffected by adversity while people without the attribute are affected), and direct ameliorative effects (an attribute that distinguishes success in at-risk individuals) (Luthar, Cicchetti, & Becker, 2000). Protective factors are related to resilience in that protective factors promote resilience. An additional complicating factor for research is that protective factors (or resiliency) are sometimes considered personal traits and other times considered a dynamic process. In this paper, we consider that certain sensory processing patterns may be protective factors for challenging behavior.

Some research has focused on protective factors, which may moderate the relationship between sensory processing and challenging behavior. Bakker and Moulding (2012) found that

mindfulness moderated the effects of sensory processing and anxiety. Additionally, while stress is sometimes considered an ill effect of sensory processing, stress can also be a positive effect in the presence of a supportive and protective environment (Boyce & Ellis, 2005; Ellis & Boyce, 2008).

While there is evidence that sensory processing is associated with behavior, much of the research either uses participants with specific conditions (i.e. autism) or uses a unidimensional approach to sensory processing. This study investigates whether sensory processing (as measured by the Child Sensory Profile 2) predicts adaptive and maladaptive behavior (as measured by the BASC 2) in children in the general population.

The aim of this paper is to address the question: how do sensory processing patterns at home predict adaptive and maladaptive behavior in the general population of children 6–11 yrs old?

## **Methods**

### **Design**

This study used a cross-sectional design with a national sample to explore the influences of parent-reported sensory processing patterns and behavioral characteristics of children ages 6 – 11.

### **Participants**

We recruited participants from the general population, stratified based on conditions that have sensory features, across the United States for the Sensory Profile 2 standardization study (Dunn, 2014). The sample for this study included 51 children, ages 6 – 11 whose parents completed both the Children’s Sensory Profile 2 (CSP2) and the BASC-2 assessments for a validity study.

## Measures

The Child Sensory Profile 2 (CSP2) is an 86-item teacher-report measure of a student's sensory processing characteristics (Dunn, 2014). The CSP2 provides scores on five sensory systems (e.g. auditory, visual, movement, body position, and touch), three behaviors related with sensory processing (e.g. attention, conduct, and social emotional), and four sensory processing patterns associated with Dunn's Sensory Processing Framework (e.g. registration, seeking, sensitivity, and avoiding). See Table 1 for more description of the sensory processing patterns. The CSP2 was normed on a large national sample (n=697), and demonstrates strong psychometric properties.

<Insert Table 1 about here>

The Behavior Assessment System for Children, 2<sup>nd</sup> Edition Parent Rating Scales (BASC-2) is a parent-report assessment that measures how frequently children engage in particular behaviors (Reynolds & Kamphaus, 2004). The BASC-2 is typically used to determine problematic behaviors that may be indicators of larger psychological issues. Although the BASC-2 has 15 scales, for this study, we selected scales of the BASC-2 that relate to previous research in sensory processing. To measure challenging behavior, we used the externalizing and internalizing composite scores. Externalizing consists of the aggression, hyperactivity, and conduct problems subscales and internalizing consists of the depression, anxiety, and somatization subscales. To measure protective factors, we used the adaptability and resilience scales. Table 2 describes the BASC-2 scales we used for our study. Higher scores on the BASC-2 indicate higher frequency of behavior.

<Insert table 2 about here>

## **Analysis**

Authors computed a Multivariate Analysis of Variance (MANOVA) to determine if there were differences in behavioral patterns based on diagnosis.

To determine how sensory processing patterns (as measured by the CSP2) predict adaptive and maladaptive behavior, we used four multivariate linear regression models on four behavior scores (as measured by the BASC-2; i.e., externalizing, internalizing, adaptability, and resiliency). We entered the independent variables (i.e. avoiding, sensitivity, seeking, and registration) simultaneously into the regression models so that we could determine the relative contribution of each pattern. Additionally, for Internalizing and Externalizing, we also ran regression models based on the component scores (i.e. Anxiety, Depression, and Somatization for Internalizing, and Hyperactivity, Aggression, and Conduct Problems for Externalizing).

## **Results**

Table 3 shows demographic info. Forty-three of the participants had no diagnosis, five had ADHD, two had ASD, one had a learning disability. The MANOVA showed that there was a difference in the behavioral scores based on diagnosis (Pillai's Trace  $F=2.56$ ,  $p=.014$ ). Pairwise comparisons revealed that children with ADHD demonstrated more frequent externalizing ( $p=.001$ ) and internalizing ( $p=.018$ ) behaviors and less frequent resiliency ( $p<.001$ ) and adaptability ( $p<.001$ ) behaviors.

<Insert table 3 about here>

Table 4 shows the results from the regression analysis using the general population sample. To determine if the differences in behavior scores based on diagnosis affected our general population regression models, we re-ran the regression models with a sample that excluded participants with a diagnosis (no diagnosis). A comparison of the results from the two regression



analyses - General Population (GP) vs No Diagnosis (ND) - revealed that there was no change in significant predictors for Adaptability. For Internalizing and Resiliency, Avoiding was a significant predictor in the GP and ND analysis, but Seeking was only significant in the GP analyses (Internalizing: GP  $\beta=-.422$ ,  $p=.006$ ; ND  $\beta=-.297$ ,  $p=.067$ ; Resiliency: GP  $\beta=.338$ ,  $p=.018$ ; ND  $\beta=.286$ ,  $p=.125$ ). Avoiding continued to predict Externalizing in the ND analysis, but Sensitivity did not (GP  $\beta=-.658$ ,  $p=.025$ ; ND  $\beta=-.528$ ,  $p=.097$ ).

<Insert table 4 about here>

We hypothesized that the differences in predictors were due to a change in power due to removing seven participants from our sample. We confirmed this hypothesis by removing a random sample of seven typically developing participants from the GP sample and obtained the same significant predictors as the ND analysis. Given the similarity of statistics, our results and discussion will focus on the sample with more power, the general population.

Table 4 shows the percentage of variance that was accounted for in each of the models. All of the models were significant at a .05 alpha level, and ranged from 44% to 71% in percentage of variance accounted for.

Avoiding and Sensitivity predicted Externalizing. Analysis of the Externalizing subscales revealed similar patterns among the components. Avoiding and Sensitivity predicted two of the Externalizing subscales, Hyperactivity (Avoiding:  $\beta=.680$ ,  $p=.039$ ; Sensitivity:  $\beta=-.625$ ,  $p=.041$ ) and Aggression (Avoiding:  $\beta=.940$ ,  $p=.004$ ; Sensitivity:  $\beta=-.759$ ,  $p=.012$ ). Avoiding was the only significant contributor for Conduct Problems ( $\beta=.954$ ,  $p=.008$ ).

For Internalizing, the overall model was significant, however no specific sensory processing pattern was a significant predictor. The internalizing sub-scales (Anxiety, Depression, and Somatization) demonstrated different relationships among the predictors. Similar to the In-

ternalizing composite, the overall model for Anxiety was significant ( $R^2=.287$ ,  $p=.003$ ), but no sensory processing pattern score was a significant predictor. For Depression, Avoiding ( $\beta=1.08$ ,  $p<.001$ ) and Seeking ( $\beta=-.422$ ,  $p=.006$ ) were significant predictors. The overall model for Somatization was not significant ( $R^2=.140$ ,  $p=.130$ ).

Avoiding was the only predictor of Adaptability. Avoiding and Seeking predicted Resiliency.

## **Discussion**

### **Behavior and Underling Conditions**

The results show that there is a difference in behavior scores based on diagnosis, which is not surprising considering the large amount of research demonstrating differences in sensory processing based on diagnosis (Dunn, Little, Dean, Robertson, & Evans, In Review). Our research is unique in that we compared the results found in the general population (including representative numbers of children with conditions know to show differences in sensory processing) with our sample of only typically developing children. The sensory processing predictors of behavior were generally the same between these samples. Where there were differences in the significance of predictors, the Beta scores were similar, indicating that the differences had more to do with the power of the sample rather than differences caused by the conditions of children in the sample. This finding suggests that while children with conditions may show differences in the frequency of behaviors related to sensory processing, the function of the behaviors may have similar intent, regardless of diagnosis. Future research should consider understanding the adaptive qualities of different sensory processing patterns in children who have been successful in managing their behavior based on sensory input.

## Challenging Behavior

Our research suggests that when Avoiding behaviors are more frequent, externalizing behaviors (i.e. hyperactivity, aggression, and conduct problems) are more frequent as well. Yet, an increase in Sensitivity behaviors reduces the frequency of externalizing behaviors. The evidence that, in the presence of Avoiding behaviors, Sensitivity behaviors reduce externalizing behaviors suggest that passive versus active regulation may support a child in reducing outwardly focused challenging behavior. To explore this conclusion, we ran another regression model using Passive Self-Regulation (Registration and Sensitivity) and Active Self-Regulation (Seeking and Avoiding) as predictors of Externalizing. Our results showed that only Active Self-Regulation predicted externalization ( $\beta=.733$ ,  $p=.019$ ), and the overall model accounted for 42% of the variance. Intervention focused on teaching children to notice their response to sensory stimuli and internally plan a reaction may be helpful in reducing externalizing behaviors. This conclusion is supported by previous research into mindfulness (Bakker & Moulding, 2012) and self-regulation (Barnes, Vogel, Beck, Schoenfeld, & Owen, 2008).

No sensory processing pattern significantly predicted internalizing behaviors (i.e. depression, anxiety, and somatization). This finding is contrary to previous research showing a relationship between sensory processing and internalizing (Ben-Sasson, Carter, & Briggs-Gowan, 2009; Ben-Sasson, Cermak, Orsmond, Tager-Flusberg, Kadlec, & Carter, 2008). One reason for this may be that the children in our sample did not exhibit enough internalizing behaviors for the parent raters to notice. Previous research has shown that parents of children who do not show behavioral problems tend to report fewer internalizing behaviors than the children report (Smith, 2007). Given the personal nature of internalizing behaviors, future research into sensory processing and behavior in the general population may want to consider child-report measures of

internalizing behavior. Our analysis of the subscales of Internalizing, however, demonstrated different contributions of sensory processing in each of the scales. No sensory processing pattern predicted Anxiety, yet the overall model was significant and accounted for 29% of the variance. This could mean that sensory processing in general influences anxiety, but no one pattern is dominant. Previous research has reported that low threshold responses are related to anxiety (Kinnealey, Koenig, & Smith, 2011; Lane, Reynolds, & Dumenci, 2012). It is possible that with a larger sample size, our study may have found more relationships among the patterns, but given our results, we cannot speculate on what those relationships would be.

Avoiding and Seeking were significant predictors of depression. When Avoiding was taken into account, Seeking predicted depression in a negative direction, indicating the more seeking behaviors a child exhibits, the less frequent the child demonstrates behaviors associated with depression. A key component of the Seeking pattern is engagement with the environment. The finding that Seeking moderates the relationship with Avoiding and depression could indicate that when children are interested in activities enough to fully engage in the environment, they display fewer depressive-like behaviors. Another hypothesis is that in environments where a child's sensory patterns are supported, they engage more in the environment. Further research is needed to understand how Seeking supports internalizing behaviors such as depression.

### **Protective Factors**

We found that avoiding was a negative predictor of resiliency. Yet, the additional presence of seeking helps support resiliency. The higher the Avoiding score, the less Resilient children were and the higher the Seeking score the more resilient. Conceptualizations on resiliency vary from considering resiliency as a personal trait versus a dynamic process (Luthar, Cicchetti, & Becker, 2000). Resiliency as measured by the BASC-2 refers more to a personal trait, similar

to ego-resiliency (Block & Block, 1980). This trait reflects resourcefulness and flexibility of functioning. Our finding that seeking predicts resiliency may suggest that seeking behaviors are adaptive in that they make children more resilient. Given previous research relating seeking patterns to repetitive behaviors in children with autism, such as Boyd, McBee, Holtzclaw, Baranek, and Bodfish (2009), our finding relating seeking to resiliency may cast a new light on behaviors considered maladaptive in the autism population.

Overall, Avoiding scores predicted all of the behaviors in the study, indicating that children who have a low threshold for sensory stimuli and also have active self-regulation strategies need more support to manage their behavior. These children may benefit from coaching to determine self-regulation strategies that are viewed as more appropriate to their peers, parents and teachers. Additionally, if avoiding behaviors increase challenging behavior and decrease adaptive behavior, occupational therapists can support children and by creating or adapting environments and routines to limit the amount of sensory information. For example, children may benefit from going to playgrounds at less-crowded times. Additionally, occupational therapists may work with families to create morning and evening routines that are predictable and allow the child to control the amount of sensory input they receive (i.e. decide when to turn the lights on in the morning, the taste and texture of their toothpaste, or how many errands to run after school).

Given the evidence suggesting the teacher/child relationship is important when considering externalizing behaviors in schools, it is possible that considering the sensory environment as a cause for externalizing behavior can help teachers find more explanations for the behavior. By recognizing and addressing environmental causes to behavior, teachers can support students before the student/teacher relationship is compromised.

Environmental variables, such as chaotic home environment and low economic resources may contribute to unpredictability in a child's life. Given the strong relationship between Avoiding and challenging behavior here, it might be that children's need for predictability and control over their environment (which is characteristic of Avoiding behaviors) and the child's inability in some environments to get the necessary predictability and control may contribute to the explanation for challenging behavior.

### **Implications for Occupational Therapy**

This research shows that sensory processing may be one factor that contributes to challenging behavior. Occupational therapists can use this evidence to collaborate with parents, school psychologists, and teachers to:

- Understand student behavior through a sensory processing frame of reference
- Design classroom environmental interventions to target successful participation in classroom, community, or family activities

### **Limitations and Conclusion**

This study was based on data that was collected for the Sensory Profile 2 standardization project. The purpose of the data collection was to establish validity using the BASC2. A larger sample size may have given us more power to notice further contributions of sensory patterns to behavior. However, even with limited power, we were able to demonstrate relationships between sensory processing and behavior. Additionally, a sample with more students with disabilities would allow us to make firmer conclusions based on diagnosis. Given these limitations, however, this study suggests that further investigation of the role sensory processing plays in challenging behaviors is needed.

This research connects sensory processing and behavioral characteristics in a general population of children. Most research on the relationship between sensory processing and behavior has been done on specific diagnostic groups – mainly autism. This research uses a sample of children from the general population, which allows us to think about sensory processing as a relevant feature for understanding all children’s behaviors.

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**Table 1**  
**CSP2 scales**

	<b>CSP2 Score</b>	<b>Behavioral Characteristic</b>	<b>What the scale measures</b>
Sensory Processing Patterns	Seeking	Craves sensory input	Needs to touch objects and people. Fiddles with objects. Is on the go. Watches people move around the room.
	Avoiding	Is overwhelmed by sensory input	Becomes distressed during large gatherings. Slower to participate in physical activities. Needs structure and routine
	Sensitivity	Detects and can be bothered by sensory input	Reacts strongly to unexpected noises. Has difficulty participating in noisy environments. Can be described as dramatic or over reactive.
	Registration	Misses sensory input	Needs help to find objects that are obvious to others, seems unaware of pain or temperature changes, seems unaware when people enter the room

**Table 2**  
**BASC-2 PRS scales**

	<b>BASC2 Scale</b>	<b>What the scale measures</b>
Challenging Behaviors (Higher score indicates more difficulty)	Externalization	Composite score of Hyperactivity, Aggression, and Conduct Problems. This group of scores indicate the level of disruptive behaviors a child demonstrates. Examples: Acts without thinking, Is overly active, Argues, Disrupts other children, Breaks rules, Gets into trouble
	Internalization	Composite score of Anxiety, Depression, and Somatization. This group of scores describe behavioral patterns that indicate a child over-controls their behavior. Examples: Complains about health, Gets sick, Worries, Changes moods quickly, Complains about being teased and not having friends
Protective Factors (Higher score indicates more ability)	Resiliency	Indicates a child's ability to use supports to overcome obstacles. Examples: Sets realistic goals, Makes friends easily, Recovers quickly after a setback
	Adaptability	Indicates ability to adjust to changes in routine and shift from one task to another. Examples: Adjusts well to changes, Recovers quickly from setbacks, Shares and plays well with others

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**Table 3**  
**Demographics**

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Characteristic	N	% of sample
<b>Age</b>		
6-8	16	31%
8-10	19	37%
10-12	16	31%
<b>Gender</b>		
Male	27	53%
Female	24	47%
<b>Diagnosis</b>		
ADHD	5	10%
ASD	2	4%
No Diagnosis	44	86%

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**Table 4**  
**Regression Models using Sensory Processing Patterns as predictors**

Covariate	$\beta$ Coeff.	t	p value
<b>Externalizing Behaviors (<math>R^2 = .522</math>)</b>			
Avoiding	.928	3.05	.004
Registration	.370	1.00	.324
Seeking	.005	.03	.978
Sensitivity	-.658	-2.33	.025
<b>Internalizing Behaviors (<math>R^2 = .463</math>)</b>			
Avoiding	.621	1.93	.060
Registration	-.129	-.33	.745
Seeking	-.129	-.69	.497
Sensitivity	.295	.99	.330
<b>Adaptability Behaviors (<math>R^2 = .575</math>)</b>			
Avoiding	-1.400	-4.87	<.001
Registration	.473	1.35	.183
Seeking	.135	.80	.426
Sensitivity	.149	.56	.580
<b>Resiliency Behaviors (<math>R^2 = .712</math>)</b>			
Avoiding	-1.423	-6.03	<.001
Registration	.179	.62	.538
Seeking	.338	2.45	.018
Sensitivity	.224	1.02	.312



Manuscript I

Comprehensive Literature Review I

Contextual Aspects of Self-Determination

Evan Dean

Occupational therapists believe that participation in meaningful, every-day life activities promote health and well-being (American Occupational Therapy Association, 2008).

Additionally, engagement in these every-day activities is “a result of choice, motivation, and meaning within a supportive context and environment” (p. S4). The first part of this equation - that participation in every-day activities are linked to choice, motivation, and meaning - demonstrates a link between participation and Causal Agency Theory’s definition of self-determination, which says that “self-determined people act in service to freely chosen goals” (Shogren, Wehmeyer, Palmer, & Forber-Pratt, in press-a, p. 17). That is, a self-determined person participates in meaningful, self-chosen, every-day activities that promote health and well-being. When we consider participation in context in light of Causal Agency Theory’s definition of self-determination, occupational therapists supporting the people we serve to be self-determined becomes an integral part of practice.

The second piece of the equation – that engagement happens in a supportive context and environment - is equally important. While models of self-determination acknowledge the role of context, little research has been conducted to demonstrate the role that context can play in supporting self-determination (Wehmeyer, 1999). The limited attention that has been paid to context is understandable since models of self-determination were developed to create educational interventions for students. Naturally, the focus would be on ways that students can develop capacity that will increase their self-determination.

In this paper, I will refer to participation as a construct that encompasses the level of engagement described above. That is, participation refers to being involved in activities that are freely chosen, motivating, and occur in a socially appropriate setting. Participation, which includes all of the physical and social elements of a setting, is distinguished from an activity,

which refers to the skills and actions of a task. For example, a person can practice the activity of basketball by practicing the component skills, such as dribbling, passing, and shooting the basketball. However, to participate in basketball means that you are part of a basketball team and work together to compete against another team. The component skills of basketball are a part of the participation, but so is teamwork, accepting other players, following rules, and following the direction of a coach. Additionally, participating in basketball becomes self-determined when the person playing basketball chooses to play basketball based on their preferences and goals.

### **Contextual Elements of Participation**

Modern conceptualizations of disability describe disability as a mismatch between a person and their environment. One of the first organizations to promote a social-ecological framework was the World Health Organization (WHO) in their International Classification of Functioning, Disease, and Health (ICF) (WHO, 2007). The ICF highlights the relationship between the environment and person by defining participation as a balance between health conditions (e.g. disorders and diseases) and environmental factors. Environmental factors are the physical, social, and attitudinal elements of a person's surroundings that can either promote or inhibit participation in real-life social settings. Occupational therapists and other professionals who are concerned with the affects of the person and the environment on participation use similar social-ecological models to guide their practice.

Professionals who support people with intellectual disability developed a model of human functioning that conceptualizes disability in a similar way to the ICF (Schalock, Borthwick-Duffy, Bradley, Buntinx, Coulter, Craig et al., 2010). This model, developed by the American Association for Intellectual and Developmental Disabilities (AAIDD), describes

disability as a part of the continuum of normal human functioning. Disability is still considered as a mismatch between a person's skills and abilities and the environment, however the AAIDD model also introduces the concept of supports, which can help bridge the gap between a person and environment.

AAIDD has also conceptualized the term supports to mean “resources and strategies used to promote the development, education, interests and well-being of a person and to enhance individual functioning” (Luckasson, Borthwick-Duffy, Buntinx, Coulter, Craig, Reeve et al., 2002). Supports are used to bridge the gap between a person and his or her environment so that a person can participate more fully (Thompson, Bradley, Buntinx, Schalock, Shogren, Snell et al., 2009). While supports can be used to build capacity within an individual, such as providing education, supports are generally thought of as environmental modifications designed to align the demands of the environment with a person's strengths. Using this definition, professionals who want to support a person to minimize the effect of a condition or impairment, can support the person by building capacity in either the person or the environment. Many times, it is in the person's best interest for professionals to focus their interventions on the environment rather than the person (Dunn, Brown, & McGuigan, 1994). For example, a person who exhibits behavioral issues in an segregated setting can be supported to work in an different environment without first needing to change his behavior in the segregated environment.

Similarly, in the early 1990's the occupational therapy profession was developing models that also highlighted the important role of contextual factors in supporting performance. The Ecology of Human Performance (EHP) is a conceptual model that is used to guide professionals in assessment and intervention (Dunn, Brown, & McGuigan, 1994). Its purpose was to bring a person's context into a more prominent focus for intervention. There are three essential

constructs in the model. The first construct, *person*, is made up of the abilities, experiences, and skills that are unique to each person. A *task*, which is a set of behaviors needed to accomplish a goal, is the second construct. Each person will use a different set of behaviors to participate in a task, which will move her or him toward a goal. Finally, the *context* construct is everything that surrounds the person, including temporal context (age, developmental stage, life cycle, and health status) and environment (physical, social, and cultural dimensions). The set of behaviors a person uses to accomplish a task are dependent on the person and the context. In this paper, the behaviors we are concerned with are actions that are volitional and lead to participation in support of freely chosen goals.

In EHP, the constructs of person and context are inseparable. In a given context, a person participates in tasks that are available, meaningful, and feasible within that context. For example, a person who is interested in gardening must participate in activities related to this activity at certain places, like shopping for seeds at a garden center or planting the seeds at a community garden or in their back yard. The types of plants that a person plants or the type of gardening a person wants to do may be influenced by the climate in which they live or by a memory of plants that decorated their home as a child. Also, a child may attach importance to gardening as a way of interacting with his or family.

When participating in a given context, a person requires support when there is a mismatch between the skills, experiences, and interests of the person and the social, physical, and cultural demands of a given context. Support within the physical environment could be adapting the environment, such as the addition of a tool to complete a task, or the removal of an obstacle to allow a person to move from one place to another. Additionally, a training program

could alter the social environment of a person with intellectual disability for caregivers designed to place more importance on the interests and goals of the person with intellectual disability.

### **Self-determination**

Self-determination is a construct that has helped professionals conceptualize the importance of people with disabilities directing their life based on their interests and goals. Wehmeyer (2005) defined self-determined behavior as “volitional actions that enable one to act as the primary causal agent in one’s life and to maintain or improve one’s quality of life” (p. 117). Within this definition, the term ‘volitional’ refers to intentional and conscious choice and ‘causal agent’ means that a person acts in order to accomplish a goal or create a change. Put another way, persons are self-determined when they engage in intentional, goal oriented actions to affect their own quality of life.

Self-determination is a personal characteristic possessed by all people (Wehmeyer, 2005). That is, all people possess a desire to affect the direction of their life and will act in a way to realize that desire. Self-determination can be promoted by environmental factors, such as policy and supports. For example, people who have experienced segregation or been discriminated against may not have developed their self-determination capacity.

In his functional model of self-determination, (Wehmeyer, 1999) conceptualized self-determined behavior as being made up of four characteristics: autonomy, self-regulation, psychological empowerment, and self-realization. According to this model, self-determination is enhanced when a person uses their strengths and supports to act toward a chosen goal. In this model, the influence of the environment is limited to providing opportunities for self-determined action. In figure 1 below, I have adapted Wehmeyer’s (1999) functional model of self-determination to place the role of context in a more prominent place in the model. In my

adaptation, self-determined behavior is still dependent on a person's strengths as well as supports. However, consistent with EHP, this model recognizes that self-determined behavior occurs in a context that can either support or inhibit the behavior.

Shogren et al. (Shogren, et al., in press-a) reconceptualized the self-determination construct to highlight that a self-determined person (called the agentic self) acts in ways that they believe will move them closer to their goals. Their model, Causal Agency Theory, describes the role context can play in provide opportunities as well as supports for self-determined action. The context can also create barriers to participation.

A separate but related theory about self-determination, Self-Determination Theory (SDT), provides a foundational aspect of Causal Agency Theory's agentic self. SDT describes the role the environment plays in motivation (Ryan & Deci, 2000). This theory describes three psychological needs that are related to motivation: autonomy, competence, and relatedness. These psychological needs can be supported or challenged by contextual factors. As therapists, and therefore part of the environment, we can assist in shaping the environment to meet these psychological needs through intervention in the physical and social environment. These psychological needs are foundational in Causal Agency Theory's conceptualization of the agentic self (Shogren, et al., in press-a).

Figure 2 depicts the dynamics of Causal Agency Theory's agentic self acting in context. The agentic self is made up of a desire to satisfy psychological and biological needs as well as a belief that its action will produce a result that moves the self closer to its freely chosen goals (Shogren, et al., in press-a). In Figure 2, the agentic self is depicted as a circle with a dotted line for the boarder. The dotted line shows that the environment can change the agentic self. The environment creates a press, indicated by green arrows pointing towards the agentic self, which

is a call to action for the person (acting as an agentic self). The agentic self is driven to action, indicated by blue arrows coming from the agentic self, if the environmental press matches the person's desire to satisfy his or her psychological and biological needs. Additionally, the agentic self must believe that action to meet the environmental press will move the person toward his or her freely chosen goals.

The context can support or inhibit action, which could either cause the person to not act, adjust their plan to meet the demands of the environment, or act successfully. It is also important to note that a person can act to meet an environmental press that will not satisfy his or her psychological needs. This action, while coming from the person, is not coming from the agentic self. That is, this action may not be in service to a person's freely chosen goals.

### **Aspects of a Supportive Environment**

Participation in goal-directed, socially relevant, activities that a person believes contributes to their quality of life is at the heart of self-determination. Since participation in these activities happens in specific (but individual) contexts and environments, it is important that these environments are supportive of a person's participation. It is also important that a person be aware of the supportive and inhibitive aspects of an environment so that they can advocate for or modify the environment to support their needs. This section will discuss aspects of the environment that can support and inhibit participation for people with disabilities. I will discuss the environmental context based on EHP's characterization of the environment as consisting of physical and social/cultural elements (Dunn, Brown, & McGuigan, 1994).

### **Physical Environment**

A recent review of evidence on the effect of the environment on participation of children highlighted the supportive aspects of the physical as well as the barriers (Anaby, Hand, Bradley,



DiRezze, Forhan, DiGiacomo et al., 2013). Half of the 31 articles reviewed by Anaby and colleagues highlighted the importance of accessible physical structures, such as ramps, elevators, parking and public transportation, and adapted toilets, supported children's participation. Additionally, connecting children to the natural environment, such as animals and plants, supported children with physical disabilities to participate in recreational activities (Harding, Harding, Jamieson, Mullally, Politi, Wong-Sing et al., 2009).

In adults with intellectual disability, adapted technology was seen as important for community participation (Hammel, Lai, & Heller, 2002). Individuals with ID rated their performance better when using adapted technology, including seating and mobility, communication devices, and devices for daily living, than when not using adapted technology. The exception to this was communication devices and other devices that required support to set up. When adults were dependent on support providers to help with set up, technology use was dependent on support providers' interest and time. So, even though the technology could be used to support participation, it was often not used.

### **Social/Cultural Environment**

The social environment plays a complex role in the participation of children in that it is not the presence or absence of social supports, but also the degree of support. This highlights what Shogren et al. (in press-a) discuss in Causal Agency Theory, that volitional action is "making a conscious choice based on one's preferences" (p. 18) and that this action occurs without direct external influences. Social supports, if provided too heavily inhibit self-determination by inhibiting volitional action.

Anaby et al.'s (2013) review found that children's participation could be supported by family members by arranging play and assisting their children in developing friendships. At the

same time, parents reported that their over-protectiveness often limited their child's independence. Similarly, Coster et al. (2012) highlighted that the role of siblings can be complex. On one hand, siblings can help a child navigate new social situations or accomplish a task. However, this support may also limit the opportunity of a child to socialize with other children. Similarly, friends can support children with disabilities to participate, however children with disabilities frequently have a small friendship pool, and when those friends are not around, participation can be limited (Coster, et al., 2012).

The role of social supports played an equally complex role in the lives of adults with intellectual disability. Verdonschot, de Witte, Reichrath, Buntinx, and Curfs (2009) found that families of adults with intellectual disability can enhance community participation and integration; however family support may not increase independence. While literature for children also looked at the role of friends as social supports, studies looking at social supports for adults with intellectual disability concentrated on the role of paid staff. Staff assistance positively affected community participation when staff provided assistance and were attentive (Perry & Felce, 2005).

The attitudes and values of a community or culture can also present supports or barriers to participation (Anaby, et al., 2013). For example, a school that promotes self-determination in its curriculum and coaches teachers to encourage students to be self-determined has led to more access to general education classrooms and improvements in student-defined goal achievement (Shogren, Palmer, Wehmeyer, Williams-Diehm, & Little, 2012). Shogren and colleagues' (2012) study demonstrated the effects of the self-determined learning model of instruction. Using this model of instruction has also led to increased self-determination in students, which is related to greater participation in adult activities, such as independent living and work (Shogren,

Wehmeyer, Palmer, Rifenburg, & Little, in press-b; Wehmeyer & Palmer, 2003). Enhanced self-determination has also been linked to improved quality of life (Lachapelle, Wehmeyer, Haelewyck, Courbois, Keith, Schalock et al., 2005).

Attitudes outside of the school environment has also been shown to be a support or barrier for children's participation (Anaby, et al., 2013). For example, families who encourage independence in their child and advocate for their child can facilitate participation. However, societal attitudes, which can involve stigma and bullying, can inhibit participation. Families often state that negative attitudes or perceived negative attitudes of community members can inhibit both the amount and quality of participation (Lawlor, Mihaylov, Welsh, Jarvis, & Colver, 2006; McManus, Michelsen, Parkinson, Colver, Beckung, Pez et al., 2006).

Finally, on the systems level, both availability and the scope of systems of support can either support or inhibit participation. Children with disabilities reported more participation in recreational activities when inclusive educational programs were available (Anaby, Law, Coster, Bedell, Khetani, & Avery, 2014). Systems-level barriers to participation included availability of accessible transportation services, lack of community programs, bureaucracy, waiting time for services, and lack of inclusive programming (Anaby, et al., 2014).

Providing more opportunity for self-direction can increase a person's self-determination and quality of life. Heller and colleagues (1998; Heller, Miller, & Hsieh, 2002), studied the impact of support systems on the participation of adults with intellectual disability. They found that people who lived in smaller settings as well as settings where residents could make decisions about their arrangement and decoration of living spaces as well as activity planning had a higher level of community integration. These findings are consistent with the self-determination literature. Researchers have demonstrated that by only changing a person's living or working

environment, a person can become more self-determined (Stancliffe, Abery, & Smith, 2000; Wehmeyer & Bolding, 2001). Participants in these studies had the opportunity to make decisions for themselves, and they responded by making the decisions.

The evidence on the effects of the social environment on participation shows a complex relationship that is dependent not only on whether or not a support is available, but also how that support is administered. Social supports that support a person to make decisions and be a causal agent tend to increase the level of participation for people with disabilities. This is important when evaluating the effects of the environment on self-determination. Assessments need to consider not only the presence of social supports, but also the degree to which those supports result in a person fully participating in the social as well as the physical aspects of activities that are important to them.

### **Tools for Measurement**

This paper has described the conceptual congruence between self-determination and environmental effects on participation. Additionally, I have demonstrated the supportive and inhibitive effects of the environment on participation. While the evidence described above does not explicitly link environmental supports to self-determination, it does demonstrate the need for this line of study. The next step will be to study the impact of the environment on self-determination. In order to measure that impact, valid and reliable tools for the evaluation of the environment are needed. This section will describe two assessments that have been used in literature that will help researchers in this effort.

The Participation and Environment Measure for Children and Youth (PEM-CY) is an example of an evaluation that measures the impact of the environment on participation (Coster, Bedell, Law, Khetani, Teplicky, Liljenquist et al., 2011). This parent-report assessment,

developed for children aged 5 – 17, measures participation and environment constructs. Participation is measured through three subscales: frequency of participation, level of involvement, and desire for change. Desire for change is used to represent satisfaction. Environment scale is a measurement of parents' perception of how supportive an environment is. Environments are divided into home, school, and community. This tool has been used to assess the level of impact an environment can have on participation (Coster, et al., 2011). For example, studies have found that children with developmental and intellectual disabilities participate less and have fewer environmental supports in school and in the community (Bedell, Coster, Law, Liljenquist, Kao, Teplicky et al., 2013; Coster, Law, Bedell, Liljenquist, Kao, Khetani et al., 2013).

This tool holds promise for therapists to support self-determination through environmental supports. The PEM-CY can give therapists information as to how supportive an environment is for a child and also how satisfied the family is with that level of support. This will allow therapists to take into account the perspective of the family when designing intervention and allow the focus of intervention to be in areas where the family desires the most change. Research has shown that there is a correlation between environments that parents find unsupportive and activities in those environments that parents desire a change (Coster, et al., 2012). The sections have good internal consistency and moderate to good test-retest reliability.

Another example of an assessment that focuses on environmental supports and barriers to participation is the Craig Hospital Inventory of Environmental Factors (CHIEF) (Whiteneck, Harrison-Felix, Mellick, Brooks, Charlifue, & Gerhart, 2004). The CHIEF is a 25 item self-report questionnaire that measures environmental factors of participation in the physical, attitudinal, services, and work/school environments. Three scores are calculated using the

CHIEF: frequency of encounters with environmental barriers (rated from 0-4), impact of the barrier on participation (rated from 0-2). The product of these two scores is computed to score the represent the overall impact of the barrier. The products can then be summed for a total score of environmental impacts on participation. The CHIEF has been used with a variety of adult disability groups and has good internal consistency and test-retest reliability (Noreau & Boschen, 2010; Whiteneck, et al., 2004).

Using environmental assessments like the PEM-CY and the CHIEF can provide a mechanism for therapists to better understand how environments influence participation in freely chosen activities. Occupational therapists provide insights about how context influences participation in any setting. Occupational therapists assist teachers or caregivers to create environments that meet people's physical and social needs. For example, a student whose sensory processing suggests sensitivity to environmental sounds may have difficulty learning in a noisy classroom. An occupational therapist might work with the teacher to find or create a quieter place for the student to work (Dunn, 2007). When the environment no longer distracts the student, she can focus on participating in ways that accomplish her goals.

By creating environments that match the person's strengths, the person will be more available to engage in learning. For example, a student with intellectual disability may learn a particular job when the environment (co-workers or job coaches) provides visual and physical prompts. So, the environment (work place) may need to be adapted from one that conveys information through talking to an environment that conveys information through pictures, gestures, and physically guiding the student. An occupational therapist supports a teacher to design the lesson in a way that is congruent with student needs, in other words, in a context and format which the student can best receive the information.

## **Conclusion**

Activities or tasks happen in specific contexts (Dunn, Brown, & McGuigan, 1994). Self-determination theories often describe action or participation as a person responding to the environmental demands of the context (Shogren, et al., in press-a). However, aspects of the activities or tasks can also support or inhibit participation. Coster et al (2013) found that parents often reported the physical, cognitive, and social demands of activities as barriers to participation. Eriksson (2005) describes these activity demands as part of the environment. Through assessment and intervention, occupational therapists and other professionals serving people with disabilities can create supportive environments to promote self-determination.

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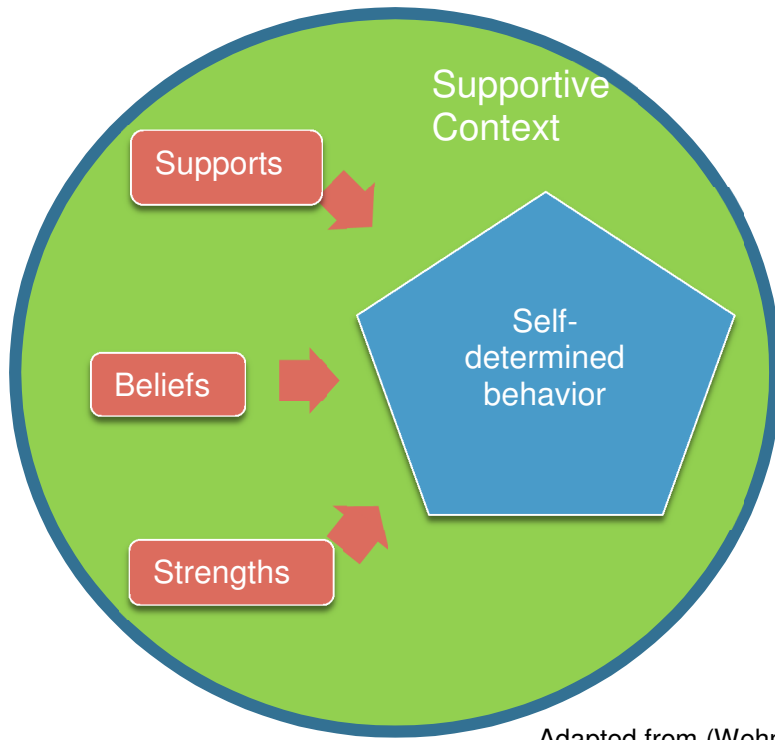
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Adapted from (Wehmeyer, 1999)

Figure 1 Self-determined behavior in Context

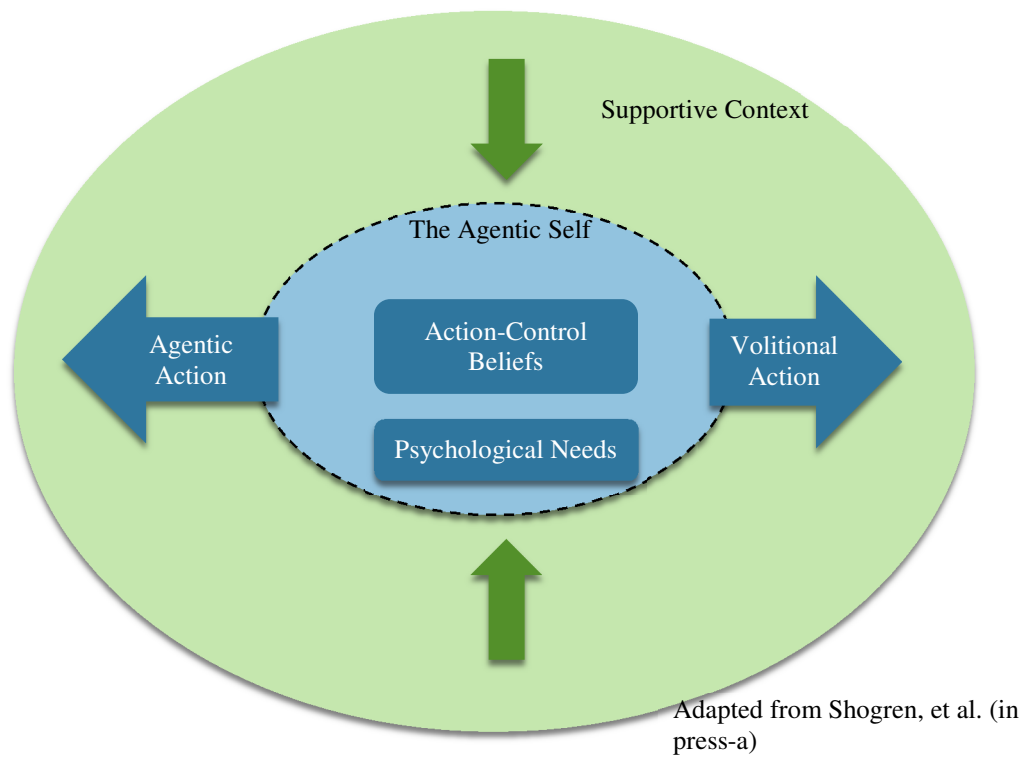


Figure 2 – The Agentic Self in Context

## Manuscript II

### Comprehensive Literature Review II

#### Role of Occupational Therapy in Promoting Self-determination Through Consumer-Directed Supports

**Abstract:** Consumer-directed services (CDS) are a type of support system designed to increase the quality of life and self-determination of clients, such as adults with developmental disabilities. Occupational therapists can play an important role in facilitating people's involvement in CDS supports. This paper describes CDS, evidence that supports their use, and ways that occupational therapists use their training in person-centered practice to enhance CDS supports and self-determination. A case study is used to illustrate the application.

**Keywords:** community-based practice, policy, self-determination



## Introduction

Self-determination is a construct that refers to a person acting in a way that they believe will accomplish their freely chosen goals (Shogren, Wehmeyer, Palmer, & Forber-Pratt, in press). For a person with intellectual disability who requires support to live a satisfying life, this definition implies that he or she should be involved with deciding who will provide support. Consumer-directed services (CDS) can promote self-determination by creating a way for a person to make decisions regarding their personal care (Powers, Sowers, & Singer, 2006). CDS programs target a person's environment by empowering individuals to create their own support network. This style of support system is consistent with theoretical foundations of occupational therapy, which emphasize adapting the environment to meet the needs of the person (Dunn, Brown, & McGuigan, 1994; Law, Cooper, Strong, Stewart, Rigby, & Letts, 1996). CDS is also consistent with person-centered and occupation-based practice (American Occupational Therapy Association, 2008).

Occupational therapists are trained to analyze the interactions between the person and everyday contexts. This skill makes therapists' contributions valuable to people who receive CDS supports as well as the agencies that administer the supports. For example, an occupational therapist contracting with a *Center for Independent Living* could provide environmental information and resources about adapted technology for job sites or homes through appropriate assessment. Similarly, a therapist working for a vocational rehabilitation (VR) agency could help a person with a developmental disability build skills or develop supports to function more independently in the workplace.

This paper describes the ways occupational therapists can assist or support adults with developmental disabilities living in the community through the emerging way of providing ser-

vices, consumer-directed services (CDS). First, policy trends that have affected community-based systems development for adults with developmental disabilities are discussed. Self-determination, a critical component of service planning for people with developmental disabilities, is defined. Additionally, ways occupational therapists can promote self-determination and quality of life through involvement in CDS systems are described. Using a case study, the paper highlights the distinct role a therapist can play in community-based practice with adults with developmental disabilities and how occupational therapists can build their practice within a CDS service design

### **Background**

Services for people with developmental disabilities have evolved over the last forty years. Families once had, essentially, two options to care for their child with a developmental disability: parents could place their child in a state-run facility, which was typically isolated from their community, or parents could keep their child at home with limited if any supports and services (Braddock & Parish, 2001).

In the 1990s, legal and policy decisions increased access to community-based services for people with developmental disabilities (Reester, Missmar, & Tumlinson, 2004). At the same time, disability advocacy groups were calling for more community-based solutions for people with developmental disabilities. In response, Medicaid created the *Home and Community-Based Services* waiver as a funding mechanism to transition people with developmental disabilities from institutions into their community. Aided by Supreme Court decisions, such as *Olmstead v L.C.* ("Olmstead v. Lc," 1999), which increasingly ruled for people with developmental disabilities to live in less restrictive environments, participation in community-based services increased

dramatically through the 1990s and 2000s. Today, most people with developmental disabilities live in homes in their community, either with their parents or house mates.

Legal and policy decisions that influenced the move to community-based services for individuals with developmental disabilities posed pragmatic challenges; specifically, decisions about how to best provide services for people with disabilities so they can live in a home safely. Agency-based service systems re-introduced people to their community and also provided a safe environment for their care. People with developmental disabilities use such agency-based service systems today as a way to connect with their community and learn skills for independent living. However, disability advocates have argued that these systems do not provide enough opportunities for individuals with developmental disabilities to make their own decisions and pursue their own interests (National Council on Disability, 2004). Subsequently, policy makers have struggled with how to create services that allow for more decision making while maintaining safety and budget safeguards.

Current research and policy goals of the disability community are aimed at improving quality of life and self-determination related outcomes for people with developmental disabilities (Schalock, 2004; Stancliffe, 2001). Quality of life is a term that researchers and policy makers use to describe the overall well-being of a person, and is closely linked with one's ability to meet basic needs, be integrated in one's community, and participate in decisions that impact one's life (Wehmeyer & Schwartz, 1998). To enhance quality of life, individuals must be connected to their communities and make decisions about their lives. Consumer-directed services (CDS) are targeted at enhancing quality of life, and aim to empower people with disabilities and their families to manage their own services.

### **Self-determination**

The American Occupational Therapy Association (AOTA) lists self-determination as an important outcome to promote independence (American Occupational Therapy Association, 2008). Wehmeyer (2005) defined self-determined behavior as “volitional actions that enable one to act as the primary causal agent in one’s life and to maintain or improve one’s quality of life” (p. 117). Within this definition, the term ‘volitional’ refers to intentional and conscious choice and ‘causal agent’ means that a person acts in order to accomplish a goal or create a change. Put another way, persons are self-determined when they engage in intentional, goal oriented actions to affect their own quality of life. Although self-determination is a personal characteristic possessed by all individuals (Wehmeyer, 2005), it can be promoted or inhibited by environmental factors, such as policy, supports, and physical structures. For example, people who have experienced segregation or been discriminated against may not have developed their self-determination capacity.

The importance of self-determination in increasing a person’s quality of life has been well supported in the literature, and appears to be closely aligned with environmental factors (Lachapelle, et al., 2005; Schalock, Keith, Verdugo, & Gómez, 2011; Wehmeyer & Schwartz, 1998). Research suggests that when individuals move to less restrictive or controlling environments, they demonstrate increased self-determination. Wehmeyer and Bolding (2001) found that adults with developmental disabilities who transitioned from a more restricted environment to a less restricted environment (e.g., moving from a home where staff is always present and the person has several roommates to their own home) became more self-determined. Similarly, Stancliffe, Abery, and Smith (2000) found that people with developmental disabilities who lived in less restrictive housing arrangements had more personal control than people who lived in more restrictive housing. Another study found that people with severe intellectual disability have few-

er chances to make decisions and tend to live in larger group environments (Neely-Barnes, Marcenko, & Weber, 2008). This study also found that while housing size was related to community integration for people with severe intellectual disability, people with mild intellectual disability (ID) were able to participate in the community regardless of housing size. Issues related to restrictive environments are important when considering CDS because these supports allow people with developmental disabilities to move from a more restrictive environment that is coordinated by an agency to a more independent environment where people make more decisions and are more accountable for their supports.

The role of environmental supports and housing in the quality of life with individuals with developmental disabilities creates an opportunity for occupational therapy to address self-determination. Occupational therapists may do this through consumer-directed goal planning and environmental strategies (Mirza & Hammel, 2009), which have been shown to impact self-determination across settings and populations. Mirza and Hammel's (2009) recent study evaluated a consumer-directed assistive technology program for older adults with intellectual disabilities. Participants reported higher levels of performance and satisfaction when they chose their goals and were a partner in the intervention process. This study suggests that occupational therapists can enhance self-determination through client-centered assessment and contextually-relevant interventions.

### **Consumer-directed Services**

Consumer-directed services (CDS) is a type of support program that focuses on self-determination aspects of quality of life by giving more authority and accountability to the program participant, providing individualized service planning, and supporting the person with disabilities to select and manage caregivers (Powers, Sowers, & Singer, 2006). This model of sup-

port stems from the belief that supports for people with developmental disabilities should be defined by the person with the person's strengths, needs, and preferences (Thompson, et al., 2009).

While most of the literature characterizes CDS as programs and services, for occupational therapy, the term *supports* may be more appropriate when referring to CDS. Supports are considered resources and strategies that promote well-being and enhance individual functioning (Thompson, et al., 2009). The term supports more accurately describes the needs of those with developmental disabilities. When referring to state or agency run programs, the term *support system* will be used to reflect that the supports are part of a larger system.

CDS are not specifically branded programs, but rather support systems rooted in a central philosophy to offer those receiving services more control over how services are provided. All states currently have some form of a CDS support system, although the numbers of people who use the supports vary widely. Some states limit enrollment in piloting programs, while others, like California, have been using CDS programs for decades. Across the country, over 800,000 people use CDS programs (Doty, Mahoney, Simon-Rusinowitz, Sciegaj, Selkow, & Loughlin, 2012), with California accounting for 60% of enrollees. Most states, however, have fewer than 500 participants. Nationally, the largest groups of CDS users are older adults and people with physical disabilities, followed by people with intellectual and developmental disabilities.

Emerging evidence suggests that CDS supports increase quality of life for adults with developmental disabilities. For example, participants in an Illinois CDS support system for people with developmental disabilities reported being more involved with their community, had fewer unmet service needs and also used more services, such as recreation and occupational therapy (Caldwell & Heller, 2003; Heller, Miller, & Hsieh, 1999). Additionally, study findings indicated that participants' caregivers demonstrated increased satisfaction with services, increased confi-

dence in caregiving skills, and were less likely to advocate for an out-of-home placement for their family member. Moreover, Caldwell and Taylor (2006) reported that families in Illinois' consumer-directed services had fewer out-of-pocket disability expenses, were engaged in more social activities, and reported greater leisure satisfaction. The above research echoes the review done by the National Council on Disability (2004), which found that people using CDS support systems were generally satisfied with their services. In addition, this review found that participants using CDS services were more satisfied with services and also had fewer unmet service needs. Thus, research suggests that CDS programs demonstrate beneficial effects for individuals with developmental disabilities. Additional studies are needed, however, to determine the comparative effectiveness of CDS supports versus community based services for individuals with developmental disabilities.

### **Implications for Practice**

Occupational therapists can play a unique role in CDS supports. With person-centered planning and intervention, occupational therapists can help create the supports adults with developmental disabilities need to live a self-determined life. This section will highlight ways that therapists can promote self-determination in their practice.

### **Strengths-based Assessment Measures**

Occupational therapists are skilled in identifying strengths and needs of a person in their every-day life. By partnering with families and understanding the interests and needs of the person with a developmental disability, an occupational therapist can be a valuable resource to families and people as they determine their support needs. The use of client centered assessment approaches can aid a therapist in capitalizing on the strengths of the individual.

An approach to assessment that is gaining traction among professionals who work with people with developmental disabilities is to determine the level of support needed to conduct daily life (Wehmeyer, 2011). With this approach, a vital assumption is that anyone can participate in any activity, such as a job or home maintenance, with an adequate amount of support. This approach of determining support needs as opposed to solely considering an individual's capacity is consistent with the definition of disability as an interaction between person and environment (Thompson, et al., 2009).

In propagating the use of self-determination within supports for individuals with developmental disabilities, two standardized tools would be beneficial. First, the Supports Intensity Scale (SIS) has been successful with helping develop supports for people with intellectual and developmental disabilities (Thompson, Bryant, Campbell, Craig, Hughes, & Rotholz, 2004; Wehmeyer, Chapman, Little, Thompson, Schalock, & Tassé, 2009). This strengths-based tool is an effective method for determining the support needs of people with intellectual and developmental disabilities. States and agencies might consider using a tool such as the SIS for individual planning and resource allocation.

Occupational therapists frequently use the Canadian Occupational Performance Measure (COPM) (Law, Baptiste, McColl, Opzoomer, Polatajko, & Pollock, 1990), which can enhance self-determination. Previous research supports the use of this tool for adults with ID, as it has been used in planning for a consumer-directed occupational therapy program for older adults with intellectual disabilities (Mirza & Hammel, 2009). The COPM is a self-report assessment where the person seeking services identifies areas of their life that may require intervention. The person then rates her or his performance and satisfaction in these areas. This tool enhances self-determination because it allows the person seeking services to identify the areas of life that will



be addressed. The occupational therapist then becomes a partner in the therapy process, where the person guides the direction of services.

### **Interventions in Context**

CDS supports recognize the ability of people with disabilities and their families to direct their lives. This recognition is consistent with occupational therapists' use of person-centered practice. Once support needs have been identified, occupational therapists can focus on working with families to address their individual goals. Coaching is a type of intervention in which a therapist works with a person in their environment to set their own goals and develop solutions to meet those goals (Keenan, King, Curran, & McPherson, 2013). This type of intervention builds a person's self-awareness and self efficacy, which are two components of self-determination (King, Baldwin, Currie, & Evans, 2006). Through the use of coaching, occupational therapists can help a person build problem-solving strategies that can be used in the home, community, and work place. A therapist may accompany a client to the work place and ask questions that prompt the person to think deeper about an issue and develop their own solutions.

Emerging evidence on coaching interventions support their use in occupational therapy. One study involving parents of children with autism demonstrated coaching to be successful in increasing the competence of parents and the participation of their child (Dunn, Cox, Foster, Mische-Lawson, & Tanquary, 2012). Parents reported that they were better able to problem-solve other issues because of the coaching intervention.

In one study, occupational therapists have collaborated with job coaches to provide coaching interventions which improved the job readiness and employment outcomes for young adults with physical disabilities (Verhoef, Roebroek, van Schaardenburgh, Floothuis, & Miedema, 2013). The occupational therapist worked as part of an interdisciplinary team to pro-

vide information about work-related issues and encouraged group members to solve problems and offer insights. Participants were more satisfied with their performance and displayed more competence in work, self-care, and leisure.

This evidence suggests that occupational therapists can use coaching interventions to help people with disabilities meet their needs. Coaching interventions are consistent with CDS supports in that they allow the person with disabilities to set their own goals and develop strategies to meet those goals.

### **Case Study**

An occupational therapist consulting with a *Center for Independent Living* was asked to consult with a woman, Penny, who was looking for work. She was interested in working with animals and enjoyed talking with other people. Penny was a wheelchair user and had limited use of her hands as well as an intellectual disability. Because of these limitations, she received funding from her state's physical disability Medicaid waiver. This support program was a consumer-directed program where participants received money from the state to provide or purchase their own personal care services. Penny had found an internship position with a local non-profit that provided advocacy and informational resources regarding service animals for people with disabilities.

During the initial meeting, Penny and her family decided to contract with the occupational therapist for consultation services focusing on employment. Specifically, Penny was looking for adaptations that could make her more efficient in her position, which required her to answer the phone, create documents on the computer, and respond to emails. During the assessment phase, Penny indicated that she liked working with animals and was good communicating with other people. From the COPM, Penny expressed she had low performance and satisfaction with

computer use. Upon visiting Penny at her work place, the occupational therapist learned that Penny had limited experience using a computer as well as difficulty typing and using a mouse. Results from the SIS indicated that Penny needed support to learn job skills, complete work-related tasks on time, and getting to and from work. The family was aware of the transportation needs for Penny and the father agreed to arrange his schedule to get Penny to work on time.

For the technological issues, the occupational therapist recommended that Penny contact Vocational Rehabilitation services, which would be able to help Penny acquire the technological solutions that would meet her needs for her work. The occupational therapist also coached Penny and her employer to design a work process where Penny could use her strengths to interact with clients on the phone until she could access the computer. For example, since most correspondence with clients happened via email, the occupational therapist helped Penny's employer design a system where the emails would be printed in order to allow Penny to follow up via phone when possible. Penny developed her communication skills and began helping the director at demonstrations and informational fairs where they advocated for the use of service dogs. The therapist supported Penny in developing her communication skills by role-playing conversations that Penny would encounter at the fairs. After Vocational Rehabilitation delivered Penny's equipment and trained her to use them, the occupational therapist was able to coach Penny to create a work process that worked for her. In this case, Penny needed to save emails that she responded to, but became overwhelmed with all of the emails in her inbox and would lose track of emails that she had not responded to. The occupational therapist taught Penny how to create folders to store the emails she already responded to so that her inbox would only contain emails to which she had not responded.

This case study demonstrated the use of self-determination principles to support a person with a developmental disability in the workplace. The occupational therapist used a person-centered assessment process that developed goals that were determined by the person with a developmental disability. Additionally, the therapist used contextually based interventions that challenged Penny and her employer to discover their own solutions to some of the workflow barriers.

### **Conclusion**

Consumer-directed services are a promising support option for adults with developmental disabilities. They offer opportunities for self-determination, which promote improved quality of life for participants. Occupational therapists can play an important role in providing CDS. Through person-centered, strengths-based planning and evaluation and contextual interventions, occupational therapists can promote self-determination and services that are consistent with the philosophy of CDS.

To provide services in CDS or other support services, occupational therapists will need to communicate their contribution to a variety of stakeholders, including families, policy makers, and support service agencies. Therapists will need to understand the funding structure of the support services (who controls the money) and also the philosophical underpinnings of CDS supports, which are described in this paper. To make an effective argument for involving occupational therapy in support services, therapists will need to align their descriptions of practice with the values of the stakeholders. Describing occupational therapy practice as strengths-based, in-context, and focusing on participation and quality of life will focus the message on values that are common among stakeholders.

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## Manuscript III

### Comprehensive Literature Review III

#### Sensory Processing: A Piece of the Learning-Related Behaviors Puzzle

Evan Dean

**Abstract:** Sensory Processing is a construct that theorizes a person's neurological responses to their environment. How a student responds to the sensory aspect of their classroom environment can have an impact on their ability to learn. Little research on learning-related behaviors considers the impact of the sensory environment on learning. This study used a correlational analysis to evaluate the relationship between sensory processing and learning-related behaviors. We found a relationship between different aspects of sensory processing and learning-related behaviors such as emotional self-control, adaptability, executive functions, etc. We discuss how school psychologists can use sensory processing to determine additional ways of supporting students in the classroom.

## **Introduction**

Students who have the emotional, cognitive, and social ability to pay attention, follow directions, organizing materials, and getting along with others tend to have more success in school than students who have difficulty with these behaviors. Research into school readiness has determined cognitive and self-regulation aspects of behaviors are supportive of school success. Research into environmental determinants of school readiness have focused on addressing access and opportunity barriers, which have been instrumental in designing systems to address barriers to learning.

If a student has difficulty listening to a teacher and consequently does not demonstrate competency, the student can fall behind in school. There are many reasons why a student may have difficulty focusing or listening to the teacher. The student's home environment may not have provided opportunities to learn behaviors that support learning, the student may be hungry, or the student may not have developed the problem-solving or planning skills needed to be successful (Blair, 2002; McClelland & Cameron, 2012).

Additionally, occupational therapists may look at the sensory environment of the classroom for an answer to the student's difficulty with focus. For example, how does noise in the classroom affect the student? How does proximity of others bother particular students? How does the visual information in the classroom (e.g., bulletin board displays, desk and supplies arrangement) affect the student's ability to pay attention to learning tasks? The effect the environment has on a student's ability to learn may be reflected in how the student's response to her or his sensory environment, which is called sensory processing (Dunn, 2007). This paper will highlight the relationship between learning related behaviors and sensory processing in the classroom. School psychologists can benefit from understanding the concepts of sensory processing

because sensory responses broaden both explanations of behaviors and possible approaches to intervention.

### **Learning-Related Behavior**

Learning-related behavior refers to the aspects of children's performance that are important for academic success (McClelland, Acock, & Morrison, 2006), such as listening, following directions, organizing materials, planning, and self-regulation. Researchers have investigated different aspects of learning-related behavior, such as cognition (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009), self-regulation (Blair, 2002; Stipek, Newton, & Chudgar, 2010), and social competence (Liu, Karp, & Davis, 2010; McClelland, Morrison, & Holmes, 2000) as well as self-control, staying on task, organizing materials, and following directions.

For example, Stipek, Newton, & Chudgar (2010) studied self-regulation and found that elementary students' ability to tune into what is going on in the classroom, work independently, seek challenges, and accept responsibility for a task predicted literacy skills. Brock et al. (2009) found that cognitive functions, such as attention and working memory contributed to self-directed learning, distractibility, and engagement in kindergarten students. Similarly, Neuenschwander, Röthlisberger, Cimeli, and Roebbers (2012) found that effortful control and executive functions both contributed to early learning and classroom adjustment, but only executive functions predicted academic success.

In his conceptual model relating self-regulation to school readiness, Blair (2002) discusses the importance of environmental considerations to support a child's emotional readiness to learn. He notes that students who are emotionally ready to learn can demonstrate the cognitive skills needed for learning. A supportive environment is one way to promote school readiness. One way an environment can be supportive for learning is by being compatible with sensory



processing patterns. For example, a student who is anxious or hyper-alert in crowded, noisy environments may have difficulty learning in a typical classroom. Few studies have focused on the relationship between sensory processing and learning-related behavior. This research is needed to determine if meeting sensory processing needs in the classroom can promote a student's ability to focus and learn.

Teachers already promote learning-related behaviors in their academic curricula because they understand that these behaviors interfere with academic outcomes (Pelco & Reed-Victor, 2007). When classroom-wide interventions are not effective for a student, a teacher may seek support for individual students from other professionals, such as a school psychologist or an occupational therapist. A psychologist might look at motivational (Berhenke, Miller, Brown, Seifer, & Dickstein, 2011) or emotional (Blair, 2002) aspects of learning. An occupational therapist may examine environmental aspects of the classroom that support or interfere with academic success (Ashburner, Rodger, Ziviani, & Hinder, 2014; Dunn, 2007).

When occupational therapists consider school environments, they consider how those environmental characteristics support or interfere with particular students' sensory response patterns, bringing a new perspective to learning-related behaviors (Dunn, Brown, & McGuigan, 1994). Sensory processing features of the environment provide alternative methods for supporting learning related behaviors. For example, an occupational therapist might observe that a student misses the teacher's instruction because the student is distracted by the sounds in the hallway; the teacher and therapist might move the student's desk or close the door to reduce the sounds that are interfering with the student's learning outcomes.

## **Sensory Processing**

Dunn's Sensory Processing Framework (DSPF) theorizes sensory processing as two continua of responses to environmental stimuli (Dunn, 2014). People respond differently to sensory information based on how soon they detect (threshold) and how they manage (self-regulation) sensory stimuli. According to DSPF, threshold ranges from high (e.g. slow to detect) to low (quick to detect), and self-regulation ranges from passive (not bothered by stimuli) to active (reactive to stimuli). These two continua interact to create four sensory processing patterns: registration (high threshold and passive self-regulation), seeking (high threshold and active self-regulation), sensitivity (low threshold and passive self-regulation), and avoiding (low threshold and active self-regulation). In personality research, sensory processing has been shown to be related to yet distinct from emotion and self-regulation (Gouze, Lavigne, Hopkins, Bryant, & Lebailly, 2012).

Research in sensory processing and learning-related behaviors has generally studied students with disabilities. Ashburner, Ziviani, and Rodger (2008) compared typically developing students to students with autism and found that in students with autism, auditory processing and sensation seeking were related to under performance in school. The authors did not find sensory processing relationships to academic performance in the typically developing group. Similarly, Reynolds, Bendixen, Lawrence, and Lane (2011) found that students with Avoiding and Sensitivity patterns scored lower on social and academic competence measures. While these studies begin to establish a relationship between learning-related behaviors and sensory processing, more research is needed. Additionally, studies using samples of typically developing students would illustrate the importance of sensory processing knowledge for classroom-wide environmental interventions (also called Tier 1 interventions).

This study investigates how students' sensory processing patterns are related to learning-related skills. When occupational therapists recognize the relationships between sensory processing and learning related behaviors, they will be more effective related service professionals at school.

This paper will address the following research questions:

1. To what extent are sensory processing patterns related to learning-related behaviors in children ages 6 – 11 years?
2. Do students with differences in sensory processing patterns have more difficulty with learning-related behaviors than students who do not have differences?

## **Methods**

### **Design**

This study used a correlation design with a national sample to explore the relationships between learning-related behavior and sensory processing in schools.

### **Participants**

Participants were recruited from across the United States for the Sensory Profile 2 standardization study (Dunn, 2014). The sample included 32 children, ages 6 – 11. Twenty-nine of the participants were typically developing, two participants had attention deficit hyperactivity disorder, and one participant had a learning disability.

### **Measures**

The Sensory Profile 2 School Companion (SPSC2) is an 44-item teacher-report measure of a student's sensory processing characteristics (Dunn, 2014). The SPSC2 provides scores on four sensory systems (e.g. auditory, visual, movement, and touch), behavior, and four sensory processing patterns associated with Dunn's Sensory Processing Framework (e.g. registration,

seeking, sensitivity, and avoiding). See Table 1 for more description of the sensory processing patterns. The SPSC2 was normed on a large national sample (n=679), and demonstrates strong psychometric properties.

The School Factors (SF) scores are an additional level of information provided by the SPSC2. The SFs represent ways that students can be supported in learning. High scores on School Factor 1 (SF1) represent additional support need from the teacher (i.e. redirection or additional guidance). Students with high scores on School Factor 2 have difficulty focusing their attention on learning and may be distractible. School Factor 3 represents a student's tolerance for sensory input. School Factor 4 represents the teacher's perspective on the student's engagement in learning. These scores provide another perspective on the student's participation in the classroom. Table 1 provides more information about the School Factors.

<INSERT TABLE 1 HERE>

The Behavior Assessment System for Children, 2<sup>nd</sup> Edition Teacher Rating Scales (BASC-2 TRS) is a teacher-report assessment that measures how frequently students engage in particular behaviors (Reynolds & Kamphaus, 2004). Although the entire BASC-2 TRS has 25 scales, we selected scales of the BASC that relate to learning-related behaviors for this study. The BASC is typically used to determine problematic behaviors that may be indicators of larger psychological issues. However, several of the scales describe behaviors relevant to the learning-related behaviors construct. Table 2 highlights the BASC scales that were used in this study and each scales relationship to learning-related behaviors. Additionally, the BASC quantifies behaviors differently in some of the scales. For example, a high score on the Learning Problems scale indicates a student has more difficulty with learning. In contrast, a high score on the Social Skills section indicates a student has more social ability. Table 2 also identifies the meaning of a

high score for each of the scales used. The BASC-2 TRS has been used extensively in practice and in research, and demonstrates good psychometric properties.

<INSERT TABLE 2 HERE>

### **Analysis**

Pearson product moment correlations were used to determine the extent of the relationship between behavior (BASC2 TRS) and sensory processing (SPSC2). All of the statistical analyses were conducted using SPSS Version 20 software (SPSS, Inc., Chicago). For research question 2, participants were grouped based on differences in sensory processing patterns. The Sensory Profile 2 defines five categories for sensory processing (Much Less Than Others, Less Than Others, Similar to Others, More Than Others, and Much More Than Others) based on the means and standard deviations within the bell curve. We create two groups for this analysis. Group 1 included students with all sensory profile scores in the “Much Less Than Others”, “Less Than Others”, and “Similar To Others” categories. Group 2 contains students with one or more sensory processing pattern or sensory system score in the “More Than Others” or “Much More Than Others” categories. The Analysis of Variance (ANOVA) was computed to determine if there were differences in learning-related behaviors based on higher-than-average sensory processing scores. Additionally, to rule out any effect caused by diagnosis, Independent Samples t-Tests were conducted to compare learning-related behaviors for students with and without diagnosis. Because there was a large difference in the number of students with disabilities in our sample, we calculated the t-scores without an assumption of equal variances.

### **Results**

Table 3 displays the demographic characteristics of the sample.

<INSERT TABLE 3 HERE>

Table 4 displays the results from the correlational analysis. When looking at sensory systems, the auditory system is highly correlated with all behavioral measures. The visual system is also moderately to highly correlated with all behavioral measures. The only relationship to touch is a moderate correlation with emotional self-control, possibly indicating that touch is not often used within educational environments. In the sensory patterns, registration is moderately to highly correlated with all behavioral measures, while Seeking ranges from not correlated on social skills and functional communication to moderately correlated with school performance, academic achievement, self-regulation, and cognition. Avoiding is moderately to highly correlated with self-regulation, executive functioning, adaptability, and social skills.

<INSERT TABLE 4 HERE>

### **Maladaptive Scales**

High scores on the four maladaptive BASC scales (i.e. Learning Problems, Attention Problems, Emotional Self-Control, and Executive Function) represent more difficulty with the behavior measured. These scores generally show a positive linear relationship with sensory processing, meaning that the more frequently a student engages in the behaviors on the sensory profile, the more difficulty the student has with the Maladaptive behavior categories on the BASC2. All maladaptive scores are moderately to highly correlated with Auditory, Visual, and Movement scores.

Related to sensory processing patterns, Learning Problems and Attention Problems are related to the Registration and Seeking patterns. Executive Functioning is related to Registration and Avoiding. Emotional Self Control (self-regulation) is the only learning-related behavior that is associated with all four sensory processing patterns.

With regard to School Factors (as measured by the SPSC2), School Factor 1 is highly correlated with all maladaptive scales. School Factor 2 is highly correlated with Attention Problems and moderately correlated with Learning Problems and Emotional Self-Control. School Factor 3 and 4 were related to Emotional Self-Control and Executive Functioning.

### **Adaptive Scales**

The adaptive BASC scores (i.e. Adaptability, Social Skills, Leadership, and Communication), in which a positive score indicates more skill, show a negative linear relationship to sensory processing. All adaptive scales are moderately to highly correlated with the Auditory and Visual systems. Adaptability and Leadership are also moderately correlated with the Movement system.

In terms of sensory processing patterns, all adaptive scores are highly correlated with the Registration pattern. Adaptability and Social Skills are also related to the Avoiding pattern. All adaptive scales are also highly correlated with School Factor 1, except for Social Skills, which is moderately correlated.

All adaptive scales showed a high correlation with School Factor 1. Additionally, adaptability showed a high negative correlation with School Factor 3 and School Factor 4, meaning that the higher the score on the school factors, the more difficulty the student has being adaptable.

### **Research question 2**

Table 5 shows the distribution of diagnosis related to the More Than Others classification. Students with a diagnosis fell in both the More Than Others and Similar To Others categories.

<INSERT TABLE 5 HERE>

For research question 2, independent samples t-tests indicated the groups were similar based on age ( $t(15.75)=.937, p=.363$ ) and gender ( $t(14.85)=.514, p=.101$ ). Figure 1 illustrates the differences in learning-related behavior scores based on diagnosis. The asterisk indicates a significant difference. Only Leadership ( $t(5.497)=4.05, p=.008$ ) showed a difference in score based on diagnosis.

<INSERT FIGURE 1 HERE>

Figure 2 illustrates the differences in learning-related behavior scores based on one or more scores on the sensory profile being in the “More Than Others” or “Much More Than Others” category. Attention Problems ( $F(1,30)=18.13, p<.001$ ), Learning Problems ( $F(1,30)=20.85, p<.001$ ), Leadership ( $F(1,30)=13.86, p=.001$ ), Communication ( $F(1,30)=7.31, p=.01$ ), Emotional Self-Control ( $F(1,30)=32.35, p<.001$ ), and Executive Functioning ( $F(1,30)=25.16, p<.001$ ) showed a significant difference based on “More Than Other” category.

<INSERT FIGURE 2 HERE>

## **Discussion**

This study indicates that there is a relationship between learning-related behavior and sensory processing. These findings support Ashburner et al. (2008) who found that academic performance and attention were associated with sensory processing. However, Ashburner and colleagues, found relationships with sensory processing and achievement only in students with autism. They did not find relationships among their typically developing sample. Our results differed from Ashburner and colleagues in that we found statistically significant relationships between sensory processing and learning-related behaviors in a sample of predominantly typically-developing students. One possible explanation for this difference was the context in which sensory processing was measured. Ashburner and colleagues measured sensory processing using



parent report of behaviors observed at home and in the community. Our study used teacher report on a version of the Sensory Profile specifically developed for use in the classroom. Since the sensory environment of the classroom can be different from home and community, students may exhibit different behaviors in these contexts, which could account for differences in the sensory profile scores. Research comparing sensory processing behaviors at home and at school support this conclusion (Brown & Dunn, 2010).

### **Maladaptive Scales**

Our results show a strong relationship between Attention Problems and the Registration and Seeking sensory patterns. The Learning Problems scale shows a similar relationship to Registration and Seeking. Both of these sensory patterns reflect high thresholds for detecting sensory input, which may mean that students who miss sensory input, such as teacher instruction or social cues, have more difficulty regulating behavior in the classroom.

When looking at school behavior, several patterns emerge, which indicate that sensory processing could be a consideration when trying to address learning-related behavior. Performance and Achievement scores are highly correlated with Auditory, Visual, and Movement scores. These results may suggest that students who require more sensory input, especially visual, auditory, and movement, have more difficulty with attention and learning. These findings are consistent with literature on children with Autism that have reported relationships between sensory processing and educational outcomes (Ashburner et al., 2008) and communication (Lane, Young, Baker, & Angley, 2010). School psychologists can collaborate with occupational therapists to use this information to support teachers in designing classroom environments and activities where students can use multiple sensory systems to engage in learning. Students may need

more auditory and visual cues in order to fully participate in the classroom and understand the lessons.

Additionally, these results indicate that students who have difficulty with movement (either moving too much or difficulty organizing movement) may be more successful if movement needs are considered in the classroom. Occupational therapists can assess the classroom environment and collaborate with the team to incorporate such accommodations in a way that will not interfere with instruction.

Emotional self-regulation was the only learning-related behavior to be related to all sensory processing domains (except for touch, which was not associated with any learning-related behavior). Executive functioning was also highly to moderately correlated to most sensory processing domains. There has been debate in the literature concerning whether cognitive or emotional aspects of self-regulation are more predictive of school success. Models that take into account emotional and cognitive functioning generally show that both are related to school function, but that cognitive functioning is more predictive of academic success (Blair & Razza, 2007; Brock et al., 2009; Denham, Warren-Khot, Bassett, Wyatt, & Perna, 2012). Including measures of sensory processing with these models may provide further understanding into the relationship between these constructs.

With regard to school factors, SF1, which measures the level of teacher support a student needs, was strongly related to all maladaptive scales. This could mean that when students require redirection or additional cues from the teacher, the teacher rates the student's performance as lower. Additionally, self-regulation and executive function were related to SF3 and SF4, indicating that students who have a low tolerance for sensory input or students who require a certain degree of sensory input in order to engage, may also have difficulty planning and adjusting their

behavior to meet environmental demands. Teachers may be able to promote academic achievement by creating classroom environments and lessons that meet the student's sensory processing preferences.

### **Adaptive Scales**

Social competence, as indicated by the social skills, leadership, and functional communication scales show a negative correlation to sensory processing, meaning the more socially competent a student is, the lower their score on the sensory profile sections. When considering social competence, it is interesting to note that Registration is the highest correlated item, which may mean that students who miss environmental cues have a harder time with social and school related activities. The Auditory and Visual systems also have high correlations with social competence, meaning that these sensory systems may support student's participation in school activities.

Adaptability showed relationships with avoiding and registration. Students who have these patterns can look similar in that students who are hyper-vigilant (avoiding) may shut down in a noisy environment and may look similar to students who are missing environmental cues. To a teacher, both of these students appear to be unavailable to learn, however an environmental adaptation to support these students will look different.

### **Research Question 2**

This study also illustrates the relationship between higher-than-average scores on the School Companion Sensory Profile 2 and a student's ability to learn. When teachers report that students respond 'more than others' on at least one sensory profile domain, they also report that these students have a more difficult time with classroom performance, academic achievement, leadership, communication, self-regulation, and cognition.

Only the leadership score showed a difference when we examined students with a condition, suggesting that considering a student's sensory processing may be more important to learning-related behaviors than whether a student has a diagnosis. Another factor that supports considering sensory processing is that only one of the three students with a diagnosis scored in the higher-than-average range on any sensory processing score, while 28% of the typically-developing sample had scores in the higher-than-average range. Perhaps sensory-related environmental adaptations would be beneficial for many students in general education classrooms, and would qualify as a Tier 1 intervention. These results are tentative given the sample size, so our findings would need to be verified with a larger sample.

### **Limitations**

This study was based on data that was collected for the Sensory Profile 2 standardization project. The purpose of the data collection was to establish validity using the BASC2. A larger sample size would have allowed us to limit the chances of Type I error. Additionally, a sample with more students with disabilities would allow us to make firmer conclusions based on diagnosis. Given these limitations, however, this study suggests that further investigation of the role sensory processing plays in learning-related behaviors is needed.

### **Conclusion**

Learning-related behaviors are important aspects of a student's success. These behaviors can be supported by environmental factors as well as underlying cognitive and emotional skills. This paper presents another factor that can be important to consider when addressing learning-related behaviors. Sensory processing describes a student's reaction to environmental stimuli. This paper shows that sensory processing is related to many learning-related behaviors and

should be considered among the possibilities of interventions. Environments that match students' sensory processing patterns can support students' academic success.

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**Table 1**  
**SPSC2 scales**

	<b>SPSC2 Score</b>	<b>Behavioral Characteristic</b>	<b>What the scale measures</b>
Sensory Processing Patterns	Seeking	Craves sensory input	Needs to touch objects and people. Fiddles with objects. Is on the go. Watches people move around the room.
	Avoiding	Is overwhelmed by sensory input	Becomes distressed during large gatherings. Slower to participate in physical activities. Needs structure and routine
	Sensitivity	Detects and can be bothered by sensory input	Reacts strongly to unexpected noises. Has difficulty participating in noisy environments. Can be described as dramatic or over reactive.
	Registration	Misses sensory input	Misses directions, seems to tune out the teacher, struggles to keep materials organized
School Factors	SF1	Needs extra support to participate.	Misses directions, Needs to touch objects and people, Is fidgety
	SF2	Has difficulty deciding where to focus attention.	Finds endless reasons to approach a teacher, Looks away from tasks to notice action in the room.
	SF3	Tolerates sensory input	Becomes distressed in large gatherings, Does things in a harder way than is necessary, Struggles to complete tasks in noisy environment.
	SF4	Needs right amount of sensory input to engage.	Fails to steady objects when working, Stands or sits at the side of the playground during recess, Misses eye contact with me during interactions

**Table 2**  
**BASC-2 TRS scales relationship to Learning-related behavior**

	<b>Learning-Related Behavior</b>	<b>BASC scale</b>	<b>What the scale measures</b>
Adaptive Maladaptive Scales (Higher score indicates more difficulty)	Academic Achievement	Learning Problems	Teacher rating on performance in math, reading, handwriting. Ability to complete tests and keep up in class.
	Classroom Performance	Attention Problems	Ability to listen and follow directions, and pay attention to classroom content.
	Self-regulation	Emotional Self-Control	Ability to regulate behavior in response to environmental demands
	Executive Functioning	Executive Function	Ability to plan, direct, and maintain behavior in pursuit of a goal
Adaptability	Adaptability	Adjusts well to changes, Recovers quick-	

		ly from setbacks, Shares and plays well with others
Social Competence	Social Skills	Polite, Helpful and encouraging to others
Social Competence	Leadership	Works well with others, Makes decisions, Creative problem solver
Social Competence	Functional Communication	Communicates feelings and needs clearly, Finds information when needed, Provides personal information when appropriate.

<b>Table 3</b>		
<b>Demographics</b>		
<b>Characteristic</b>	<b>N</b>	<b>% of sample</b>
<b>Age</b>		
6-8	11	34%
8-10	17	53%
10-12	4	13%
<b>Gender</b>		
Male	19	59%
Female	13	41%
<b>Ethnicity</b>		
Black	7	22%
Hispanic	5	16%
White	10	31%
Other	10	31%
<b>Diagnosis</b>		
ADHD	2	6%
LD	1	3%
No Diagnosis	29	91%

**Table 4****Correlations between SP2 and BASC-2 TRS**

	Sensory Systems							Sensory Patterns				School Factors		
	Aud	Vis	Move	Tou	Beh	Avoid	Reg	Seek	Sens	SF1	SF2	SF3	SF4	
LP	.643**	.682**	.524**	.082	.397*	.298	.714**	.487**	.21	.679**	.287	.473**	.399*	
AP	.603**	.670**	.509**	-.005	.347	.168	.666**	.507**	.209	.668**	.321	.338	.308	
ESC	.727**	.661**	.603**	.358*	.711**	.664**	.713**	.530**	.503**	.755**	.412*	.663**	.747**	
EF	.741**	.676**	.554**	.243	.545**	.509**	.689**	.472**	.422*	.722**	.386*	.512**	.631**	
Adaptive Scales	-.600**	-.516**	-.502**	-.232	-.707**	-.621**	-.640**	-.367*	-.424*	-.620**	-.341	-.617**	-.675**	
Social	-.476**	-.448*	-.259	.093	-.344	-.319	-.464**	-.169	-.104	-.415*	-.107	-.292	-.407*	
Lead	-.606**	-.611**	-.445*	.059	-.396*	-.253	-.694**	-.375*	-.081	-.659**	-.162	-.370*	-.360*	
Comm	-.572**	-.582**	-.416*	.074	-.348	-.23	-.679**	-.33	-.046	-.601**	-.153	-.33	-.372*	

*NOTE.* Aud = Auditory; Vis = Visual; Move = Movement; Tou = Touch; Beh = Behavior; Avoid = Avoiding; Reg = Registration; Seek = Seeking; Sens = Sensitivity; SF = School Factor; LP = Learning Problems; AP = Attention Problems; ESC = Emotional Self-Control; EF = Executive Functioning; Adap = Adaptability; Social = Social Skills; Lead = Leadership Skills; Comm = Functional Communication

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

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**Table 5 – Comparison of Similar to Others to More Than Others based on diagnosis**

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	Similar to Others	More Than Others
No Diagnosis	21	8
Diagnosis	2*	1 <sup>+</sup>

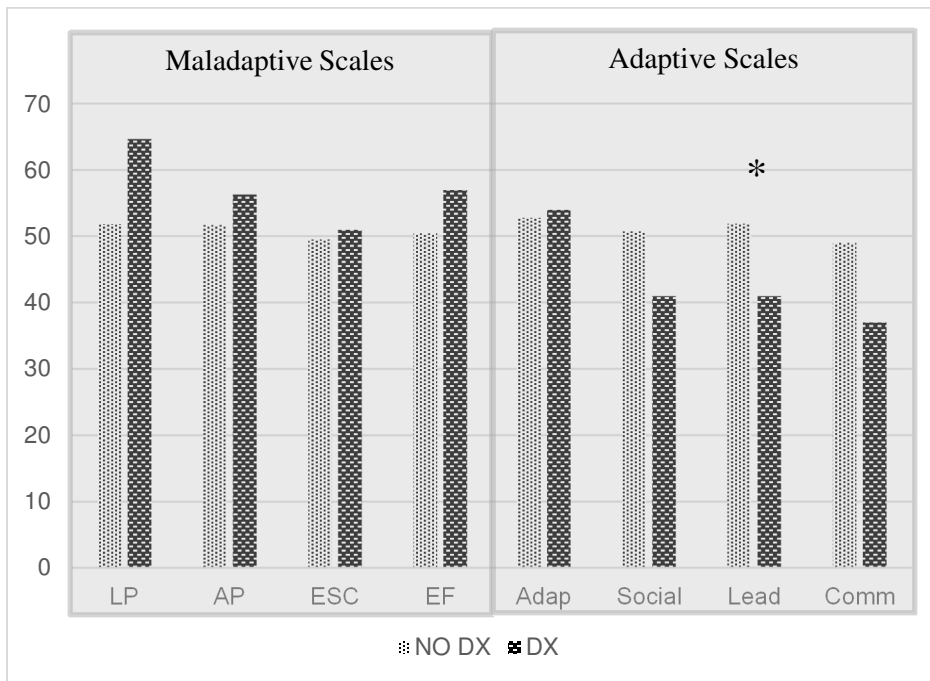
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\* Diagnoses were Learning Disability, ADHD

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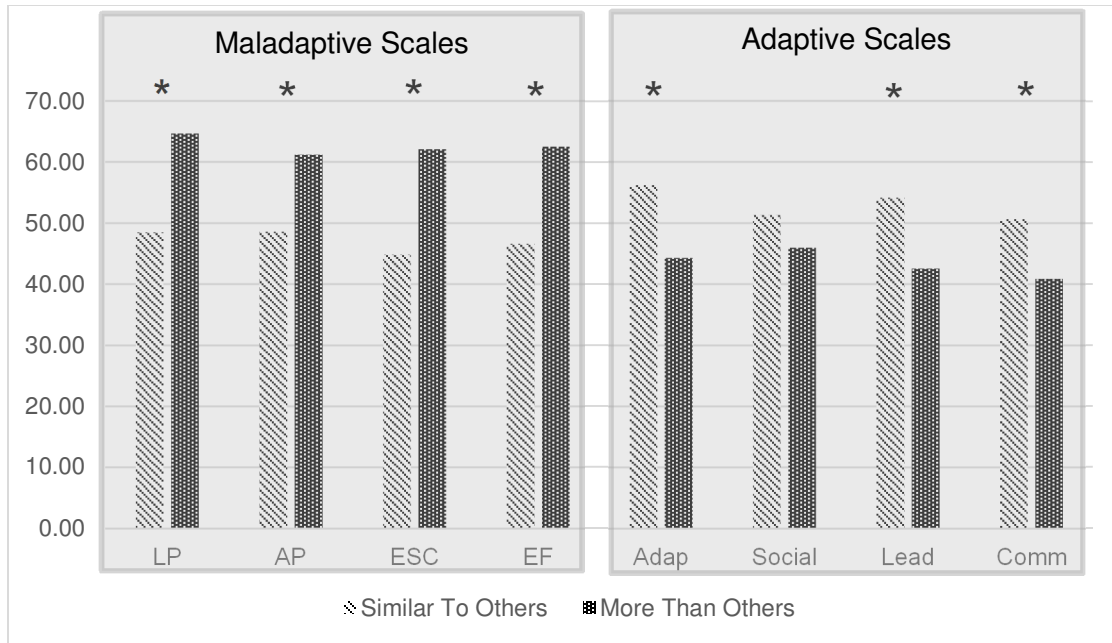
<sup>+</sup>Diagnosis was ADHD

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**Figure 1 – Comparison of Learning-Related Behaviors based on Diagnosis.** “NO DX” indicates students who do not have a diagnosis (N=29), “DX” indicates students who do have a diagnosis (N=3). \* significant at .05 alpha level.

*NOTE:* LP = Learning Problems; AP = Attention Problems; ESC = Emotional Self-Control; EF = Executive Functioning; Adap = Adaptability; Social = Social Skills; Lead = Leadership Skills; Comm = Functional Communication



**Figure 2 – Comparison of Students who have one or more sensory profile score in the “More Than Others” range.**

*NOTE:* LP = Learning Problems; AP = Attention Problems; ESC = Emotional Self-Control; EF = Executive Functioning; Adap = Adaptability; Social = Social Skills; Lead = Leadership Skills; Comm = Functional Communication