

INCREASING SWIM INSTRUCTORS' PERCEIVED KNOWLEDGE OF SENSORY-BASED  
STRATEGIES WHEN COACHING CHILDREN WHO MAY  
HAVE SENSORY DIFFERENCES

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## **Abstract**

Although swim instructors are solely taught water safety regulations and correct swimming techniques, they are nonetheless viewed as mentors by the kids they work with. They are required to finish both their basic swim instructor (BSI) course and their cardiopulmonary resuscitation (CPR) certification, which primarily covers the fundamentals (American Red Cross Training Services, 2023; Kraft & Leblanc, 2018). However, neither provide a method of teaching swimming to children who might have sensory processing differences. This lack of education may affect both the child's participation and the swim instructor's capacity to impart knowledge. Research revealed that swim instructors are not very knowledgeable in this area, and children with specific diagnoses and sensory processing issues can benefit from sensory-based activities in the water (Kraft & Leblanc, 2018; Pinru & Burhaein, 2019).

The primary objective of this capstone project is to address the knowledge gap on how to interact with children who have poor sensory control by providing swim instructors at Waves Swim and Safety LLC in Reno, Nevada, with a toolkit on sensory activities. The introductory educational toolkit includes items relevant to occupational therapy practice and offers swim instructors strategies to enhance their teaching and students' engagement in swim classes.

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## **Chapter 1: Introduction**

Swim instructors lack training and experience in gaining knowledge specific to supporting the engagement of children who have sensory differences within the aquatic environment (Kraft & Leblanc, 2018). Based on research by Kong and Moreno (2018), one in six youths struggle with sensory processing. The prevalence and incidence of sensory challenges include both typical and atypical developing children. According to Miller (2023), at least one in 20 members of the public suffers from variations in their sensory processing differences related to vestibular input. Kong and Moreno (2018) and Ringold et al. (2022) explain that the main disorders that are involved with poor sensory regulation are children who have cerebral palsy (CP), down syndrome (DS), attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD) or a history of prematurity. The human senses can include sight, hearing, smell, and taste, however, the focus for this project is on tactile (touch) input, vestibular input, and proprioceptive input.

Children who have difficulty processing sensory information may behave in ways that are not typical because they are receiving either too much or too little stimulation. Swim instructors are required to work with children who may or may not have a disability and are not trained on how to support engagement in the aquatic environment when working with someone who demonstrates sensory differences. Swim instructors are also only required to complete their swim and water safety certification and CPR certification before teaching children how to swim within Washoe County (Reno, Nevada) (American Red Cross Training Services, 2023). Swim instructors in the Reno, Nevada area can help children participate more actively in swim lessons and become more adept at regulating their sensory demands by learning about sensory-based strategies that they can apply in any pool.

Occupational therapists can facilitate or improve people's participation in daily life by using the *Occupational Therapy Practice Framework (OTPF): Domain and Process Fourth Edition* (AOTA, 2020, pg.1). The OTPF is the backbone of occupational therapy, and it addresses what factors hinder the person's ability to learn as well as addresses being able to modify the environment for learning help the learner succeed to their full potential (AOTA, 2020). Additionally, the American Occupational Therapy Foundation's (AOTF) goals are to enable people to fully participate in meaningful life activities and provide education to further expand the occupational therapy lens and knowledge to other professionals (AOTF, 2024). These two organizations support occupational therapy and emphasize the importance of closing the knowledge gap in a community that desperately needs it. AOTF and American Occupational Therapy Association (AOTA) also support this capstone as it hopes to increase children's participation in swim lessons and increase awareness of the valuable contributions occupational therapists can make in aquatic environments.

The educational toolkit was developed to fill the training gap of working with children who have sensory issues at Waves Swim and Safety LLC, which is a local specialty swim school in northern Nevada. The introductory educational toolkit begins with an overview of what vestibular, tactile, and proprioceptive input is. The next sections dive into an introduction to what sensory differences a child can experience to help the swim instructor notice children's sensory responses inside and outside the pool. Lastly, the swim instructors were educated on sensory-based strategies they can use with these children in the pool environment through visuals and descriptions of evidence-based activities. Overall, the introductory toolkit served as the first step towards incorporating sensory-based strategies with an occupational therapy perspective as an extra educational tool for working as a swim instructor.

## **PIO Question**

Among staff within the aquatic environment, does an introduction of an educational toolkit on sensory-based strategies increase perceived knowledge when coaching children aged four to fourteen?

## **Definitions**

The three primary senses, aquatic environment, sensory strategies, knowledge, conceptual definitions for a toolkit, swim instructors, and terminology used throughout this study are all explained for clarity.

### ***Swim Instructors***

The definition of a swim instructor is someone who instructs individuals of all ages and skill levels in swimming as well as how to be safe in, on, and/or around water (LaRoza, 2023). The job of the swim instructor is to be mindful of the fact that every student learns uniquely, to show patience, and to be able to modify levels and skills to meet the needs of each student. Finally, they are urged to make sure that instruction is suited to each student's level of swimming and unique requirements by monitoring student development and modifying their lesson plans as necessary.

### ***Toolkit***

A collection of information designed for a particular audience and applicable to numerous fields is called a toolkit. Toolkits can help members of the target audience use theory and evidence, exchange resources and methods, and provide knowledge in a rapidly evolving field of practice (Young Adult Library Services Association [YALSA], n.d.). A toolkit is utilized for the transfer of learning, coaching, and training purposes (CalSWEC, n.d.). According to Derera (n.d.), toolkits should be made to meet the organization's current needs and satisfy all

levels of the organization or business mission and vision statements. A further operationalization of the notion would be an information-disseminating toolkit as opposed to an information-providing toolkit for a program or an engagement and communication tool (CalSWEC, n.d.).

### ***Three Primary Senses***

The vestibular, proprioceptive, and tactile systems are the three primary types of sensory systems. Our ability to feel and understand things, including pain and temperature, is known as the tactile system (Shaffer, 2023). The definition states that the vestibular system, housed in the inner ear, regulates muscle tone, postural control, balance, and hand-eye coordination. Finally, the proprioceptive system controls the spatial exchanges between our body and the surroundings.

### ***Aquatic Environment***

An aquatic environment is a building housing an indoor/outdoor swimming pool or an artificial area of water that is utilized for swimming (Cambridge Dictionary, n.d.). According to LaRoza (2023), each environment should collaborate closely with the Sports Centre Manager to fulfill and surpass predetermined goals and objectives as well as to be financially successful. This is achieved through maintaining current knowledge of both the College's policies and processes for safeguarding, as well as the laws governing their recruitment and retention of staff (LaRoza, 2023). The aquatic environment also enforces facility operating guidelines and pool safety regulations for everyone using the facilities.

### ***Sensory Strategies***

Sensory strategies focus on enhancing sensation to improve engagement in meaningful occupations and recreational outcomes. These kinds of approaches concentrate more on how a person reacts to sensory information and how to modify the setting or method to suit the ideal challenge. Movement breaks, wobbly surfaces, weighted vests, dynamic seating, and minimizing

sensory components of environments are a few examples of sensory-based methods (Sagester et al., n.d.). In this instance, we'll discuss using sensory strategies that take advantage of the aquatic environment to address the child's sensory needs.

### ***Knowledge***

Knowledge is a term that describes the information and abilities that a person has gained through education or professional experiences (Shama, 2018). It can also refer to knowledge in a specific field, a fully justified belief, or familiarity with truth or circumstance acquired by experience.

## **Chapter 2: Statement of the Problem**

According to O'Brien and Kuhaneck (2019), children who struggle with sensory processing, especially those who are hypersensitive to touch and sound, are more likely to have negative interactions with people as adults. Likewise, research from Arky (2022), explains how certain children with ASD have been known to walk toward water, frequently with fatal consequences. According to one explanation, their sensory problems compel them to want the feedback that water provides (Arky, 2022). These youth struggle to process information from their senses, which can overwhelm them and cause strange and perplexing actions. This demonstrates why more parents are putting their children who are sensory seeking and or sensory deprived into swim lessons to help regulate their child's sensory needs and increase safety in the aquatic environment. Another perceived problem is that there are a multitude of children with sensory difficulties that parents pass up as a child just acting out or throwing a tantrum. For example, a child may have a tantrum after swim class because they don't want to change out of their bathing suit after being in the pool due to feeling overwhelmed with the tactile sensations of wet clothes against their skin. Being able to incorporate sensory techniques in the pool environment can improve tactile sensation for this child to be able to complete these tasks with no difficulties. In contrast, children who are unresponsive and do not turn to sounds and or participate in intense rocking are under-responsive to proprioceptive and vestibular input (Kong & Moreno, 2018). The occupational performance of the children during swim classes and potentially in daily activities can be enhanced by teaching the swim instructors strategies to enhance the child's tactile, proprioceptive, and vestibular input in the aquatic environment.

According to Bundy and Lane (2020), research has been done on school-aged children and adolescents to examine the connection between sensory integration and education. Bundy

and Lane (2020) claim that sensory integration is also necessary for developing secondary skills in emotional regulation and attention, leading to higher-level learning abilities, such as cognitive processing and self-regulation. This indicates that broadening swim instructors' knowledge of these three basic senses is a crucial first step toward successful learning experiences, which may involve more engagement during swim lessons and other relevant meaningful activities.

Additionally, it indicated that high-order thinking, learning, and functioning require the proper functioning of the three primary senses which is why this capstone experience is needed.

Overall, Bundy and Lane's (2020) literature supports increasing swim instructors' knowledge of sensory integration and the crucial role it plays in supporting participation in life activities.

Additionally, it suggests that there is a relationship between sensory integration and education or work, even though this relationship has not been thoroughly investigated during adulthood.

The impact of aquatic services has been addressed in studies among neonatal intensive care units (NICU) and with early intervention with toddlers and infants swimming programs (Butzman et al., 2022; Costa et al., 2016). There are, however, few studies that inform swim instructors on how aquatic-based strategies can improve sensory regulation in both typical and atypical children and adolescents. A peer-reviewed article focused on coaching through in-person education by Flippin and Clapham (2021) also demonstrates how fathers and mothers have been taught how to increase participation in the pool if their child has sensory deficits. However, rarely any studies that focus on the population of increased knowledge within the swim instructors (Kraft & Leblanc, 2018). Furthermore, increasing the swim instructor's knowledge should empower them to help more children with sensory differences and increase engagement and participation during swim lessons.

## **Significance of Occupational Therapy**

Sensory processing disorder (SPD) hinders the child's ability to learn how to swim. When an occupational therapy practice applies the sensory integration frame of reference, occupational therapists can work with both adults and children in meaningful professions. When working with children who may or may not have sensory differences, occupational therapists are permitted to develop training materials, continuing education units (CEUs), and/or toolkits that can help close the knowledge gap in the literature by enhancing swim instructors' understanding of sensory-based aquatic strategies.

Occupational therapists can provide education to other professionals, such as swim instructors, on how to decrease these hindering factors within the aquatic environment. Additionally, the OTPF describes how occupational therapists create activities and strategies related to roles, routines, sensory strategies, and occupational adaptability factors; they also address functional occupational performance difficulties associated with emotional, social, and mental health (AOTA, 2020). The AOTA (2020) describes an example of self-regulation interventions that occupational therapists can utilize to implement in community sites to establish a sensory-friendly environment for children who may have sensory processing deficits. Furthermore, this capstone project can add to the body of knowledge about aquatic-based strategies and expand knowledge on how to modify the aquatic environment to better suit the sensory demands of children with sensory differences. This initial educational toolkit can be an introduction to new implications for future research on children with SPD who can emotionally and mentally adapt to this meaningful occupation of swimming.



## **Outcomes**

This capstone project aimed to strengthen the knowledge of swim instructors in sensory-based aquatic strategies that they can apply while teaching children who may have sensory differences to swim. The likelihood of increasing participation in the child's swimming lessons could be increased by developing a foundational educational toolkit for swim coaches. More precisely, the toolkit's results will result in a greater understanding of how to identify sensory differences in children and how to encourage engagement with tactile, vestibular, and proprioception activities in aquatic environments. The introductory educational toolkit also contains illustrations and instructions for using evidence-based teaching methods in on-site and mobile swim classes.

## **Need for the Project**

Individuals who have sensory processing issues in children and adolescents may exhibit either hyper- or hyposensitivity. Children's behavior can present with having tantrums which in turn interfere with their occupational performance. These meltdowns can be a result of their clothes being uncomfortable, getting water on their face, being clumsy, and or having trouble completing a task on their own (Arky, 2020). This could mean they also struggle to process the information they are taking in, making it quite challenging for them to feel at ease, perform well, and be receptive to socialization and learning in the aquatic environment.

One way to help these children regulate their sensory input is through aquatic strategies, which is why it is most advantageous to educate swim instructors on these strategies to effectively increase participation and knowledge of how beneficial the aquatic environment is for children with sensory differences. Providing the educational toolkit to swim instructors can address the need for swim instructors to want more knowledge before working with children

with disabilities to increase their students' engagement in the meaningful occupation of swimming.

### **Target Population**

This capstone project will focus on swim instructors who work with adolescents and young children aged 4 and fourteen to close the knowledge gap before teaching swim and the gap in ongoing education provided to instructors. This is the initial step in addressing occupational therapy in the local Northern Nevada community's aquatic environment, as there are limited occupational therapists in the state of Nevada. According to Kraft and Leblanc (2018), before starting their careers as teachers, swim instructors get credentials, but this does not ensure that they will succeed when working with youth who could have trouble with sensory processing. Swim instructors are not taught how to create activities or strategies that meet a child's sensory demands or how to present the just-right challenge to a child through the two mandatory certificates. The goal of this capstone project is to educate swim instructors so they can better support students who may be experiencing difficulties with sensory processing during one-on-one swim lessons.

### **Chapter 3: Literature Review**

This review of literature is to determine the evidence for training swim instructors using the Knowles adult learning theory and sensory-based aquatic methods for different diagnoses involving sensory differences. Articles about adult learning, occupation-based learning, adaptive aquatics, and sensory-based aquatic programs met the inclusion requirements. Additional search phrases that were utilized in this search were aquatic training, pediatric swimming activities, sensory processing disorder, and sensory interventions. Although high levels and stronger evidence-based literature were first researched, it was found to have no relevance related to occupational therapy teaching methods or sensory-based aquatic strategies. As a result, case-control designs, case reports, qualitative research, and more literature reviews were added to the list of inclusion criteria. Articles beyond a decade were excluded unless they offered theoretical or historical background to support this capstone. The literature reviews in the first portion emphasize adult learners' and swim instructors' educational needs. The following section targets various sensory strategies with evidence around adapted swim programs and sensory-enhanced aquatic play programs that swim instructors could utilize within the aquatic environment. Within this section, the literature review will address various diagnoses involved with sensory differences. Lastly, a synthesis of the information related to this capstone's topic of interest will follow.

#### **Adult Learning**

The characteristics of adult learning are anchored in the andragogy approach. This learning theory is more student-centered and allows adult learners to link new knowledge to a wide range of personal experiences. Livingston and Cummings-Clay (2023) discuss the use of andragogy, an adult learning theory, in teaching methodology. Livingston and Cummings-Clay

argue that instructors should use learner-based practices that grow from the content of lessons to engage learners, even if the information is new to them. This level five article suggests that andragogy has been effective in engaging the characteristics of college and high school learners in developing skill sets vital to various disciplines. Livingston and Cummings-Clay mentioned the best way to increase knowledge in learners is to encourage discussions, visual examples, and topics that the learners are motivated by. The article by Livingston and Cumming-Clay provides educators with instructional approaches that advance adult learning outcomes by identifying the six key assumptions about adult learning: self-concept, motivation, experiences, orientation to learning, readiness to learn, and the need to know. One critique of this occupational therapy adult learning theory is that it does not apply to everyone, such as the orientation to adult learning as compared to children. This is why this capstone focuses on providing an introductory educational toolkit to swim instructors who are adults. Although this article has a low level of rigor, its relevance to this capstone is high, as education will be provided to swim instructors to increase their knowledge of sensory-based aquatic strategies with the use of andragogy approaches.

### ***Swim Instructors' Educational Needs***

Swim instructors lack education before teaching and are not given the education they need to succeed to their full potential. Kraft and Leblanc (2018) emphasize the need for swim instructors to engage in further learning activities to increase their knowledge of how to coach children during swim lessons. A qualitative case study by Kraft and Leblanc examined the experiences swim instructors had with developing their knowledge for teaching youth with ASD. The purpose of this level four study was to determine the preferred knowledge sources used by swim instructors when creating customized lessons for swimmers with ASD. Using criterion-based sampling, all of which had the minimum requirement of CPR and Canadian Red Cross

training, a theme analysis was conducted to ascertain the teachers' level of expertise in catering to the demands of this community. Data was gathered through semi-structured interviews, observations, and a demographic questionnaire. Given that children with ASD are underrepresented in physical activity alternatives, Kraft and Leblanc stated that swimming lessons have been suggested as the ideal kind of physical activity for this population to help regulate their sensory systems. The study's major findings were that swim instructors preferred knowledge sources such as personal experience, colleagues, and online resources for building their swimming lessons. Kraft and Leblanc concluded, by having a deeper comprehension of the experiences that instructors have gained expertise from, teacher educators can include this understanding to prepare more qualified people to assist children with ASD in physical activities. Although this literature had a lower rigor, it was very relevant to this capstone as it demonstrated that swim instructors prefer being taught sensory-based aquatic strategies in person to prepare for swim lessons with children who have sensory differences.

The article from Flippin and Clapham (2021) described a pilot study that investigates the efficacy of a 12-week multimodal treatment program for youth with ASD that combines face-to-face father-child swimming practices with telemedicine coaching. The goal of the research is to improve a father's ability to communicate with his child and use responsive play and sensory tactics, therefore reducing obstacles to father participation in early autism treatments. Flippin and Clapham suggest that the hybrid intervention program has the potential to be an effective approach to increasing the dad's involvement in their children's interventions within the pool setting. The article's hybrid and telehealth coaching delivery methods offered families hope; however, the evidence cannot be generalized to other populations, which is why this capstone utilized in-person teaching for swim instructors. Although the rigor of this article is low, the

relevance is moderate, as they educated adults on how to teach children and young adults how to participate in swim lessons when they have sensory differences. This level five article also demonstrates how education is beneficial to both genders, meaning that education on sensory-based aquatic strategies will be effective for males and females coaches.

According to Kraft et al. (2019), coaches and teachers must have efficient methods for encouraging physical activity in kids with ASD. The article's goal was to lessen the dearth of resources by offering coaches and teachers practical advice on how to help kids with ASD engage in physical activity. Given that drowning is the primary cause of mortality for children with ASD, swimming is both an excellent physical activity and a crucial life skill for these kids. For children with ASD, Kraft et al. proposed experiential learning approaches to increase the likelihood that swimmers will engage in water leisure activities. These strategies included providing a safe and predictable environment, using visual aids, providing examples, using peer teaching, and using cues and prompting. This level five article was a low-rigor; however, it demonstrates moderate relevance as it suggested that the toolkit this capstone is providing to the swim instructors should have visual aids to ensure they are doing the sensory-based aquatic strategies safely.

### **Adapted Swimming Strategies with Various Diagnoses**

*Case-Smith's Occupational Therapy for Children and Adolescents*, written by O'Brien and Kuhaneck (2019), shares how occupation-based interventions, such as swimming lessons, are designed to help children with sensory difficulties because they use engagement in ordinary daily activities or leisure activities to increase participation. According to O'Brien and Kuhaneck (2019), children with sensory processing difficulties can benefit from the calming support, pressure, and buoyancy that come with submerging themselves in water. This can help them

meet new physical milestones, improve their social skills, and strengthen their self-regulation abilities. Research indicates that children diagnosed with ASD, ADHD, CP, developmental coordination disorder (DCD), also referred to as dyspraxia, and DS are among the disorders that may present with sensory differences that impede their ability to control their emotions and meet developmental milestones (Kong & Moreno, 2018; Ringold et al., 2022; Zimmer & Desch, 2012). The policy statement by Zimmer and Desch (2012) shared that activities that are believed to organize the sensory system by providing proprioceptive, vestibular, and tactile inputs are included in sensory-based aquatic strategies. Furthermore, Zimmer and Desch (2012) proposed that occupational therapy, in addition to sensory-based aquatic methods, could be a comprehensive approach to controlling sensory imbalances.

To compare sensory modulation in children with DCD to that of ASD and typically developing (TD) children, Ringold et al. (2022) undertook a study. With 136 participants, Ringold et al.'s study used clinical and behavioral measures to investigate differences in sensory modulation in DCD and to comprehend the connections between sensory modulation and behavior, social-emotional measures, and motor skills in DCD relative to peers with ASD and TD. Word-of-mouth and social media ads were used to recruit participants. The Sensory Over-Responsivity Scale (SensOR), the Child Behavior Checklist (CBCL), the Interpersonal Reactivity Index (IRI), and the Short Sensory Profile Two (SSP-2) were some of the measures used. According to Ringold et al., 31% of the DCD group, which is situated in between the ASD and TD groups, exhibited issues with sensory modulation. This demonstrates that all children with or without a diagnosis experience sensory differences, which is why this capstone chose to focus the target population on swim instructors who work with typical and atypically developing children. A major critique of this study is the low relevance as the study does not include swim

sensory-based strategies; however, the rigor is high and allows this capstone to focus on education for swim instructors who work with a variety of students, no matter their level of disability.

Research by Conatser et al. (2019) reported in the *International Journal of Aquatic Research and Education* that they studied adapted aquatics for kids with significant motor impairments. The goal of the study was to equip aquatic teachers with the skills and information necessary to teach students with severe disabilities in a regular aquatic class without requiring them to be segregated. According to Conatser et al.'s study, aquatic instructors must be aware of and open to the use of innovative teaching and administrative strategies that promote a secure and productive learning environment for all kids. Conatser et al. concluded that instructors could improve their ability to teach all children, feel more confident in their ability to teach, and witness more positive and effective outcomes in their aquatic programs with little knowledge and experience. This research article illustrates the way in which swim instructors plan classes for kids with and without disabilities. The highly rigorous level five study also has moderate relevance to this capstone as it demonstrates a need for swim instructors' increased knowledge of unique strategies that foster a safer and more successful learning environment for children.

### ***Sensory-Based Aquatic Strategies***

In Anderson et al.'s (2022) level three qualitative study, the researchers explored how youth apply water safety concepts they learned from a Learn-to-Swim (LTS) program in a hypothetical aquatic scenario. The participants were 29 children aged six to 12 who completed the LTS program. The article utilized semi-structured interviews and a visual illustration prompt to assess the participants' expressed water safety behaviors. Literature by Anderson et al. found that most participants could identify a struggling swimmer, but they also showed some



misconceptions or hesitancy in other behaviors, such as calling for help or entering the water. The result from Anderson et al. also demonstrated that other sources, such as toolkits and visuals, are important for water safety knowledge, and that social agents, such as parents or instructors, play a role in water safety messaging. The non-random sample in this article is a major point of criticism because it reduces the findings' representativeness and capacity to be generalized to different groups and environments. Another critique is the recall bias and social desirability bias that is introduced by self-reported data from participants and the authors do not report how the interviews were transcribed, coded, or analyzed, which may affect the validity and reliability of the results. Furthermore, Anderson et al. did not provide a clear theoretical framework to guide the study. Anderson et al. also do not review the existing literature on water safety education, behavior change, or youth development, which may limit the contextualization and contribution of the study. Although the strength and rigor of the study were low, these aquatic scenarios provide this capstone with sensory-based aquatic strategies that are advantageous for teaching safety skills alongside sensory-based aquatic strategies within the aquatic environment. This also was relevant to the development of the toolkit for this capstone as this article utilized visual illustrations, which is why the swim instructor's toolkit has visuals with explanations alongside them to increase their knowledge of sensory-based aquatic strategies.

Literature by Ballington and Naidoo (2018) utilized a cross-over study design to investigate the impact of an aquatic-based program on children with CP who were 8 to twelve years old. In this level four study, participants were split into an intervention and control group, and a pretest-posttest and randomized group were employed. While the control group carried on with their regular activities, the intervention group met for two 30-minute sessions every week. Gross motor function measurement was used for pre-and post-intervention testing, and the study

employed the Halliwick Concept's ten-point program, which will be covered in more detail in the upcoming article reviews. Ballington and Naidoo demonstrated that the aquatic-based services had a significant effect on gross motor function scores of children with CP post-intervention as compared to the control group. To achieve long-term improvements in gross motor function in children with cerebral palsy, Ballington and Naidoo also stated that aquatic-based programs should be combined with traditional forms of therapy and taken into consideration as a vital, continuous mode of treatment. These motor functions included improving sensory aspects of the child's vestibular and proprioceptive input which demonstrated how relevant this article is to this capstone project. This lower-level study is moderately rigorous. Although the main critique is the study design as it should have used a longitudinal approach to determine the long-term follow-up to determine if the improvements were sustained over time, it demonstrates how much of an impact the swim instructors within the capstone can make on their swimmer's lives in the pool and outside the pool.

The previously mentioned Halliwick Concept is a method for teaching swimming, autonomous movement in the water, and participation in aquatic activities to all persons, with a special emphasis on those with physical and/or learning disabilities. To quantify and summarize the different aquatic therapies for children with disabilities, Ka et al. (2013) carried out a systematic literature review. There were 45 intervention trials that were detailed under nine disability groups were included in the level one study. According to Ka et al., the categories of "diseases and disabilities of the nervous system" (N = 15) and "mental and behavioral disorders" (N = 15) included the greatest number of publications. The classification of aquatic interventions was a significant criticism of this paper, as Ka et al. found it challenging for several reasons: different types of pools (temperature and depth), an unclear combination of several intervention

types, tailored therapy or training programs without a decision-making process, a lack of standard terminology, and the absence of intervention details. Although the rigor of this study was moderate, it is highly relevant to this capstone experience as it demonstrates a need to teach swim instructors how to increase their swimmer's participation when they have a physical or learning disability.

Vodakova et al. (2022) carried out a single-subject investigation to assess the impact of a seven-week Halliwick method intervention program on children with ASD's gross motor, mental, and aquatic competence. For two weeks, seven children with ASD took swimming lessons once a week, followed by a seven-week Halliwick method intervention program. The Gross Motor Function Measure exam was performed to ascertain the degree of gross motor abilities, and the Alyn Water Orientation exam was utilized to gauge the impact on aquatic skills. According to Vodakova et al.'s results, seven participants improved their gross motor and aquatic skills, although two of them did not enhance their mental adjustment to the breathing control sections of the water. But it's important to consider a few of this study's limitations. First off, with just seven individuals, this study is a single-subject investigation. Second, a long-term follow-up was lacking to ascertain if the gains in gross motor function and aquatic skills persisted over time. Finally, this study did not compare the Halliwick method with other forms of therapy or interventions. The rigor of this article was high the relevance is moderate as it demonstrated that sensory-based aquatic strategies help improve children with ASD's ability to participate in class and increase their vestibular and proprioceptive input.

The final piece of data pertaining to the Halliwick methods comes from a scoping review conducted in 2021 by Rohn et al. to investigate the application of Halliwick aquatic therapy in the rehabilitation of children with impairments. There were 24 papers in the study that satisfied

the requirements for this level two evidence. Results from Rohn et al. showed that Halliwick aquatic therapy has been used in the rehabilitation of youth with a variety of disabilities, including ones with sensory differences such as CP, ASD, and DS. The studies reported improvements in motor function, balance, sensory responses, and aquatic skills. The fact that 14 out of the 24 studies' outcomes and intervention methods were not consistently reported is a significant criticism leveled at this scoping review. According to Rohn et al., more investigation is required to determine whether the Halliwick method is beneficial for the rehabilitation of children with sensory differences. This rigor was moderate and the relevance to this capstone is moderate as the sensory aquatic methods utilized in a majority of the articles improved children's sensory responses.

### ***Sensory-Enhanced Aquatic Play and Adapted Aquatics***

The peer-reviewed article by Fabrizi (2015) used a repeated measures design and followed ten children who were diagnosed with ASD and their caregivers who participated in a six-week aquatic play program. According to a study by Fabrizi, an aquatic playgroup for young children with sensory deficits can significantly increase children's playfulness. Although statistical significance was shown in children with sensory deficits in playfulness, the analysis did not detect any change in caregiver responsiveness. This is the primary reason why this capstone utilizes an upstream approach and targets the swim instructors instead of caregivers using education. The main criticism of this literature was its small sample size (ten kids and their caregivers), which limited how broadly the results could be applied. Another criticism of this data is that Fabrizi did not provide a control group, which makes it challenging to conclude whether the improvements that were seen were caused by the aquatic playgroup or by other

variables. Despite these critiques and low rigor, the study provides valuable insights into the effectiveness of aquatic play groups for young youth with sensory differences.

The Butzman et al. (2022) case series aim was to develop a nine-week aquatic play program that enhanced the children's play skills, sensory-processing skills, social-emotional development, and motor abilities in a fun and natural environment of the pool. A total of 11 children with ASD, CP, DS, and conditions that resulted in developmental delays (DD) were recruited by flyers and word of mouth to occupational therapy clinics in the southwest region of the United States. Butzman et al. held the program in the community pool and utilized the outcome measures of Developmental Assessment of Young Children-Second Edition (DAYC-2), Sensory Profile 2, and Goal Attainment Scaling (GAS). The sensory processing aquatic play activities in Butzman et al. included heavy work and movement in the water to promote self-regulation, maintaining focus during functional play activities, participation in an obstacle course to increase arousal state and self-modulation, and scooping toys into an empty bucket to increase direction following. According to Butzman et al., 79% of the children's individual goals were either met or surpassed, with categorical changes noted on the DAYC-2 and Sensory Profile 2. Parental emotions of isolation decreased and satisfaction among parents with services increased after the aquatic play session. A major limitation is selection bias since the design is a case series, meaning there is no randomization or control group which severely limits the generalizability of the findings and ability to attribute the observed outcomes solely to the aquatic program. The rigor was high for this study and the relevance was moderate as the aquatic play program included sensory-enhanced aquatic strategies that can be utilized in the toolkit of the capstone. This study also demonstrates how sensory-based strategies can be utilized within the aquatic environment to increase participation in children with sensory differences.

Pinru and Burhaein (2019) conducted a review study that looked at how best to use water activities as play therapy for youth with ASD. According to Pinru and Burhaein, play activities in an aquatic setting can help children with ASD who struggle with sensory control, social interaction, conduct, interests, and motor abilities. Five games were among the sensory-enhanced water play tactics used in this article: games with fishing nets; games with touch balls, floats, or specific objects; mini water polo; games with searching for certain objects or coins; and games with sowing objects or coins. Pinru and Burhaein found that children with ASD can benefit from the aquatic game in terms of improved sensory regulation and the development of psychological components such as behavior, emotions, and social qualities. The critique of this level five article is the study design chosen, a randomized control trial with these strategies would have benefited this literature more as it requires data and analysis beyond what is already known in the field. Because the authors Pinru and Burhaein utilized a review of prior articles and did not synthesize any data it affects the quality and validity of this literature. This also affects the applicability and transferability of the findings in other contexts. Although this evidence has a low rigor, the relevance is moderate as it provides ideas for playful sensory-based aquatic strategies that swim instructors can learn from this capstone's project educational toolkit.

To conclude this review of literature, this last article applied and utilized occupational therapy measurements to determine the effectiveness of learning sensory-based strategies. In reviewed research published in 2019, Pinru and Burhaein examined the most effective ways to apply water activities as play therapy for youth with ASD. Pinru and Burhaein claimed that play activities in an aquatic environment can benefit children with ASD who have difficulties with motor skills, interests, behavior, social interaction, and sensory regulation. The five games utilized were fishing nets, touch balls, floats, or specific objects, mini water polo, hunting for

specific things or coins, and sowing objects or coins were among the sensory-enhanced water play strategies employed in this research. Pinru and Burhaein discovered that the aquatic games help children with ASD develop psychological traits including behavior and emotions as well as better sensory modulation. Compared to the control group, the intervention group demonstrated a statistically significant improvement in their motor coordination and swimming skills after the intervention. According to Moura et al., LTS activities in a school setting can help kids improve their motor coordination and swimming skills. The critique of this article is small sample population, makes a significant impact on the reliability of the literature. This highly rigorous study is moderately relevant to this capstone project as the LTS program is the same program that is utilized by the swim instructors at Waves Swim and Safety LLC, where this capstone project is being held. This article also helped the researcher of this capstone project get a better understanding of the swim instructors' current teaching style and ways to teach swim instructors more effectively on sensory-based aquatic strategies.

### **Synthesis**

This evidence-based literature review explored articles on the topics of adult education using andragogy approaches, swim instructors' educational needs, adapted swimming strategies with various diagnoses, and sensory-based aquatic strategies. The evidence demonstrates many connections as well as moderate to high relevance to this capstone project. Many researchers demonstrated gaps in the lack of knowledge provided to swim instructors on sensory-based strategies before working with children (Flippin & Clapham, 2021; Kraft & Leblanc, 2018; Kraft et al., 2019). Meaning that further research on increasing swim instructors' perceived knowledge is needed before working with children who may have sensory differences.

The literature emphasizes the need to educate swim instructors in person with visuals to ensure knowledge is developed from the introductory toolkit (Flippin and Clapham, 2021, Kraft et al., 2019; Livingston & Cummings-Clay, 2023). Many children with ASD, ADHD, DS, and CP have trouble with motor skills, and the enjoyable activity of sensory-based aquatic strategies can help ease symptoms such as better balance, better special awareness, and help with sensory responses (Butzman et al., 2022; Conatser et al., 2019; Kong & Moreno, 2018; Ringold et al., 2022). Butzman et al. (2022) explained that by being submerged in water, the buoyancy, and properties of the water such as pressure provide a supportive and calming environment that is beneficial for children with sensory differences. The benefits include, but are not limited to, developing their sensory processing skills, and reaching new self-regulation abilities (Butzman et al., 2022). Sensory differences are common among various diagnoses and the water environment allows children to help regulate their vestibular, tactile, and proprioceptive input (Butzman et al., 2022; Kong & Moreno, 2018; Ringold et al., 2022; Zimmer & Desch, 2012). These sensory-based aquatic strategies need to be addressed so that swim instructors are successful during all swim lessons.

These studies collide with other literature demonstrating that swim instructors can be taught sensory-based strategies with consideration of the LTS program to ensure swimmers' safety and aquatic skills are enhanced (Anderson et al., 2022; Moura et al., 2022). Evidence from this literature review also explained that the benefit of having children with sensory deficits participate in swim lessons can increase strength and coordination, improve social and communication skills, increase focus and calmness in children, better swimming skills, and most importantly improve sensory processing (Butzman et al., 2022; Fabrizi, 2015; Pinru & Burhaein 2019; Ringold et al., 2022). With a strong level of evidence, further literature discovered how



making a game out of swim lessons can enhance physical activity, cardiorespiratory function, muscle strength and endurance, and overall sensory behavioral responses (Pinru & Burhaein, 2019). When coaching children who may have sensory impairments, swim instructors can benefit from learning from the evidence-based practice literature that includes aquatic play groups and sensory-enhanced aquatic play activities.

Evidence from this literature review explained that the benefit of having children with sensory deficits participate in swim lessons can increase strength and coordination, improve social and communication skills, increase focus and calmness in children, better swimming skills, and most importantly improve sensory processing (Ballington & Naidoo, 2018; Fabrizi, 2015; Ka et al., 2013; Rohn et al., 2021; Vodakova et al., 2022). All but one of these studies include the Halliwick method, which is an approach that emphasizes teaching swimmers, no matter their experience or ability, to swim independently, and participate more fully during swimming activities (Ballington and Naidoo, 2018; Ka et al., 2013; Rohn et al., 2021; Vodakova et al., 2022). Incorporating the concepts of the Halliwick method will ensure that swim instructors increase their knowledge on how to utilize sensory-based aquatic strategies with safety. All in all, this evidence-based literature demonstrates that this capstone is needed to increase perceived knowledge of sensory-based strategies that can be utilized within the aquatic environment.

## **Chapter 4: Theoretical Frameworks**

The andragogy approach, otherwise known as Knowles' adult learning theory, focuses solely on adult education. According to research by Bouchrika (2022), adults are more self-directed and driven than children, hence the core of andragogy is the notion that they should have access to learning experiences that are significant to their lives. Six concepts that will be incorporated into the final toolkit and used in the instructional process of this capstone project make up the existing theoretical framework, which is the approach and manner of educating adult learners. The six main concepts of occupational therapy learning theory are self-concept, learning from experience, readiness to learn, immediate applications, internal motivation, and the need to know are also outlined by Bouchrika.

Adult learning theory also takes into consideration how adult learners want to learn concepts that are related to their everyday life roles and relevant to their meaningful activities, which includes being internally motivated to learn new swimming strategies. The swim instructors chose this job and may have had more experience in the aquatic environment before they transitioned to becoming instructors. This implies them being self-motivated to help the children they teach and to maximize their client's occupational performance. These principles play a large role in the transfer of learning to adults because the needs of the learner are emphasized which increases knowledge retention rates. According to Bouchrika (2022), with andragogy teaching methods, adults are also made to engage with their surroundings, which can make it easier for swim instructors to learn sensory-based strategies using an in-person toolkit presentation.

The Sensory Integration Frame of Reference serves as another theoretical foundation for this capstone project. According to the American Occupational Therapy Association Annual

Conferences, Ayres sensory integration is a supporting technique that reinforces core principles of occupational therapy, such as promoting an adaptive response and engagement (Ayres, 1974; Glennon & Smith Roley, 2007; Smith Roley & Glennon, 2006). In this case, the strategies that will be utilized within the toolkit will be from an occupational therapy perspective because it is a meaningful activity for the swim instructor as well as their students. The primary focus of the sensory integration frame of reference is on the interaction between the three primary senses of proprioceptive, tactile, and vestibular input and how they contribute to the child's changing sensory environment. Shaffer (2022) defines sensory integration as the brain's ability to process and arrange information gathered from the senses while engaging in daily tasks. Meaning that it's a procedure that helps the physical and mental bodies mature.

When working with patients whose participation restrictions are linked to difficulties processing and integrating sensory information, therapists use occupational therapy sensory integration to frame their clinical reasoning (Brayman et al., 2003; Schaaf & Davies, 2010). The senses lay a strong basis for normal development, impacting learning and behavior, speech and language production, gross and fine motor development, social and emotional maturity, and behavior (Shaffer, 2023). Difficulties with sensory integration can be caused by a variety of conditions. One explanation, according to Shaffer (2023), is that children seek out high-intensity sensory activities to make sense of the environment because their brains have a very high threshold for certain feelings. Because of the constant touch and buoyancy that the water offers, it presents such a demanding sensory environment that requires this frame of reference. It has a significant effect on kids both with and without disabilities since elements like buoyancy can help children's, sensory systems feel more regulated and organized. In this capstone project, the aquatic environment is directly exploited to deliver tactile, proprioceptive, and vestibular

sensations to aid in regulating and provide increased occupational performance and sensory integration. Therefore, a sensory integration frame of reference is utilized throughout this capstone experience to enhance the children's role as a swimmer by providing their teachers with equipment that provides various sensory opportunities.

Another theoretical framework in occupational therapy that is encompassed in this capstone is the Person-Environment-Occupation (PEO) model as it highlights how a person's occupational performance is influenced by their interactions with their environment and occupation (Law et al., 1996). The three domains of the person, environment, and occupation are mutually affected by each other. The person includes various aspects of the individual such as their role and sensory capability, the environment involves different environmental factors the swim instructors must take into consideration such as the pool water, social and physical aspects of their swim school, and lastly, occupation refers to the groups of tasks the swim instructors engage in to meet their self-maintenance and fulfillment needs. Additionally, this occupational therapy model is typically represented as three interwoven circles. The overlapping region indicates the degree of congruence of the relationship between the individual, environment, and occupation as well as how dynamically occupational performance is shaped (Law et al., 1996). The quality of occupational performance increases with a higher level of congruence and vice versa. Furthermore, the PEO model also takes a lifespan perspective which is why this model can be viewed as a tool to improve swim instructors' knowledge and occupational performance during swim lessons by enhancing the congruence of the three domains. In all, the swim instructors', the classroom where the toolkit is being presented, and the occupation of learning are the three domains within this capstone project. The PEO model was considered while

educating the swim instructors on the sensory-based aquatic strategies toolkit to increase success and participation during swim lessons for the sole purpose of learning.

## **Chapter 5: Statement of Purpose**

The objective of this capstone project is to broaden swim instructors' knowledge of sensory-based aquatic strategies to support their efforts to encourage involvement from kids who may have sensory differences. Ultimately the focus was to develop an introductory educational toolkit on vestibular, tactile, and proprioceptive strategies that swim instructors can reference at poolside throughout their entire careers. To effectively serve the target demographic, it is also expected that the toolkit itself was provided in a way that is supported by evidence and is relevant to adult learning theory. Training within the state of Nevada is limited for swim instructors, specifically related to adapted aquatics. They are only required the basics before getting into a pool with a child who may or may not have a disability. It is required within the state of Nevada for the swim instructor to be at least 16 years of age to take their required courses of CPR and BSI before teaching swim lessons. The barriers to learning are a lack of resources and financial constraints, lack of awareness of educational programs, and access to swimming facilities is challenging within the northern Nevada region. As compared to other states, Nevada wages are lower compared to other states which impacts the affordability and access to swim lessons.

Courses are provided at least one time a month within each metro area of the state of Nevada. For northern Nevada, they are held in Spring Valley, Enterprise, Sparks, Clark, Carson, and North Valleys region. This allows swim instructors to get their basic BSI course and CPR certification. The American Red Cross Training Services (2023) enables the teacher to gain knowledge on how to assist people in safely enjoying their time in the water. This is done by teaching water safety in different environments such as public pools, homes, and natural bodies of water. For this purpose of the capstone, the education will only focus on the public pool

environment and home pool swim lessons. The aquatic instructors are educated on hydrodynamics for resistance and creating movement in the water, swimming efficiency and why some things float, helping individuals with disabilities enjoy the water safely, and basic survival and swimming skills to help children gain water competence (American Red Cross Training Services, 2023).

The swim instructors also can learn how to teach courses on safety training and basic water rescue, fundamentals of diving, stroke mechanics for competition, and higher-level skills that help prepare swimmers of all ages for any aquatic activity (American Red Cross Training Services, 2023). Although these swim instructors can take an additional course to learn more about how to work with children who have a disability or other health conditions it is not required for them before working with children. These extra courses also do not educate coaches on how to adjust the swim lesson when a child reacts poorly to the water environment, notice when a child has other sensory differences during swim lessons, and or how to create activities for them to increase their participation during swim lessons. These are the ultimate reasons why this capstone's sole purpose is to create a toolkit for swim instructors within the northern Nevada area that focuses on increasing knowledge of how to work with children who have sensory differences.

## **Hypothesis**

Following their education through a toolkit, Waves Swim and Safety LLC's swim instructors will report feeling more knowledgeable about sensory-based strategies to encourage kids with sensory differences to engage and participate more during swim lessons.

## Objectives

1. As indicated by the before and after knowledge questionnaire, at least 60% of the swim instructors at Waves Swim and Safety LLC will have increased their perception of their knowledge of sensory-based strategies that they may use with students, as reported by the capstone student within 14 weeks.
2. The capstone student will incorporate at least 60% of the items at Waves Swim and Safety LLC within the toolkit to ensure swim instructors have access to sensory-based aquatic strategies within 9 weeks.
3. Within nine weeks, the capstone student will create an introduction toolkit to teach swim instructors sensory-based strategies that they may use in the water to encourage more swimmers to participate.



## **Chapter 6: Methodology**

### **Agency Description**

Together, Waves Swim and Safety LLC participated in this capstone project to expand their knowledge of how to improve student engagement when they are learning to swim. Waves Swim and Safety LLC employees specialize in private one-on-one swim lessons over six weeks at a mobile swim or residential swim school for all ages and all skill levels. They currently have three primary swim instructors who have six to 35 years of experience teaching. The Waves' Swim and Safety holistic approach focuses on safe water practices in an intimate environment to accommodate their families and children's ability to learn. Waves Swim and Safety LLC's approach ties into the occupational therapist lens to ensure swim lessons are client-centered which supports the area of this capstone project. Waves' method focuses on mastering the essential elements of swimming which include balance, buoyancy, motion, breathing, and rhythm. The basis of their teaching methods teaches students to remain safe and in control of the water, however, they do not offer occupational therapy aquatic services. Meaning they do not have the educational training and knowledge on sensory-based aquatic strategies and would benefit from these resources and strategies to help their employees increase engagement with children who may have sensory differences.

### **Target Population**

This project's population of interest consists of swim instructors who work one-on-one with kids in the Reno, Nevada area between the ages of four and fourteen. These swim instructors in this area would strongly benefit from increased knowledge of sensory-based strategies since there is a lack of knowledge provided to them before they teach and there are fewer occupational therapists within the state of Nevada. Swim Instructors in the northern

Nevada area are only required to get their CPR and their basic swim and water safety certification before working with children who may or may not have a disability (American Red Cross, 2023). This population was also chosen because children and adolescents of this age are not typically accompanied by a family member. The toolkit was specifically designed with the demographic of swim instructors at Waves Swim and Safety LLC in mind, with specific education levels ranging from current college students to higher education as the PEO model and the adult learning theory were applied (see Appendix B). For instance, the pages' design was selected to appeal to the intended audience, and the strategies vocabulary was selected with care to guarantee that it met the swim instructors' existing level of educational standing.

### **Methods and Procedures**

A fourteen-week experience at Waves Swim and Safety LLC was completed for this capstone project, which counts toward the occupational therapy doctorate program's partial requirements. A thorough needs assessment was carried out to understand the demographic and educational background of swim instructors, the current policy of the state of Nevada, and other studies of swim instructors' opinions regarding training materials. A comprehensive understanding of how to teach sensory-based techniques, investigate ways to meet and regulate the child's sensory needs in the aquatic environment, and gain a better understanding of aquatic programs and occupational therapy-based interventions were all made possible by the literature review. Initially, the methodologies involve observing how swim instructors currently teach children aged four to fourteen during swim classes to properly comprehend their current background knowledge in aquatic-based strategies. This helped increase understanding of areas where swim instructors were already familiar with to avoid repetition. The initial methods also

included informing local aquatic facilities and swim schools in the northern Nevada area via email and flyers of the day the educational toolkit will be presented.

A before and after knowledge questionnaire was created and piloted specifically for this capstone (see Appendix A). To enhance the validity of the questions and ensure that the before and after knowledge questionnaire was composed in easily comprehensible language for the public, a pilot study was conducted in southern Nevada with a capstone faculty mentor, a capstone site mentor, and a swim instructor. The questions included a numerical rating scale otherwise known as a five-point Likert scale. The numerical rating scale is representative of the knowledge questionnaire. The questionnaire was designed to assess swim instructors' knowledge before and after the toolkit was presented on types of sensory differences and sensory responsivity and lastly, how to use vestibular, tactile, and proprioceptive sensory-based aquatic strategies during swim lessons. The toolkit was created to identify how to recognize when a child demonstrates sensory differences, what types of sensory differences there are, and strategies for how to approach swim sessions with a child who may present with vestibular, tactile, and proprioceptive difficulty (see Appendix B). After presenting the toolkit to swim instructors there was a knowledge questionnaire given to them regarding their level of perceived knowledge around sensory-based strategies in the aquatic environment and it was required to be taken an hour after education is provided.

Finally, to ensure consistency throughout the experience on knowledge of sensory-based aquatic strategies, swim teachers at Waves Swim and Safety LLC received the same presentation and toolkit as other swim instructors in the northern Nevada region. Before and after the training, swim instructors were given a knowledge questionnaire to see if their level of knowledge had increased. The data analysis was carried out as the primary means of project evaluation and

results dissemination. Before providing the findings to Waves Swim and Safety LLC, the data was subjected to descriptive statistical analysis to determine the dispersion and central tendency from the knowledge questionnaires administered. Lastly, a separate summary of the data gathered from swim instructors was provided to Elona, the owner of Waves Swim and Safety LLC.

### **Ethical and Legal Considerations**

Being able to understand the agency and place of instructors' roles in the aquatic environment at Waves Swim and Safety LLC is important for understanding the swim instructors' rules and regulations. Throughout this capstone experience, the Health Insurance Portability and Accountability Act (HIPAA) regulations were adhered to. During the before and after knowledge questionnaire that was reviewed with Waves Swim and Safety LCC staff, no identifying or demographic information was gathered. Protecting the child's autonomy and safety during sensory strategies was taken into consideration while developing the introductory toolkit. Being able to ensure privacy and increase advocacy for swim instructors was accounted for during the entire experience at Waves Swim and Safety LLC. Lastly, this capstone was approved for exemption from IRB as it does not include any human research.

## Chapter 7: Results

There were two swim schools and a total of five swim instructors who represented the sample size this capstone experience could access. Five swim teachers completed the before and after knowledge questionnaire, and five swim instructors attended the dissemination presentation in person despite numerous attempts to encourage the dissemination of the sensory-based toolkit. According to the before questionnaire results, swim instructors at Waves Swim and Safety LLC and Silver Bear Swim School had slight to moderate knowledge of providing sensory-based strategies and the just-right challenge to their student swimmers.

Crucially, swim instructors revealed that, when it came to selecting appropriate pool equipment, the three primary senses, and teaching children with sensory problems, they felt only slightly knowledgeable. On the other hand, many swim instructors perceived they knew a moderate amount about the symptoms children with SPD typically exhibit and how to adjust aquatic activities to accommodate the child's sensory needs. The results of the swim instructors' before knowledge questionnaire revealed that they were not adequately educated on how to coach or increase engagement with swimmers' who present with sensory differences during swim lessons ( $M = 2.7, SD = 0.35$ ).

The post-dissemination questionnaire results for swim instructors showed an increase in knowledge on sensory-based strategies when coaching children aged four to 14 ( $M = 4.3, SD = 0.15$ ). According to the interpretation, after education on the introductory toolkit, swim teachers perceived feeling very knowledgeable to extremely knowledgeable. Swim instructors in the Northern Nevada Region possessed a great deal of knowledge when it came to selecting a sensory-based aquatic strategy, having the appropriate equipment, and recognizing children who exhibit sensory-seeking behaviors. The three main senses, identifying the symptoms that may

appear in children with sensory impairments, and selecting sensory-based solutions for hyper-responsive children were areas in which they felt extremely knowledgeable. Based on the questionnaire and verbal feedback from the swim instructors, the results showed that the capstone project met its overall purpose and objective of enhancing education for swim coaches, thanks in part to the introductory toolkit. This capstone demonstrated that swim instructors in the northern Nevada region have better views of their level of knowledge regarding sensory-based strategies in the water. Finally, information gathered from swim instructors' questionnaires and data shows that they have no complaints about the teaching materials.

## Chapter 8: Discussion

For children and adolescents with sensory differences, the literature reveals how sensory-based approaches can be helpful for sensory processing areas of input, static and dynamic balance, and overall physical development within the aquatic environment (Ansari et al., 2021; Brayman et al, 2003; Pinru & Burhaein, 2019). The development and sensory demands of the child are greatly influenced by swim instructors. According to the American Occupational Therapy Association (AOTA), they can also make an enormous impact on a child's cardiovascular health, mobility, flexibility, and help prevent chronic issues (Wall, 2020). Nonetheless, research indicates that swim instructors do not learn enough from the mandatory CPR and American Red Cross courses (Flippin & Clapham, 2021; Kraft & Leblanc, 2018; Kraft et al., 2019). When working with children who may have sensory problems, swim instructors continue to find it challenging to connect and participate actively without these tools, training, and support. The American Occupational Therapy Foundation (AOTF) is in favor of research on occupational therapy and educating other professions, particularly regarding raising awareness of the critical connection between occupation—like swimming—and health. While finding a long-term solution to this issue will take more time, giving swim teachers access to this introductory educational toolkit was an appropriate place to start.

Based on the questionnaire and verbal feedback after the toolkit was presented, the capstone's results demonstrate that an educational toolkit is a useful tool for achieving the objectives of enhancing the education and knowledge of swim instructors. In the end, swim instructors learned how to use sensory-based aquatic strategies to create the just-right challenge and increase participation during swim sessions with children who may have sensory differences. Even though this capstone experience's uncontrollable variables limited the quantitative data that

was obtained, the findings add to the body of literature as a solution to the problem of swim instructors not having access to resources or continuing education to support them in their teaching journeys when coaching children with sensory differences. Subsequent research endeavors have to contemplate broadening the understanding of particular equipment for adapted aquatic activities and sensory strategies for children under the age of four.

### **Limitations**

Time constraints, restricted access to the sample population, a lack of randomized selection techniques, and assessment items that have not been validated or reliably verified outside of the procedures are some of the project's potential limitations. Additionally, the project has a small sample size because there were limited swim instructors in the Reno, Nevada area. Limitations of this project also include having to come in person for the educational toolkit. Future projects should utilize more platforms such as online educational toolkits, and or Zoom/ Webex meetings to reach a larger population. The toolkit was disseminated during the week of spring break which may have limited the attendance of the swim instructors. Finally, because there has been limited research done on this subject, certain conclusions and gleanings have been drawn from the outcomes of that research. The project's findings and its materials were targeted at a particular population, so they cannot be generalized to a broader one.

### **Implications**

Due to the limitations of this capstone, results are not generalized to other swim clinics or swim instructors outside of Waves Swim and Safety LLC and Silver Bear Swim School in the Reno, Nevada area. Future studies at this capstone site should focus on how swim instructors' growing expertise will boost their self-confidence when interacting with children who have sensory issues as well as sensory strategies for children under the age of four years old. Another



implication includes getting a better understanding of swim instructors' prior level of education before working with children with sensory challenges. Additionally, future capstone experiences should focus on whether the knowledge transfers over to the children demonstrating sensory processing challenges outcomes in the pool and within other familiar environments (school/home environment) would be advantageous.

## **Chapter 9: Conclusion**

The benefits of sensory-based aquatic strategies and swim environments are still largely unexplored, but this capstone represented an important first step toward educating swim instructors through an occupational therapy-centered lens in the hopes that they would learn how to support their student's success in the water. The capstone experience produced an introductory instructional toolkit that further enhanced the education of swim instructors in Northern Nevada. Overall, this study demonstrated that although swim instructors generally report needing more education and training before working with children who might have sensory differences, an educational toolkit is an appropriate and useful means to spread knowledge.

## Appendix A

### *Swim Instructors' Before and After Knowledge Questionnaire*

1. How knowledgeable are you regarding being able to recognize the symptoms children with sensory processing disorder (SPD) may present with?
  - a. Extremely knowledgeable
  - b. Very knowledgeable
  - c. Moderately knowledgeable
  - d. Slight knowledgeable
  - e. Not knowledgeable at all
  
2. How knowledgeable are you regarding the 3 primary senses (tactile, proprioceptive, and vestibular input)?
  - a. Extremely knowledgeable
  - b. Very knowledgeable
  - c. Moderately knowledgeable
  - d. Slight knowledgeable
  - e. Not knowledgeable at all
  
3. How knowledgeable are you regarding being able to provide the just-right challenge for your children during swim lessons?
  - a. Extremely knowledgeable
  - b. Very knowledgeable
  - c. Moderately knowledgeable
  - d. Slight knowledgeable
  - e. Not knowledgeable at all

4. How knowledgeable are you regarding choosing sensory-based aquatic strategies for a child who demonstrates hyper-responsivity/over-responsivity?
  - a. Extremely knowledgeable
  - b. Very knowledgeable
  - c. Moderately knowledgeable
  - d. Slight knowledgeable
  - e. Not knowledgeable at all
  
5. How knowledgeable are you regarding choosing sensory-based aquatic strategies for a child that demonstrates hypo responsivity/ under responsivity?
  - a. Extremely knowledgeable
  - b. Very knowledgeable
  - c. Moderately knowledgeable
  - d. Slight knowledgeable
  - e. Not knowledgeable at all
  
6. How knowledgeable are you regarding being able to modify the aquatic environment to meet the child's sensory needs?
  - a. Extremely knowledgeable
  - b. Very knowledgeable
  - c. Moderately knowledgeable
  - d. Slight knowledgeable
  - e. Not knowledgeable at all
  
7. How knowledgeable are you regarding being able to choose the right pool equipment for swim lessons when working with a child who may have sensory differences?

- a. Extremely knowledgeable
  - b. Very knowledgeable
  - c. Moderately knowledgeable
  - d. Slight knowledgeable
  - e. Not knowledgeable at all
8. How knowledgeable are you regarding being able to identify a child that presents with sensory seeking behaviors during a swim lesson?
- a. Extremely knowledgeable
  - b. Very knowledgeable
  - c. Moderately knowledgeable
  - d. Slight knowledgeable
  - e. Not knowledgeable at all

JAN 2024

Issue 1



# SENSORY- BASED AQUATIC STRATEGIES

A TOOLKIT FOR SWIM INSTRUCTORS

In partial fulfillment of the requirements for the  
Occupational Therapy Doctorate at the  
University of Nevada, Las Vegas



BY GABRIELLE PALMER OTD/S



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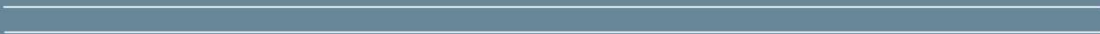
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Resources for swim instructors

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My heartfelt appreciation for all their help and generosity.







# HOW TO *use* THIS DOCUMENT

## A TOOLKIT FOR SWIM INSTRUCTORS

The main goal of this toolkit is to increase swim instructor's knowledge on sensory-based aquatic strategies. This knowledge is needed when working with children with sensory processing differences. This toolkit is intended for swim instructors who work children aged 4-14 on site and/or during mobile swim lessons. I want you to be more successful with this toolkit and utilize at poolside, during all swim classes to help increase the child's participation.

- **Section 1:** All three primary senses explained
  - Refer to this section to increase your knowledge on the different senses your student and you experience.
- **Section 2:** Different types of sensory responses.
  - Includes examples of how children with sensory differences may appear in and out of an aquatic setting.
- **Section 3:** Sensory-based aquatic strategies (SBAS)
  - Safe and helpful swim strategies for children with sensory differences.
  - This section will have a strong occupational therapist perspective, as we do specialize in tailoring strategies and activities around children's sensory needs.
- **Section 4:** Summarization of sensory difference
- **Section 5:** Provides resources for you to utilize throughout your careers as swim instructors.

# THE THREE PRIMARY SENSES DEFINED

There are eight senses in total, but three are primary senses: tactile, vestibular, proprioceptive input. As humans, these three senses are extremely important to us. Every day, our brains continuously collect information from our senses to give us knowledge about the world around us. The organization of the data is known as **sensory processing**. It's an innate process that usually occurs without conscious effort. A child with **sensory processing difficulties (SPD)** has trouble connecting,

processing, interpreting, and/or using the information they get from their senses to carry out daily tasks. These abnormalities can manifest as developmental milestone delays, as well as atypical development in self-regulation, movement, learning, language, social, and emotional abilities.

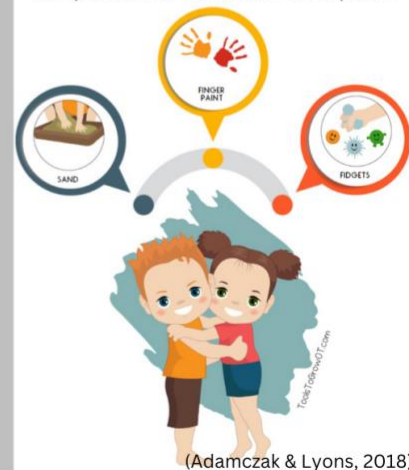
The early development of the tactile, vestibular, and proprioceptive systems is the foundation for early sensory integration of information, which is essential to a child's growth and learning. The term **sensory integration (SI)** also describes the body's capacity to take in, process, and react to sensory data from its surroundings. If the reaction to the sensory input is disorganized, deficits in sensory integration will be visible. For some children with developmental issues, processing sensory input requires a lot of effort, concentration, and sometimes even seems overwhelming. Their engagement in swim classes may suffer as a result of this overstimulating event, and they may exhibit more

tantrums at home or at school. As a swim instructor, you may contribute in meeting the sensory needs of the child by being more knowledgeable about these three senses and sensory-based aquatic strategies.

**TACTILE (Touch):** Touch is the perception of pressure, temperature, discomfort, and other sensations that humans get from skin receptors. The pool water can offer the deep pressure input that children with SPD need. Children who have trouble comprehending sensory information benefit from the deep pressure and overall increase in tactile input, which can help them become more

## TACTILE

This sense helps a child detect light touch, deep pressure, texture, temperature, vibration, and pain.



# VESTIBULAR

The sense that detects movement through sensory receptors in the inner ear.



orderly and calm. In relation to touch and temperature, the recommended water temperature range for children with SPD, ages five to fourteen, is 84 to 90 degrees. Further symptoms that children with SPD may exhibit include the urge to touch everything or discomfort from the elastic components of bathing suits, the sensation of a towel on their body, the feeling of water all over them, including on their faces, and the hands of the instructors when guiding the swimmer. Children with differences in this area may exhibit **tactile defensiveness**, which

refers to over-responsivity or sensitivity to touch, and will be explored in further depth in section 2 of this toolkit (page 12).

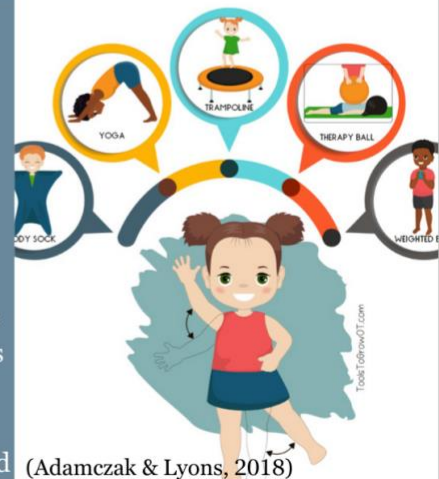
**VESTIBULAR (Movement):** The perception of any changes in body position, direction, or head movement is known as vestibular input. This implies that the vestibular system's input of sensory information is influenced by the child's head position. Deficits in vestibular input and interpretation lead to **poor balance** while walking in the pool, utilizing a ladder, **recovering from vertical from front or back**, centering oneself on floats, kickboards, or tubes, and controlling the body's response to gravity. Children who differ in this area may also have **gravitational insecurity**, which is characterized by an over-reactive vestibular response that causes fear or anxiety in response to harmless movements. We will go into more detail on gravitational insecurity in section 2 of this toolkit (page 12).

**PROPRIOCEPTIVE (Body Awareness):** The proprioceptive system is present in our muscles and joints. The proprioceptive system receives sensory inputs from the **muscles**, tendons, and

**joints**, which eventually tells us where the arms, legs, and body are in relation to one another and how they are moving. Deficits in movement result from abnormalities in proprioceptive input, which prevents the body and its limbs from interpreting its position in space and momentum. Similarly, making it extremely challenging for a young child to learn how to swim safely. Children who cannot identify where the body is in space when swimming may display inconsistent movements and skills because corrections in stroke mechanics are predicated on being able to feel minor changes in arm, leg, and trunk

# PROPRIOCEPTION

The sense that helps a child with body awareness is known as proprioception.



angles, and speed at which movement is accomplished. If deficits in this area are noticed, it would be beneficial for you, the swim instructor, to ask the swimmer/ swimmers parents to bring in old clothes and swim or walk in neck deep water as the weight of the clothes provide increased awareness that can help them feel stroke corrections until the correction becomes more automatic. Children with proprioceptive differences highly benefit from heavy work and deep pressure, which will be demonstrated and described in further detail throughout the next two sections of this toolkit.

**SENSORY NEEDS (Swimmer's sensory profile):** The sensory profile helps us learn how to meet the swimmer's sensory needs during swim lessons. There are 3 types of sensory modulation including sensory over-reactivity, sensory under-reactivity, and lastly sensory seeking. These are all how the child's brain reacts to sensations and regulate their emotions.

### **JUST RIGHT CHALLENGE**

Visualize each of these three sensory systems as a cup; the cup stands for the threshold of our brains. This refers to the amount of sensory input required to feel safe and comfortable in our own bodies. **Being able to fill our cup up just right will satisfy our neurological sensory needs.** Your cup size varies from those of your swimmers/students because **everyone has a unique cup size.** Children swimmers with SPD may have significantly larger or smaller cups. You will discover how to gauge how much is necessary to provide your kids with the just right challenge. **The just right challenge** is a phrase that describes a therapeutic activity at a level that is challenging enough to help a swimmer develop their skills, but not so challenging that it becomes frustrating or overwhelming. This is something occupational therapist specialize in, and the idea is to find an activity that is at the appropriate level of difficulty for the child, so they can experience success while still being challenged to improve their skills.



Filled just right



Filled too little



Filled too much

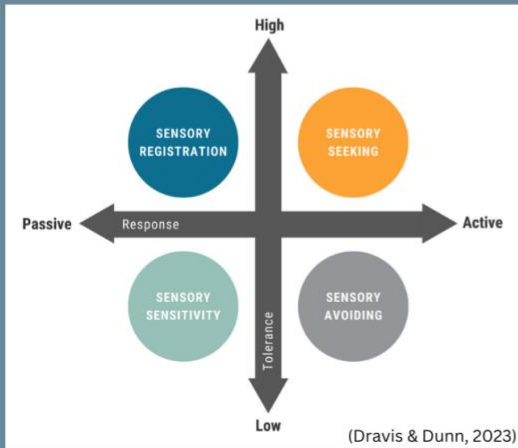
# TYPES OF SENSORY DIFFERENCES

Literature indicates that children with autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), cerebral palsy (CP), down syndrome, and/or a history of prematurity are the primary disorders associated with poor sensory regulation. Research also suggests that approximately one in six kids, whether they are typical or atypical, have difficulties processing sensory information. Furthermore, vestibular differences affect one in every twenty children in the United States, which sadly contributes to these children having a more sedentary lifestyle. Additionally, research demonstrates that

children who struggle with sensory processing, especially those who have hyper (over) sensitivity (high sensitivity to touch), are more likely to have negative interactions with people when they grow up. For this and many other reasons, it's critical to incorporate sensory-based aquatic strategies (SBAS) into your swim lessons in order to encourage your students to have more playful lives and engage in more social situations.

Both hyper (over) and hypo (under)-reactivity can be symptoms of sensory differences. Many symptoms, ranging from hyper (over)-responsiveness (crying at loud noises) to hypo (under)-responsiveness (not responding to pain), can be experienced by children with SPD. The Dravis & Dunn (2023) figure on this page

provides evidence for this. Registration, seeking, sensitivity, and avoiding make up the four quadrants. A type of sensory processing known as **sensory seeking** involves both active sensory responses and a high threshold for sensory stimuli. This means that for children to engage in self-regulation techniques and feel safe in their bodies, they require a high volume of sensory input. The children who show little reactions to sensory stimuli and a high tolerance are known as **sensory registration**. This means that they could struggle more to control their emotions. A child that demonstrates **sensory avoidance** will show signs of having a low threshold for sensory inputs, as well as the ability to use self-regulation techniques and produce appropriate reactions. Lastly, a



Child <b>misses</b> sensory input more than others	Child <b>obtains/ seeks</b> sensory input more than others
Child <b>detects/ notices</b> sensory input more than others	Child is <b>bothered</b> by sensory input more than others

References: Dravis & Dunn, 2023; Rahaei et al., 2020; Wall, 2024

form of sensory processing known as **sensory sensitivity** is represented by a low tolerance to sensory input and a greater inability for these children to regulate their own behavior. As a swim instructor, being able to recognize these differences can help you better adjust the swim session and keep you on track to reaching your teaching goals. Now let's look at the definition of tolerance and response, how they're classified into four major sensory profiles, and how you can notice these differences during your next swim session.



### Definitions

**Tolerance:** How much sensory input (stimuli) is required to elicit a reaction? If someone has a high tolerance, they are usually hypo (under) - responsive and require more input. In contrast, if someone has a poor tolerance, they are hyper (over)-responsive and require little input.

**Self-Regulation (response):** Self-regulation is the way a person "responds" to their environment. A **passive** reaction is when someone does nothing to change or modify the surrounding environment. When a child actively regulates the amount of sensory information they get from the environment, it is known as an **active** response.

## SENSORY DIFFERENCES CONTINUED

**1) Sensory Seekers:** These individuals respond actively and have a high tolerance for sensory input. They typically need a lot of sensory input, such as deep pressure, constant movement, or regularly touching objects in their environment. To satisfy their sensory needs, these individuals could act in maladaptive ways, such as appearing "busy" or moving constantly in an effort to increase their sensory experiences.

### Common Behaviors

- Constantly touching people or objects
- Unable to sit still / fidgeting / "on the go"
- Jumping, spinning, splashing, or rocking
- Falling on purpose or taking risks without regard to safety

**2) Sensory Avoiding:** These children have a low sensory tolerance and a strong reaction. They respond quickly to most sensory stimuli, and when they become overstimulated, they will actively try to change/ modify their surroundings. Sensory avoiders may appear disagreeable, rule-bound, and routine-driven because they often strive to avoid overstimulation or dysregulation.

### Common Behaviors

- Easily upset or distracted with loud / sudden noises
- Covers ears or avoids noisy environments
- Oversensitive to certain smells, and textures
- Avoids touch or messy / sticky activities
- May struggle with balance activities

**3) Sensory Registration:** Individuals with sensory registration exhibit a passive response and a high threshold for sensory stimuli. They need a high amount of sensory input to acknowledge sensations, but their response is typically passive. To meet their sensory needs, these individuals don't actively seek out sensory experiences. A lack of motivation may be detected, resulting in reduced participation in swim lessons and quality of life.

**Common Behaviors:**

- Lazy or clumsy
- Seems tired or lacking energy, despite sleeping well
- Doesn't notice things like food on their face, clothes on wrong, or offensive smells
- Tends to "space out"
- Slouches on furniture, walls, and other people



**4) Sensory Sensitivity:** Individuals with sensory sensitivity exhibit a low threshold for sensation and a passive reaction. It takes little sensory input to become "overstimulated," but they are unable to modify their environment to fulfill their sensory needs. Due to their low sensory tolerance, these people may become easily distracted in hectic settings, and are commonly referred to as "complainers," perceiving and commenting on sensory stimuli more frequently than others.

**Common Behaviors:**

- Easily upset or distracted with loud / sudden noises
- Covers ears or avoids noisy environments
- Oversensitive to certain tastes, smells, and textures
- Avoids touch or messy / sticky activities
- Seems distressed frequently but does little to avoid or relieve stress

“How a person perceives sensory input is entirely unique from one individual to another”

### Sensory Modulation (3 Types)

1. Sensory Hyper (over)-Reactive: Child will react strongly to information in their environment
2. Sensory Hypo (under)- Reactive: Child will not notice any environmental stimuli
3. Sensory Seeking: Child frequently seeks a lot of sensory experiences

#### Sensory Modulation

Sensory modulation is the way a child's brain reacts to sensations and regulates their responses. The first type is sensory hyper (over)-reactive type when the child is noticing, feeling, and reacting very strongly to information during swim lessons (tantrums and outburst). The second one is sensory hypo (under) -reactive type, when the swimmer does not notice or take in any relevant environmental stimuli (no reaction to water splashing on self). Lastly, this is one we discussed earlier and is it sensory seeking. Sensory seeking involves the child frequently seeking intense sensory experiences (always moving around, jumping, and/or splashing).

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With being at this part of the toolkit, I hope that you understand how being able to find the child sensory needs and having a well-structured swim session provide the opportunity for meeting the just right challenge for your swimmer. Likewise, you can also help aid in the prevention of chronic problem and improve

the child's cardiovascular system, mobility, and flexibility. Furthermore, the sensory-based aquatic strategies within this toolkit are designed to be meaningful to the individual swimmer and assist the swim instructors to help provide controlled sensory input to elicit an appropriate response from the child. I also want to mention that these are merely suggestions to boost other activities in your brain, as well as the activities may be modified to the child specific sensory needs safely. In an attempt to facilitate knowledge and provide connection to the children who you might see during swimming lessons, let's talk about each of the three types of sensory inputs.

## HOW WILL THIS LOOK WITH THE 3 PRIMARY SENSES?



## Types of Sensory Differences Continued

Tactile Input	Vestibular Input (Movement)	Proprioceptive Input
<p><b>Hyper (over) - Reactive (Tactile Defensive)</b></p> <ul style="list-style-type: none"> <li>• Responding negatively to unexpected, light touch or the thought that they will be touched</li> <li>• Sensitivity to walking barefoot on certain textures</li> <li>• Bothered by certain fabrics of clothing or surfaces</li> <li>• Avoiding messy play</li> <li>• Withdrawing from group play</li> </ul> <p><b>Hypo (under) - Reactive</b></p> <ul style="list-style-type: none"> <li>• Not noticing touch unless it is very intense</li> <li>• Lacks “inner drive” to touch, handle, and explore toys and materials that appeal to most other children</li> <li>• Needing a lot tactile stimulation to become engaged in the world around them</li> <li>• High pain tolerance – shows little or no response to pain</li> </ul> <p><b>Sensory Seeking</b></p> <ul style="list-style-type: none"> <li>• Needing more deep pressure/skin contact than most</li> <li>• Enjoying strong vibration or movement</li> <li>• Needing to touch and feel everything in sight</li> <li>• Rubbing or even biting own/other’s skin excessively</li> <li>• Seeking messy experiences, often for a long duration</li> </ul>	<p><b>Hyper (over) - Reactive (Gravitational Insecurity)</b></p> <ul style="list-style-type: none"> <li>• Fear and anxiety in response to falling/possibility of falling</li> <li>• Scared if feet leave the ground</li> <li>• May respond with negative, defiant behavior (i.e. refusing to be moved or picked up)</li> <li>• Extreme caution/avoidance of movement</li> </ul> <p><b>Hypo (under) - Reactive</b></p> <ul style="list-style-type: none"> <li>• Lacking inner drive to move and may require extra movement to “get in gear” and then may be difficult to stop</li> <li>• Not noticing being moved</li> <li>• Taking a long time to notice they are dizzy after spinning</li> <li>• Not catching their own fall because they did not notice themselves falling</li> </ul> <p><b>Sensory Seeking</b></p> <ul style="list-style-type: none"> <li>• Always “on the move”– running, climbing, splashing</li> <li>• Enjoys “linear” movement such as swinging or rocking</li> <li>• Enjoys “rotary” movement, such as spinning in circles</li> <li>• Seeks a lot of vigorous activity to satisfy sensory needs</li> <li>• May move without caution, crashing into things</li> <li>• Engage in risky behavior with decreased safety awareness (ex: climbing on countertops, crashing into others)</li> </ul>	<p><b>Hyper (over) - Reactive</b></p> <ul style="list-style-type: none"> <li>• Negative response to deep pressure activities (avoiding hugs from family members)</li> <li>• Avoiding active movements like running and jumping</li> </ul> <p><b>Hypo (under) - Reactive</b></p> <ul style="list-style-type: none"> <li>• Lacking an inner drive to move and play</li> <li>• Walking on their tiptoes to get more input to their feet, legs, and spine</li> <li>• Having poor body awareness leading to “clumsiness”</li> <li>• Having low muscle tone (muscles are “floppy” at rest)</li> <li>• Locking their muscles to compensate for low muscle tone (elbows at ribs, “W” sitting)</li> </ul> <p><b>Sensory Seeking</b></p> <ul style="list-style-type: none"> <li>• Purposefully bumping, climbing, jumping, or crashing into objects</li> <li>• Constantly chewing on objects (toys, shirts, pencils, etc.)</li> <li>• Craving deep pressure sensations (hugs, being wrapped in towel)</li> <li>• Engaging in self-stimulatory behavior to regulate their emotions (banging head, nail-biting)</li> <li>• Stomping or slapping feet when walking</li> </ul>

# SENSORY-BASED AQUATIC STRATEGIES (SBAS)

## VESTIBULAR, PROPRIOCEPTIVE, AND TACTILE AQUATIC STRATEGIES

During these strategies, continue to utilize the basis of your teaching method, the Universal Float. Therefore, the main focus of all of these activities are to remain safe and in control of the water.

### Songs before/during swim lessons

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- 01** This is the way we kick our feet, kick our feet, kick our feet. This is the way we kick our feet in the big pool. This is the way we paddle our arms, paddle our arms, paddle our arms. This is the way we paddle our arms in the big pool. (repeat with “splash our hands” and with “blow our bubbles”)
- This song allows the swimmer to get used to the feel of the water, such as the water on their skin and the temperature of the water.



Utilize for all children who demonstrate sensory differences at start of lesson

### I’m a little pancake (roll-overs: half or full circle)

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- 02** Swimmer starts faces down, (once calm with their ear in the water) child lifts their head to the left and rotates to their back (starts song)
- “I’m a little pancake on my back, I’m a little pancake nice and flat, I am a little pancake on my back, just flip me over and swim right back”
- Make sure the child's ears are fully submerged when floating on their back
  - Assist as needed



Utilize for all children who may demonstrate sensory differences

SBAS | 13

References: Anderson-Lee et al., 2014; Lepore et al., 2013

## Humpty Dumpty (initiation to diving)

03

Swim Instructor (in pool) and child (sitting on edge of pool) are facing each other, (start song) "Humpty Dumpty sat on a wall, Humpty Dumpty had a great fall - Ready 1,2,3 go" (child fully submerges into the water and verbalizes or assists if needed to return to the wall)

- Can encourage singing the song together
- Builds muscle/motor memory for safety skills

Utilize for children who may demonstrate poor proprioceptive input and vestibular differences



## Fishes in the ocean (jumping into pool)

04

"Fishes in the ocean, fishes down below, we all jump. 1, 2, 3 go!"

- Supports water acclimation

Utilize for children who may demonstrate poor vestibular and proprioceptive input

- Sensory seeking activity



## Elbow, elbow, tummy, knee song (climb out of pool)

05

"Elbow, elbow, tummy knee, tummy, knee. Below bow, elbow, tummy knee. Climb out of the water"

- Increases water safety

Utilize for all children when getting out of the pool if they do not take the stairs



## Bye-bye song (song to end swim lesson)

**06** As the swim instructor and child walk out of the pool, sing:  
“Bye, Bye (Name). Bye, Bye (Name). Bye, Bye (Name), we’re glad you came to swim!”

- Assist with building routine and transitioning out of the pool

Utilize for all children, especially for children who may demonstrate poor regulation when it comes to transitions



## Water waves (warm-up ‘heavy work’)

**07** Use the buoyancy and pressure of the water to push it forward -just like a standing push-up (repeat 5 times)

- Can help calm child’s body prior to swim lessons

Utilize for children who may demonstrate poor proprioceptive input

- Sensory seeking activity



## Floating/ Buoyancy (on front)

**08** Have the student hold onto the wall with both arms extended forward and gently lift the feet behind them if assistance is required. Place the swimmer’s hands on your shoulders and the instructor’s hands on the underside of your hips (facing down). This will allow the student to feel the buoyancy of the water

- Can have the student blow bubbles in this position and/or do flutter kicks
- Can swish student back in fourth for increased stimuli input



Utilize for children with all sensory differences

SBAS | 15

References: Anderson-Lee et al., 2014; Lepore et al., 2013

## Frog jumps (initiate flip/ bucket turns)

**09** Student is in front or perpendicular to you, with feet flat on the ground, student has straight arms on the side of their hips. Student knees bend and feet push off the pool floor to jump forward.

- Feet can also be against the side wall of the pool as you assist their shoulders. When you say push, let the student push against the wall (heavy work).

Utilize this for children who demonstrate poor proprioceptive input.

- Sensory seeking activity



## Rocket ship / Kick board

**10** Have the student face forward with their stomach down while their arms are holding onto the rocket ship or a kickboard (the board can be vertical or horizontal facing)

- Face in the water and blowing bubbles (sense of feeling on their tummy while kicking)
- Add flippers for children who present with tactile defensiveness

Utilize this for all children with proprioceptive and tactile differences



## Dive for toy at bottom of pool

**11** The swimmer can throw a sinking toy of choice, count to 1,2,3, and then dive for the toy.

Teachers can ask the child to grab a toy with the right arm on the first dive and the left arm for the second dive.

Utilize this activity for children who present with vestibular or proprioceptive differences.



## Floating gym mat (cheese mat)

12

This mat can facilitate balance, spacial awareness, and if holes are present increased tactile input (the more holes the harder it is for the swimmer to balance)

Positions on the mat:

- Quadruped
- Rolling side to side or off the mat into the water
- Knee balance
- Animal walks/ hold

Utilize for all children that present with sensory differences



## Sponge Activity / Firm Pressure

13

Wilbarger Therapy Brush or washing students with sponges to help stimulate the tactile system and prepare many children with sensory differences to start their swim lessons (1 minute)

- The teacher can assist if needed or the swimmer can complete it on their own

Firm pressure can be a big hug before a swim session and or the feeling of being wrapped up in a towel after swim lessons

- Helps students organize/regulate their sensory system

Utilize for children that present with tactile differences or children who are diagnosed with ASD.



## Paddle arms (beginning of freestyle)

14

Student performs big circles, asking them to reach as far as you can

- The teacher can assist with movement by guiding students' arm
- To modify: Have swimmer lay face down on side of pool wall and then cycle one arm

Utilize for children with proprioceptive and vestibular differences



## Flip turn in pool (front-stroke freestyle)

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15

Have the swimmer get enough air, count 1, 2, 3. Flip, land, turn. Continue this 2–5 times.

Utilize for children who demonstrate vestibular differences and proprioceptive differences



## Tombstone kicks (more advanced children)

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16

Holding a kickboard vertically and kicking to dock and back

- Increases endurance (heavy work) because the children have to kick fast to move with the board (can move board horizontally to make it more difficult)

Utilize for children with proprioceptive input differences or sensory seeking behaviors



## Backflip/ front flip

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17

Towards /near the deep end of the pool, the child propels self back wards and tucks knees into chest to rotate for a backflip. Student propels self forward and tucks knees to chest to rotate for a front flip.

- Flips are beneficial for vestibular differences

Utilize for children who demonstrate vestibular and proprioceptive differences



## Handstand (initiating diving)

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18

Ask the student to raise their arms to the sky and squeeze their ears. Have the swimmer count 1,2,3 and tuck their knees to chest while bringing hands/ head to floor of pool.

- Assist swimmer as needed.

Utilize for children who demonstrate proprioceptive differences



## Taco Float

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19

Swimmer floats on back in the pool while instructors fold the cheese over their head/ body (hold for 10–30 seconds)

- Can use for only children who do not need assistance to float on back

Utilize this for children with all sensory deficits.



## Jellyfish float (learning bouyancy)

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20

Have the swimmer close to the wall, have the student take a breath, hold the breath, and lean forward. The student leans to move forward at the waist and puts his or her head in the water. The student bends their knees slightly to raise off the bottom, while arms and legs hang from the body.

- This teaches students buoyancy and how the water provides support
- It can also increase students' confidence in the water

Utilize for all children with all sensory differences

References: Anderson-Lee et al., 2014; Lepore et al., 2013



SBAS | 19



# SENSORY-BASED AQUATIC STRATEGIES SUMMARY



Deficits in tactile input can present as tactile defensiveness, poor vestibular input can present as gravitational insecurity, and lastly poor proprioceptive input should be approach with activities involving deep pressure/ heavy work

Children with **vestibular difficulties:**

Perform activities to increase ability to recover from facing down to facing up floats and improve balance on flotation device to decrease chances of drowning

When you see a swimmer with **poor balance:**

Utilize a floating mat and provide activities that put the student slightly off balance to practice recovery, such as underwater log rolls, somersaults, and swinging.

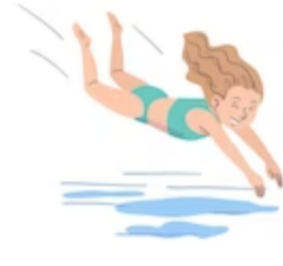
**Heavy work** can be accomplished by utilizing more swimming items such as gloves, paddles, kickboard, and marshmallows which can add more resistance during water activities

**Decreased awareness of position in space:**

Create turbulence around the child to increase awareness of the child's body position in space and utilize activities that challenge the swimmer to vary swimming speed

**Every child will have difference sensory needs in the aquatic environment and different sensory responses**

# SENSORY-BASED AQUATIC STRATEGIES TEACHING ADVICE (DO'S & DON'T'S)



## DO

Ask your student, “Do you like big hugs or little hugs” to determine how much tactile stimulus the child craves or needs.

## DON'T

Touch students without telling them what you are going to first

## DO

Provide structure and routine within the aquatic lesson as well as clear limits and rules that students can understand and achieve

## DON'T

Force students into a specific positions, instead demonstrate and guide

## DO

- Reinforce appropriate behavior with specific positive praise to increase positive interactions
- Look for purposeful behaviors within a meaningful activity

## DON'T

Assume a child has sensory processing differences after one lesson, it takes time to learn and understand the child sensory needs

# Example Impairment With Activity Goals

## IMPAIRMENTS

(Primary & Secondary)

1. **Poor mental/ spacial adjustment** (swimmer will cling to swim instructor, is fearful of unsupported movement, and does not accept water to face)
  - a. This impairment decreases participation and active mobility in the water
2. Limited spinal rotation that restricts mobility and active range of motion, potentially leading to **postural deficits, weakness,** and loss of functional skills.
3. **Weakness in antigravity musculature** (glutes, quads, and shin muscles); utilizes inefficient, high-energy muscle groups
  - a. Leads to decreased joint strength and range of motion
  - b. Demonstrates with decreased fluidity when walking and limited gross motor (large movement) task performance
4. **Poor standing balance** (vestibular impairment)
  - a. Limited standing while walking; leading to frequent falls with increased risk for injury.
  - b. Limits gross motor skills and playfulness
5. **Painful, limited active range of motion within joints**
  - a. Leads to poor postural alignment, decreased active movement, motor skills, and quality of life

## RELATED AQUATIC GOALS

1. Swimmer can straddle two noodles with instructor supporting from behind, student will accept gentle “snaking” movements, side to side in the water while arms are holding noodle for 60 seconds in the first 2-3 weeks.
2. Modified Bad Ragaz Ring Method
  - a. position with stomach towards the sky, slight chin tuck, instructor supports at rib cage while asking swimmer to roll slightly while bringing one hip to the surface. Can progress to moving child in circular motion around the instructor.
3. Student with stomach towards the ground with instructor support at lower rib cage, alternate support to increase spine rotation. The swimmer will then complete flutter kicks 15–20 times with 3 repetitions.  
Repeat with frog kicks



Water walk with support from marshmallows; water to chest in height; use marching songs and encourage knee to chest movement. Teaching “giant steps” and move in all directions for 10 minutes (as pain permits)

5. Student will hold balanced on cheese float with activating glutes and shoulder blade muscles for 30 sections with 5 repetitions within 6 months

## Resources

Examples of Sensory Variables and Their Possible Effects in the Aquatic Environment

INCREASING SENSORY INFORMATION	DECREASING SENSORY INFORMATION
<ol style="list-style-type: none"> <li>1. Bright lights</li> <li>2. Increased water turbulence</li> <li>3. Cluttered deck, and many people</li> <li>4. Colder water temperature</li> <li>5. Barefoot</li> <li>6. The vertical position requires the least postural adaptation and often feels the most stable</li> <li>7. Deep pressure through joint surfaces (often 4 points position, sitting, standing - wherever the most contact with the support surface is achieved)</li> <li>8. Fast, jerky movement (slashing, jumping, falling)</li> <li>9. Firm contact with skin - swimsuit, vest, or wetsuit (needs to fit snugly)</li> <li>10. Familiar, organized program and clear behavioral expectations</li> </ol>	<ol style="list-style-type: none"> <li>1. Minimize lighting and noise (calming music)</li> <li>2. Calm water</li> <li>3. Limited equipment, few people</li> <li>4. Warmer temperature (88-90 degrees); highly variable for child</li> <li>5. Water shoes (may also increase sensory input by adding weight, resistance, and stability)</li> <li>6. Facing down and up positions may feel destabilizing</li> <li>7. Unstable, unsupported positions</li> <li>8. Slow rhythmic movement (rocking, gentle bouncing, gliding, rolling)</li> <li>9. Light touch; flapping garments can be disorganized.</li> <li>10. Lack of program structure and appropriate feedback</li> </ol>

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This toolkit should not be used in lieu of a professional's assessment or diagnosis. The information provided is for general information and increasing knowledge only.

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**Curriculum Vitae**  
**Gabrielle Palmer OTD/S**  
**Gabypalmer222@yahoo.com**

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**Education**

*University of Nevada, Las Vegas* Expected Graduation May 2024  
Occupational Therapy Doctorate  
Capstone title: *Increasing Swim Instructors' Perceived Knowledge of Sensory-Based Strategies When Coaching Children Who May Have Sensory Differences*  
Adviser: Dr. Katlin Ploeger, OTDR/L, BCP

*University of Nevada, Reno* 2019  
Bachelor of Science in Community Health Science- Public Health

**Internship Experiences**

***Level 1 – 5-week experience (8 hours/week)***

Orthopedic Motion: Outpatient adults 2021  
– Adjusted and fabricated AFO's and Prosthetics  
Cornerstone Christian Academy and Tykes Preschool: Pediatric Academia 2021–2022  
– Administered handwriting and sensory assessments  
Tik Talk Therapy – Outpatient pediatric clinic 2023  
– Planned and implemented social groups for children with various diagnoses  
Henderson Health and Rehab – Inpatient, SNF 2023  
– Completed contracture screenings and built rapport with patients and staff

***Level 2 - 12-week experience (40 hours/week)***

Renown Regional Medical Center – Acute 2021  
– Completed evaluations and treatments with multi-trauma patients  
Encompass Rehabilitation Hospital – Inpatient Rehab Facility 2022  
– Increased independence in patients' ability to complete meaningful activities for two-hour treatment sessions  
Mesa View Physical Therapy – Outpatient, Home Health, and Highland Manner Skilled Nursing Facility (SNF) 2023  
– Provided quality home health care services in rural Nevada and communities within the Arizona strip  
– Completed evaluations at the SNF and documented on multiple electronic medical records for patients with orthoepic diagnoses specific to shoulders and hands

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**Related Work Experience**

Caregiver – Various diagnoses in adults aged 65 +	2021– 2023
Resident mentor – Residential Treatment for Kids aged 6-1	2019 –2020
PT Technician – Educated therapeutic exercises for orthopedic conditions	2017 –2019
Intermediate Gymnastics Coach – Created programs/ taught adolescent life skills	2015 –2017

**Professional Affiliations**

Nevada Occupational Therapy Association	2020 – Present
American Occupational Therapy Association	2020 – Present

**Teaching and Learning Experiences**

Graduate and Professional Student Association (GPSA) Mentor	2021 – 2022
UNLV T&F Assistant Coach	2021
Physical Therapy Technician	2017 – 2019
Gymnastics Coach	2015 – 2017

**Institutional Service**

Student Occupational Therapy Association (SOTA)	
<i>Treasurer</i>	2022–2024
<i>Volunteer during SOTA community events – social groups for elderly</i>	2020–2024

**Honors and Awards****Scholarships**

General Fieldwork Assistance Scholarship	2022 – 2023
Occupational Therapy Out-of-Area Scholarship	2021 – 2023
Women’s Track & Field Scholarship	2020
Mountain West Academic Awards	2016 – 2020

**Grants**

UNLV Access Grant	4,450.00	2020 – 2024
UNLV COVID-19 Graduate Grant	800.00	2020
UNLV CARES Support Grant	100.00	2020
HEERF Grant	1,250.00	2022 – 2023
Federal Pell Grant	10,500.00	2016 – 2020

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