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Expanding the Literature on Health and Nutrition for Individuals with Significant Disabilities

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Abstract

This dissertation contains three separate papers, each constituting a chapter, on health and nutrition for individuals with significant disabilities. The first paper is a narrative literature review outlining obesity prevalence, obstacles to healthy living, and promising interventions in both nutrition and physical activity for the population. The second paper is a phenomenological study detailing the lived experiences of six parents of children with significant disabilities regarding the children's eating habits. Five distinct themes were revealed from coded transcripts and included variety of foods (including those recommended for high, moderate, and low intake); food particularity, preferences, and inflexibility; health conditions impacting eating routines; family mealtime adaptations; and variation in engagement with physical activity. The third paper is an intervention study conducted remotely with four high school students with significant disabilities. This single case research study investigated the system of least prompts to increase participants' behavior in choosing the food representing the missing food group when shown an array of photos of foods representing the other four groups. Findings indicate that the intervention was effective for increasing all participants' ability to choose the correct missing food. All students mastered the skill and two maintained at 6-week follow up.

Key Words: nutrition education, physical activity, eating habits, significant disabilities, high school students, system of least prompts, remote instruction/learning

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Expanding the Literature on Health and Nutrition for Individuals with Significant Disabilities

Chapter One: Introduction

The United States is in the midst of a health paradox. Amid current preoccupations with dietary restrictions, superfoods, and “clean” eating, the nation is experiencing contrasting rates of health problems related to diet and lifestyle [Bratman & Knight, 2000; Casazza et al., 2015; Dunn & Bratman, 2016; National Center for Health Statistics (NCHS), 2016]. The threat that conditions such as diabetes, hypertension, high cholesterol, cardiovascular disease, stroke, arthritis, and cancer pose to public health drives a focus on prevention through research-based treatment (NCHS, 2016). Therefore, being informed about healthy eating is a current public health goal (Missbach et al., 2017; Ogden et al., 2014).

Amongst abundant and conflicting information about what to eat from media and the diet industry, researchers and government agencies attempted to clarify recommendations based on experimental research or meta analyses of studies. These recommendations include eating a variety of foods from basic food groups (proteins, grains, dairy, fruit, and vegetables), but with the flexibility to also eat any other foods one enjoys in moderation (Academy of Nutrition and Dietetics, 2015, 2018; Auestad, 2015; Hawley et al., 2008; U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2020). Finally, due to concern about health for future generations, increasing attention focuses on dietary knowledge and habits of children and adolescents (Neufeld, 2016; Trasande & Chatterjee, 2009). This includes children with intellectual and developmental disabilities.

Intellectual disability (ID) in children is characterized by a number of challenges to educational performance. These challenges include intellectual functioning such as learning, reasoning and problem solving, as well as adaptive behavior in conceptual, social and practical skills, manifesting before the age of 22 [American Association on Intellectual and Developmental Disabilities (AAIDD), 2021; Individuals with Disabilities Education Act (IDEA), 2004]. Living situation, context, and whether sufficient supports are provided may influence how impacted someone is by ID (Colquitt et al., 2018; WHO, 2019). ID may occur on its own or combined with developmental disabilities (known as IDD) or other diagnoses (known as multiple impairments, MI). These three categories will be collectively referred to as significant disabilities (SD) for the purpose of this dissertation, unless otherwise indicating specific populations within each chapter or past research on a specific disability category.

People with significant disabilities (SD) face a "cascade of disparities" in health (Krahn et al., 2006, p. 70). Such disparities include higher rates of illness and comorbid conditions, reduced access to health education and services, and inadequate behaviors to address health (Foley et al., 2008; Krahn et al.; Phillips et al., 2014; Timmeren et al., 2016).

Marks et al. (2010) and Krahn et al. (2006) examined health and well-being outcomes from genetic, socioeconomic, environmental, health care, and behavioral determinants, as well as access to intervention. Krahn et al. classified health conditions as behavioral (influenced by the challenges associated with having ID), comorbid (medical conditions commonly occurring with ID), and secondary (those occurring because of previous medical conditions). They went on to recommend early identification, inclusive practice, and self-determination for people with ID to reduce occurrence and impact of all three types of conditions.

Compared to those who are typically developing, youth with SD are at risk for adverse health outcomes including inadequate food knowledge and choices (Adolfsson et al, 2008; Gibson et al., 2011; Hinckson et al., 2013; Stewart et al., 2009). Research indicates a need to teach functional skills to children and adolescents within these populations that affect health, such as food-related content and behavior (Morse & Schuster, 2000; Scott & Havercamp, 2016; Wallén et al., 2013).

Dietary Knowledge and Behavior

In order to maintain health, individuals, including young adults with SD, must engage in behaviors conducive to wellness, while avoiding those that are not (Jobling & Cuskelly, 2006). For those living alone or with minimal support, these behaviors must be regulated by the individual. Self-sufficiency is also a goal for those who continue to live with family, but independence for either group requires requisite knowledge on which to base health decisions and/or the capacity to self-regulate.

Diet and nutrition are critical variables that affect individual health across the lifespan (Allensworth, 2015; Anzman-Frasca et al., 2015; Bazzano, 2006; Brown, 2018; McKenna, 2010; O'Dea & Mugridge, 2012; World Health Organization, 2003). An unbalanced diet is a risk factor for many chronic diseases, including cardiovascular diseases, certain types of cancers, chronic respiratory diseases, diabetes, and obesity (World Health Organization). Food preferences established early in life are likely to influence lifelong eating patterns (Birch, 1999). Therefore, addressing diet choices during formative years is important (Zonneveld et al., 2019).

In general, young adults tend to consume insufficient fiber, vegetables, and fruits (Huang et al., 2003). Similarly, Marks et al. (2010) found that up to 93% of adults with ID consume a high fat diet and up to 66% eat fewer daily servings of fruits and vegetables than recommended, suggesting even greater need for health intervention for this population than those who are typically developing. Reeve et al. (2015) as well as Humphries et al. (2009) conducted literature reviews indicating that numerous studies found significant disparities in health between people with ID and the rest of the population. Areas of concern included diet, physical activity, weight, and insufficient behaviors related to preventing weight issues (Lin et al., 2010; Salaun & Berthouze-Aranda, 2011).

Specifically, some researchers found that many children and adolescents prefer less healthy foods (Fisher et al., 1996; Joseph et al., 2002), and in the case of a particular study, prepared snack foods, with refusal of vegetables, and to a lesser extent, fruit (Zonneveld et al., 2019). All three studies suggested that food choice is highly affected by a number of factors. First is quality, meaning high versus low preference (Fisher et al.). Food choices are also driven by immediacy, how quickly the food can be obtained (Joseph et al.). Choices are also influenced by magnitude, or amount of food given (Trosclair-Lasserre et al., 2008) and effort to earn or obtain the food (Roane et al., 2001). These findings are problematic considering fast food and processed snacks are highly preferred, quickly and easily accessed, with potential for large portions.

When considering factors that contribute to healthy eating habits, Alexander et al. (2018) and Pember and Knowlden (2017) found that teen and young adults' successful efforts included managing behavior through self-monitoring, goal-setting, small steps, meaningful reinforcements, and social opportunities. Participants with ID in a study by Guerra et al. (2019) reported that limiting processed carbohydrates, controlling portion sizes, and using healthy substitutions were favorable nutritional strategies, though they had trouble meeting exercise goals without support. Medlan and Peterson (2000) found that the majority of participants with ID in their study identified “good meals” as the basis of a healthy lifestyle.

Jobling and Cuskelly (2006) wanted to examine health knowledge and behavior concurrently, investigating 38 individuals with Down syndrome, relating to four aspects of health: hygiene, substance use, exercise, and healthy eating. They found that while the majority of participants demonstrated some awareness of basic hygiene, they were not yet able to consistently demonstrate such skills without caregiver support. Knowledge about substance use, exercise, and healthy food was low overall.

Similarly, Noland et al. (1986) reported health knowledge for adolescents with SD to be inadequate, concluding that they may have greater need for health knowledge than other adolescents, consistent with other research (Humphries et al., 2009; Marks et al., 2010; Reeve et al., 2015). Noland et al. predicted that one possible explanation for such low levels of health knowledge may be that special education teachers are inadequately trained in health education (only 19% of the sample was in an inclusive environment). A second possible explanation was health education teachers may not have sufficient knowledge and skills to teach students with SD (National Joint Committee on Learning Disabilities, 1993). Additionally, Noland et al. suggested that students with ID were traditionally neglected in the regular health classroom because the standard materials were rarely adapted.

Everett et al. (1994) surveyed over 300 secondary health teachers about teaching students with ID in inclusive settings. Twenty-five percent had no training in instructing such students, though expectations of student performance were not shown to be different for teachers who received training. Teachers who perceived this population as having greater need for health education showed higher scores in efficacy and outcome expectations. Over half reported that materials available for teaching this population were inadequate. There is evidently need for better preparation and support of teachers (both special educators and health teachers) and for specifically adapted materials to assist in teaching health habits to this population, thereby increasing quality of life and independence as teens prepare to transition (Reed et al., 1992).

Overview of Dissertation Content by Chapter

This doctoral dissertation consists of three separate papers, each constituting a chapter, on health and nutrition for individuals with significant disabilities. Chapter 2 was published in *Physical Disabilities: Education and Related Services* (Grumstrup & Demchak, 2017). This paper was a narrative literature review focused on health issues for individuals with intellectual disabilities (ID), intellectual and developmental disabilities (IDD), and multiple impairments (MI).

Chapter 3 is an article published in *The Qualitative Report* (Grumstrup & Demchak, 2019). This qualitative phenomenological study, through interviews, aimed to understand the experiences of parents of children with significant multiple disabilities about the children’s eating habits. Semi-structured initial and follow-up interviews used general questions to gather data, which were subsequently coded and examined for themes across participants.

The study in Chapter 4 is a single case research design study focused on an intervention in nutrition education, with plans to submit to a peer-reviewed journal. This study was conducted remotely (using Zoom) to investigate, through a multiple probe design, if the system of least prompts was effective to increase a nutrition education skill for high school students with intellectual and multiple disabilities. The study in this chapter begins to address the lack of rigorous research aimed at increasing food knowledge for school age youth with SD.

Chapter 5 includes a discussion that encompasses all of the findings and implications from the previous three chapters when examined across studies. Chapter 5 also includes recommendations for future research given the findings from Chapters 2 through 4.

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Chapter Two: Obesity, Nutrition, and Physical Activity for People with Significant Disabilities[1]

The United States is facing an urgent health dilemma with the current level of obesity for adults at 36.5% of the population, children and youth ages 2 to 17 at 17% (National Center for Health Statistics [NCHS], 2016). Obesity is defined as a body mass index (BMI) of 30 or higher and is calculated by a person's weight in kilograms divided by the square of height in meters (Centers for Disease Control, 2016). Obesity is associated with an increased risk for further health conditions including diabetes, hypertension, high cholesterol, cardiovascular disease, stroke, arthritis, and certain cancers (NCHS, 2016). The threat these conditions pose to public health has precipitated a focus on research, treatment, and prevention. Increasing attention focuses on dietary habits of children as childhood obesity becomes a widespread health concern, especially in terms of costs for outpatient treatments, prescription drugs, and emergency room visits (Neufeld, 2016; Trasande & Chatterjee, 2009). Health of children with significant disabilities such as intellectual disability (ID), multiple impairments (MI), or intellectual/developmental disabilities (IDD) warrants special attention because of further complications with health compared to the typical population (Gibson, Temple, Anholt, & Gaul, 2011; Stewart et al., 2009). Significant disabilities refer to several types of diagnoses (e.g., ID, MI, IDD) that prevent individuals from achieving the same number

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and level of skills as their typically developing peers (United States Department of Education, 2007).

ID is defined by the American Association on Intellectual and Developmental Disabilities (AAIDD) as a combination of significant deficits in both intellectual functioning (reasoning, learning, problem solving) and adaptive behavior, resulting in an IQ score of 70-75 or lower and manifesting prior to age 18 years (AAIDD, 2013). Similarly, ID is defined by the Individuals with Disabilities Education Act (IDEA) of 2004 as “significantly subaverage general intellectual functioning, existing concurrently [at the same time] with deficits in adaptive behavior and manifested during the developmental period, that adversely affects a child’s educational performance” (IDEA, 2004).

Some individuals with ID have comorbid conditions such as autism, cerebral palsy, epilepsy, communication disorders, as well as other conditions and are identified as having multiple impairments. IDEA (2004) defines multiple impairments as

> concomitant [simultaneous] impairments (such as intellectual disability-blindness, intellectual disability-orthopedic impairment, etc.), the combination of which causes such severe educational needs that they cannot be accommodated in a special education program solely for one of the impairments. The term does not include deaf-blindness.

When individuals have developmental disabilities, such as autism, as well as intellectual disabilities, they are sometimes referred to as having intellectual/developmental disabilities (IDD).

Prior literature reviews indicate significant disparities in health, namely higher rates of obesity, between people with ID and people who are typically developing (Humphries, Traci, & Seekins, 2009; Reeve, Ashe, Farias, & Gostin, 2015). Areas of concern include weight, diet, and physical activity, with a lack of sufficient behaviors related to preventing weight problems (Lin et al., 2010; Salaun & Berthouze-Aranda, 2011). These concerns for youth with ID interact with the physical and social environments in which children grow up, serving to enhance or impede improvements in health (Hubbard, Bandini, Folta, Wansink, & Must, 2014). These issues can be of concern to families, school personnel, community members, and those who work in vocational settings.

The purpose of this narrative literature review is to broadly examine the issue of obesity and related conditions for people with significant disabilities, including ID, IDD, or MI. A narrative literature review summarizes a topic using informal or subjective methods to gather the information. It differs from a systematic review in that it does not focus on a clinical research question or employ stringent or systematic search or elimination strategies (Kysh, 2013). This review was conducted by searching the terms “significant disabilities” and “health” in the ERIC, Education Research Complete, Education Full Text, and PsychInfo databases for scholarly (peer-reviewed) journal articles from 2007 to 2017. The results centered on nutrition and health habits and needs/educational needs for people with significant disabilities (i.e., ID, MI, or IDD). This review is organized around recent research pertaining to these research questions: What is the prevalence of obesity for this population and what are factors that contribute to obesity and related conditions? What interventions can facilitate a healthy lifestyle for individuals with significant disabilities? What are the barriers to acquisition of knowledge and implementation of skills needed to lead a healthy lifestyle?

Obesity: Prevalence and Contributing Factors

Children and adolescents with IDD are 2 to 3 times more likely to be obese than the general population (Rimmer, Yamaki, Davis Lowery, Wang, & Vogel, 2010; Salaun & Berthouze-Aranda, 2011). Obese children and adolescents with ID are at risk for later occurrence of hypertension, heart disease, stroke and Type II diabetes (Reilly & Kelly, 2011). Obesity in individuals with ID raises the risk of related health conditions as well as future weight gain, shorter life span, and overall diminished quality of life (Pett et al., 2013). It could thus be argued that obesity and related conditions can create further struggles for those already living with the challenges associated with ID (Begarie, Maiano, Ninot, & Azema, 2009). Furthermore, research indicates that specific disability groups are associated with the highest body bass indices (BMI): autism, spina bifida with co-occurring ID, and Down syndrome (Rimmer et al., 2010). Additionally, females with ID are more likely to have higher levels of overweight and obesity than their male counterparts (De, Small, & Baur, 2008). There are a number of factors that contribute to the increased prevalence of obesity in individuals with significant disabilities.

Contributing Factors

One factor that might contribute to increased likelihood of obesity relates to mobility issues for those who have multiple impairments. It may be that the number of people with ID who use a wheelchair or who otherwise have limited mobility could be contributing to the unusually high prevalence of obesity for those with ID due to lower levels of physical activity. Although research does support this hypothesis, there is also an extremely high rate of obesity within the ambulatory segment of this population (Ells et al., 2008; Stewart et al., 2009).

Other comorbidities include nutrition deficiencies, including both under- and overweight caused by feeding/oral motor difficulties, narrow food preferences, frequent choking episodes, dental issues, food allergies, specialized diets, and medication side effects that influence diet or metabolism (Gibson et al., 2011). Some of these comorbidities might contribute to increased risk of obesity. Although factors related to the disabling condition (e.g., mobility, medication side effects) can contribute to obesity, additional factors likely contribute to increased obesity in individuals with significant disabilities.

Just as food availability, family eating habits, convenience, preference and peer influence shape nutrition habits of typically developing adolescents (Rhee, 2008), they also influence habits of adolescents with ID (George, Shacter, & Johnson, 2011). For adolescents with significant disabilities, these factors can be compounded further into weight gain due to medication side effects and more frequent participation in and longer time periods of sedentary activities compared to typically developing peers. George et al. go on to claim that adolescents with ID frequently have inadequate comprehension of what constitutes healthy diet and exercise. Their study examined rates of obesity in the parents of children with ID, as well as common attitudes about children’s weight, family diet, and exercise habits. Parents of children with ID were more likely to be obese than parents of children who were typically developing. The children with ID in the study were more likely to be obese than their typically developing peers. Also important was the discrepancy between the parents’ perceptions of children’s weight status (they rated it as healthy) and children’s actual BMI (many of them were actually obese) calculated by the researchers.

The prevalence of and factors contributing to obesity for those with significant disabilities have resulted in a variety of interventions targeting obesity. The goal of many interventions is to improve the skills of individuals with significant disabilities as related to nutrition/dietary patterns and physical activity.

Effective Interventions

Two factors that contribute to obesity in the ID population are dietary patterns and level of physical activity. There is evidence supporting interventions that target nutrition and exercise interventions, separately or combined (Katz, O'Connell, Njike, Yeh, & Nawaz, 2008).

Nutrition Interventions

The literature indicates need for improvement in lifestyle behaviors for individuals with significant disabilities. Within the existing body of literature there are promising methods for delivery of diet and nutrition information. These methods include picture-supported guides (e.g., line drawings, photographs), sorting visuals such as line drawings or photos and actual foods into categories and bins according to food type and healthfulness, practice with measuring food into appropriate portions, and tasting and rating healthy snacks for preference (Fleming et al., 2008).

Further evidence suggests that research-based health improvement programs can benefit from modifications to target youth with moderate to high support needs. Modifications are needed due to special dietary needs, recipe complexity, family involvement, and communication deficits (Hinckson, Dickinson, Water, Sands, &

Penman, 2013). These researchers go on to suggest that incorporating picture supports, color coding, age appropriate music, as well as game- and water-based exercise have been shown to improve access to health programming. In this same study, targeted skills for teaching revolved around portioning, selecting food types, eating out, grocery shopping, identifying triggers for overeating, and learning proper sleep habits. The authors found trivial or unclear outcomes, except for one significant outcome, which was that participants increased the distance walked for exercise. However, parents of participants reported fewer doctor visits and school absences and there was an overall reduction in eating sweets for the participants during the program.

Physical Activity Interventions

Interventions targeting increased exercise or physical activity can be school- or community-based as well as involve technology. School-based interventions include those incorporated into the daily schedule or into the curriculum and can involve peers. Community-based interventions can include various after school activities and those based in the community such as Special Olympics. Technology-related activities can revolve around popular technologies such as Nintendo Wii as well as more specialized technologies involving micro-switches.

School settings. Children with ID tend to exercise less than typically developing peers and levels of exercise decline as children with ID move through adolescence into adulthood (Shields, Dodd, & Abblitt, 2009). Of further concern are changes to school schedules to allow for more instructional time and less physical education and recess. Unfortunately, when physical education and athletics for children with ID do occur, these activities are often adult-led and presented in structured settings that do not include many, if any, typical peers (including adaptive physical education services targeting students with disabilities only, and activities led by teachers of self-contained adaptive skills programs) (Casey, Rasmussen, MacKenzie, & Glenn, 2010).

In response to these problems, there have been some recent efforts to examine the role that peers have in motivating children with significant disabilities to develop healthy play and exercise behaviors at a young age. There is evidence that structured interventions in school settings through peer training and support can significantly enhance social connections for adolescents with significant disabilities (Asmus et al., 2017).

Though some studies have shown positive outcomes with modeling of exercise with error correction (Fleming et al., 2008), it has been the goal of recent research to improve levels of physical fitness through promotion of positive peer relationships. One study showed an increase in interaction among students with significant disabilities and their peers following peer training in how to provide coaching to students with disabilities (Klavina & Block, 2008). Other researchers suggest that children with significant disabilities in school settings may need a continuum of options to participate in physical activity, including specialized settings, reverse inclusion, and full inclusion (Block, Taliaferro, & Moran, 2013).

Community settings. Various Special Olympics chapters at the state and local levels have developed initiatives to improve food choice, weight, hygiene, strength, flexibility, endurance, exercise and sleep habits. These initiatives have various levels of participation with varying degrees of support from Special Olympics’ employees and community partners, and include classes for athletes and their families or caregivers to improve health knowledge and practice as measured by pre- and post-tests. Marks, Sisirak, Heller and Wagner (2010) found evidence for improvements in all of the above health indicators within five of the organization's pilot projects across five different states. Although over four million individuals with disabilities participate in Special Olympics-affiliated events (Special Olympics, 2015), which are considered "specialized" sports with all participants having a disability, there has been a recent goal to expand their integration into sports with peers without disabilities.

According to Grandisson, Tetreault, and Freeman (2012), "integration" is defined as most of the participants being typically developing, rather than "unified" (about half have disabilities), or inclusion into school-based physical education. Their research maintains that gains made by participating in sports appear to generalize to other areas of life, such as school and career for adolescents with ID, and families of participants report less stress and more fulfillment. Other research emphasizes the importance of activity preference, context, and experience when encouraging peer support for children with significant disabilities in community settings (Shields, Synnot, & Kearns, 2015).

Norins, Harada, Parker, and Brecklinghaus (2008) have claimed gains for typically developing peers in integrating children with disabilities into sports such as increases in tolerance for differences and building of respect and equity between themselves and those with disabilities. Stanish and Temple (2012) found evidence that pairing adolescents with ID with typically developing peers in community settings improved physical fitness levels for those with ID.

Other community-based initiatives exist that have indicated social, fitness, and weight reduction benefits for adults with ID (Heller, McCubbin, Drum, & Peterson, 2011). Yan, Finn, and Corcoran (2015) specifically found reductions in waist circumference, level of participation in exercise, improvement in sit-to-stand, and balance tests following a 6-week program of one-to-one peer models. Other researchers found improvement in cardiovascular fitness, balance, upper and lower body strength, and flexibility in adults with ID compared to a control group after 14 weeks of guided training in endurance, strength, and balance exercises. Endurance exercises included walking, jogging, and aerobics. Strength training included free weights, resistance bands, and medicine balls. Balance training included varying stride length, work on single legs, line walking, and use of some balancing pads of different elevations (Oviedo, Guerra-Balic, Baynard, & Javierre, 2014).

Use of technology. Dickinson and Place (2014) sought to utilize the engagement that many children with multiple impairments, specifically ID and autism, have in electronics to improve physical health. In a randomized controlled study, they assigned children with multiple impairments to a Nintendo Wii exercise game, with hopes that the children's markers of physical fitness would improve significantly over the course of a year compared to a control group. The authors did find improvement in all markers of physical fitness on the Eurofit fitness assessment, except for flexibility. The children improved significantly in strength, endurance, speed and BMI measurements.

In another study using technology to improve health for obese students with ID, Chang, Shih, and Lin (2014) evaluated activation of students' favorite music videos by students pedaling a stationary bicycle with the pedaling motion linked to the screen by use of an air mouse device. The authors predicted that the students would be more likely to continuously pedal, and therefore exercise, if the pedaling kept the videos on display.

A significant increase in pedaling time was found for the condition of the video stimuli compared to the condition in which no video stimuli were received.

Summary

Specific interventions (e.g., adapted materials using picture supports) can lead to improved dietary behaviors for individuals with significant disabilities. Additionally, individuals with significant disabilities can experience enhanced physical activity when they are involved with their typically developing peers in both school- and community-based programs. Finally, technology-based interventions (e.g., Nintendo Wii) also contribute to increased physical activity for individuals with significant disabilities. Unfortunately, a variety of barriers interfere with knowledge and skill acquisition.

Barriers to Knowledge and Skill Acquisition

Barriers to acquisition of knowledge and skill in multiple areas are well documented for people with significant and multiple disabilities. Some of these barriers are related to the disability itself while others are more logistical. Barriers include lack of understanding of consequences for choices or overestimation of actual health status for all ages in this group (Brehmer-Rinderer, Zigrovic, & Weber, 2014). Similarly, implementation of acquired knowledge by the individuals with ID is made more complex by the tendency of those individuals to overestimate their own competence (Salaun, Reynes, & Berthouze-Aranda, 2014). Existence of diminished motor capabilities is also problematic for some, as it affects participation in physical activity (Rimmer et al., 2010). Another barrier related to the disability itself can be the need for expensive specialized equipment and transportation for participation in community recreation (Mulligan, Hale, Whitehead, & Baxter, 2012).

Age appropriate leisure activities that tend to be passive such as watching television, playing games, or looking at magazines (Block et al., 2013) present a barrier. Organizational and individual constraints, such as resources, age limits, ease of access, motivation, skill level, and reliance on caregivers were also identified as barriers (Taliaferro & Hammond, 2016). There is also a lack of professionals who have exercise and nutrition expertise and who are also trained in instruction of people with significant disabilities (Fleming et al., 2008).

Another barrier is lack of assessment of knowledge of children with ID (Maiano, Begarie, Morin, Garbarino, & Ninot, 2010). There are assessment tools to measure nutritional deficiencies and risks completed by the parent or caregiver, though not from the child's perspective (Penagini, Mameli, Fabiano, Brunetti, Dilillo, & Zuccotti, 2015). Instrumentation also exists to assess nutrition knowledge of individuals with physical, but not intellectual disabilities (Rastmanesh, Taleban, Kimiagar, Mehrabi, & Salehi, 2007) and adults, but not children, with ID (Illingworth, Moore, & McGillivray, 2003). This lack of knowledge assessment designed for children with significant disabilities is problematic for school age students because assessment is an essential step of building an Individualized Education Program (IEP) (U.S. Department of Education, 2007). If the school team wishes to address health as part of the child's adaptive behavior skills, there is a gap in instrumentation to do so. For individuals that have transitioned out of the school system, this lack of assessment during their K-12 experience could present a barrier to independent living skills.

Furthermore, many individuals require intervention from families or caregivers in order to maintain consistent use of skills (Kleinert, Miracle, & Sheppard-Jones, 2007).

This includes the need for caregivers to identify and help implement life goals that avoid the deficit view of disability, when the focus should be on positive lifestyle and independent living (Carrington & Lennox, 2008). Unfortunately, research demonstrates that caregivers may have poor levels of knowledge about proper diet and exercise (Melville et al., 2009). Data from these authors indicate that over 25% of caregivers acknowledged barriers to changing a person's lifestyle; however, the caregivers reported that the barriers were irrelevant to their client's abilities to change diet choices (Melville et al., 2009). Melville et al. went on to show that caregivers' attitudes toward physical activity are that it is much less important in maintaining a healthy lifestyle than food choices. These limitations in caregivers' knowledge and attitudes can restrict their guidance in facilitating lifestyle changes for individuals with ID (Melville et al.).

Recommendations

A number of recommendations emerge directly or are implied from this literature review:

- University teacher education programs are encouraged to embed more training in health education for future special education teachers so that teachers can incorporate effective interventions such as:
    - Specifically including information about nutrition, diet, and exercise in classroom curriculum
    - Providing adaptations such as picture supports to teach nutrition and other related skills
    - Directly teaching individuals with significant disabilities to participate in physical activities

  - Encouraging physical activity interactions with peers without disabilities to facilitate improved skills for individuals with significant disabilities
  - Encouraging participation in community-based activities
  - Supporting student knowledge of cause and effect, as well as teaching students concrete definitions of healthy choices. Student should also be taught how to compare their own behavior to the definitions of healthy habits.
- Address logistical barriers through strategies such as:
  - Using a community facility that has universal access
  - Holding activities in a central location within a town or city
  - Holding activities at a time where caregiver schedules most likely allow assistance in getting to and from the location
  - Holding activities often enough that individuals get a chance to practice skills regularly and ensuring sessions are long enough to build and practice skills, but not so long that the time commitment is too great to hold sessions consistently.
  - Prioritizing activities that can be enjoyed by all without the use of specialized equipment to avoid lack of equipment as a barrier.
- Provide caregiving training on supporting people with significant disabilities to improve health habits. This includes building caregiver knowledge of healthy choices, as well as methodology in teaching that knowledge to those with significant disabilities in their care.

Future Research

When considering the issue of appropriate nutrition and physical activity for individuals with significant disabilities, there are still questions that need to be answered. Some future research needs emerged from this current review and expand on research already conducted while in other cases new research may be needed.

Expanding Existing Research

Future research should include measures of social validation by participants with significant disabilities in research studies. Social validity refers to how interventions are accepted by participants as well as participant satisfaction with procedures. Including such measures might help to determine the likelihood of generalization and maintenance of improved behavior of participants with significant disabilities. If participants and their families are satisfied with changes in behavior and perceive procedures as acceptable, it might be more likely that improved behavior will be maintained and perhaps even generalized. In contrast, if participants indicate dissatisfaction upon completion of a study, it is likely that any improvements in behavior will not be maintained or generalized. It is important that successful interventions are acceptable to both participants with significant disabilities and their families to increase the likelihood of maintenance and generalization.

Another area of future research should specifically target a systematic review of the existing research using recommendations from the *What Works Clearinghouse* (WWC). The WWC provides guidelines for evaluating the methodological rigor of studies as well as assessing the strength of intervention effects. Such a systematic review could further contribute to the literature by providing a comprehensive synthesis of rigorous, effective interventions.

New Areas of Research

There are a number of topics which were not addressed within the current review because there appears to be no or limited research on the topics. These topics may be of importance for future research targeting nutrition or physical activity for individuals with significant disabilities.

How does socioeconomic status (SES) affect individuals with disabilities and their families? What is the incidence of individuals with ID living in “food deserts?” Food deserts are areas of the country where fresh food is scarce, usually within impoverished areas (American Nutrition Association, 2015). Are there higher numbers of individuals with significant disabilities living within food deserts than outside of them? Is there a shortage of adult disability services that cause lower SES for individuals with ID, thereby contributing to living in poverty?

For adult individuals with significant disabilities who live in supported living (group homes), what level of support is needed for the individuals to exercise healthy food choices? Are they being taught to shop for groceries themselves or relying on staff to shop? If so, how much control do the individuals with ID or IDD have over what is purchased? Additionally, how much control do these adults with have over menu planning, portion sizes, as well as options for type and amount of exercise? How much preparation is being given to adolescents in the school system before they transition to these settings?

For those individuals living in ICF-IDDs (Centers for Medicaid and Medicare Services, 2016), what level of services in nutrition and other areas of health are provided? What are the minimum requirements for services to the residents? At what level of fidelity are these services actually provided? This review touched upon narrow food preferences or options for this population. What research and intervention exist in treating food refusal for this population? Can restrictive choices be improved through applied behavior analysis?

Limitations

A limitation of this literature review is that it was conducted as a narrative review rather than as a systematic review. Following the guidelines of a systematic review would have served to strengthen the quantitative credibility of research to date related to obesity, nutrition, and physical activity for individuals with significant disabilities. A systematic analysis of the quality of current research might result in different findings than the current review as well as identify limitations in research quality that should be addressed in future research.

Closing Comments

There is a substantial amount of evidence outlining the risks faced by individuals with ID if the level of obesity and related conditions continue to increase. Also, the barriers faced by this population create a greater risk of health conditions than the typically developing population, which is facing its own rise in health problems. Although the barriers are clear and include those related to the disability itself (e.g., co-morbid conditions), knowledge (e.g., over estimation of competence or of cause and effect), and logistical concerns (e.g., scheduling, specialized equipment), there is some early and emergent methodology to suggest specific interventions can lead to improvements for people with significant disabilities (e.g., adapted materials, peer supports, use of technology). However, there is a need for continued research in the area (e.g., social validation of interventions, existence of food deserts and their impact, effective interventions in supported living situations). Providing specific interventions for individuals with significant disabilities and training for caregivers, parents, and teachers on instilling behaviors conducive to health improvement beginning early in life can lead to improved outcomes for individuals with significant disabilities.

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Chapter Three: Parents of Children with Significant Disabilities Describe Their Children's Eating Habits: A Phenomenological Study[2]

In 2007, when faced with the question of what we should eat for optimum health, food journalist and author Michael Pollan answered "eat food. Not too much. Mostly Plants." A recent focus on diet is largely due to the obesity level in U.S. adults at 36.5% of the population and children ages 2 to 17 at 17% (NCHS, 2016). Increasing attention focuses on dietary habits of children as obesity becomes a widespread health concern, especially in terms of costs for outpatient treatments, prescription drugs, and emergency room visits (Neufeld, 2016; Trasande & Chatterjee, 2009). Health of children with intellectual disability (ID), multiple impairments (MI), or intellectual/developmental disabilities (IDD), warrants special attention because of further complications with health compared to the typical population (Gibson, Temple, Anholt, & Gaul, 2011; Krahn & Fox, 2014; Stewart et al., 2009).

Government Dietary Recommendations

The debate about improving health in our nation centers around the modern "Western" diet of highly processed, salty, sugary, high-fat foods combined with sedentary lifestyles (Jinks, Cotton, & Rylance, 2011). To counter this common diet, the Academy of Nutrition and Dietetics (AND), in conjunction with the U.S. Department of Agriculture (USDA) and the Department of Health and Human Services (HHS), developed health guidelines for adults and children (Office of Disease Prevention and Health Promotion, 2018; AND, 2018). The AND and the U.S. governmental agencies

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recommend most people build their diet around fresh vegetables and fruit, whole grains and products, and low fat or fat free dairy, along with lean meats, beans, eggs, and nuts. Refined grains are recommended to make up less than 50% of grain products consumed daily. Additionally, it is recommended that foods with fewer nutrients make up leftover calories only after all nutrition needs are met by consuming the foods meant to constitute the majority of a diet. (Academy of Nutrition and Dietetics (AND; 2015, 2018).

The government guidelines recommend limiting sodium intake by eating unsalted and low salt versions of nuts and snacks, as well as limiting deli meats such as bacon, sausage, hot dogs, pepperoni, and lunch meats (USDA, 2016). The guidelines also recommend avoiding added sugar in the form of sodas, punch drinks, many popular “fun” cereals targeted towards children, flavored/sweetened yogurts, cakes, pies, and cookies (AND, 2016b).

Processed foods are also a source of confusion for many. Processed foods are any foods that have a combination of ingredients, and/or alter the whole components of food prior to sale or consumption (AND, 2016c). Many people correctly view cookies, potato chips, and fast food as processed; however, organic breads, soups, and trail mix are also processed foods (AND, 2016c). How to tell the better choices from ones to avoid? The AND (2016c) lists the following as examples of good choices that make healthy eating easier and are minimally processed: bagged lettuces, cut vegetables and roasted nuts, canned tomatoes, frozen fruit and vegetables, and canned tuna. They list the following examples as moderately processed, to eat in moderation: foods with ingredients added for flavor and texture (sweeteners, spices, oils, colors and preservatives) including jarred pasta sauce, salad dressing, yogurt and baking mixes. Finally, they list the following examples as highly processed and to be cautious of, due to large amounts of added sugar, fat, and sodium: crackers, granola, deli meat, candy, donuts, fast food, frozen microwave dinners, pizza, and chips. The AND advises when choosing processed foods to go for those with more fiber and protein and less saturated fat, sugar and salt (AND, 2016c).

Health and Diet of Children with Significant Disabilities

The American Association on Intellectual and Developmental Disabilities (AAIDD) defines ID as a combination of significant deficits in both intellectual functioning (reasoning, learning, problem solving) and adaptive behavior, resulting in an IQ score of 70 to 75 or lower and manifesting prior to age 18 years. Some individuals with ID have comorbid conditions such as cerebral palsy, epilepsy, communication disorders, and other conditions, identified as MI. When individuals have developmental disabilities, such as autism, as well as intellectual disabilities, they are commonly referred to as having IDD (AAIDD, 2013). A broad term for diagnoses such as ID, IDD, and MI is significant disabilities (SD).

Health disparities, such as higher obesity rates, poorer diet, lower rates of exercise, and sedentary lifestyle, are evident between individuals with significant disabilities and those who are typically developing (Grumstrup & Demchak, 2017; Humphries, Traci, & Seekins, 2009; Reeve, Ashe, Farias, & Gostin, 2014). Current concerns with obesity-related health issues for individuals with SD necessitates research into what the problems are and what is being done to address them.

The literature related to obesity and children and adolescents with SD indicates they are more likely to be obese than the general population (Rimmer, Yamaki, Davis Lowery, Wang, & Vogel, 2010; Salaun & Berthouze-Aranda, 2011). Obesity is defined as a body mass index (BMI) of 30 or higher, calculated by weight in kilograms divided by the square of height in meters (CDC, 2016). Obesity is linked to risk for further conditions including diabetes, hypertension, high cholesterol, cardiovascular disease, stroke, arthritis, and certain cancers (NCHS, 2016). Obesity in individuals with SD raises the risk of related health conditions as well as shorter life span, future weight gain, and lower quality of life (Pett et al., 2013; Reilly & Kelly, 2011). Obesity-related conditions may create further struggles for those with an already challenging condition, such as SD (Begarie, Maiano, Ninot, & Azema, 2009). Other research indicates that some disability groups are associated with high BMIs: autism, spina bifida with co-occurring ID, and Down syndrome (Rimmer et al., 2010).

In contrast, some individuals with SD require diet intervention but are not overweight, with a significant number considered underweight (Maaskant, Van Knijff-Raeven, Van Schrojenstein Lantman-de Valk, & Veenstra, 2009). Some studies also show a tendency for people with SD to be malnourished, lacking sufficient nutrients to maintain optimum function (Franssen, Maaskant, & van Schrojenstein Lantman-de Valk, 2011), whether they are over or under-weight. (Meijers et al., 2009). Many individuals are at risk for nutrient deficiencies, caused by feeding/oral motor difficulties, narrow food preferences, frequent choking episodes, dental issues, food allergies, specialized diets, and medication side effects that influence diet or metabolism speed and efficiency (Gibson et al., 2011).

Of further importance to the topic of health for individuals with significant disabilities is nutrition and food choice, as diet is widely assumed to have a role in obesity (Caton et al., 2012). Some research suggests that individuals with SD adhere to a less healthy diet over a healthy one (McGuire, Daly, & Smyth, 2007), and that these issues often persist into adulthood (Fodstad & Matson, 2008). It has also been proposed that individuals with ID have limitations in understanding healthy food choices and nutrition (George, Shacter, & Johnson, 2011). However, Jobling and Cuskelly (2006) suggested that knowledge about what constitutes a healthy diet may not be the issue in this population; that the individuals can describe or show what constitutes healthy eating, but preference dictates what they actually eat.

Other research has focused on problem behaviors during mealtime, such as in the following examples. Several assessment studies indicate a need for intervention to increase food flexibility in those with ID and IDD (Keen, 2008; Koegel et al., 2012). A response to this need occurred through single case research design (SCRD) studies attempting to address this issue. Some studies focused on increasing the variety of food the child would eat (Gentry & Luiselli, 2008; Knox, Rue, Wildenger, Lamb, & Luiselli, 2012; Koegel et al., 2012). Others focused on increasing independence at meal time for children who were prompt dependent or had limited independent feeding skills (Qvarfordt, Engerström, & Eliasson, 2009; Bailey & Angell, 2005). Another study addressed both issues of prompt dependence and limited independent self-feeding skills (Kadey, Roane, Diaz, & Merrow, 2013).

It is clear that researchers have responded to questions about what the problem is (e.g., health disparities in SD), and what can be done about it. Interventions were primarily implemented in SCRDs, which are important in addressing specific and targeted behaviors for low incidence populations (Horner et al., 2005; Kratochwill et al, 2013; Wolery & Dunlap, 2001). However, such studies are not designed to provide in-depth knowledge of individual experiences with an emphasis on how or why certain phenomena occur.

Purpose

The purpose of this qualitative study was to seek in-depth descriptions of individual eating habits of children with SD from the perspective of parents. Our research was guided by the following questions: What do the children reportedly prefer to eat? What foods do they refuse? How do food preference and refusal relate to AND (2016a, 2016b, 2016c, 2018) recommendations? Are the diets of the children with SD different from others in the household? How have parents respond to food refusals and eating differences? This study could address gaps in the existing literature and contribute to an understanding of the eating habits of children with SD.

Method

This is a phenomenological study, aiming to understand the lived experiences (Rossman & Rallis, 2017) of parents of children with significant disabilities, specifically MI, about their children's diets. Interviews describe, in detail, the parents' experiences with their children's dietary habits. Each interview was analyzed through thematic analysis of phenomenological meaning categorization, specifically using Moustakas' (1994) modified van Kaam method to develop insights from the perspectives of those involved (Koch, 1995; Rossman & Rallis, 2017).

Researcher Background, Context, and Positionality

One of the researchers, Brianna, has 9 years' experience working with students with significant disabilities, specifically those with IDD. Brianna was a teacher in a self-contained program at the high school level, then a consulting teacher specializing in students from this population district-wide. Brianna made many health changes and improvements within the last 5 years, so holds the view that diet and exercise are instrumental to health outcomes. Furthermore, based on her experiences with parent concerns and her prior research, she believes children with SD are at higher risk for poor diet, decreased exercise, and their effects.

The second researcher, MaryAnn, has been a professor teaching courses and conducting research in the area of severe disabilities for over 30 years. Additionally, she has been the director of a statewide technical assistance project funded by the U.S. Department of Education, Office of Special Education for nearly 30 years. This project, the Nevada Dual Sensory Impairment Project, provides consultation and training to families and service providers who have children with impairments in both vision and hearing. Through this work, she has had extensive experiences and developed relationships with families of children with SD that include sensory impairments.

It should be noted that we co-authored a narrative literature review outlining current issues in obesity, nutrition, and intervention for people with significant disabilities. (Grumstrup & Demchak, 2017)

Participants

This study was approved by the Institutional Review Board at our university. The study was exempt from federal regulations in accordance with the requirements of the Code of Federal Regulations on the Protection of Human Subjects.

We each recruited participants by electronic flyer to various groups affiliated with parents of children with SD, such as Down Syndrome Network of Northern Nevada, Easter Seals, Cerebral Palsy Network, and other family collaboration and advocacy networks known to one or both of us. Additionally, as was also permitted by IRB approval, families known personally by either of us received the same flyer. The only criterion for inclusion were that parents must have a child with ID,IDD, or MI (ID paired with another diagnosed condition (e.g. autism, cerebral palsy, epilepsy, sensory impairments, genetic conditions).

Consent to participate was defined in the IRB application for this study as participants contacting either or both researchers if interested, and subsequently assenting to answer interview questions. All participants were given a consent and information letter, but no signed forms were required as participants were adult parents. Eleven parents initially contacted the researchers with interest in participating. One potential participant had a child who did not meet the disability criteria for the study; three others ultimately did not schedule interviews. Seven parents completed the interview process for this study; three of these parents were personally known to Brianna while three others were known to MaryAnn. One participant who completed the interview was ultimately eliminated because it was determined that the child did not meet inclusion criteria of having ID, IDD, or MI. This child was diagnosed as having autism spectrum disorder with no evidence of accompanying ID. The study ultimately included six parent participants of seven children. One child, Grizz, was substantially younger than the other children represented in this study; however, his parent’s interview responses were included as Grizz and his parent met the study’s inclusion criteria and we had not included age ranges in those criteria. This parent has several children with disabilities, including those who were adolescents or young adults, and she chose to focus on Grizz; it was by chance that all but one child was an adolescent or young adult. Table 1 shows participant demographics, child strengths/interests, and interview type. For the purposes of this study all of the participants' children are referred to as "children" throughout the results and discussion, even though six of the children are adolescents or young adults.

Table 1

Participant Demographics

Participant	Type of Interview	Child's Name/ Gender	Child's Age	Child's Disability & Related Conditions	Child's Strengths/ Interests
Dana	Phone	Amber, Female	28	ID, vision and hearing impairments, chromosomal abnormality	Happy and self-sufficient, enjoys video games, Disney, and walks
Rita	Email	Grizz, Male	6	ID, drug effects, cleft palate, heart condition, autism	Likes iPad, flags, balloons, YouTube videos, jeeps, hummers, is funny
Alice	Email	Kiki, Female	17	ID, chromosomal abnormality, vision and hearing impairments, low muscle tone, health impairments (Crohn's disease)	Likes music, online videos, dancing, great sense of humor, strong "street smarts"
Elizabeth	Email	Matthew, Male	22	ID, ASD, seizure disorder	Ability to laugh at himself, good at puzzles, Legos, board games, likes baseball, movies, and summer camp
Bill	Email	David, Male	23	ID, ASD, PDD, hip dysplasia, carpal tunnel,	Loves people unconditionally, empathetic,

				scoliosis, hypotonia	connection with animals, enjoys baseball, jets, trains, cartoon video clips
Sara	Email	Emma, Female	30	ID, had a genetic syndrome, skeletal malformations, ASD characteristics, OCD	Remarkable knowledge of sports statistics, gold medal in bowling (Special Olympics), enjoys concerts, rock music, and sports
	Email	Aiden, Male	23	ID, had a genetic syndrome, skeletal malformations, ASD characteristics, OCD	Good at multitasking with technology, knowledge of meteorology, enjoys video games, tracking weather, bowling in Special Olympics (also recently won a gold medal)

Data Collection

We sought detailed information about the individual family experiences of participants, and also description of diet and eating habits from which we could develop themes to compare to the literature for children with SD. Therefore, we designed questions to be open-ended. Semi-structured interviews with general questions and follow up questions informed this study. The interview protocol of 15 initial questions is included in the appendix. Further follow up questions were asked as they arose naturally and as needed for clarification of parent responses and varied due to the individual answers given. There were two or three interviews for each participant. An initial interview provided the bulk of the data with a second interview to ask further questions. A few participants required a brief, third follow-up to clarify information. All participants reviewed final transcripts for accuracy. Interviews were conducted by phone or email based on participant choice. The rationale for allowing this choice was that parents of children with SD lead very busy, complex lives and we wanted participation to be convenient (increasing the likelihood a parent would commit to the study). One participant chose her initial interview to be over the phone, with the interview recorded on a digital audio recorder. We both were present during this interview, which lasted approximately 21 minutes. Follow up for this interview was conducted over email. The remaining 6 parents chose email format and answered our interview questions at their convenience. Transcript review occurred via email for all participants

Data Analysis

Moustakas' (1994) modified van Kaam method of analysis was utilized. This method allowed the grouping of similar topics and refinement of these groupings to show relationships between the experiences described by different participants (Anthony & Weide, 2015). This method was chosen because of clear directions for implementation but openness to adaptation. Additionally, the method lent itself to exploration of experiences and letting themes emerge naturally, reinforcing the notion that those who have experienced phenomena are the ones who should communicate that experience (Anderson & Eppard, 1998; Mapp, 2008; Mpuang, Mukhopadhyay, & Malatsi, 2015).

The Mousakas (1994) van Kaam method generally consists of seven steps for analyzing qualitative data:

1. Preliminarily group elements (ideas) by giving initial codes.
2. Eliminate or exclude redundancies while noting repetitions of ideas.
3. Relate different codes to each other for possible compatibility (combine codes).
4. Present categories with evidence in the participants' own words and validate categories with two or more people judging their validation.
5. Determine potential themes across participants from the categories.
6. Meaningfully relate themes within and across participants to determine compatibility to the phenomena of study. Are individual ideas expressed by the majority of the sample, and compatible with the final themes on the whole?
7. Reflect on the themes in the participants' own words and synthesize findings into essence of the experience

The email interviews were in written form, serving as the transcriptions. The single phone interview was recorded on a mobile device, downloaded as a voice file onto a computer, then transcribed by Brianna using oTranscribe, chosen because it is an open-source and web-based program. Transcripts were saved electronically on the university's approved file storage and sharing system for research and sensitive data; names were changed to pseudonyms chosen by each participant (or chosen by the researchers if directed to do so by participants) to ensure anonymity. Thematic analysis through phenomenological meaning categorization was implemented for each interview by identifying codes, categories, and themes (Rossman & Rallis, 2017).

A code was defined as a single word or short phrase that assigned an attribute to portions of one's data (Rossman & Ralis, 2017). Each separate transcript was analyzed by idea or phrase for each response at the point when the statements changed to a new idea (e.g., the point where a participant changed from talking about one interest of their child, to a completely different one). It was possible to have two sentences with one code, or one sentence with three different codes, as the sentence could contain responses representing multiple, different ideas (e.g., food particularity, resistance to change, and high intake food choices).

Categories were defined as groupings of codes that all represented similar characteristics in one's data (Rossman & Rallis, 2017). Similar codes in our data were placed into categories; subsequently categories were reviewed to determine if any should be combined.

Finally, a theme was described as a declaration of the pattern interpreted within or across categories (Rossman & Rallis, 2017). Our themes emerged by reviewing the categories. The first transcript was analyzed, categorized and themed before moving onto the second to begin the process again. The second was analyzed, categorized, and themed before moving onto the third, and so forth. The researchers returned to transcripts where analysis was complete to reanalyze as new codes emerged. Categories were compared across participants, with themes emerging holistically across participants.

Trustworthiness and Credibility of Data

Several actions contributed to the trustworthiness of the data analysis. All data were preserved to establish an audit trail. Initial and follow up interview transcripts were dated to indicate collection timeline, and also doubled as evidence that data were gathered across time and not in a single “shot,” which is important to making claims in qualitative research (Rossman & Rallis, 2017). All revisions and versions of data code, category, and theme keys were kept in the same secure (locked with no public access) location as the coded transcripts.

All participants were requested to review transcripts for accuracy. Additionally, we made an attempt at triangulation of data through collaborative analysis of transcripts. Discussion of disagreements occurred for codes, categories, and/or themes until 100 percent consensus was reached. Though the researchers could not be inside the participants’ minds, they could search for evidence of participant perspective (Rossman & Rallis, 2017),with the knowledge that researcher experiences and perspectives could influence interpretations of statements. The goal of the Husserlian phenomenological study is understanding someone’s lived experiences while attempting to avoid influencing experiential descriptions and suspend one’s own preconceptions (Mapp, 2008; Parahoo, 2006). The awareness that multiple perspectives can differ and that it may be impossible to suspend all beliefs and biases strengthens reliability of qualitative research and is referred to as researcher reflexivity (Rossman & Rallis, 2017; Saldana, 2015).

Qualitative inquiry is systematic and rigorous when researchers are explicit about their purposes and clear about their perspectives (in this case, through the review of literature). Recognizing that researchers reflect on their own meaning of participant behaviors, and that participants may do the same with the researcher, helps to address reliability and validity of a study (Saldana, 2015).

Finally, attempts were made to establish usefulness of the study by providing detailed theoretical (literature review, researcher background) and methodological descriptions. We described participants and their situations with the hope that readers can make their own determination about whether these results would be useful with similar participants.

Results

When the data were organized, they were grouped into five major themes. All appeared repeatedly, to varying amounts, in most or all interviews. All foods discussed in this section were determined to be recommended high intake foods, recommended moderate intake foods, and foods to limit or avoid, according to guidelines by the AND (2018, 2016c). A theme related to various types and levels of participation in physical activity was an incidental finding in that the focus of the study and initial interview questions was on eating habits. The five themes are as follows:

1. Variety of foods (including those recommended for high, moderate, and low intake).
2. Food particularity, preferences, and inflexibility
3. Health conditions impacting eating routines
4. Family mealtime adaptations
5. Variation in engagement with physical activity

Variety of Foods

Our review of literature revealed prior research consensus that many people with significant disabilities are affected by malnutrition and poor nutrition choices. In contrast, our interviews found that most target children ate a variety of foods, many of which are recommended for high amount of consumption (frequently, three or more times per day) by the AND (2016a, 2016c). However, our target children also often ate foods recommended for limited intake (less than every day), and some recommended for moderate intake (sometimes, once or twice per day). The AND (2018) asserts that "A healthy eating plan that includes all foods is possible." We agree that variety refers to eating a range of foods, from healthy to less healthy, but chosen for needs, preference or pleasure, consistent with recommendations for all Americans.

Foods recommended for high consumption. Some foods are recommended to be eaten frequently or sometimes by AND, and most of the children in the study liked and consumed a number of these foods. Alice reported, for example, that her daughter, Kiki likes a variety of high-intake foods : "We do smoothies with veggies and green apple (no skins), brown rice or pasta, chicken mostly grilled, cubed, boiled or lightly seasoned, fish (salmon, shrimp, or halibut) …eggs…bananas." From this statement, it is clear Kiki likes to eat fruit, vegetables, whole grains and lean proteins, all of which are widely recommended as building blocks to a healthy diet.

Foods recommended for moderate consumption. Foods recommended for moderate intake by the AND (2018, 2016c) appeared repeatedly across interviews. According to Bill, David eats a lot of starchy foods, including "pancakes, English muffins, sourdough bread, tortillas, spaghetti…white rice." When asked for clarification during follow up, Bill confirmed that David would not eat whole grain versions of any starch or grain foods. As stated previously in the literature review, refined grains are recommended by AND (2015) to be less than half of total daily grain consumption. Other participants reported frequency of these moderate intake foods, mostly in the form of refined grains or starches, as well other processed foods combining multiple food groups such as tacos, sandwiches, and spaghetti. The variety within this subgroup of foods contributes to our view of the overall variety in the children's diets.

Foods recommended for limited consumption. Although high intake foods were mentioned most frequently during our interviews, limited intake foods were also very common across all participants' children. As noted previously, AND recommends these types of foods make up a small percentage of calories per day or week, for example as leftover calories after a variety of nutritious foods are consumed and dietary needs met. Rita said that Grizz loves "Pop Tarts…ham, bologna, mozzarella sticks…French fries and hash browns." Due to sodium and sugar content, foods such as these constitute those that should be eaten less often. However, less healthy foods comprise a varied percentage of the whole diet and contribute to variety in food choices.

Food Preferences, Particularity, and Inflexibility

Though the children in this study eat a somewhat varied diet across the AND's "recommended" spectrum, there was still strong indication of narrow food interests or preferences. Some children were reportedly particular about food textures.

Regarding her two children, Sara said, "Textures of food, such as meats, hot and cold foods or anything hard such as carrots or most vegetables, they would not eat." She added, "My children have come a long way regarding eating, however; there are still many things that they dislike." Since texture or food temperature preferences could indicate higher levels of particularity, this quote illustrates such particularity observed by parents.

Also related to restrictive eating patterns, parents described broad groups of foods their children refuse. Rita reported that "Grizz stays within his safe foods (listed as noodles, cheese, apples, grapes, oatmeal, eggs sometimes, pop tarts, some meat). Never straying too far from his home food base…he is not adventuresome in the eating department." Rita's statements represent inflexible behaviors and choice around food.

Furthermore, three of the target children consumed very limited or no fresh fruits and/or vegetables. It was reported that David will only eat corn on the cob and Matthew, even though he is 22 years old, will only eat fruit or vegetables in baby food form. Rita indicated that Grizz likes "apples and grapes," but no vegetables. Not only do these statements give evidence to the general theme of food particularity, they also show that some of the children in the study could have greater dietary variety if they did not refuse entire food groups.

Health Conditions Impacting Eating Routines

We found that many of the children in the study have various health conditions that affect their food choices or eating habits. This was consistent with the literature on those with SD and nutrition complications due to various dietary needs and physical conditions (Gibson et al., 2011; Stewart et al., 2009). For example, Grizz requires tube feedings and special dietary formulas. Sara says, regarding Aiden and Emma (who both have the same genetic syndrome), "When they were young, they both had a difficult time with food. Due to their condition, swallowing and chewing was difficult and eating became more of a necessity than a pleasurable experience for them.”

Kiki has Crohn’s disease and requires a restrictive diet to reduce its symptoms. Alice continued to explain Kiki’s digestive difficulties:

> Lately, she goes in waves of eating and not eating. Since the Crohn’s affects your entire body from mouth to anus there are times when she won’t eat because she is in pain. Then when she is feeling better she will tend to eat too much! Then there are the times when she eats (regular amount) and when she bears down to poop she ends up throwing up all of her meal. Then she won’t eat right away; but when she finally eats, she will gorge herself since she is so hungry. It really is a vicious circle!

The AND asserts that all foods have room in a healthy diet. However, these statements do not consider needs inherent to some children with SD. Some have physical conditions that prohibit or limit certain foods. The combination of medical conditions and personal preferences that restrict diets create complex barriers when encouraging children to eat a variety of nutritious foods.

Family Mealtime Adaptations

Parents in our study reported attempting to change some of their children’s eating habits, as well as developing strategies to address the dietary challenges their children have. According to Elizabeth, she will make a separate meal for Matthew if he does not like what they are eating. She also stated, “I would love to see him eat fresh vegetables. He won't even try most of the vegetables but at least he's polite as he's refusing to do it, ‘No thank you’ over and over.”

Other reported strategies included repeated attempts to introduce foods (with mixed levels of acceptance by the children), allowing the child to choose from what is made, and the whole family changing their diet to only eat what the child can eat (due to medical needs). It appears that families face a number of challenges in feeding their children a varied diet. The strategies discussed by different participants seemed tailored to the needs of the child, while attempting to fit those needs into the family routine.

Variation in Engagement with Physical Activity

Diet and exercise are widely assumed interdependent in increasing and maintaining health. Despite sedentary lifestyles being a problem reported in the literature (Jinks, Cotton & Rylance, 2011), we had a serendipitous finding related to the children in our study participating in a wide range of physical activities. Parents described most children as enjoying and participating in at least one sport or physical activity with two of the children getting regular exercise. This frequent physical activity is contradictory to research that children with SD live sedentary lifestyles or have low levels of physical activity compared to peers (Grumstrup & Demchak, 2017; Humphries, Traci, & Seekins, 2009; Reeve, Ashe, Farias, & Gostin, 2014). Rita reported that Grizz likes his “bike, basketball, and will walk a full mile.” Amber “walks every day and tries to be active,” according to Dana.

Though the remaining children were reported to enjoy physical activities, these were seasonal or limited. Bill said David “enjoys playing Wii, especially baseball and bowling games. He plays baseball in the Challenger Little League senior division.” Kiki goes to dance class once per week and swims seasonally. Two other children compete in Special Olympics. If physical activity is seasonal or sporadic in nature, it is difficult to establish a consistent routine in which to gain frequent exercise. Though parents freely shared with us the activities their children enjoy or participate in, low frequency of exercise was reported as a concern by some.

Elizabeth said, “my concerns are that with the fast food and sweet tooth he has he will continue to put on weight. Other than walking he doesn’t get much exercise.” Elizabeth’s statement conveys concern for lack of exercise due to Matthew’s preference for sugary foods coupled with low opportunity and/or interest to be physical. Other parents blamed complications created by medical issues in the children getting adequate exercise. The variety of statements made about children’s physical activity illustrates a variety of reasons special needs can contribute to levels of exercise.

Discussion

It was evident that children with SD in this study are unique individuals not without challenges. Parents worried if physical activities their children enjoy are enough. Many of the foods the children like should be limited according to the AND. Many of the foods recommended for high intake by AND were lacking in these children’s diets. Results consistent with other findings include overweight/obesity (Rimmer et al., 2010; Salaun & Berthouze-Aranda, 2011) and underweight and malnutrition (Franssen et al., 2011; Maaskant et al., 2009). However, our results yielded a less common finding: individuals with ID do exhibit some desirable health behaviors, similar to findings in a review on successful health initiatives by Heller, McCubbin, Drum, & Peterson (2011).

Rimmer et al. (2010), Salaun and Berthouze-Aranda (2011), and Grumstrup and Demchak (2017) reported that children and adolescents with SD were more likely to be overweight or obese than their typical peers. Three children in this study were reportedly overweight or obese. Matthew and Amber are overweight and Emma is in the obese range of BMI.

Additionally, our results supported Franssen et al. (2011) who found that many individuals with SD are malnourished and/or underweight, and Gibson et al. (2011) who described eating challenges due to oral motor difficulties. In our study, Aiden has a history of being underweight and deficient in many nutrients because he struggles with oral motor strength and sensitivity to textures. Additionally, even though David is at a healthy weight, Bill expressed concern over the amount of nutrients David is getting and stated that he requires supplements. Grizz requires a supplemental formula and tube feedings to ensure he is getting adequate nutrients.

Gibson et al. (2011) and Heller et al. (2011) discussed the barriers to health that people with SD face, such as limited knowledge, narrow diet preferences, medication side effects, and oral motor difficulties. Narrow food preferences and refusal behaviors, such as some displayed by children in our study, are commonly reported in the literature pertaining to children with disabilities (Gentry & Luiselli, 2008; Keen, 2008; Knox et al., 2012; Koegel et al., 2012). Narrow food preferences can contribute to reduced amounts of healthful foods in the diet, a possible reason why those with SD are reported so frequently to have dietary issues. Our study found narrow diets with most participants' children, often reportedly related to textures. Emma and Aiden also have motor difficulties from their physical conditions and Kiki has a restricted diet due to Crohn's.

Our study included many statements from participants about involvement with their children's diets. However, results indicated that despite parent assistance, the children did not always reduce unhealthy habits or add healthy ones. David and Matthew are reportedly eating the same foods they have their entire lives, refusing new foods. Several published studies suggested that diet and weight of people with SD can be influenced by parent or caregiver intervention and remaining in the family home (Fodstad & Matson, 2008; Hamilton, Hankey, Miller, Boyle, & Melville, 2007; George, Shacter, & Johnson, 2011). In contrast to this literature, parents of both David and Matthew were reportedly unsuccessful in attempts to modify their children's diet toward more healthy choices. Elizabeth was able to encourage her children to eat more foods over time, but this was a slow process and Emma and Aiden still refuse many foods.

Parents report continuing attempts to add new foods or encourage the children to taste different things. For example, Alice reported that Kiki was able to overcome some textural aversions to foods with occupational therapy, but still dislikes certain food consistencies. Grizz was reported to refuse most new foods; however, due to his age, he still has plenty of time for his parents to continue attempts at trying new foods. The aforementioned literature on parent involvement in habit change, as well as experiences such as Sara's (Aiden and Emma both eat more foods than when they were younger) may predict that further encouragement from parents could expand Grizz's acceptance of new foods.

Although there was much agreement between our results and the literature, this study revealed unique insights. We identified resistance to change as an additional barrier to those documented in the research. Five of the participants reported that their children were resistant to change to varying degrees, though Emma and Aiden both changed their diets somewhat to include greater variety and Kiki overcame some issues with textures before being diagnosed with Crohn's.

There were also themes indicating strong health habits that refuted literature on children with SD. For example, the theme of food variety was did not align with past findings. Our participants' children face many barriers to healthy diets and lifestyle, but some healthy habits emerged repeatedly. Nutritious "frequently recommended" foods and opportunities for physical activity were prominent enough that two themes featured what was going well. Amber was unique in that she reportedly eats virtually all foods offered to her

The prominent theme about physical activity was also unique. The literature on physical activity for individuals with significant disabilities indicates that they exercise less than typically developing peers and amount of activity declines as children move from adolescence into adulthood (Shields, Dodd, & Abblitt, 2009). Furthermore, reduced opportunities for activity are reported as problematic in the research (Casey, Rasmussen, MacKenzie, & Glenn, 2010). We found that all children in the study participated in and enjoyed at least one physical activity. Some were active regularly, which is not consistent with messages throughout the literature. However, our findings were consistent with Shields et al. that older children and adults are not getting as much exercise as the younger children. Also, most children participated in seasonal, limited, or inconsistent exercise and had a variety of reasons for not getting more. These possible reasons include low interest, possible lack of opportunity, low mobility, or health conditions that create illness.

Limitations

Possible limitations for this study include sample size and homogenous demographics of participants. The choice given to participants to interview over email is also a limitation. It is possible that we did not get the amount of information if someone had to type it versus the ease of speaking it. However, we felt that the email option was appropriate because parents of children with disabilities (and all parents) lead very busy lives. In addition, participants may have felt comfortable writing their answers, reflecting on them, and editing before submitting. However, editing the information before we saw it could also be a limitation of the study in that participants might have eliminated relevant information for any number of reasons (e.g., fear of being judged or viewed negatively).

In addition, there is a risk of familiarity bias and skewed interpretation of results, as we knew all participants. Some researchers suggest that it is important in qualitative research to balance trust and relationship-building with ability to limit judgement in interpretation of data (Rossman & Rallis, 2017; Shenton, 2004; Silverman, 2000). In our study, it was possible that we subconsciously wanted to find positive statements in the interviews because we cared about the participants and their children. Multiple attempts to contact parents with whom we did not have a personal relationship were made, but largely unsuccessful.

Implications

The studies about what is working in health interventions for people with SD reviewed in Heller et al. (2011), were conducted in 2009 and before, leaving a nine-year gap prior to the present study. This presents a time period lacking information about individuals with significant disabilities who are leading healthy lifestyles. Furthermore, that review focused largely on quantitative research. Our study is important because it describes diets of individuals with significant disabilities and family experiences in detail.

It provides new information about why some children have certain eating behaviors, how parents feel about the eating habits, and at what health habits their children are succeeding**.** We also uncovered important insight into mealtime adaptations and strategies developed by the participants in response to their experience with their children’s diets. It appears they perceived the children’s habits as needing improvement and so accordingly attempted to make changes while still meeting the needs of the family.

Overall, our results support suggestions that individuals with significant disabilities have distinct diet and eating behaviors from the general population (Bailey & Angell, 2005). Although mealtime issues are not included in the definition of ID, IDD, or MI, these problems continue to be documented in the literature. Findings from this study, like Fodstad and Matson (2008), suggest that eating problems persist into adulthood and should be a major area of concern due to widely established links between diet and overall health. It is evident from our study, that parent intervention in habits they consider problematic does not always yield change.

More research is needed to explore experiences with health behaviors from the perspective of adults with disabilities. A phenomenological study interviewing adults within the population of those with significant disabilities could be valuable. Would descriptions of eating and exercise habits from the individual’s perspective provide additional insights? Furthermore, quantitative research with a larger sample size could be conducted with adults with significant disabilities to explore prevalence of mealtime or diet issues. Larger quantitative studies, such as survey designs or comparative work between different groups could yield a more accurate picture of a population.

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Appendix: Interview Guide

1. Can you tell me about your child?

a. What are his/her interests?

b. What makes him/her unique?

c. What is he/she good at?

d. What are his/her challenges?

2. What does your child like to eat?

a. What are his/her absolute favorite foods?

b. Has this changed over time?

3. What (if anything) does your child dislike to eat?

a. Are these foods something you have attempted to get him/her to eat?

b. Has this changed over time?

4. How different would you say is your child's diet (if at all) from the rest of your household?

a. Can you describe the differences (if any) between your child's food choices and his siblings'?

b. Can you describe the differences between your food choices and your child's?

5. Do you have any concerns about your child's eating habits?

Chapter Four: Nutrition Education for Students with Significant Disabilities Using System of Least Prompts Delivered via Remote Instruction

The transition from high school to adulthood is a crucial time for establishing adaptive behavior skills for independent living (Pember & Knowlden, 2017). To address such behavior, recommended programming for students with significant disabilities (SD), such as intellectual and multiple impairments (MI), includes functional skills that can be used independently beyond the classroom (Alqahtani & Schoenfeld, 2014). Such behaviors encompass many activities including but not limited to daily living, personal care, healthcare use, transportation use, and vocational participation. Food-related knowledge and behavior, addressed through nutrition education (NE), are subsets of the wide variety of functional skills and include a range of behaviors and competencies on their own.

Contento et al. (1995a) defined NE as "any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition-related behaviors conducive to health and well-being" (p. 308). Food choices and dietary behaviors developed in childhood and adolescence are generally more difficult to change in adulthood (Perera et al., 2015). Inadequate nutrient intake is associated with poor academic performance and chronic diseases later in life (Anzman-Frasca et al., 2015; Bazzano, 2006; O’Dea & Mugridge, 2012; Sofi et al., 2013). NE in schools can provide children and teens with the information and skills to develop healthy food choices and dietary behaviors (McKenna, 2010), shaping food habits that ultimately influence health and academics (Bazzano; Contento et al., 1995b). An abundance of evidence suggested this is especially crucial for individuals with SD, given that they experience increased adverse health conditions and behavior compared to same-age peers (Gibson et al., 2011; Grumstrup & Demchak, 2017; Hinckson et al., 2013; Phillips et al., 2014; Stewart et al., 2009).

Past Interventions

Past research for children and adolescents with SD focused on improvement in mealtime behavior, skills (Bailey & Angell, 2013; Qvarfordt et al., 2009), and food flexibility, such as expanding amount or type of foods a child will eat (Johnson et al., 2008; Koegel et al., 2012). Other researchers focused on a variety of health outcomes through programs designed to change behavior. Hinckson et al. (2013) investigated how motivational strategies, nutrition education, and physical activity training affected various measures of health for children with intellectual disability (ID) in New Zealand. Researchers in Sweden addressed nutrition knowledge for adolescents with ID through a group comparison design (Wallén et al., 2013). Save for Bailey and Angell, all of the above studies targeting improvement in eating behavior, independence, or nutrition knowledge focused on students other than those with ID, intellectual / developmental disabilities (IDD), or MI or were conducted in a country outside the U.S. These findings further indicate need for research on American school children and adolescents with SD.

To this end, Grumstrup and Demchak (2019) conducted a systematic review to identify and summarize the literature on NE for this population. Thirty-five individual intervention studies were identified that aimed to increase a variety of food knowledge and behavior in school settings for students with SD in the U.S. Cooking was a prevalent dependent variable (Ayres & Cihak, 2010; Graves et al., 2005; Johnson et al., 2013; Mechling et al., 2008; Mechling et al., 2010; Mechling & Gustafson, 2009; Schuster &

Griffen, 1991; Trask-Tyler et al., 1994). Functional grocery shopping skills were another commonly-studied outcome (Bouck et al., 2012; Douglas et al., 2015; Douglas et al., 2018). Still other researchers focused on literacy skills applied to food vocabulary and comprehension (Coleman et al., 2012; Collins et al., 1995; Douglas et al., 2011). No studies were identified that targeted food information, food facts, or choice-making, skills especially crucial in preparing adolescents to transition from high school and live with as much independence as possible (Alexander et al., 2018; Humphries et al., 2009; Jobling & Cuskelly, 2006; Marks et al., 2010; Medlan & Peterson, 2000; Noland et al., 1986; Pember & Knowlden, 2017; Reed et al., 1992; Reeve et al., 2015).

The review (Grumstrup & Demchak, 2019) also evaluated the quality of research according to established review criteria by What Works Clearinghouse (WWC; 2017) and Horner et al. (2005). Six studies (17%) of 35 met WWC standards with or without reservations, with four studies having moderate or strong evidence of causal relation. Three of these four studies focused on various methods (e.g., video prompting, symbol prompting, response prompting) to increase cooking skills (Douglas et al., 2011; Griffen et al., 1992; Mechling & Stephens, 2009). The fourth study used constant time delay to teach selection of the lowest price grocery item (Sandknop et al., 1992). Twenty-nine studies (82.86%) did not meet WWC designs standards and were, therefore, automatically designated to have no evidence of causal relation.

It is also worth noting that among studies identified in the Grumstrup and Demchak (2019) review, most studies (approximately 75%) were published before 2010. This suggests lower priority or social importance for these dependent variables over others, despite the abundance of documentation on adverse health outcomes for individuals with SD. Lack of high-quality experimental intervention research suggests a need to investigate NE interventions while adhering to established quality indicators for design and dissemination.

NE Recommendations Addressed within the Literature.

Based on recommendations from numerous researchers (Contento, 2012; Forgac, 1999; Hayes et al, 2018; Lytle, 1994; National Academy of Sciences, 2013; The Society for Nutrition Education and Behavior, 2016; Watson, 2001), NE should:

- Include knowledge and facts.
- Incorporate goal setting, goal evaluation, and choice-making.
- Be delivered by an instructor informed about current research and recommendations on NE as well as general pedagogical and program evaluation skills.
- Be delivered for sufficient duration and intensity, and with enough instructor feedback to ensure behavior change.

These recommendations apply to all children, including those with SD (Adolfsson et al, 2008; Everett et al., 1994; Gibson et al., 2011; Hinckson et al., 2013; Noland et al., 1986; Reed et al., 1992; Stewart et al., 2009; Wallén et al., 2013). To address such recommendations, abundant intervention research was conducted for the general population in schools (Alexander et al., 2018; Baskale & Bahar, 2011; Cespedes et al., 2013; De Bock et al., 2012; Hovland et al., 2010; Katz et al., 2011; Lazorick et al., 2015; Mikkelsen et al., 2014; Nemet et al., 2013; Stock et al., 2007; Witt & Dunn, 2012).

There were also many studies conducted with students with SD that targeted various outcomes. Some of these studies followed previous researchers advocating that specific methodologies and outcomes be investigated (Aeschleman & Schladenhauffen, 1984; Collins et al., 1995; Hall et al., 1992; Haring et al., 1987; Nietupski et al., 1983; Schuster & Griffen, 1991). Suggested outcomes for study that were subsequently investigated included cooking (Ayres & Cihak, 2010; Graves et al., 2005; Johnson et al., 2013; Mechling et al., 2008, 2010; Trask-Tyler et al., 1994), grocery shopping (Bouck et al., 2012; Douglas et al., 2015; Douglas et al., 2018), food vocabulary, and food ordering and purchase (Coleman et al., 2012; Douglas et al., 2011).

Identifying strategies for generalizing mastered skills (grocery shopping and ordering/purchasing food items) across settings was also recommended within older studies (McDonnel & Horner, 1985; McDonnel et al., 1984). These suggestions were followed by two teams of subsequent researchers (Ferguson & McDonnel, 1991; Morse & Schuster, 2000).

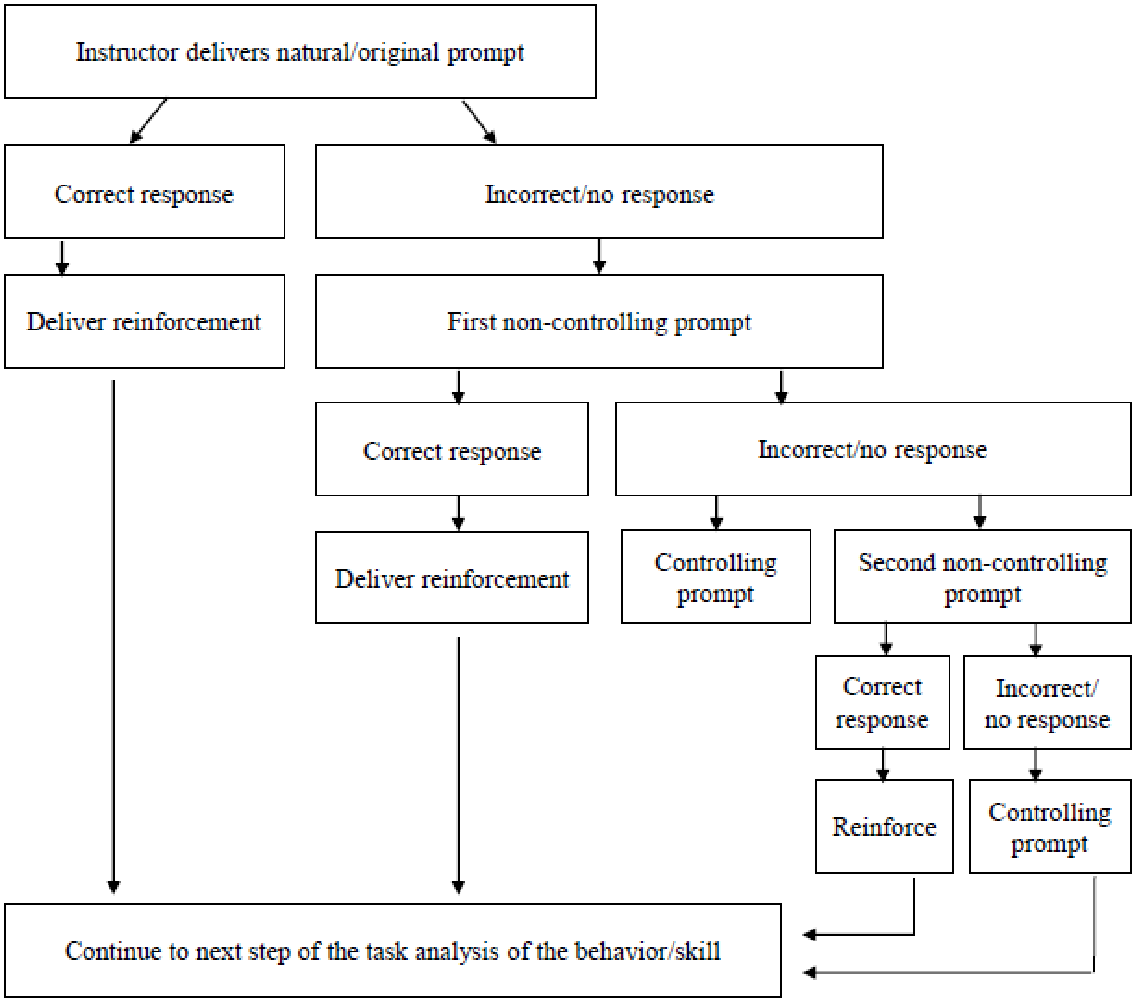
Mechling et al. (2008; 2010) suggested researchers focus on interventions designed to reduce dependence on others and increase markers of self-determination for students with SD, but no school-based NE interventions were identified teaching NE facts or choice-making to students with SD in the United States. This recommendation by Mechling et al. has not been followed; documentation of health problems and risks for this population persists (Basch, 2011a, 2011b; Lin et al., 2010; Marks et al.,2010; Michael et al., 2015; Salaun & Berthouze-Aranda, 2011; Scott & Havercamp, 2016; Wallén et al., 2013), as does lack of research on effective interventions to address such issues. Therefore, a strong case is made for addressing such behaviors in schools utilizing promising practices, such as response prompting procedures.

Response Prompting: System of Least Prompts

According to MacDuff et al. (as cited by Walte et al., 2017), all learners, regardless of diagnosis, need frequent practice and feedback to develop essential skills. Teachers should provide frequent and immediate feedback and allow many opportunities for skill practice and generalization across multiple settings to ensure students form functional responses (Vince Garland et al., 2016). The ultimate goal is to ensure that the skills can be performed independently, without additional cues from others (MacDuff et al. as cited by Walte et al.). The system of least prompts (SLP) is an evidence-based practice for individuals with SD (Shepley et al., 2019). The SLP employs a pre-set prompt hierarchy, after the opportunity for the learner to respond independently, during instructional sessions beginning with the least intrusive (e.g., gestural) and moving to the most intrusive (e.g., physical) to ultimately ensure a correct response (Lee et al. 2016; Manley et al., 2008). The steps for implementing the SLP, according to Walte et al., are shown in Figure 1.

Figure 1

Flowchart for System of Least Prompts Process



Purpose

The purpose of this study was to investigate the efficacy of SLP within a remote environment to teach a NE skill to secondary students with SD. This skill was choosing the food representing the missing food group within an array of photos representing four different food groups. In this manner, the participant completed a balanced “meal” according to Academy of Nutrition and Dietetics (AND; 2018), U.S. Department of

Health and Human Services and Department of Agriculture (2020) guidelines for adolescents, and the MyPlate model (USDA, 2019).

Research Question

This study investigated the following question: Is the system of least prompts (SLP), utilized over a remote meeting platform (Zoom), effective to improve performance in choosing separate food items from basic food groups in order to complete a balanced “meal?”

Method

Participants

Participants were selected through requests to a local public school district. Inclusion criteria were that students volunteer to be in the study, be between 13 and 22 years of age, and diagnosed with ID alone or combined with other diagnoses. Participants were required to have ability to verbally respond to a question or cue, due to requirements of participating remotely (e.g., touching an answer or pointing to their screen was not possible). Finally, it was required that participants understand photos. Exclusion criteria were students that did not meet all of the above inclusion criteria.

The four participants were 15-21 years of age and were eligible for special education services under intellectual disability or multiple impairments. One participant, P.J., received previous instruction on foods belonging to specific food groups within an inclusive health class setting. The three remaining participants had received no known instruction on the targeted skill. See Table 1 for demographics. Participants had similar intellectual and adaptive behavior profiles and understood photographs according to a symbol assessment (Beukelman & Mirenda, 2013).

Table 1

Participant Demographics

Participant	Age, Gender	Race/Ethnicity	Eligibility	IQ, Adaptive Behavior
Lena	16 years, F	Latina	ID	52[a], 63[b]
Luminati	15 years, M	Latino	ID	63[c], 62[b]
Kacey	17 years, F	Pacific Islander	ID	70[d], 62[e]
P.J.	21 years, F	Latina	MI	70[c], 65[b]

Note: [a]WISC-V. [b]Adaptive Behavior Assessment System. [c]Kaufman Assessment Battery for Children. [d]Wechsler Nonverbal Scales of Ability. [e]Vineland Adaptive Behavior Scales

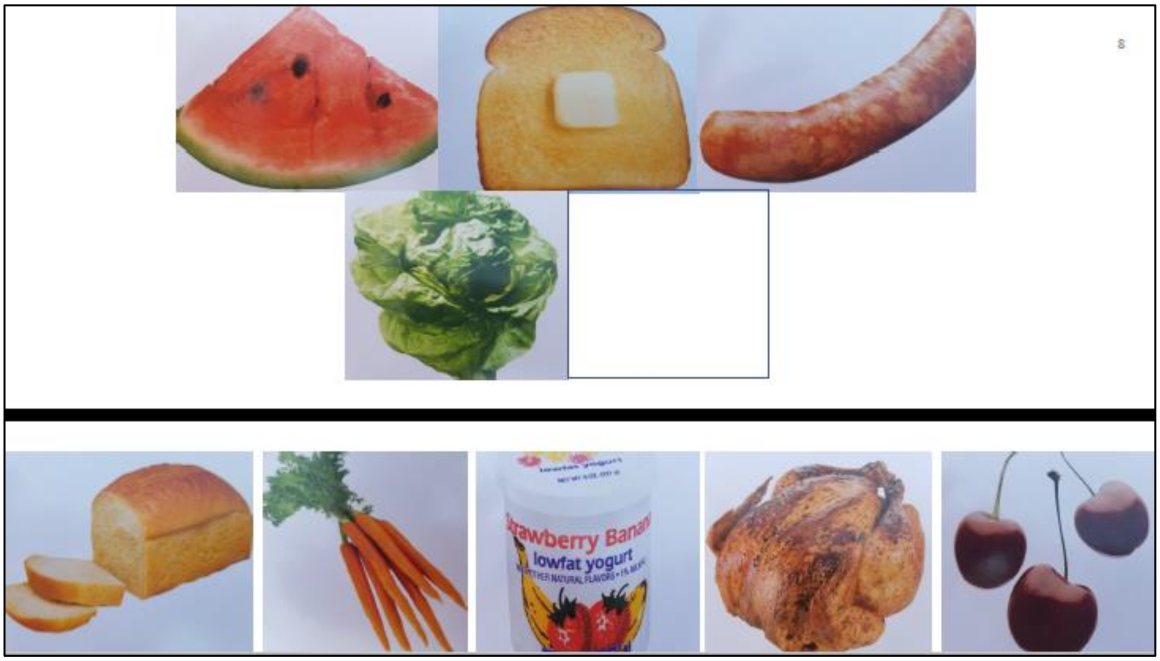
Setting and Materials

The school was a Title I high school of approximately 1,180 students in a large Western state school district within an urban area. The educational setting was a self-contained special education program focusing on academic, adaptive, vocational, communication, and social behavior. The classroom had 15 students and seven adults, including the classroom teacher and paraprofessionals. Because of health and safety restrictions due to COVID-19, the study took place online via a remote meeting platform (i.e., Zoom). During sessions, the student sat either at the teacher's computer or in a quiet area of the classroom with a tablet. On days when schools were conducting virtual learning due to air quality concerns from nearby wildfires or COVID-19 containment precautions, students participated from home. One student, who had opted for distance learning at the time of the study due to COVID-19, participated from home for the entire study. The researcher conducted all sessions with the participants from a remote location.

Presentation software (i.e., PowerPoint) was used to present one slide, or trial, at a time individually to participants. Sixteen different slideshows with 160 unique slides were used throughout the study. Slides depicted photos of individual foods spanning all main food groups. The student was shown one “meal” per slide in the online platform. Also on the slide were five choices per trial of the possible food missing (i.e., one food from each group among the answer choices). A sample slide for one trial is shown in Figure 2.

Figure 2

Sample Slide Depicting One Trial



Dependent Measure and Response Definitions

Dependent Variable: Meal Building

The DV measure for this study was as follows: When presented with a photo depicting a group of four foods (representing four different food groups), the participant chose a food item representing the food group that was missing in order to “build” a balanced meal. See Figure 2 and Appendices A and B. A correct response was defined as the student stating the correct food item, stating the correct food group the target item belongs to, or giving an accurate description of the target item (e.g., “the round red ones” for cherries). An incorrect response was defined as student choosing a food from a group that was already displayed on the “plate”, or if the student expressed refusal. Incorrect responses also included the student giving a response that was not one of the foods or groups in the choice lineup (e.g. “snack,” “drink”).

Data Collection

Data were collected by the researcher during each session. The dependent variable (DV) was percentage of independent, accurate responses within each session throughout all conditions for each participant. Percentage was calculated by dividing the number of correct trials by the number of total trials for the session, then multiplying by 100. Data were collected continuously (i.e., every session) during the intervention condition until mastery was reached for each participant.

Mastery criterion for the DV was a minimum of 80% accuracy for three consecutive sessions. Criteria for beginning intervention with a lower tier (following at least three consecutive baseline sessions in that tier) was a previous tier reaching mastery or marked changes in trend, level, and immediacy of IV, whichever occurred first.

Interobserver Agreement

Inter-rater reliability or interobserver agreement (IOA) using the point-by-point method was performed for a minimum of 30% of sessions for each condition (i.e., baseline, intervention, and maintenance) across each participant. IOA percentage was calculated by dividing the number of agreements by the total number of agreements plus disagreements, multiplied by 100. The second observer was a university researcher familiar with single case research and students with significant disabilities. The second observer was trained in study protocols including the SLP, codes for each prompt, correct and incorrect responses, and how to calculate percentage of correct responses for each session.

IOA for baseline was 100% for all participants. For the intervention phase, IOA ranged from 80% to 100% (M = 98%) across participants. Finally, for the maintenance condition, IOA was 100% across participants.

Independent Variable

The independent variable (IV) was the SLP with specific praise for prompted and unprompted correct answers, implemented following the stabilization of baseline data. See Figure 1 for the process of implementing the SLP. The specific prompt hierarchy and definition for the dependent variable are detailed under Procedure.

Procedural Fidelity

Procedural fidelity data were collected for a minimum of 30% of sessions for each condition across all participants. A list of researcher behaviors related to the SLP and the correct use of materials was utilized (See Appendices A and B). A percentage of steps implemented correctly was calculated by dividing the number of correct steps by the number of total steps, then multiplying by 100. Procedural fidelity observations were conducted by a university researcher familiar with single case research and students with significant disabilities.

Procedural fidelity ranged from 94% to 100% (*M* = 99.65%) across participants in the baseline phase. For the intervention phase across participants, procedural fidelity ranged from 94% to 100% (*M* = 98.25%). Lastly, procedural fidelity within the maintenance phase ranged from 98% to 100% (*M* = 99%) across participants.

Social Validity

Social Validity has three components: treatment goals, procedures, and outcomes (Carter, 2007; Wolf, 1978). The Intervention Rating Profile 15 (IRP-15) incorporates all three components across its 15 items and was developed for use with school interventions (Martens et al., 1985). The questionnaire, adapted to reflect that the intervention is for instructional purposes rather than to address problem behavior, was completed by the classroom teacher collaborating with the researcher. Additionally, an adapted version of the Children's Intervention Rating Profile (CIRP; Witt & Elliott, 1985) was administered to participants following completion of the study. The scale is at a fifth-grade reading level and so it was modified as needed to include visual supports and replace more difficult vocabulary with simpler synonyms. It was also an option to have the CIRP read aloud to the student, and the student point to a visually supported answer for each question.

Design

This study implemented a multiple probe design across participants. It was chosen because it is not necessary to withdraw an effective intervention for this design to demonstrate experimental control. Furthermore, target skills for this study, like most academic skills, are not reversible. It is assumed that behaviors students do not already possess will not be acquired by introducing the activity repeatedly without direct instruction (Gast & Ledford, 2014). Additionally, multiple measures of the skill without intervention could cause fatigue or boredom and result in problem behaviors.

Multiple probe designs are compatible with classroom instructional activities because they allow for simultaneous data collection across participants, which is typical in a classroom setting. This design is flexible and rigorous in controlling threats to internal validity by staggering the introduction of the IV across tiers (e.g., behaviors, participants). Procedural fidelity is also embedded to measure how accurately the researcher is carrying out the procedure as designed (Gast & Ledford, 2014).

There were a minimum of five data points for each baseline condition across participants to start. For the second and subsequent participants, the last baseline data point was required to overlap with the first data point of the preceding participant's IV condition. Continuous baseline data were collected for the first tier (i.e., first participant). Once either criterion (described under Data Collection) for introducing the IV to the next participant was reached for the DV in tier one, at least three baseline data points were collected then the IV was implemented for tier two, while maintaining baseline procedures for the third and fourth tiers. Baseline conditions for subsequent tiers (i.e., two through four) were maintained at this time, with baseline probes every sixth session. Any time consecutive baseline data were being collected prior to intervening in a tier, the lower tiers also received consecutive baseline data probes.

Procedure

Pre-baseline Symbol Assessment and Instruction on Food Symbol Identification

Prior to baseline, all participants were assessed according to symbol understanding assessment detailed by Beukelman and Mirenda (2013). This assessment determined whether students could understand object, partial object, photo, and/or line drawing symbols. For this study, participants were required to understand photographs. Also prior to baseline, all participants were assessed on current knowledge of each food symbol (photo) and to which food group each photo belonged. Training occurred to teach students to categorize all target symbols into the correct food groups.

Baseline

The attention cue for the DV in baseline was “Are you ready?” or “Are you ready to work?” For baseline, encouraging statements (e.g., “keep going, you’re working hard…”) were delivered, irrespective of correct performance, every five trials. No other feedback was given.

The DV was choosing the missing food from each “meal” depicting the four other food groups to complete a balanced meal. There were 10 trials (i.e., 10 “meals,” each with a missing food group) per baseline session, with one trial consisting of the participant making one food choice.

Photos of four foods were shown on a slide to the student using screen sharing in Zoom. The instructor delivered the attention cue, then the instructional cue, “tell me what food is missing to make a balanced meal,” or something similar. No other cues were given at this time. A correct (+) trial was defined as the participant choosing the food representing a group that was missing, naming the correct group the food is in, or giving an accurate description (e.g., “nuts” for almonds). A trial was incorrect (-) if the student chose a food already represented in the group of photos (i.e., the “meal”), did not respond, gave an answer that was too vague (e.g., “snack,” “treats”), or left the work area. See Appendix A for detailed baseline procedures.

Intervention

Consistent with baseline, the attentional cue during the intervention condition was "are you ready?" or "are you ready to work?" One trial consisted of photos of four foods from four different groups, with one food group missing from that "meal/plate." The instructional cue was "Tell me what food is missing to make a balanced meal" or similar. The student response consisted of choosing the one food representing the missing group needed (from a field of five, one food representing each group).

If the student had no response or responded incorrectly within 5 seconds, the system of least prompts was employed to ensure the correct answer was reached.
The prompting hierarchy was as follows:

I: Independent/correct: Student verbally states actual food, group it belongs to, or accurate description, e.g. "green spiky thing" for artichoke
IV: Indirect verbal: "You already have a (group). What else do you need?"
DV: Direct verbal: "Remember, the five groups are protein, grains, vegetables, fruits, and dairy."
M: Model: "You need to pick a (food), that's what was missing" while gesturing with cursor

The researcher moved through the prompt hierarchy for each trial depending on if the student answered correctly or incorrectly. Upon no response or an incorrect response, the first prompt in the hierarchy was presented, indirect verbal. If the student appeared to be processing (eyes moving across the screen, making noises indicative of getting ready to answer, such as "hmmm…" or "I think it's…"), the researcher waited for the student to answer, even if it took longer than 5 seconds. If the student answered correctly, descriptive praise was provided and the next trial immediately presented. If the student did not respond within 5 seconds (with no indication of processing or getting ready to answer, as described above) or responded incorrectly, the next prompt in the hierarchy, direct verbal was presented. If the student then performed correctly, descriptive praise was provided and the next trial presented, and so forth.

For error correction (any response that was not a food, a group, or accurate description), the researcher said "_ is not a food group" and moved to the next prompt in the hierarchy. At the end of each trial, the researcher summarized that the correct food or group was chosen because it was missing or stated that the student had helped to build a balanced meal. Also after each trial, the most intrusive prompt required was recorded on the data sheet. Descriptive praise was provided for all correct responses, prompted and unprompted. Every five trials, encouraging statements ("keep going, you're working hard…"), were delivered (whether correct or not) during intervention trials. See Appendix B for intervention procedures.

Remediation. It was determined that one student required remediation part way through intervention due to lack of data stability and progress. The specific food groups that had the most errors overall, as well as the percentage of time that specific foods were being correctly chosen compared to number of opportunities presented were analyzed. It was determined that the student was consistently making errors related to what group a target food belonged.

For remediation sessions, the system of least prompts was used to teach individual target foods and their appropriate groups. The attention cue was "are you ready?" One slide was presented at a time depicting a single food photo. The instructional cue was alternating “what food is this” or” what group is this in?” (given one time each per slide). After 5 seconds, if the student did not respond or responded incorrectly, the first prompt in the hierarchy was presented. The prompting hierarchy was as follows:

- I: Independent
- IV: “This isn’t a (repeat incorrect food or group). Try again.”
- DV: Offer two choices: “Is this a (target food/group) or (distractor)” *correct choice or distractor in random order each time prompt delivered*
- M: Say the correct food or group

Specific verbal praise was given for prompted and unprompted correct responses. Each session consisted of 20 trials, with two steps per slide (name food and name group), and two representatives from each of the five groups targeted in each slideshow (10 foods per session). Different combinations of foods were presented in each slideshow and each session. Incorrect responses were defined as the student not responding, saying incorrect food or group, or leaving work area. Error correction was employed if student said an answer that was not directly verbalizing a food or group. The researcher then said “_ is not a food/group” and delivered the next prompt in the hierarchy. Following mastery within remediation (a requirement of three consecutive sessions with 90% correct or better), intervention on the dependent variable resumed.

Maintenance

At least one maintenance probe was collected for all four participants on the sixth day following the conclusion of intervention, then one additional probe 6 weeks later. Though the researcher implemented all sessions, training for the teacher took place to ensure that the intervention could continue with a typical person familiar to the students and to facilitate skill maintenance in the natural setting, also enhancing social validity.

Data Analysis

Data were graphed according to a multiple probe design and data patterns were analyzed using visual analysis procedures with regards to trend, level, immediacy of change, variability, overlap expressed as percentage of non-overlapping data (PND), and consistency of similar phases, according to established guidelines (Horner et al., 2005; Kratochwill et al., 2013; Lane & Gast, 2014; Ledford et al., 2018). Trend was calculated using the split middle method, whereby the middle point splits the data series in half, then the mid-date and mid-rate of each half connect to form the trend line. Data variability was calculated by determining the percentage of data points within a stability envelope of ±25% of the median and along the trend line for each phase.

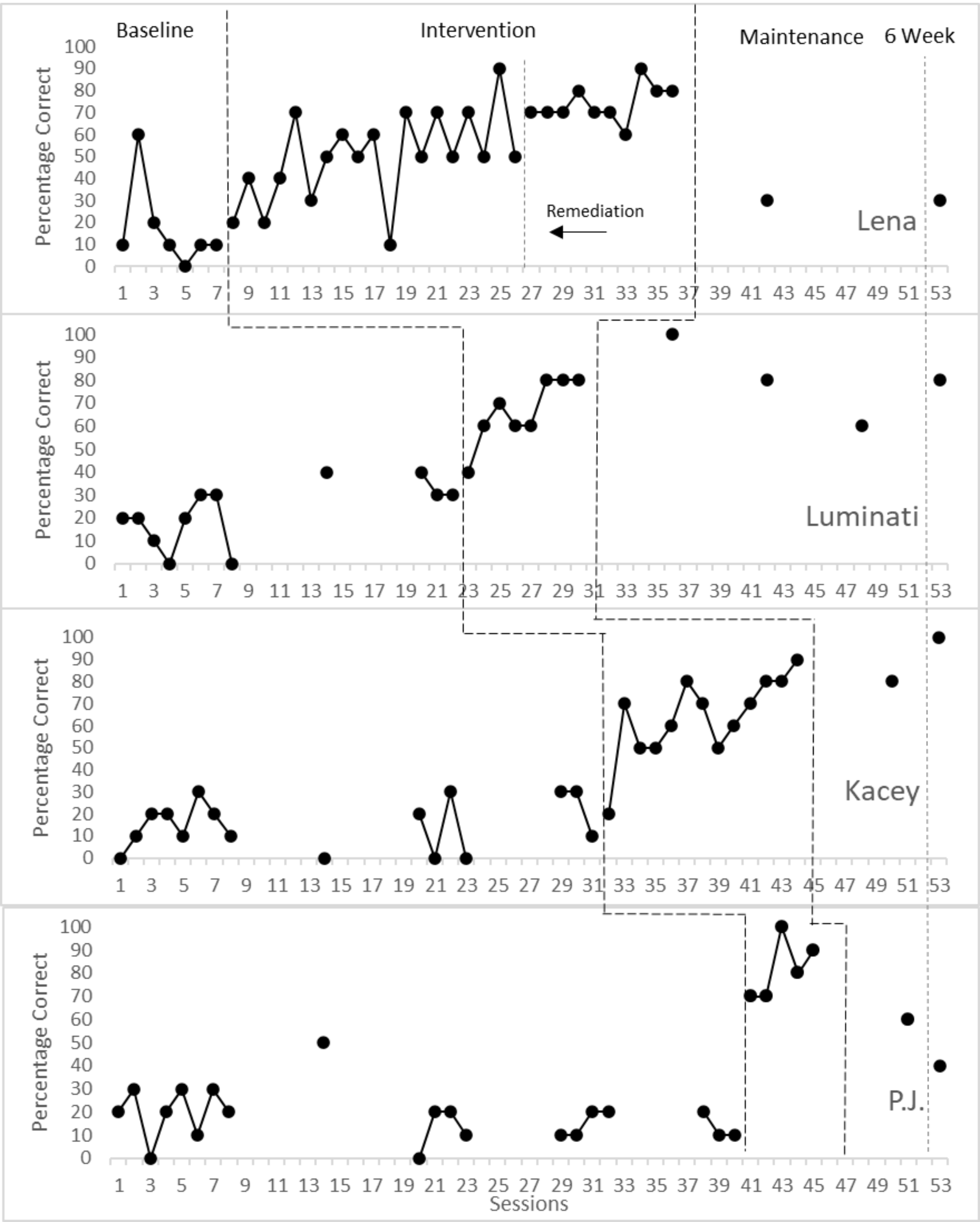
Finally, Tau-U magnitude of effect calculation was conducted using an online calculator (Tarlow, 2016). This method was chosen because it is more sensitive to changes between baseline and intervention phases than other non-overlap methods, with the potential to correct for positive trends in baseline (Lee & Cherney, 2018; Parker et al., 2011). Using the guidelines provided by Vannest and Ninci (2015), Tau-U effect sizes were determined to be very large if greater than .80, large if between .60 and .80, moderate if between .20 and .60, and small if less than .20. These were compared to established percentage metrics on PND of 90% or higher as very effective, 70 to 90% as effective, 50 to 70% as questionable, and below 50% as ineffective (Olive & Franco, 2008; Scruggs & Mastropieri, 1998).

Results

All four participants increased independent and correct responses between baseline and intervention phases, and all four mastered the skill. When presented with a field of five foods, one from each of the basic groups, students identified the correct missing food at least 80% of trials for three consecutive sessions after five to 29 sessions (*M* = 13.75). See Figure 3. The intrusiveness of prompts decreased over time for all students within the intervention phase. All students but Lena reached criterion in 13 or fewer sessions. The mean percentage of correct and independent performance increased by a range of 43.75 to 65% (*M* = 50.62%) between baseline and intervention phases.

Figure 3

Percentage of Correct Responses for Meal Building



Lena

Lena's performance in baseline ranged from zero to 60% (*M* = 17.14%). Data were variable (57.14% within ±25% from the median of 10) with a decelerating trend.

Her performance increased slightly from the last session in baseline to the first in intervention, from 10 to 20%. However, data remained highly variable for the first 19 sessions of the intervention phase, ranging from 10 to 90% correct (*M* = 50).

At this point, intervention sessions were paused and remediation was conducted. Remediation lasted 22 sessions (two sessions per day) with performance ranging from 65 to 95% correct in naming individual foods and corresponding groups. For those sessions following remediation, data stabilized (range = 60 to 90% correct, *M* = 74%). This represented a mean increase in performance of 24% from before to after remediation.

Overall, performance during intervention ranged from 10 to 90%, with a mean of 62%. Lena showed an accelerating trend in performance, but with slightly variable data overall (75.86% of data within the stability envelope of ±25% from the median of 60%). Lena mastered the dependent variable in 29 intervention sessions. Lena performed at 30% correct for the maintenance probe six sessions after intervention ended. For the 6-week follow-up maintenance probe, Lena also performed at 30% correct.

Lena’s mean performance in meal building improved greatly between baseline and intervention with an overall increase of 44.86%. Percentage of non-overlapping data (PND) for Lena was 44.83, showing an ineffective change between baseline and intervention phases. However, Tau-U, which is more sensitive than PND to changes between baseline and intervention, was calculated as .501 (*p* = 001). This was a statistically significant and moderate effect in increasing the skill over time from baseline.

Luminati

Luminati's data demonstrated a modestly accelerating trend during baseline, with slightly variable data (75% within the stability envelope about the median of 25%) and ranging from zero to 40% correct responses (*M* = 22.50%). Upon introduction of the independent variable, his performance increased by 10% (from 30% in the last session of baseline to 40% in the first of intervention). Luminati's performance during the IV phase ranged from 40 to 80%, with a mean of 66.25%. Data were stable (100% within the calculated envelope about the median of 65%) and followed a clear accelerating trend. Luminati reached mastery in eight sessions. He mostly maintained his skills at follow-up, with performance ranging from 60 to 100% (*M* = 80%) in the three probe sessions in the weeks following the end of intervention. At the 6-week follow-up, Luminati performed at 80% correct.

In general, Luminati's meal building performance increased by a mean of 43.75% between baseline and intervention. PND for Luminati was 87.50%, indicating the intervention was effective. Tau-U calculations are consistent with a large effect in increasing performance over time between baseline and intervention (.734, *p* = .000). Results were statistically significant.

Kacey

Performance in baseline followed a zero-celerating trend with considerably variable data (50% of data ±25% from the median of 15%) for Kacey. Her range of correct responses was zero to 30%, with a mean of 15%. Following introduction of the intervention (an increase of 10%, from 20% to 30% between the last session of baseline and the first of the IV phase), Kacey's performance ranged from 20 to 90% (*M*

=63.85%). Data during intervention showed markedly accelerating trend and stability (92.31% of data were within ±25% of the median of 70%). Kacey mastered the dependent variable in 13 sessions. For the maintenance probe six sessions post intervention, Kacey had 80% independent correct responses, consistent with mastery level. She performed at 100% at follow up 6 weeks following the previous maintenance probe. Kacey improved performance overall, with a mean increase of 48.85% between baseline and intervention. PND (92.31%) for Kacey indicated the intervention was very effective, while Tau-U indicated a significant and large effect (.708, p = .000).

P.J.

P.J.'s performance in baseline followed a slightly decelerating trend with somewhat variable data (65% were ±25% from the median of 20%). The range of correct responses was zero to 50% (M = 17%). Upon introduction of the intervention, P.J. had an immediate and marked increase in performance from 10 to 70% between the last baseline and first intervention sessions. The overall trend for P.J. during intervention was sharply accelerating with 80% of data within ±25% of the median, indicating stability. Percentage correct ranged from 70 to 100%, with a mean of 82%. She reached mastery in five sessions, quickly improving her mean performance for meal building during intervention, an increase of 65% between the two phases. For the maintenance probes six sessions following intervention and again 6 weeks later, P.J. performed at 60 and 40% correct and independent, respectively. PND was 100% (indicating a very effective intervention) and Tau U was .630 (p = .001), a large effect.

Social Validity

To assess social validity, modified versions of the Intervention Rating Profile-15 (IRP-15) and the Children's Intervention Rating Profile (CIRP) were completed by the classroom teacher and by all four participants, respectively.

Teacher

The IRP-15 has 15 items designed to communicate the teacher's perceptions of the acceptability, usability, versatility, and perceived benefits of the intervention. The items are rated from 1 ("strongly disagree") to 6 ("strongly agree") on a Likert scale. Total acceptability scores possible range from 15 indicating no/low acceptability, to 90 indicating high acceptability. The cooperating teacher for the study rated the intervention as highly acceptable, with a score of 90.

Students

To reduce chance of bias, the cooperating teacher assisted the students to complete the CIRP. Students were read the seven items aloud and verbally dictated their answers to each. The Likert scale choices ranged from 1 ("agree") to 6 ("I do not agree"). Unlike the adult version, some questions are designed to communicate unfavorable attitudes toward the intervention if marked as "agree," and favorable attitudes if marked "disagree." Space for additional write-in comments is also included.

Overall, students communicated that they agreed with items indicating favorable attitudes with means ranging from 1 to 2. For two of the items designating unfavorable attitudes, means were 6, suggesting that they disagreed. The third item of this nature, "there are better ways to teach me" had notable variation. Most students slightly agreed, suggesting they felt it was not the best method to teach them. According to Luminati, “Kids should take it. It actually helps you concentrate.” P.J. also commented positively regarding the intervention: “I learned a lot.” See Table 2.

Table 2

Social Validity Scores by Item and Student

	Kacey	Lena	Luminati	P.J.	Mean
The program used was fair	1	1	1	1	1
I think my teacher was too harsh on me	6	6	6	6	6
Being in this program caused problems with my friends	6	6	6	6	6
There were better ways to teach me	3	3	6	3	3.75
This program could help other kids, too	2	1	1	1	1.25
I liked the program we used	4	1	1	2	2
Being in this program helped me do better in school	3	1	1	1	1.5

Note. A score of 1 indicates agreement, a score of 6 indicates disagreement.

Discussion

This study investigated if the SLP, utilized with presentation software (i.e., PowerPoint) over a remote meeting platform (i.e., Zoom), was effective to improve performance in identifying the fifth missing food when shown a “meal” representing four different food groups. Results indicate that use of this specific response prompting method delivered remotely via Zoom was effective for teaching all four students to identify the food needed to complete a balanced meal encompassing all five food groups. Furthermore, the data indicated that the need for direct verbal and model prompts decreased over time. Throughout most trials in later sessions, when students gave an incorrect response, they needed only the indirect verbal prompt (i.e., the least intrusive) to state the correct answer. Needing only the least intrusive prompt indicated an increase in independence even when responses were incorrect.

The prerequisite skill of categorizing separate food photos into the correct food groups was taught in February of the 2019/2020 school year, before schools were closed due to COVID-19. All students in this study mastered that skill previously. Students were not tested on their maintenance of this skill prior to beginning the current study, which was modified prior to the beginning of the 2020/2021 school year to be delivered remotely. Luminati, Kacey, and P.J.'s performance during intervention indicated that they retained this skill from the spring.

Lena had the most inconsistent performance during intervention. As it was, the decision to remediate was made after 19 sessions. The data were analyzed according to individual foods and general groups on which she was making errors across sessions. Patterns in her performance indicated issues with knowing what foods belonged in which groups. The stabilization of data following remediation suggested that loss of prerequisite knowledge on foods and their groups was causing lower performance. Additionally, she had one session in intervention where she performed at 10% correct. This session took place during a distance learning day, with Lena's young niece repeatedly attempting to see and touch her Zoom screen, creating distractions.

Kacey, the only student who participated entirely from home, also had several sessions where performance reduced following sessions with higher performance. In these sessions she performed at 50%. For all three, she was woken up by the phone call from the cooperating teacher to prompt her to join the Zoom session; she was immediately expected to join the teaching session. The researcher and teacher then made the decision that the reminder phone call would take place at least 10 minutes before the session to give Kacey time to fully awaken. Performance increased steadily after allowing 10 minutes to wake up.

Sessions 26 and 27 for Luminati reflected a drop in performance from session 25. Both of these sessions took place while he was home due to illness. For each session, he was asked if he felt up to working, and he said yes for each.

Maintenance in the weeks following conclusion of the intervention varied between the students. Two students, Kacey and Luminati, showed mastery level of 80% or higher following conclusion of the IV. Luminati maintained this level at his second maintenance probe but dropped to 60% on his third. It should be noted that he was ill during the session and communicated clearly that he was not feeling well or focused. P.J.’s lower maintenance performance of 60% was surprising, given the rapid rate of mastering the skill during intervention. Perhaps this lower maintenance performance was influenced by practicing the skill fewer times, as her IV condition was the shortest of all students. Additionally, Thanksgiving break took place the week following P.J. and Kacey’s achievement of mastery and between two of Luminati’s maintenance sessions. This holiday break presented an extra 5-day lapse between sessions, possibly explaining loss of skill for P.J. and Luminati.

The break took place between Lena’s second to last and final intervention sessions, but interestingly, did not affect her performance. Similar to P.J., Lena’s percentage of independent responses decreased markedly during the maintenance probe six sessions after mastery. It should be noted that Lena and P.J. gave almost immediate responses for most trials during these sessions, as opposed to intervention sessions, when they took more time to look at the foods already present and the array of choices before making a selection. This quick responding during maintenance might indicate that both students were guessing or not taking the time to analyze which food groups were already present and which was therefore missing.

At the 6-week follow-up probe, student performance also varied. Kacey and Luminati both maintained skills at the mastery level. Lena and P.J. did not. These percentages were mostly consistent for students between maintenance sessions shortly after conclusion of intervention and the probe 6 weeks following the last of such sessions. Specifically, one student that maintained skills short-term, also did so long-term, while two did not maintain short or long term. Luminati maintained mastery level for two of three short term sessions, and then again after 6 weeks. Similar to the short-term probe sessions, Lena and P.J. both showed evidence of rushing through each trial at the 6-week follow up.

Knowing the five basic food groups and using this knowledge to make choices that reflect balanced meals is an important foundational skill for healthy eating behavior. This study contributes to the research base in a variety of ways. First, extensive review of literature indicated a need to target food information, food facts, or choice-making, as no intervention studies were identified that focused on these skills for students with SD. Such behaviors are essential in preparing adolescents to transition to their adult lives with as much independence as possible, especially given the risk for future health problems faced by this population (Alexander et al., 2018; Humphries et al., 2009; Jobling &

Cuskelly, 2006; Marks et al., 2010; Medlan & Peterson, 2000; Noland et al., 1986; Pember & Knowlden, 2017; Reed et al., 1992; Reeve et al., 2015).

Second, there is a lack of high-quality experimental intervention research in food and nutrition for this population. Review of literature suggested a need to investigate nutrition education interventions while adhering to established quality indicators for design and dissemination. This study was conceptualized, executed, and reported using accepted guidelines for single case research designs. Specifically, the individual quality indicators adhered to in this study are a combination of those by Horner et al. (2005) and WWC (2017). These are as follows:

- Participants described sufficiently for replication.
- Participant selection described sufficiently for replication.
- Setting described sufficiently for replication.
- DV described.
- DV quantifiable/measurable.
- Fidelity of implementation conducted on at least 20% of each phase for each participant.
- Independent variable manipulated.
- Inter-assessor agreement (IAA) reported.
- IAA on 20% of data points per participant and phase.
- IAA is an average of at least 80%.
- Intervention effect/experimental control demonstrated.
- Attempts to demonstrate effects over time/sufficient data points per phase.

- External validity (direct replication within study, all participant data reported).
- Social Validity: DV is socially important.
- Social Validity: Magnitude of change socially important.
- Social Validity: Implementation of IV practical and cost-effective.
- Social Validity: IV implemented over time, typical agents, and typical contexts considered.

Horner et al. (2005) include more recommendations than WWC (2017); specifically, description and recruitment of participants, as well as setting description to ensure replicability of the study. Additionally, Horner et al. suggested the dependent variable be reported in a way that it is quantifiable and measurable. Lastly, they recommended a study address social validity (i.e., whether the DV is socially important, outcomes socially significant, the intervention is cost-effective and practical to implement, and implemented across time, settings, and typical agents). Typical agents refer to parents, teachers, caregivers, or service providers normally in contact with the child in the target setting. Social validity is a crucial component of experimental research because when participants and associated typical agents approve of, enjoy, and value the intervention and resulting skills, then the practice is more likely to continue beyond the study and in applied settings. For example, the cooperating teacher for this particular study reported that due to the value of the system of least prompts and outcomes for the four students who participated, that she sought and gained approval from school administration to add a life skills course in nutrition and cooking to the offerings at her high school. This development further supports the importance of the target skill because not only is it documented in the research literature as important, but deemed as so, firsthand by a classroom teacher.

Third, this study demonstrated that the SLP is one evidence-based practice that translated to remote instruction, an important implication given the current pandemic. When the study was designed, it was unknown whether two dimensional visuals presented on a screen and/or the inability to physically prompt students would hinder implementation of the intervention. The results indicate that the SLP can be feasibly utilized in a virtual setting with students with mild to moderate intellectual and multiple disabilities. Finally, it is important to note that even in the presence of COVID-19, with the resulting tumult, worry, and changes, the SLP delivered via Zoom was effective in teaching the targeted skill.

Implications for Practitioners

One of the most important implications of this study is that evidence-based practices such as the SLP can be utilized during distance learning, especially valuable at the present time when educators are experiencing confusion and stress around how to teach students with special needs using online platforms. More generally, the results of this study indicate that the SLP is effective, feasible, and enjoyable to students for increasing skills around food groups and balanced meals. Save for one student, the intervention was efficient for mastery of the dependent variable, though the student who took the longest to reach mastery still did so. High procedural fidelity outcomes and favorable teacher response according to social validity measures also support the idea that this intervention is reasonable to implement. The materials in this study were easy to make and did not have additional costs.

Finally, there was some evidence skills were maintained for two students. However, given that two students did not perform at mastery level for any maintenance probes, it is recommended that teachers return to the intervention to increase performance upon assessment indicating a drop in such performance.

The timeline for this study did not allow generalization training and assessment. It is valuable to teach students to generalize behaviors by implementing teaching across different adults or peers, multiple locations where the skill might apply, or with a variety of relevant materials. Addressing generalization enhances the likelihood the behavior will occur in new and varied situations where required. Outside the context of a study, general case programming is recommended, whereby the student performs the behavior in a range of situations where it is appropriate but does not perform the behavior in situations where it may not be appropriate. Overall, general case programming (O’Neill, 1990) requires the teacher do the following (a) define the instructional universe; (b) define the range of relevant stimulus and response variation within the universe; (c) select examples from the instructional universe for use in teaching and probe testing; (d) sequence teaching samples; (e) teach using the samples; and (f) test for generalization using the testing samples.

Limitations and Future Research

The decision to not test maintenance on the prerequisite skill of identifying individual foods and their food groups was a limitation. Had assessment for student retention of this skill taken place, it may have reduced the length of the intervention phase for Lena. The sessions where Lena performed without mastery of prerequisite knowledge may have caused her undue stress or frustration, and certainly caused the study to take more time, demanding more manpower and energy than necessary.

In this study, the days counted between baseline, as well as maintenance probes (except for the 6-week follow up), were school days only. This may be a limitation as weekends and holiday breaks presented longer time periods between sessions in some cases. Specifically, between the end of intervention and maintenance probes for Kacey and P.J. and between the second and third maintenance probe for Luminati. For P.J. and Luminati, this gap may have contributed to lower performance at maintenance. While the predetermined schedule of probes in the weeks following mastery was consistent (i.e., every sixth session), the actual number of days varied.

Additionally, it was not possible to collect any data on whether the students' ability to complete a balanced meal in the intervention actually resulted in them choosing and eating balanced meals. As the goal of NE is to promote voluntary lifestyle choices that are conducive to health (Contento et al., 1995a), it would be valuable to examine if interventions designed to teach balanced eating then result in corresponding choices in mealtime behavior.

Future research should also focus on systematic replication of this study to investigate if similar success can be achieved with new but similar students and by different research teams in additional locations. Future replications of this study could strengthen the literature on remote instruction for learners with SD, having valuable implications for distance learning in immediate (e.g., pandemic) or long-term (e.g., rural settings or home hospital) situations.

Future research might also explore the use of SLP or other response prompting procedures delivered remotely to students with more intensive needs. It is possible that remote instruction would be inappropriate for certain students because they may understand symbols at the object level and/or require partial or full physical prompting to ensure a behavior is performed. If so, experimental research on use of SLP to teach skills around identifying foods and food groups, as well as examples and non-examples of balanced meals, would nonetheless contribute to the literature on improving health behaviors for the diverse population of individuals with SD.

Conclusion

This study suggests that widely-used and research-supported practices, such as SLP, can be successfully implemented even when instructors and students are not face-to-face. Furthermore, the results demonstrated that this specific method was effective in teaching skills related to food groups and what constitutes a balanced meal. Additionally, students and the cooperating teacher reported that the intervention was acceptable, effective, and simple to implement, especially encouraging during the disruption caused by the COVID-19 pandemic. Furthermore, completion of the study inspired the teacher to initiate a new course on nutrition and cooking offered at her school site. Finally, with half of the participants maintaining skills at mastery levels 6 weeks after the intervention, there is some evidence for the SLP contributing to lasting change in health-related skills.

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Appendix A

Baseline Procedure

Steps
One slide per trial depicting 4 foods from 4 groups shown to student
10 trials per session
Attentional cue delivered at start of session: “Are you ready to work?” or “Are you ready?”
Deliver instructional cue: “Tell me which one will make a balanced meal” or “What food is missing from this plate to make a balanced meal?” or similar
5 s response latency (count in head). Allow student to finish answering if appears to be processing (eyes moving across screen, saying “hmmm…” or “I think it’s…”
Trial is complete when student says answer or does not respond for 5 seconds (whichever happens first)
Incorrect or no response within latency period: No feedback
Correct choice prompted or unprompted (verbal answer-actual food, group it belongs to, or accurate description, (e.g. green spiky thing for artichoke): No feedback
Deliver praise for working / attending every 5 trials whether correct or not
Replace slide with next slide depicting a new but comparable group of photos (comparable: same number photos total, same proportion of food groups), repeat instructional cue

+ Correct: participant chooses food representing the group that is missing from the meal, says the correct group missing, or accurately describes the food (e.g. “green spiky thing” for artichoke) from field of 5 by verbalizing

– Incorrect: student chooses a food already represented in the group of photos (the “meal”), does not respond, says an answer that is too general (e.g., “the snack,” “treat,” “drink,” etc.), or leaves the work area

Appendix B

Intervention/Teaching Procedure: Meal Building

Steps
One slide per trial depicting 4 foods from 4 groups shown to student
10 trials per session
Attentional cue delivered at start of session: “Are you ready to work?” or “Are you ready?”
Deliver instructional cue: “Tell me which one will make a balanced meal” or “What food is missing from this plate to make a balanced meal?” or similar
5 s response latency (count in head). Allow student to finish answering if appears to be processing (eyes moving across screen, saying “hmmm…” or “I think it’s…”
Incorrect or no response within latency period: Present least intrusive prompt in hierarchy
Correct choice prompted or unprompted (verbal answer-actual food, group it belongs to, or accurate description, e.g. green spiky thing for artichoke): Provide specific praise and immediately present next trial (next slide)
Error correction (for answers that are not directly verbalizing a food, group, or accurate description, e.g., “snack,” “drinks,” “treat,” ‘dessert); say “_ is not a food group” and deliver next prompt in hierarchy
At the end of each “plate,” (trial) summarize what food group was missing/why
Deliver praise for working / attending every 5 trials whether correct or not
Replace slide with next slide depicting a new but comparable group of photos (comparable: same number photos total, same proportion of food groups), repeat instructional cue

1 trial= 1 choice/slide

I: Independent/correct-verbally states actual food, group it belongs to, or accurate description, e.g. “green spiky thing” for artichoke
IV: Indirect verbal: “You already have a _. What else do you need?”
DV: Direct verbal: “Remember, the five groups are protein, grains, vegetables, fruits, and dairy.”
M: Model: “You need to pick a (food), that’s what was missing” while gesturing with cursor

Chapter Five: Overall Discussion, Implications, and Future Research

This dissertation included three papers related to health and nutrition for individuals with significant intellectual, developmental, and multiple disabilities. While the United States faces health issues population-wide (CDC, 2015a), the urgency for improvement in health-related behaviors is even greater for individuals within this population (Reeve et al., 2014; Salaun & Berthouze-Aranda , 2011).

Discussion and Implications

In Chapter 2, it was established that this population has two to three times higher overweight and obesity prevalence than typically developing individuals. Furthermore, these individuals have higher risk for reduced lifespan and quality of life. From this review, evidence was clear in outlining the risks faced by people with SD if the level of obesity and related conditions continue to increase. Also barriers, such as comorbid medical conditions and mobility limitations faced by this population pose a compounded risk of health conditions compared to the general population, which is facing its own rise in health problems.

This review summarized the problem and established the need for further research on nutrition education interventions, including those that explicitly teach food information and making choices while using visual supports and measuring social validity. Systematic review on intervention research was also a recommendation that emerged from this study. While this work helped to articulate the problem, it did not explain why the problem occurs or and how individuals experience it.

Chapter 3 included a study attempting to do just that. Five themes emerged from the interviews and were compared to findings in the literature. Overall, it was found that target children eat a variety of foods, were particular about specific foods and textures, and resistant to change. Similar to literature summarized in Chapter 2, children in the qualitative study had a variety of conditions, illnesses, and challenges that posed additional contributing factors to diet such as malnutrition concerns, oral motor strength, and resistance to change (Mulligan et al., 2012; Rimmer et al., 2010; Taliaferro & Hammond, 2016). It was evident that families attempted and/or developed strategies to address their child's eating challenges, but such involvement did not always yield behavior change. This finding was inconsistent with research cited in Chapter 2 claiming that parent involvement increases healthy behaviors (Fodstad & Matson, 2008; George et al., 2011; Hamilton et al., 2007). The children in the Chapter 3 study also participated in a variety of physical activities, inconsistent with literature outlining sedentary behavior for the population (Jinks et al., 2011). This finding was especially encouraging as it contributed examples to the literature of successful health habits for people with SD.

The study in Chapter 3 included some important characteristics: detailed descriptions of eating habits, family experiences around these behaviors, and what habits are positive for the children. The study provided detail into the everyday lives of parents whose children's disabilities impact their eating (or do not, in some cases). Additionally, narrow food choices detailed in Chapter 3 suggested need to conduct future research on increasing knowledge about healthy food for this population. Given the general problem set up by Chapter 2 and the possible explanations for the problem and its effect on families revealed in Chapter 3, a study addressing individual behavior change presented a solution.

The need to teach functional skills, including nutrition knowledge and behavior, is well documented for children with significant disabilities (Johnson et al., 2013; Morse & Schuster, 2000; Wallén et al., 2013). A logical response to research documenting what the problem is, why it may be happening, and how individuals experience it, is to investigate what can be done about it. Chapter 4 addressed needs established in the preceding two chapters by incorporating a number of recommendations. These included fostering foundational nutrition knowledge by teaching choice-making, utilizing visual supports, and implementing social validity measures.

Chapter 4 featured a study testing the use of response prompting, specifically the system of least prompts, to teach meal-building skills. The study results suggested that one specific response prompting methods (i.e., the SLP), widely used in special education, can be employed via remote instruction. This is especially relevant as at the time this is being written, the world continues to experience increased distance education due to the pandemic. But successful remote learning for students with SD has longer lasting implications for rural settings, home hospital services, and enrollment in alternative online schools. The results of the study also indicated that the SLP is a feasible and effective method for increasing knowledge around food groups and choices. Though studies on successful increases in individual behavior are essential and encouraging, it is important to examine the bigger picture of medical and environmental factors that impact health.

Systemic, Environmental, Circumstantial, and Behavioral Determinants of Health

Examination of Chapters 2 through 4, as well as the wider literature base, revealed multiple determinants of health for individuals with SD. These variables include genetics, comorbid or secondary health conditions, health care quality/access, socio-economic status (SES), environment, social isolation, weight, exercise habits, individual knowledge and behavior, and self-determination (Krahn et al., 2006; Marks et al., 2010; Mitchell et al., 2018; Stevens et al., 2018). The responsibility of improving health for this population lies not only with the individual, but with policymakers, employers, health providers, educators, and caregivers because many elements that influence health are outside of a person's control.

For example, higher income influences better health (Allensworth et al, 2011; Freudenberg & Ruglis, 2007; Woolf et al., 2007). Explanations include living in a safe neighborhood, having personal transportation and easier access to healthy foods and physical activity, as well as increased likelihood of medical care, paid leave, and retirement plans (Birch, 2017). Further, higher paying jobs are more likely aligned with personal aspirations, thereby leading to better job satisfaction (Ellenkamp et al., 2016; Freudenberg & Ruglis; Woolf et al.).

Research shows that people with SD have lower SES overall, with many in poverty, compared to the general population (Vornhort et al., 2018). Specifically, Cornell University (2017) found that households of adults with SD had a 47% lower income on average than households where the adults were described as having no disability. Further, the Bureau of Labor Statistics (2019) found the incidence of people with disabilities who were unemployed was nearly triple that of those without disabilities.

These data indicate that low SES or poverty as health determinants affect individuals with SD disproportionately. Possible factors contributing to poverty for this population are sub-minimum wage paid to workers with intellectual disabilities

(Friedman & Rizzolo, 2020; National Disability Rights Network, 2011) and training level and/or attitudes of employers toward people with SD (Kocman et al., 2017; Myers & Cox, 2020). Other variables influencing lower employment and SES include those affecting work attendance, participation, and quality, such as skill level, employer concerns about safety, and illness-related absences (Ellenkamp et al., 2016; Kocman et al.; Young et al., 2017). Policy makers and legislators seem the agents ablest to amend laws on sub-minimum wage, while awareness and training on working with people with disabilities could improve the rate of people with SD hired for competitive employment. The issue of health problems that prevent work attendance or reduce work performance relate directly to quality of and access to health care.

Kaye (2019) found that even after the Affordable Care Act (ACA), people with intellectual or multiple disabilities had discrepancies in healthcare and quality, compared to those without disabilities. Individuals with SD were more likely to be insured after ACA implementation than before (though still less likely to be insured than the general population). However, they were less likely to receive quality and timely care after implementation of ACA than before, and less likely than the rest of the population. This research implies that reduced care access and quality disproportionately affect individuals with SD. Furthermore, as this population is known to have higher rates of comorbid and secondary health issues, it can be surmised that the impacts of these factors are further compounded by delays in health care or by subpar quality once an individual is treated. These are examples of problems that should be addressed by health policy makers, providers, and insurance companies.

Some researchers have positioned access to health education as a social justice issue. Individual education level is related to health outcomes in adulthood, with evidence suggesting that healthy children learn better and have more academic success than those with health issues (Allensworth, 2015; Basch, 2011a; Bradley & Greene, 2013; Freudenberg & Ruglis, 2007; Woolf et al., 2007). This relationship to adult health is reinforced by the following CDC (2015a) statement: “In turn academic success is an excellent indicator for the overall well-being of youth and a primary predictor and determinant of adult health outcomes” (p. 1). Similarly, Birch (2017) cited a speech by Gene Carter, the former CEO of Association for Supervision and Curriculum Development:

> Health and education are related. They are interrelated. They are symbiotic. There is a connection between the two sectors. When one fails, so does the other. When one succeeds, that success feeds the other. We do not just have an isolated duty to want the child to be healthy and educated—we have a moral imperative (p. 840).

Despite assertions that everyone should receive education on health information and behavior, other evidence showed that health knowledge and subsequent outcomes are an unevenly distributed privilege. Birch (2017) claimed that access to quality health education is ultimately a social justice issue, given the impacts on health outcomes for people in marginalized groups such as poverty and disability.

Though some factors intersect to influence health for individuals with disabilities and are beyond the control of the individual, behavior change, skill acquisition, and self-determination are nonetheless crucial for health. These domains are the focus in schools because direct and immediate responsibility can be taken for ensuring students have the knowledge and skills necessary to be independent and have higher quality of life. School settings provide a number of advantages for addressing health education and behaviors, including that nearly everybody goes to school (Brown, 2018; McKenna, 2010) and states have established NE standards (Nevada Department of Education, 2014; Perera et al., 2015). Also, schools can support healthy dietary behavior and choices in formative years (Bazzano, 2006; Contento et al., 1995b; McKenna, 2010) because healthy children and adolescents learn better (Allensworth et al., 2011; Basch, 2011a; Bradley & Greene, 2013; Freudenberg & Ruglis, 2007; Woolf et al., 2007). Furthermore, quality health education increases social justice for marginalized groups (Allensworth, 2015; CDC, 2015b; Birch, 2017). Finally, students with SD often require systematic instruction to acquire and maintain functional skills (Collins, 2012; Kostikj-Ivanovikj & Chichevska-Jovanova, 2016; Sparks et al., 2016).

Past Recommendations Addressed vs. Future Research Needed

The papers outlined in this dissertation contributed important answers to questions of who, what, where, why, and how related to health and nutrition for this population. First, a recent review of literature that established and described an overall problem was completed. This review focused both on who the population is (i.e., individuals with SD) and what the problem is (i.e., health disparities). Many recommendations emerged from this chapter.

The study in Chapter 3 showed insights into parental experiences around eating habits for children with multiple disabilities, addressing how the phenomenon is experienced and why the children have such habits. Specifically, this study responded to research topics suggested in Chapter 2, including exploration of support level needed for individuals with ID to exercise healthy food choices, level of control over menu planning, portion sizes, and options for type and amount of exercise.

In Chapter 4, an intervention study was conducted that addressed how nutrition education can be implemented through the system of least prompts; who it works for (i.e., adolescents with intellectual and multiple disabilities); and where (i.e., a remote learning environment). Specifically, this study also followed recommendations from Chapter 2 to utilize visual supports to teach nutrition information as well as social validity measures to gauge the acceptability and feasibility of the intervention according to the teacher and the participating students. Finally, Chapter 3 suggested exploring health education and preparation given to adolescents in the school system before they transition. The study in Chapter 4 successfully addressed important functional skills related to health, with data suggesting skill maintenance for some students after the intervention (i.e., system of least prompts) was complete.

Though multiple recommendations from the greater literature base and Chapters 2 and 3 were addressed, many more research avenues still remain. First, Chapter 2 established a need to investigate how SES, poverty, and living in “food deserts” affect individuals with disabilities and their families. Also, for adults living in congregated residential settings outside the family home, it was suggested researchers examine the level of services provided in nutrition and health. It was further suggested that studies on treating food refusal for this population be examined, as well as if narrow food choices might be improved through strategies associated with applied behavior analysis.

Chapter 3 recommended that future researchers gain insights about eating and health from individuals with SD firsthand to possibly explain why they have specific health behaviors. There were also recommendations in this chapter to examine quantitative research, such as survey or comparison studies between groups, for a more accurate portrayal of the target population.

Finally, Chapter 4 illustrated an important beginning in establishing a literature base for use of prompting procedures to increase skills related to nutrition education for people with SD. In order to identify evidence-based practices, it is important for experimental research to be replicated systematically, with the same procedures applied to different participants in a new setting by additional researchers. One guideline for determining an evidence-based practice from single case research is the 5-3-20 rule established by Horner et al. (2005), which has precedence throughout the literature (Burns, 2012; Horner & Kratochwill, 2012; Moeller et al., 2015). The rule states a specific intervention be implemented across at least five quality studies, three different research teams, and 20 participants. This means that four more replications of the SLP to teach nutrition information need to be implemented by at least two additional research teams with at least 16 total additional participants. Furthermore, these studies must adhere to quality indicators for single case research design and dissemination.

All parents in Chapter 3 were personally known by one of the two researchers (some were known to one researcher, the remaining to the second), as attempts to recruit participants with no relationship to the researchers were unsuccessful. For the study in Chapter 4, the researchers personally knew the cooperating teacher, but not any of the students prior to the study. The difficulty individual researchers or teams can have in finding participants makes it even more crucial that as many new investigators as possible systematically replicate studies. This increases the chances that an intervention can generalize to similar, but new individuals.

Conclusion

The papers featured in this dissertation answered a variety of different questions about specific issues faced by the population of interest, possible reasons the problems persist, how the issues affect individuals and families, and one promising method for addressing the problem within remote learning environments. Chapter 3 built off of the needs established in Chapter 2, while Chapter 4 addressed recommendations identified in both Chapters 2 and 3. From the different lines of inquiry examined in each individual paper, a variety of recommendations emerged for continuing lines of research or beginning new ones. These three chapters, when examined together, strengthen the research base in a variety of ways. They described both large-scale issues and detailed individual experiences, what research has been done in the past, and tested established methods for teaching health knowledge that show promise for lasting behavior change.

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