A Dissertation

entitled

Tovertafel: Evaluating the Benefits of a Novel Multi-sensory Intervention for Nursing Home Residents with Dementia

by

Jennifer J. Perion

Submitted to the Graduate Faculty as partial fulfillment of the requirements for the Doctor of Philosophy Degree in Health Education

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Abstract

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Background The purpose of this two-part descriptive study was to evaluate an online training course designed to introduce direct care workers to the Tovertafel, a multi-sensory technology device, and provide information about how to facilitate interactive game sessions with older adults who have dementia. While direct care staff are often an integral part of multi-sensory interventions, a review of previous studies indicates that staff training is often under-reported in the literature. Ensuring that direct care workers are comfortable with new practices or technology is crucial to their success, as they are usually the staff who implement new programs. Research suggests that staff members who have been trained using consistent methods are more likely to understand the intended activities and results, which increases the success of the program.

Methods In Part One of the study an interactive online training course was created using constructs of the New World Kirkpatrick Model (NWKM). A convenience sampling of undergraduate students enrolled in academic programs offered by the

College of Health and Human Services at a midwestern university were invited to participate in the training and complete an online survey. Additionally, students enrolled in three recreation therapy courses at the same university were assigned to complete the activities. Following course completion, an online survey obtained ratings of engagement (i.e., aesthetics, ease of use, novelty, and involvement), relevance, and knowledge/skills gained from the training. In Part Two of the study, undergraduate recreation therapy students were invited to practice using the Tovertafel games and provide input on their experiences. A survey was created using constructs of Social Cognitive Theory to measure perceptions of behavioral capability, self-efficacy, expected outcomes and reinforcing attitudes.

Results In Part One, 72 undergraduate students participated in the online training course and subsequent survey. The majority were white (83.3%), non-Hispanic (81.9%) females (88.9%). Most participants agreed or strongly agreed (median=4) with positive statements related to engagement with the course. Statements about relevance to their intended career were rated even higher (median=5). Wilcoxon signed-rank tests for matched pairs revealed statistically significant improvements on self-reported pre-post knowledge/skills scores ($p<0.005$). Responses to open-ended questions suggested improvements to the design (e.g., color choice) and content (e.g., expanded topics and resources). Eight undergraduate recreation therapy students participated in Part Two of the study; all were White non-Hispanic with a mean age of 20.4 years. Participants indicated that they possessed the skills and confidence necessary to use the Tovertafel to lead a group activity among older adults with dementia. Additionally, they expressed positive attitudes about the games and their use by recreation therapy professionals and

confirmed that the activities were enjoyable. Participants were likely to use the Tovertafel in the execution of patient care and recommend the activity to other recreation therapists.

Discussion The analysis of data collected during Parts One and Two of the study indicate that the online training succeeded in achieving the stated goals. A review of the findings suggests an innovative approach to training evaluation that combines the use of NWKM with SCT constructs. When COVID-19 restrictions are lifted, an investigation is planned to learn whether the Tovertafel reduces problem behaviors such as aggression, agitation, and apathy among long-term care residents with dementia and as a result, improve the well-being for residents and direct care staff. Using the online training course in the original intervention evaluation study will improve the project and ensure that direct care workers are adequately trained and prepared to assist with implementation and evaluation of the Tovertafel intervention post-pandemic. Health educators engaged in practice and research related to multi-sensory technology interventions can use the findings of this study to ensure facility staff involved in the activities are adequately trained and that procedures are properly documented in published works.

This dissertation is dedicated to the memory of my mother-in-law Barbara Perion. I am grateful for the lessons you taught me about living a life with dementia. Thank you for allowing me to learn about not just the challenges, but also the beauty and humor that are possible.

Acknowledgements

I would like to express my sincere gratitude to my advisor, mentor, dissertation chair, and friend Dr. Victoria Steiner. Without your continuous guidance, encouragement, and support it would not have been possible for me to complete this dissertation and program. I would like to express my appreciation to my dissertation committee members – Dr. Kinney, Dr. McBride, and Dr. Saltzman. Thank you for your valuable feedback, support, understanding, and insights throughout the process. A special thank you to Dr. Saltzman for the late night forward of a "neat" video that got this all started.

I am grateful to my family and friends for their love and support. A special thank you to my husband Jack for his support, encouragement, and patience. I appreciate the enthusiasm and reinforcement from my daughter Emily and all of my "unofficial children." I am always grateful to my parents for instilling the value of education.

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Finally, I would like to express a thanksgiving for all of the blessings that have come my way during this journey. My prayers weren't always answered the way that I thought they would be, but I am grateful for what I have and for the love of a God who patiently guides my boat even when I am furiously rowing in the opposite direction. I am truly blessed and immensely thankful.

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List of Abbreviations

AES-10.....Apathy Evaluation Scale
ADL .....Activities of daily living
GCWBT .....Greater Cincinnati Well-being Tool
IADL .....Instrumental activities of daily living
NDB .....Need-driven behaviors
NDBM .....Need-driven Dementia-compromised Behavior Model
NWKM .....New World Kirkpatrick Model
PWD.....Person living with dementia
QoL .....Quality of life
RMBPC-NH.....Revised Memory Behavior Problem Checklist-Nursing Home
SCT .....Social Cognitive Theory

Preface

This dissertation was originally proposed prior to the onset of the COVID-19 pandemic. As a result, the first three chapters provide details about a project intended to evaluate a multi-sensory device known as the Tovertafel among residents of two long-term care facilities who are living with moderate-to-severe dementia. With the onset of the pandemic, access to long-term care staff and residents was not possible. Uncertainty about the duration of pandemic restrictions necessitated a change of focus from the implementation of the Tovertafel activities to the training of direct care staff to use the Tovertafel through a virtual format. From the beginning, the importance of involving direct care staff in the Tovertafel activities was recognized as a crucial factor in the success of the study. Like many multi-sensory technology interventions, the original project plan was to provide informal staff training, and there was little thought to providing details about the training process in the reporting of the study. Pandemic restrictions provided a break in activity to reflect on the value of developing a standardized and evaluated training course to ensure that direct care staff are prepared for their role in the intervention when it is eventually implemented. When read in its entirety, this dissertation chronicles the progression of the multi-sensory technology intervention beginning with the originally intended plan through a discovery of ways to improve the project through the use of formalized staff training that incorporated both a training evaluation model and a behavioral theory. These discoveries, born out of necessity during an unprecedented public health crisis, have provided the student researcher with priceless opportunities for growth and learning.

Chapter One

Introduction

This introductory chapter presents the etiology and symptoms of dementia. The impact that memory-related behavior problems have on the psychological well-being of nursing home residents with dementia and their caregivers is explored. The Need-driven Dementia-compromised Behavior Model (NDBM) is examined as a possible cause for behaviors memory-related behaviors such as agitation, aggression and apathy. The potential benefit of multi-sensory technology interventions as a strategy to address the needs of residents is introduced. Finally, details about the proposed study including the conceptual model and research questions, are provided. This chapter consists of the following major sections: Statement of the Problem, Background, Theoretical Framework, Summary, Purpose of the Study, Implications for Health Educators, Conceptual Model, Research Questions and Hypotheses, Significance of the Study, Definition of Terms, Assumptions, Limitations of the Study, Delimitations of the Study, and Conclusion.

Statement of the Problem

Dementia is a multi-faceted condition that results in the deterioration of cognitive and physical abilities (Centers for Disease Control and Prevention, 2019a). For family and professional caregivers, the burden of care can be great, especially in the later stages when people living with dementia are completely dependent upon the assistance of others for even basic needs (Alzheimer's Association, 2019). Equally challenging are behavior

problems associated with dementia such as agitation, aggression, and apathy (Cohen-Mansfield et al., 2015). Nursing home residents who exhibit behavior problems often add to the burden and reduce well-being of nursing assistants, who perform the majority of direct care in these facilities (Bamonti et al., 2017; Centers for Disease Control and Prevention, 2018). There is a growing recognition that behavior problems among people living with dementia may not be a symptom, but rather an adaptive way of communicating by individuals who have lost the ability to control their environment or speak for themselves (Algase et al., 1996). For nursing home residents, behaviors such as agitation or aggression are often a way to express discomfort, pain, or a desire to become engaged with their environment in a meaningful way (Ahn & Horgas, 2014; Kolanowski et al., 2011; Moyle et al., 2018). Apathy, which is a passive behavior, may indicate a need for activity, structure, or positive interaction with others (Massimo et al., 2018). The Need-driven Dementia-compromised Behavior Model (NDBM) suggests that addressing the underlying needs of a person with dementia can be an effective way to reduce need-driven behaviors (NDB) (Algase et al., 2010; Beck et al., 2011; Bedard et al., 2011; Kolanowski et al., 2011; Moyle et al., 2018). One way to achieve this is through the use of interventions designed to engage multiple senses (multi-sensory stimulation) that include technical components such as computers, projectors, or robotics (Ahn & Horgas, 2014; Beck et al., 2011; Fukui et al., 2011; Kolanowski et al., 2011). While studies show the potential for technology-driven multi-sensory interventions to reduce NDB, few have utilized a theory to contextualize changes in behavior to help explain what aspects of the interventions are most effective. Additionally, there is a need to understand how nursing

assistants feel about the use of multi-sensory technology and its efficacy in reducing NDB and professional caregiver burden in the nursing home setting.

Background

Etiology and Prevalence of Dementia. Dementia is a general term used to describe a number of neurological disorders that cause impaired function of the brain, resulting in cognitive and physical degeneration (Alzheimer's Association, 2019). Some dementia is caused by modifiable factors such as vitamin B12 deficiency, or as a side-effect of medications (The Alzheimer's Association and Centers for Disease Control and Prevention, 2013). Other forms of dementia are due to the presence of one more underlying conditions such as Parkinson's disease, stroke, or Lewy body disease (Alzheimer's Association, 2019; Centers for Disease Control and Prevention, 2019a). The most common form of dementia is Alzheimer's disease, comprising between 60 to 80 percent of all dementia diagnoses (World Health Organization, 2017). Alzheimer's disease is a progressive disease, taking up to 20 years before signs and symptoms of brain damage become noticeable (Alzheimer's Association, 2019). During the early stage, individuals may be able to compensate for cognitive and physical decline, and usually continue to live at home and remain socially and physically active (Alzheimer's Association, 2019). As the disease progresses, dependency increases until the individual is unable to care for her or himself and may be placed in a nursing home or other long-term facility (Alzheimer's Association, 2019; Harris-Kojetin et al., 2019).

A new case of dementia is documented about every four seconds across the globe, resulting in 7.7 million new cases each year (Alzheimer's Association International & World Health Organization, 2012). The World Health Organization (WHO) estimated the number of people diagnosed with dementia globally will grow from 47 million in 2015 to 132 million by 2050, largely due to the aging of global populations (World Health Organization, 2017). In the United States, the number of adults over the age of 65 with Alzheimer's disease is expected to rise from 5 million in 2014 to 14 million by 2060 (Centers for Disease Control and Prevention, 2019a).

Common symptom of dementia.

Memory problems. Perhaps the most widely recognized symptom of dementia is the development of memory problems (Centers for Disease Control and Prevention, 2019a). Normal aging often includes cognitive changes such as occasional lapses in memory, difficulty performing more than one task at a time, and slower speed processing thoughts, but generally these events are infrequent and do not impede everyday functioning (Centers for Disease Control and Prevention, 2019b). Compared to normal aging, the memory problems related to dementia are much more pronounced and impactful on everyday living and are usually the first signs that there might be a problem (Alzheimer's Association, 2019). Common memory problems associated with dementia include lapses in memory that result in repetitive questions, forgetting recent events, losing objects, and confusion about time and space (Centers for Disease Control and Prevention, 2019a). In later stages of dementia, memory problems begin to impact the

person's ability to live independently and remain socially active (Alzheimer's Association, 2019).

Memory-related behavior problems. For many people living with dementia, there is a reduction in the ability to control emotions, resulting in behavior and motivation changes that can impede social interactions (Alzheimer's Association International & World Health Organization, 2012). Some behaviors, such as agitation and aggression, negatively impact caregivers, adding additional burden and stress, and are often the primary reason that family members choose to place a family member in a nursing home (Kales, Gitlin, & Lyketsos, 2015). Passive behaviors such as apathy are the most common memory-related behavior problems, impacting up to 88 percent of nursing home residents, and have been found to negatively impact the ability of older adults to provide self-care and lead to an accelerated deterioration in overall health (Colling, 2004). While apathy has been associated with significant negative outcomes for people living with dementia, nursing assistants and researchers often pay passive behavior less attention because they represent lower levels of caregiver burden (Massimo et al., 2018).

Physical problems. As dementia progresses over time and parts of the brain experience significant damage, people with dementia begin to exhibit changes in sleep patterns, difficulty with vision and depth perception, and changes to the senses of smell and touch (Joussain et al., 2016; Yamasaki & Tobimatsu, 2018). People with dementia usually have difficulty performing daily tasks such as bathing and dressing, and may become incontinent (Alzheimer's Association, 2019). Often the physical aspects of dementia reduce opportunities for meaningful interactions with others, increasing the chances for isolation and loneliness (Cohen-Mansfield et al., 2017). In the later stages of

dementia, motor functions including the ability to walk or manipulate objects deteriorate and eventually the individual is bound to bed and in need of full-time care (Alzheimer's Association, 2019). The National Alzheimer's Association reports that approximately 75 percent of older adults with Alzheimer's disease end their lives in a nursing home setting (2019).

Nursing home care for people with dementia. When the symptoms of dementia, especially behavior problems, become too much for family caregivers to manage, they often seek long-term care services, including nursing home care (Kales et al., 2015). The majority of older adults living in nursing homes are long-term or permanent residents who are in need of nursing care, assistance with activities of daily living (ADL), and 24-hour supervision (National Institute on Aging, 2017). Approximately 60 percent have been diagnosed with some form of dementia (Harris-Kojetin et al., 2019), but only 4 percent of the nursing home beds in the United States are in dementia-care units, which are specially tailored to residents who may need greater levels of supervision and specialized care (Alzheimer's Association, 2019). Even in the best facilities, people living with dementia spend a significant amount of time in a state of inactivity, with few opportunities for pleasure and engagement (Cohen-Mansfield, Marx, et al., 2012; Colling, 2004). This is concerning because lack of stimulation is associated with greater likelihood of physical, mental, and social decline among residents with dementia (Sposito et al., 2017). Since there is no cure for dementia, the focus of researchers outside of the biomedical field has primarily been on providing support to caregivers and helping people with dementia maintain a high quality of life (QoL) for as long as possible (Centers for Disease Control and Prevention, 2019a). Researchers have found that

defining and assessing QoL among people living with dementia can be a challenging task, however.

Quality of life and well-being of people with dementia. Various QoL models measure factors such as happiness, life satisfaction, personal growth, or purpose in life, while still others have been developed to explain QoL for people with chronic diseases such as cancer or mental disorders (Jonker et al., 2004; Ryff & Keyes, 1995). Lawton et al. (1984) proposed a QoL model adjusted for older adults, consisting of four sectors:

- Behavioral competence: overall health, cognitive ability, daily activities and social interactions.
- Perceived quality of life: a subjective evaluation of a person's social and community involvement.
- Psychological well-being: positive affect (pleasure, engagement/interest, and contentment) and negative affect (anger, anxiety/fear, and sadness).
- Objective environment: a measurement of the influence that outside factors have on overall life satisfaction.

The problem with this model, when applied to people living with dementia, is that some of the sectors are based on factors that are either deteriorated (such as cognitive and physical health), require personal reflection beyond the capability of the individual, or produce inflated results because of lack of awareness (Burgener et al., 2005). Because of these limitations, some social scientists have suggested that the most accurate way to measure QoL among people living with dementia is to use the sector of psychological well-being, measured primarily through positive and negative affective states (Burgener

et al., 2005; Jonker et al., 2004; Lawton et al., 1984). Factors of positive affect include pleasure and self-esteem, while negative affect includes emotions such as anger and anxiety (Cohen-Mansfield et al., 2015). In this way, a measurement of the perceived lived experience of someone without the ability to control things like autonomy or their objective environment can be taken (Burgener et al., 2005).

Positive and negative affect are useful in research because they are observable and fairly stable mood indicators, even among people who are severely cognitively impaired (Cohen-Mansfield, Dakheel-Ali, et al., 2012), and changes in affect through environmental stimuli are easily recognized (Lawton et al., 1996). As evidenced by empirical studies, measuring improved psychological well-being levels suggests higher levels of perceived quality of life in spite of diminishing physical and mental capabilities (Gross et al., 2015; Lawton et al., 1984; Perez-Saez et al., 2018; Schall et al., 2018; Windle et al., 2018). While the well-being of people living with dementia is a primary consideration for researchers, the challenges posed by dementia are problematic for professional caregivers as well (Bamonti et al., 2017), and are a secondary focus of the current study.

Burden on nursing assistants. A significant amount of the direct care provided in nursing homes is delivered by nursing assistants (Centers for Disease Control and Prevention, 2018), who often have frequent, long-term interactions with residents (Booth et al., 2018). Nursing assistants perform demanding tasks such as heavy lifting and intimate physical care for low pay and often with inadequate training (Bamonti et al., 2017; Institute of Medicine, 2008). In the state of Ohio, Nursing Assistants (referred to as State Tested Nursing Aides, or STNAs) are required to complete 75 hours of training and

pass a state-administered competency evaluation test (Ohio Department of Health, 2018). Caregiving can be very difficult, and nursing assistants often react to the challenges of high caseloads, difficult care situations and grief from the death of residents with high levels of depression, emotional exhaustion, or in some cases, depersonalization of individuals in their care (Bamonti et al., 2017; Elliott et al., 2018). The presence of behavior problems among residents is recognized as a significant factor in nursing assistant burnout, depression, and career departure (Woodhead et al., 2016). Dementia care providers, such as nursing homes and day care centers, report very high turnover rates for direct care staff (Institute of Medicine, 2008). Because the relationship between direct care staff and care recipients can greatly impact the quality of care provided, finding ways to improve the work environment may increase the well-being of workers and residents alike (Booth et al., 2018). Additionally, nursing assistants who are provided opportunities to learn new skills and develop feelings of competence may be more willing to take on new roles and seek innovative ways to meet the needs of their care recipients (Elliott et al., 2018; Melhuish et al., 2017).

Theoretical Framework

The Need-Driven Dementia-Compromised Behavior Model. The neurological degeneration caused by dementia produces a number of problematic symptoms including memory loss, physical disability and the development of problem behaviors (Alzheimer's Association, 2019). Memory-related behavior problems impact the well-being of people living with dementia as well as the people who provide their care (Azermai, 2015; Ellis et al., 2016). One explanation for the development of memory-related behavior problems

among individuals with dementia is that they are an attempt by people with diminished cognitive, physical and communicative abilities to express unmet needs (Algase et al., 1996). The Need-Driven Dementia-Compromised Behavior Model (NDBM) attempts to explain memory-related behavior problems primarily as expressions of need, rather than direct symptoms of dementia (Algase et al., 1996). The model is comprised of three primary constructs: background factors, proximal factors, and need-driven behaviors (see Figure 1) (Ahn & Horgas, 2014).

- Background factors refer primarily to physiological and demographic factors that tend to be rather fixed, such as gender, personality, or ethnicity; or relate to medical conditions such as cognitive or general health, which are best addressed through pharmacological or medical interventions (Algase et al., 1996). Background factors such as physical or cognitive ability are often the reason that people with dementia are unable to manage proximal factors such as their physical and social environment (Dettmore et al., 2009).
- Proximal factors are internal and external factors that create unmet needs in persons with dementia, such as an uncomfortable physical environment, pain, social isolation, or boredom (Algase et al., 1996). Proximal factors are often manipulated in intervention studies to reduce NDB.
- Need-driven behavior problems are behaviors exhibited by people living with dementia such as agitation, aggression, negative affect, and apathy. Instead of viewing behavior problems as symptoms of dementia, the NDBM posits that

NDB are expressions of need by people with a reduced capacity to communicate, and therefore are manageable (Algase et al., 1996).

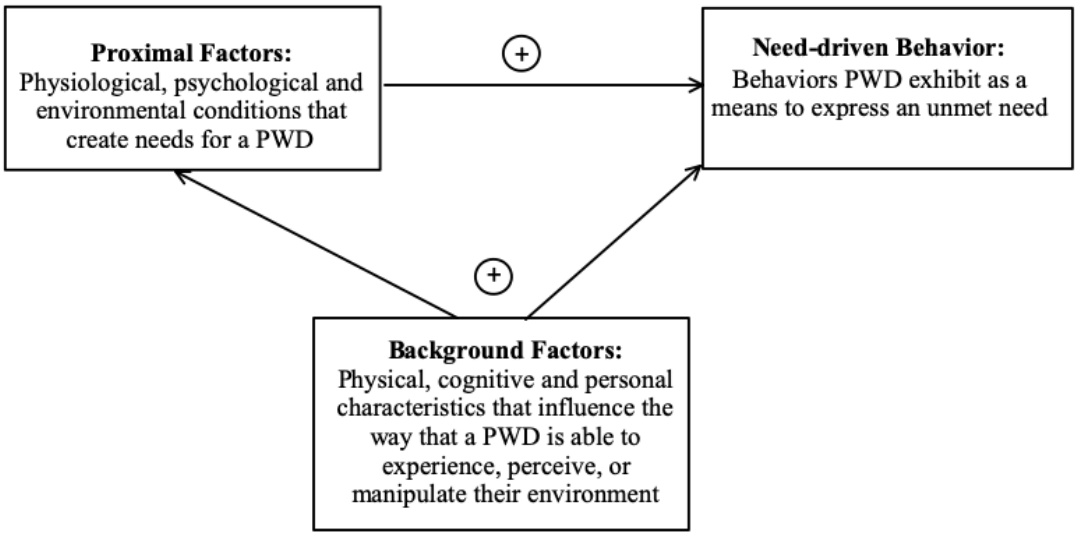

Figure 1. The Need-driven Dementia-compromised Behavior model (Algase et al., 2010; Algase et al., 1996)

As illustrated in Figure 1, background factors may produce NDB directly, for example when a physical disability results in frustration, exhibited through aggressive behavior (Algase et al., 2007). Background factors can also indirectly influence NDB through proximal factors, as illustrated in Figure 2. In the example, cognitive function, medical co-morbidities, and functional disability (background factors) prevent a person living with dementia from seeking relief from pain (proximal factor), creating a need for assistance that is outwardly expressed through NDB such as depressive symptoms or disruptive behaviors (Norton et al., 2010).

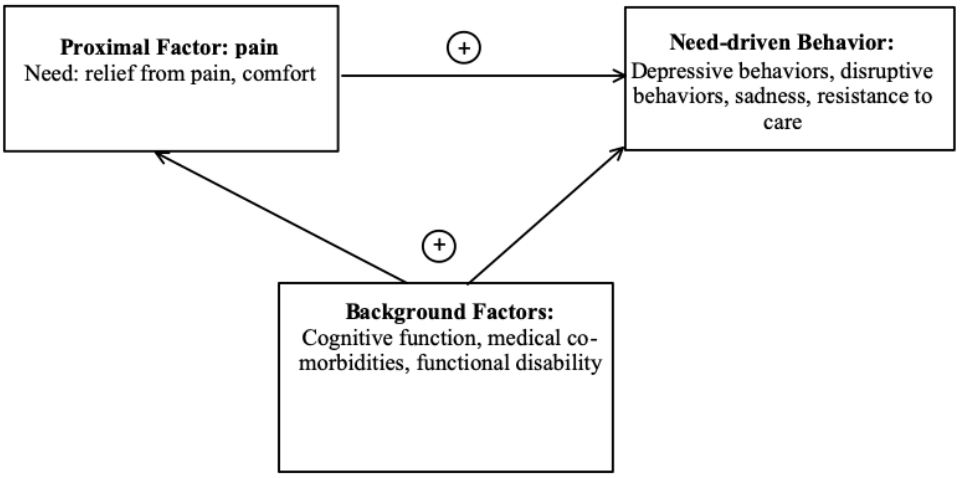

Figure 2. The Need-driven Dementia-compromised Behavior applied to the proximal factor of pain (Norton et al., 2010)

In the example illustrated in Figure 3, researchers attempted to reduce wandering (NDB) through an intervention seeking to address environmental factors such as crowding, extreme levels of sound, light, temperature, and humidity that created the need for a comfortable environment.

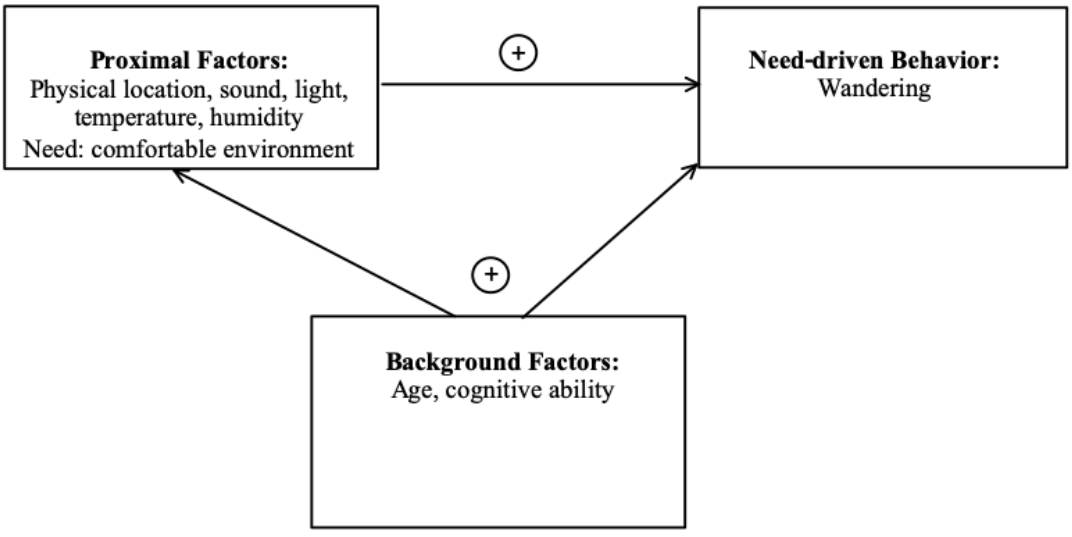

Figure 3. The Need-driven Dementia-compromised Behavior applied to the proximal factor of environmental discomfort (Algase et al., 2010)

Studies show that interventions aimed at addressing the unmet needs of people with dementia reduce NDB and as a result improve the well-being of nursing home residents with dementia (Algase et al., 2010; Beck et al., 2011; Bedard et al., 2011; Kolanowski et al., 2011; Moyle et al., 2018).

Nursing assistants are an important aspect of NDBM interventions. When nursing assistants fail to recognize behaviors as an expression of need, or when the proximal factors are misinterpreted, the development of additional NDB may occur as secondary symptoms (Algase et al., 1996; Algase et al., 2007). When caregivers recognize unwanted behaviors as a means of communication, and are able to respond to those needs, the NDBM provides a method for direct care workers to improve the well-being of people living with dementia while at the same time reducing their own caregiving burden (Fukui et al., 2011). Some unmet needs are difficult to address, such as the need for optimal physical or psychological health, but others, like emotional comfort, social engagement and physical activity, are easier to manipulate (Dettmore et al., 2009). One method for doing this is through the use of multi-sensory interventions.

Responding to unmet needs through multi-sensory technology. Multi-sensory interventions involve activities that activate two or more senses in the attempt to engage participants with their physical and social environment (Collier et al., 2010). There are many types of multi-sensory interventions for people with dementia, from the use of music and art (Evans et al., 2017; Perez-Saez et al., 2018; Tan et al., 2019) to gardening (Noone et al., 2017), interactions with animals (Fields et al., 2018; Wesenberg et al., 2018), or in a growing number of studies, technology (Bruil et al., 2018; Collier et al., 2010; Garlinghouse et al., 2018; Goto et al., 2014; Gustafsson et al., 2015; Heesterbeek et

al., 2019; Joranson et al., 2015; Luyten et al., 2018; Maseda et al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sanchez et al., 2016; Sposito et al., 2017). Interventions that include a technical component have the potential to simulate social interaction, as in the case of robotic animals (Gustafsson et al., 2015; Joranson et al., 2015; Moyle et al., 2017), or to titillate the senses with images, sounds and smells that provide a sense of novelty appealing to a person with dementia as well as caregivers (Bruil et al., 2018; Collier et al., 2010; Heesterbeek et al., 2019; Joranson et al., 2015; Moyle et al., 2017). Multi-sensory technology interventions attempt to engage people living with dementia by offering opportunities to become more physically, cognitively, and socially engaged with their environment (Kolanowski et al., 2011; Moyle et al., 2018). Multi-sensory technology has been used to address NDB, and research shows that the methods are largely successful, if not long-lasting (Bruil et al., 2018; Maseda et al., 2014; Moyle et al., 2017).

Social Cognitive Theory. Constructs of Social Cognitive Theory (SCT) were used to develop questions related to staff satisfaction with the Tovertafel and their intentions to utilize it as part of their routine activities aimed at NDB and indirectly improving the well-being of staff and residents. Social Cognitive Theory was developed by Albert Bandura in the 1980s, and focuses on the interaction between personal, environmental and behavioral factors, which is referred to as reciprocal determinism (Glanz et al., 2015). The SCT suggests that the interpretation of personal behavior (e.g., initiating a Tovertafel session) will change the environment (e.g., reduced negative experiences with residents due to behavior problems), which in turn changes personal attitutes (e.g., desire to continue the use of the Tovertafel) (U.S. Department of Health &

Human Services, 2005). The SCT is a good fit for this study because it recognizes the role of reinforcements to continue a behavior and the role of observational learning as a means to acquiring greater self-efficacy and behavioral capability (the skills needed to perform a behavior) (Glanz et al., 2015; U.S. Department of Health & Human Services, 2005).

Summary

There is no cure for dementia (Alzheimer's Association, 2018; Centers for Disease Control and Prevention, 2019a), so finding ways to increase the well-being of people diagnosed with this degenerative and fatal condition is important. Dementia results in the degradation of cognitive, physical, and emotive abilities, which makes it difficult to control one's surroundings or express needs (Algase et al., 2010; Algase et al., 1996). Often older adults with dementia are placed in nursing homes because of behavior problems that make family caregiving too burdensome (Kales et al., 2015). Some researchers theorize that memory-related behaviors such as agitation, aggression or apathy develop as an attempt by people with dementia to express an unmet need, and when that need is addressed, the unwanted behaviors diminish (Burfield et al., 2012; Fukui et al., 2011). A number of multi-sensory technology interventions have been developed that seek to provide opportunities for increased engagement, pleasure and social interaction, which are common unmet needs in nursing home environments (Collier et al., 2010; Garlinghouse et al., 2018; Goto et al., 2014; Gustafsson et al., 2015; Heesterbeek et al., 2019; Joranson et al., 2015; Luyten et al., 2018; Maseda et al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sanchez et al., 2016; Sposito et al., 2017).

Additionally, reducing NDB can increase work satisfaction and decrease burden among nursing assistants (Bird et al., 2016). Interventions that provide novel ways to promote a positive connection between residents and nursing assistants, especially when they are viewed as fun or novel, may increase the well-being of residents as well as nursing home staff (Booth et al., 2018; Elliott et al., 2018).

Purpose of the Study

The purpose of this study is to improve scientific understanding of the effectiveness of an innovation called the Tovertafel (Active Cues "Magic Table"), that is designed to provide physical, social, and cognitive engagement for people with cognitive impairment through multi-sensory interactive games. The investigation will seek to learn whether the intervention reduces NDB by addressing the unmet needs of nursing home residents for physical, cognitive, and social engagement, and as a result, improves their well-being. Additionally, the study seeks to understand nursing assistants' experiences when using the device as part of daily enrichment activities for residents.

Implications for Health Educators

This study provides several implications for health educators. First, the implementation of the Tovertafel intervention provides an opportunity to improve the well-being of both nursing home residents and nursing assistants. The presence of diminished cognitive and reasoning abilities in people living with dementia prevent health educators from teaching them new skills or strategies to address unmet needs, (Algase et al., 2010; Algase et al., 1996), so programs designed to reduce NDB are aimed at educating staff instead. Participation in the design and execution of multi-sensory

technology provides the opportunity for direct care staff to learn more about strategies designed to reduce NDB among residents. Nursing assistants will attend training sessions to learn to use the Tovertafel and will be instructed how to use the activity to encourage engagement among participants. Nursing assistants, as direct care workers in nursing homes, are frequently faced with the difficulties of dealing with NDB, but rarely possess the skills necessary to implement an intervention that might improve the situation (Dettmore et al., 2009). Conversely, health educators are presented with the opportunity to gain insight from experts who live in the real world. Research shows that integrating direct care staff into the intervention process is a useful way to gain insight into the needs of nursing home residents and can be effective in identifying innovative ways to provide optimal care (Fukui et al., 2011).

Finally, the proposed study provides health educators with an opportunity to aid in the development of stronger relational ties between professional caregivers and care recipients in the nursing home setting. Interventions that provide one-on-one interaction between staff and residents, especially when they result in reduced burden of care, may create positive situations that benefit both the caregiving staff and the care receiving residents (Booth et al., 2018). Research shows that direct care staff who feel that they are able to help residents and feel good about their work are more likely to be open to person-centered care, and to initiate activities aimed at providing opportunities for stimulation and engagement (Booth et al., 2018; Sposito et al., 2017).

Conceptual Model

This study will utilize the Needs-driven Behavior-compromised Behavior model as a theoretical framework. The NDBM consists of three primary constructs: background factors, proximal factors, and needs-driven behavior problems. Because background factors like neurological status and cognitive status tend to be rather fixed, they are recognized in the current study, but will not likely change as a result of the Tovertafel intervention (Algase et al., 1996; Algase et al., 2007). Previous studies have utilized engagement as a proximal factor to reduce behaviors such as vocal agitation (Bedard et al., 2011), agitation, apathy and mood (Kolanowski et al., 2011). The Tovertafel is designed to encourage physical, social and cognitive engagement among people with dementia, and therefore this will be considered a proximal factor in the current study (Anderiesen, 2017). Using interactive games projected on to a table, residents will be encouraged to interact with the images physically, interact with others socially, and utilize remaining cognitive skills to manipulate the images and play games. It is hypothesized that the multiple types of engagement will address needs that residents have to alleviate social isolation, boredom, and a need for physical activity. Increased engagement will be measured using an observational tool to detect changes in physical activity, interest (social engagement), and attention (cognitive engagement). Behaviors will be measured through researcher and staff-reported observations of pleasure, self-esteem, sadness, negative affect (e.g., anger, physical agitation and verbal anxiousness), memory-related behavior problems (e.g., repetitive questions, restlessness, or destructive behavior), and apathy.

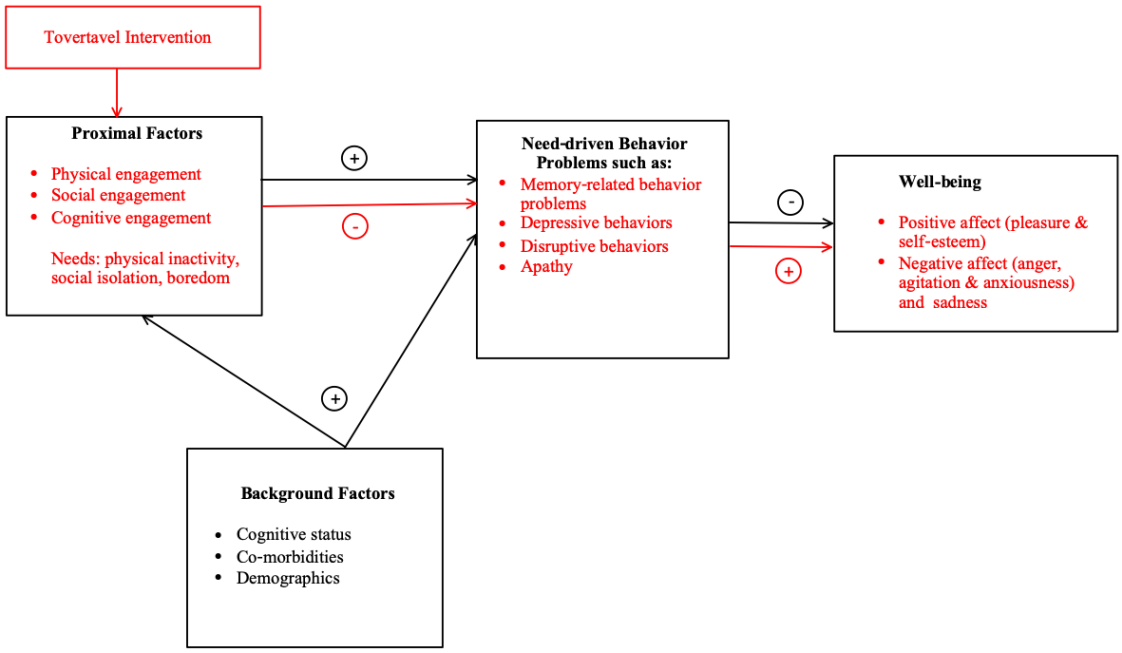

Figure 4. Conceptual model of the study

An illustration of the conceptual model of the study is provided in Figure 4. The conceptual model provides a context for the project, but the purpose of the current study is not to test the model. Rather, the purpose is to look for changes in the proximal factors, changes in need-driven behavior, and finally measure changes in the measures of well-being. In the next section, the research questions and hypotheses for the study are provided.

Research Questions and Hypotheses

The proposed study has four research questions, each with associated hypotheses:

Question 1: Does playing Tovertafel games increase physical, social and cognitive engagement and improve psychological well-being (i.e., increased pleasure and self-esteem and decreased negative affect and sadness) among residents?

- Hypothesis 1a: While playing with the Tovertafel, residents will be more physically, socially and cognitively engaged.

- Hypothesis 1b1: While playing with the Tovertafel, residents will exhibit increased pleasure.

- Hypothesis 1b2: While playing with the Tovertafel, residents will exhibit increased self-esteem.

- Hypothesis 1b3: While playing with the Tovertafel, residents will exhibit decreased negative affect.

- Hypothesis 1b4: While playing with the Tovertafel, residents will exhibit decreased sadness.

Question 2: Following a one-week intervention using the Tovertafel, are residents more physically, socially and cognitively engaged and are there improvements in residents' memory-related behavior problems, apathy, and psychological well-being

- Hypothesis 2a: Residents who participated in the intervention will be more cognitively, socially and physically engaged.

- Hypothesis 2b: Residents who participate in the intervention will have fewer memory-related behavior problems.

- Hypothesis 2c: Residents who participate in the intervention will show reduced signs of apathy.

- Hypothesis 2d1: Residents who participated in the intervention will exhibit increased pleasure.

- Hypothesis 2d2: Residents who participated in the intervention will exhibit increased self-esteem.

- Hypothesis 2d3: Residents who participated in the intervention will exhibit decreased negative affect.

- Hypothesis 2d4: Residents who participated in the intervention will exhibit decreased sadness.

Question 3: Do Nursing Assistants report that residents' memory-related behavior problems have less impact on caregiving burden and the well-being of other residents and staff following the one-week intervention?

- Hypothesis 3a: Nursing Assistants will report less impact of memory-related behavior problems on their ability to provide care.

- Hypothesis 3b: Nursing Assistants will report less impact of memory-related behavior problems on the well-being of other residents and staff on the unit.

Question 4: Upon completion of the study, how do Nursing Assistants rate their satisfaction with the Tovertafel, and do they express perceived benefits from the intervention?

- Hypothesis 4a1: Nursing assistants will indicate competency to initiate and lead Tovertafel sessions on their own.
- Hypothesis 4a2: Nursing Assistants will agree that the Tovertafel sessions increase engagement, as well as reduce memory-related behavior problems and apathy of the residents.
- Hypothesis 4a3: Nursing assistants will agree that they enjoyed using the Tovertafel, are likely to use it as a regular group activity and recommend it to others.

Significance of the Study

Dementia is a progressive neurological condition that brings about cognitive, physical, and behavioral changes that greatly impact the well-being of older adults and result in higher levels of burden and stress for caregivers (Alzheimer's Association, 2019; Centers for Disease Control and Prevention, 2019a). Memory-related behavior problems such as aggression, agitation, and apathy may be the result of an inability on the part of people living with dementia to express needs that arise from physical, environmental and social situations (Algase et al., 1996; Algase et al., 2007). Research shows that multi-sensory technology interventions that are designed to increase engagement and social interaction are effective in reducing NDB (Algase et al., 2010; Bruil et al., 2018; Gustafsson et al., 2015). This study will use a projection device called the Tovertafel to deliver multi-sensory interactive games. The Tovertafel is a piece of equipment that is installed on the ceiling and projects images and games onto a flat surface positioned under it (Anderiesen, 2017). It was designed to provide opportunities for increased physical, social and cognitive engagement during play sessions, with the goal of reducing

apathy and negative affect among nursing home residents with dementia (Anderiesen, 2017). Using infrared sensors, the device detects movement, making the games interactive and responsive to participant input (Anderiesen, 2017). The games designed for people with dementia consist of low-risk, low-frustration activities (Anderiesen, 2017).

To date, this is the first study to investigate the effects of the Tovertafel to improve the well-being of nursing home residents with dementia in the United States. Considering the growing number of older adults with dementia, the results of this study have the potential to impact large numbers of people living with dementia by addressing needs for engagement and increasing psychological well-being. It is also the first study to provide feedback from direct care workers, adding knowledge about the use of the Tovertafel in a nursing home setting. The inclusion of direct care staff in the delivery and evaluation of the intervention provides opportunities for greater insight into the ways that multi-sensory technology can improve the work experience of staff and encourage an often-overlooked segment of the heath care field to consider innovative ways to deliver optimal person-centered care (Dettmore et al., 2009; Fukui et al., 2011). Nursing homes and other providers who seek to provide enrichment activities for people with dementia may use the findings to help develop new opportunities to improve well-being among residents and direct care workers.

Definition of Terms

Apathy – The absence of motivation, self-directed goals and general disinterest in cognitive, social, emotional, and physical engagement (Massimo et al., 2018). Apathy is associated with reduced mental processing, a lowered ability to express or respond to emotions, withdrawal from people and stimuli, and reduced physical activity (Colling, 2004).

Background factors – A construct of the Need-driven Dementia-compromised Behavior Model. Background factors are relatively fixed, mostly physiological and demographic factors of dementia such a cognitive and health status, age, gender, and ethnicity (Algase et al., 1996).

Dementia – The term refers to one of a number of neurological disorders that result in brain changes that bring about changes in cognitive abilities. The most common form of dementia is Alzheimer's disease, representing 60 to 80 percent of all people living with dementia (Alzheimer's Association, 2019).

Engagement – Refers to a physical or verbal response provided by an individual to an activity or stimulus (Cohen-Mansfield, Dakheel-Ali, et al., 2012). To be engaged, people generally need to respond in a way that is measurable by duration, attention and attitude (Cohen-Mansfield et al., 2009). Physical engagement is measured through bodily motions such as movement of hands, arms, or head, to participate in an activity; movement to block an activity; and voluntary movement to show affection or gain attention. Social

engagement is measured through observable interest in others; offering support of others without prompting; or acknowledging support from a peer. Cognitive engagement is measured through the observation of participants who sustain attention in the activity while engaged; do not require verbal prompting or cueing; or initiate or engage in conversation during the activity.

Memory-related behavior problems – Behaviors that are often present in persons with dementia such as agitation, aggression, negative affect, and apathy. In the Needs-driven Behavior-compromised Model, memory-related behavior problems are viewed as expressions of need by a person with reduced ability to communicate, rather than symptoms of dementia, and therefore are manageable through person—centered care that focuses on addressing those needs (Algase et al., 1996).

Multi-sensory technology – Refers to interventions aimed at promoting physical, social and/or cognitive engagement among nursing home residents with dementia through activities that engage multiple senses such as sight, hearing, taste, and touch.

Negative affect – Refers to emotional responses that can be either expressed by the individual or observed by others. Indicators of negative affect include emotions such as anger, physical agitation, and verbal anxiousness (Cohen-Mansfield, Dakheel-Ali, et al., 2012).

Nursing home – Refers to residential facilities that provide ongoing skilled nursing care. Long-term care provided in a nursing home setting generally involves round-the-clock skilled nursing care. Individuals receiving care may reside at the facility for short-term stays (e.g., rehabilitation, respite), or they may consider the long-term care facility a permanent residence (Alzheimer's Association, 2019).

Pleasure – The presence of outward signs of happiness such as smiling, laughter or enjoyment (Cohen-Mansfield, Marx, et al., 2012).

Positive affect – Refers to emotional responses that can be either expressed by the individual or observed by others. Indicators of positive affect include pleasure and self-esteem (Cohen-Mansfield, Dakheel-Ali, et al., 2012).

Proximal factor – As a construct of the Needs-driven Behavior-compromised Model, proximal factors are internal and external factors that create unmet needs in persons with dementia such as an uncomfortable physical environment, pain, social isolation or boredom (Algase et al., 1996). Proximal factors are often manipulated in interventional studies to reduce memory-related behavior problems.

Psychological well-being – One of the four sectors that comprise the concept of quality of life, psychological well-being refers to the positive affective states (e.g., pleasure, self-esteem) and negative affective states (e.g., anxiety, apathy, agitation) (Burgener et al., 2005).

Sadness – A depressed emotional state evidenced by crying, facial expressions, or moaning (Lawton et al., 1996).

Self-esteem – A feeling of pride and accomplishment measured through the observation of non-verbal expressions of pride, verbal expressions of satisfaction, and inferred prideful reminiscence of past accomplishments (Rentz, 2002).

Technology – When applied to multi-sensory technology interventions, the term "technology" refers to non-invasive electrical devices used as active or passive facilitators of physical, social, and/or cognitive engagement of nursing home residents with dementia (Maresova et al., 2018).

Assumptions

The researchers have made assumptions about the study participants and environment that are important to consider.

1. Much of the data collected during the study will rely on reports from the nursing assistants. The quality and accuracy of the data used for the study is dependent upon the assumption that the nursing assistants will spend the time necessary to reflect on each resident for which they provide care and provide truthful responses to the questions.

2. Staff participating in the study are motivated by genuine interest in the Tovertafel and the well-being of the residents in their charge rather than personal motives such as gaining the favor of their employer or seeking promotion within the organization.

3. The Tovertafel presents projected games onto a flat surface, resulting in an activity that has a "magic" element to it. The study relies on the assumption that residents will be receptive to the activity and willing to participate in the activities.

4. The inclusion and exclusion criteria for the residents are sufficient to ensure that all participants are comparably capable of participating in the intervention.

5. The researchers bring to the table a certain level of personal expectations and bias that will influence the design, execution, and interpretation of the study.

Limitations of the Study

There are four main limitations to the proposed study that may impact the results.

1. Due to the subjective nature of the reporting of individuals under their direct care, it is possible that Nursing Assistants will provide answers that reflect a bias toward physiological symptoms and explanations for behaviors. If so, this would threaten the internal validity of the findings.

2. Some Nursing Assistants may not spend enough time with the residents each day to accurately respond to the behavior questionnaires, which would reduce the internal validity of the findings.

3. Because the study is not a true experimental random control design, the findings can only be viewed as correlational. A direct cause and effect relationship cannot be derived from the results.

4. The use of two similar nursing homes located in the same geographic area may reduce the diversity of the sample, reducing the generalizability of the results.

Delimitations of the Study

Several deliberate design choices were made by the researchers to improve the quality of study.

1. Inclusion and exclusion criteria delimit the study to only residents with significantly impaired cognitive abilities, increasing the potential validity of the findings.

2. The complexity of the study precludes the feasibility of extending the intervention activities to multiple nursing facilities, so the study is delimited to include two nursing homes.

3. Because of the subjective nature of the data collection methods, both the researchers and nursing assistants share in the data collection processes, providing a level of triangulation of the findings and reducing the possibility of researcher bias.

4. The data collection and analysis methods are delimited to the reporting of data that cannot identify any particular individuals.

5. The survey questions were delimited to include the opinions of only direct care nursing assistants who have direct, one-on-one interactions with participants.

Summary

This chapter introduced the reader to common signs and symptoms of dementia and explained the implications of an aging society that will likely result in greater numbers of people with dementia. A special emphasis was placed on the impact that memory-related behavior problems can have on the well-being of these individuals as well as their caregivers. A review of the Need-based Dementia-compromised Behavior Model was provided, and the potential of multi-sensory technology as a strategy to meet the needs of people with dementia was introduced. The next chapter presents literature related to the Need-driven Dementia-compromised Behavior Model and a review of multi-sensory interventions that utilized a technological component.

Chapter Two

Review of Literature

Introduction

This chapter presents literature related to the study. The information in this chapter provides the reader with sufficient background information about the theoretical framework of the proposed study, and an understanding of how multi-sensory technology has been used in previous studies to address memory-related behavior problems among nursing home residents with dementia. An interpretation of the studies as they apply to the current study is also provided. The major sections of this chapter are Overview, Literature Search Strategy, Use of Theory, Use of Technology, Background and Proximal Factors, Study Design and Results, Interpretation of the Literature, Gaps in the Literature, and Summary.

Overview

The first chapter presented evidence that dementia is a condition that impacts older adults cognitively, physically, and socially (Alzheimer's Association, 2019; Centers for Disease Control and Prevention, 2019a; Cohen-Mansfield et al., 2017; Colling, 2004; Joussain et al., 2016). In the later stages of dementia, older adults are often placed in nursing homes where they receive supervised health care but are also often subject to environments that are devoid of opportunities for engagement and personal enrichment (Cohen-Mansfield, Marx, et al., 2012; Colling, 2004). One of the more troublesome problems associated with dementia are the behavior problems such as aggression,

agitation, and apathy, which diminish well-being for people living with dementia and caregivers alike (Kales et al., 2015; Massimo et al., 2018; Woodhead et al., 2016). Some social scientists have suggested that problem behaviors are not a symptom of dementia, but rather an attempt on the part of people with diminished physical and cognitive ability to communicate needs that are not being met (Algase et al., 1996; Algase et al., 2007; Beck et al., 2011; Cohen-Mansfield et al., 2015). One theory that attempts to explain the relationship between unmet needs and behavior problems is the Need-driven Dementia-compromised Behavior Model, which posits that a combination of background and proximal factors create needs among people living with dementia that result in need-driven behaviors (Algase et al., 1996; Algase et al., 2007). Researchers have developed a number of interventions in an attempt to address the unmet needs of people living with dementia living in nursing homes, some of which involve multi-sensory technology (Bruil et al., 2018; Collier et al., 2010; Garlinghouse et al., 2018; Goto et al., 2014; Gustafsson et al., 2015; Heesterbeek et al., 2019; Joranson et al., 2015; Luyten et al., 2018; Maseda et al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sanchez et al., 2016; Sposito et al., 2017). This chapter provides a summary of the research that has been conducted to explore the concept of the NDBM and use of multi-sensory technology interventions to reduce the occurrence or severity of NDB.

Literature Search Strategy

Procedure. Prior to designing the current study, a search of scholarly literature related to the theory and intervention strategy was performed. Several credible academic library databases were utilized to find articles published in the past ten years. Through

adaptive selection of key terms, relevant publications were located. The search strategies utilized are explained in this section.

Academic databases. Searches were performed in CINAHL Plus with full text, Academic Search Complete, PsychInfo, PUBMed, and Web of Science. Two separate searches were necessary because there was no literature located that included both the use of the Need-driven Dementia-compromised Behavior Model and multi-sensory technology among nursing home residents.

Use of Boolean operators. Boolean operators such as AND, OR, and NOT allow for the use of multiple terms to create a specified search for articles in literature databases (Fatehi et al., 2014). This strategy was employed in combination with the use of exact phrase searching through the use of quotation marks (Fatehi et al., 2014). A summary of the databases and key words used is provided in Appendix A.

Terms utilized for searches.

Need-driven Dementia-compromised Behavior Model. The search for literature was limited to articles related to studies that investigated the Needs-driven Dementia-compromised Behavior Model with people living with dementia living in a nursing home or long-term care facility. Research related to community-dwelling individuals, people with early-onset dementia (i.e., under the age of 65) were removed, as were systematic reviews and articles published prior to 2007. The date limitation was selected because the model was updated by the originating author in that year (Algase et al., 2007). A total of nine articles meeting the search criteria were located.

Multi-sensory technology. The search for literature was limited to articles published since 2009 relating to multi-sensory technology interventions that contain elements of technology. The term "technology" refers to non-invasive electrical devices used as active or passive facilitators of physical, social, and/or cognitive engagement of nursing home residents with dementia (Maresova et al., 2018). The choice to limit the search to the last ten years was based on the fact that technology in general, and health-related technology in particular, has a life cycle that generally means that technology older than ten years is most likely either largely changed or no longer in general use (Gutierrez-Ibarluzea et al., 2017). Only interventions delivered to adults with dementia living in a nursing home or long-term care facility were selected from the resulting list of articles. The database searches resulted in thirteen articles published since 2009 that met the criteria.

Use of Theory

The search for published research involving the NDBM revealed nine articles, eight of which involved interventions with nursing home residents. One qualitative roundtable study was included to explore the value of involving direct care staff in the planning and execution of interventions aimed at reducing NDB. Each of the articles cited the NDBM as the central theory behind the planning and execution of the published study.

Only two of the thirteen multi-sensory technology studies utilized a theory. Gustafsson et al. (2015) discuss two theories in their study involving robotic cats, although the extent to which they were utilized to develop the study is not provided. The

biophilia hypothesis and the social support hypothesis were used to explain the attraction that humans have to animals, and the social benefits of owning pets (Gustafsson et al., 2015). The authors limit the discussion of theory to a justification of the use of robotic cats in the introduction and a brief reference connecting the human need to nurture to the biophilia hypothesis in the discussion (Gustafsson et al., 2015). Sanchez et al. (2016) references the Model of Imbalance of Sensoristasis to suggest that agitation among people living with dementia may be the result of imbalance between stimulating and calming activities. The theory is discussed in the introduction but does not appear in the study methodology or in the discussion of the findings (Sanchez et al., 2016).

While the remaining eleven multi-sensory technology intervention articles included in the review did not mention a theory, they all mentioned the role of unmet needs either directly (by using the term "needs" or "unmet needs," or through a discussion of the lack of an element such as social engagement, physical activity, or comfort (Bruil et al., 2018; Collier et al., 2010; Garlinghouse et al., 2018; Goto et al., 2014; Heesterbeek et al., 2019; Joranson et al., 2015; Luyten et al., 2018; Maseda et al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sposito et al., 2017). The implied recognition of the role that unmet needs play in the behaviors of people living with dementia who live in nursing homes supports the relevance of the NDBM in the planning and interpretation of multi-sensory technology interventions. But theory is only one consideration when reviewing research, so the next section will provide an overview of the study designs utilized in the selected literature.

Use of Technology

A robust body of evidence exists suggesting that interventions aimed at increasing positive affect and decreasing negative affect using multi-sensory technology are effective in improving the well-being of people with dementia (Bruil et al., 2018; Cohen-Mansfield, Dakheel-Ali, et al., 2012; Garlinghouse et al., 2018; Gustafsson et al., 2015; Heesterbeek et al., 2019; Joranson et al., 2015; Luyten et al., 2018; Maseda et al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sanchez et al., 2016; Sposito et al., 2017). This literature review is limited to multi-sensory interventions that use technology as an integral part of the intervention, either directly or indirectly. Technology can take on many different meanings. In this study, the term "technology" refers to non-invasive electrical devices used as active or passive facilitators of physical, social, and/or cognitive engagement of nursing home residents with dementia (Maresova et al., 2018). The aim of this study is to assess a multi-sensory intervention that involves a piece of technology that emits virtual images that engage participants physically, socially, and cognitively.

Technology is pervasive in modern society, so it should come as no surprise that it has been integrated into the nursing home setting. A number of interventions aimed at reducing NDB have been designed using technical components that are meant to enhance and, in some cases, customize the experience for residents (Garlinghouse et al., 2018; Heesterbeek et al., 2019).

The Needs-driven Behavior-Compromised model suggests that addressing physical discomfort, lack of socialization, or boredom can reduce behavior problems, and as a result, increase well-being for people with dementia (Algase et al., 1996). Most

research related to multi-sensory technology focuses on the need to provide a form of engagement aimed at satisfying a need, even when there is no reference to a model or theory (Joranson et al., 2015; Maseda et al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sposito et al., 2017). Activities that provide stimulation of more than one sense (multi-sensory) can reduce negative behaviors and increase positive emotions such as pleasure, even among individuals in the later stages of dementia (Moyle et al., 2017; Sposito et al., 2017). Strategies aimed at addressing unmet physical, social and cognitive needs are particularly attractive because they can be attempted before seeking pharmacological solutions (Bedard et al., 2011; Joranson et al., 2015; Sanchez et al., 2016), and behavior-centered interventions that are easy for staff to learn and implement are more likely to be clinically meaningful and practical, and therefore adopted by busy staff (Beattie et al., 2004; Fukui et al., 2011). The sections that follow provide a synthesis of the research including a review of the technologies used, study design and approaches, and the benefits and limitation of the interventions.

Approaches to multi-sensory technology. Modern technology offers researchers the opportunity to deliver unique methods for encouraging interaction and engagement for people with dementia (Luyten et al., 2018). The use of technology can provide a "magic" element to them that encourages people to engage with the activity and with others around them (Bruil et al., 2018; Luyten et al., 2018). Technology can also allow researchers to personalize activities, providing deeper meaning and connection among participants (Garlinghouse et al., 2018; Heesterbeek et al., 2019). A number of approaches have been taken to integrate technology into multi-sensory interventions, as described in this section.

Snoezelen Room. Researchers often use Snoezelen rooms in multi-sensory technology interventions. A Snoezelen room is a staged room with varied stations containing items such as bubble tubes, fiberoptic lights, music, aromatherapy devices, projectors, vibrating water beds, tactile devices, or mirror balls (Collier et al., 2010; Goto et al., 2014; Maseda et al., 2014; Sanchez et al., 2016; Sposito et al., 2017). Participants are led to the room, which is usually separate from everyday spaces, and allowed to interact with the items in undirected sessions usually lasting about 30 minutes (Maseda et al., 2014). Five of the studies included in the search for this review utilized a Snoezelen room to measure changes in agitation, memory-related behavior problems, depression, positive affect, cognitive function, and levels of engagement (Collier et al., 2010; Goto et al., 2014; Maseda et al., 2014; Sanchez et al., 2016; Sposito et al., 2017).

Robotic animals. Another popular multi-sensory technology intervention is the use of robotic animals. These devices are utilized with people living with dementia because they can be calming and provide a sense of comfort and socialization (Moyle et al., 2017). Two studies were found that utilized robotic seals (Joranson et al., 2015; Moyle et al., 2017), and a third study utilized similar technology with a robotic cat (Gustafsson et al., 2015). The devices contained robotic mechanisms that moved the head, legs, eyes and tail and also had a microphone that emitted the sounds of a baby harp seal (Joranson et al., 2015; Moyle et al., 2017) or a cat (Gustafsson et al., 2015). The software embedded in the robot allow the devices to respond to its environment such as the use of certain words or the stroking of its fur, making it an interactive, responsive device (Joranson et al., 2015).

Projection devices. Projectors were used to deliver innovative multi-sensory technology interventions for nursing home residents in three studies. Researchers in one study used the Tovertafel to encourage engagement among Dutch nursing home residents (Bruil et al., 2018). The Tovertafel is a device that projects images onto a flat surface (Bruil et al., 2018). The device has sensors that give the device the ability to detect hand and arm movement and adapt the projections, resulting in an interactive gaming experience through the delivery of various games (Anderiesen, 2017). An interactive art installation called the VENSTER was used in a second nursing home-based study (Luyten et al., 2018). Two large screens were mounted on a wall and connected to a computer that randomly projected scenes that react to the location of viewers in the room (Luyten et al., 2018). The software was designed to detect when people entered the room and would respond with music that corresponded with the video categories (calming, activiting and interactive) (Luyten et al., 2018). Finally, researchers used video projections in a study aimed at increaseing physcal engagement among nursing home residents (Heesterbeek et al., 2019). Participatns sat in a simulator that projected physcal activities such such as horseback riding, diving, walking, dancing, snowboarding, and skiiing while corresponding music and sounds were played and the platform moved along with the action (Heesterbeek et al., 2019).

Reminiscence therapy. Reminiscence therapy is a recreational activity that creates an opportunity for sharing and connection through auditory prompts such as music, photographs, or movies, or other items that evoke memories (Nijhof et al., 2013). This type of activity works well with people who have dementia, because while short-

term memory is impacted by dementia, long-term memories are often intact and can be elicited through guided prompting of discussions (Garlinghouse et al., 2018).

Technology such as digital photography, online resources and multimedia presentations have shown some potential in reminiscence therapy, providing unique and engaging experience opportunities (Garlinghouse et al., 2018). Researchers used technology to conduct a reminiscence intervention by using a game called Chitterchaters (Nijhof et al., 2013). The intervention game involved four computer-driven items: a TV (played videos), a radio (played music), a telephone (recited poems or a story), and a treasure box (revealed various objects when opened) (Nijhof et al., 2013). The group sat in a circle and participants took turns manipulating the items as directed by a facilitator (Nijhof et al., 2013). After viewing or listening to the multimedia portion of the game, the group spent time discussing it before moving on to the next item (Nijhof et al., 2013). In a second reminiscence therapy study, researchers interviewed residents, staff and family members and used the personal information and a 3-D printer to create representations of meaningful items such as pets, musical instruments and other objects that might be of interest to the resident (Garlinghouse et al., 2018). The items were used by staff and family members to initiate unstructured conversations with the residents (Garlinghouse et al., 2018).

As evidenced by the literature in this review, there is a diversity of technology available to researchers, and it is being integrated into multi-sensory technology interventions in a variety of ways. Like the interventions themselves, researchers used varied approaches to their study design. In the next section, a comparison of study

designs utilized including study size, theoretical constructs, background and proximal factors, and targeted behaviors is provided.

Background and Proximal Factors

Background factors. While background factors are generally acknowledged by researchers, they are rarely the focus of intervention studies because they are considered very stable and unresponsive to nonpharmacological interventions (Dettmore et al., 2009). Because the theory is specific to dementia studies, all research utilizing the NDBM include cognitive ability, cognitive status, or cognitive impairment as background factors (Algase et al., 2007). The NDBM studies included in this review also considered demographic characteristics such as gender, age, race or ethnicity, functional abilities, and medical co-morbidities as background factors (Ahn & Horgas, 2014; Algase et al., 2010; Beck et al., 2011; Bedard et al., 2011; Burfield et al., 2012; Kolanowski et al., 2011; Norton et al., 2010). Some studies simply acknowledged the presence of background factors (Ahn & Horgas, 2014; Algase et al., 2010; Beck et al., 2011; Burfield et al., 2012; Dettmore et al., 2009; Kolanowski et al., 2011), while others report differences in outcomes based on the factors. For example, Bedard et al. (2011) reported that their intervention aimed at reducing verbal agitation was most effective among individuals with higher cognitive function and among men. Similarly, Moyle et al. (2018) found that the use of lifelike dolls to reduce NDB was only utilized by female residents.

Because the multi-sensory technology studies either used another theory (Gustafsson et al., 2015; Sanchez et al., 2016) or no theory at all (Bruil et al., 2018; Collier et al., 2010; Garlinghouse et al., 2018; Goto et al., 2014; Heesterbeek et al., 2019;

Joranson et al., 2015; Luyten et al., 2018; Maseda et al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sposito et al., 2017), the background factors were not explicitly stated, however they can be surmised by the inclusion factors provided by the authors. Consistent with NDBM studies, all thirteen of the multi-sensory studies included cognitive function as an inclusion factor, and one study included functional ability (Sposito et al., 2017). While only three studies included age as an inclusion criterion (Bruil et al., 2018; Heesterbeek et al., 2019; Moyle et al., 2017), none of the articles reported a mean participant age under 60, and all were nursing home residents with dementia.

The nine NDBM studies and the thirteen multi-sensory technology studies appear to have utilized similar background factors, even if they were not expressed by all of the authors. The similarities did not carry over to the proximal factors investigated between the two categories, however. Because proximal factors are the items manipulated during a study (Algase et al., 1996), they bear examination.

Proximal factors. When using the NDBM to deliver an intervention, proximal factors are considered the independent variables to be manipulated (Algase et al., 1996). Researchers may choose to focus one proximal factor or examine a group of similar proximal factors that are likely to be influenced by the study (Algase et al., 2010). A summary of the proximal factors under investigation in the NDBM and multi-sensory technology literature is provided in this section.

Three of the NDBM studies included in this review focused on pain as a proximal factor (Ahn & Horgas, 2014; Burfield et al., 2012; Norton et al., 2010). Two studies looked at behaviors that develop as the result of unmet physical needs such as crowding,

and extremes in sound, light, temperature and humidity (Algase et al., 2010; Beck et al., 2011). Finally, three studies investigated the proximal factor of engagement as it pertains to unwanted behaviors (Bedard et al., 2011; Kolanowski et al., 2011; Moyle et al., 2017). A final study was included in the review that did not look at specific proximal factors, but rather investigated the role of caregiving staff in the process of identifying proximal factors and the resulting needs that staff should address to reduce NDB (Fukui et al., 2011).

Identifying proximal factors in studies that use the NDBM is rather straightforward, because the authors generally provide the information in the methods discussion. Identifying proximal factors in the multi-sensory technology studies meant identifying the variables that the researchers sought to manipulate. Because the Tovertafel was designed to provide physical, social, and cognitive stimulation (Anderiesen, 2017), the study by Bruil et al. (2018) is assumed to have considered lack of physical activity, need for social interaction and boredom as proximal factors. A similar assumption can be made for the Snoezelen room interventions that provide various sensory options (Collier et al., 2010; Goto et al., 2014; Maseda et al., 2014; Sanchez et al., 2016; Sposito et al., 2017). Heesterbeek et al. (2019) designed a study to increase physical activity, and the studies involving robotic animals and reminiscence therapy were intended to increase social activity (Garlinghouse et al., 2018; Gustafsson et al., 2015; Joranson et al., 2015; Moyle et al., 2017; Nijhof et al., 2013). Similarly, Luyton et al. (2018) sought to increase engagement. Interpreting proximal factors in studies that do not explicitly identify them can be difficult, but the knowledge assists the reader in understanding the origin of the unmet need, and ultimately the efficacy of the research.

While the proximal factors of the NDBM studies ranged from pain to environmental factors to engagement (Ahn & Horgas, 2014; Algase et al., 2010; Beck et al., 2011; Bedard et al., 2011; Burfield et al., 2012; Dettmore et al., 2009; Kolanowski et al., 2011; Moyle et al., 2018; Norton et al., 2010), the multisensory stimulation studies were all rather unified in their pursuit of activities to encourage some sort of engagement (Bruil et al., 2018; Collier et al., 2010; Garlinghouse et al., 2018; Goto et al., 2014; Gustafsson et al., 2015; Heesterbeek et al., 2019; Joranson et al., 2015; Luyten et al., 2018; Maseda et al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sanchez et al., 2016; Sposito et al., 2017). Provided the approaches resulted in improved behaviors among the participants, engagement appears to be the proximal factor most suited for multi-sensory technology interventions. The next factors to consider are the methodological approaches and results of the studies to determine their efficacy.

Study Design and Results

In this section, greater detail about each of the studies included in this review is provided so that the reader can determine the quality of the research, the methods employed, and the results reported by the authors. Because such detailed information may be difficult (or at the very least tedious) for the reader to synthesize, this section concludes with a summary that contextualizes the studies and reflects on their applicability to the present study. Because the NDBM studies explicitly stated the proximal factors under investigation, and they can be easily categorized into four groups, they are presented in this fashion. The multi-sensory technology interventions were more

logically grouped by type of the type of technology utilized, as this provides an easier method for understanding the application of the activities.

Design and results of the NDBM studies.

Pain. Three NDBM studies were identified that attempted to reduce NDB through the reduction of pain or pain severity. Two of the studies (Ahn & Horgas, 2014; Burfield et al., 2012) used secondary data obtained from the Minimum Data Set (MDS 3.0), a data collection tool that Medicare-certified nursing home facilities complete quarterly (Saliba et al., 2012). The data collection tool consists of 284 items categorized into 15 areas including activities of daily living, mental status, and physical abilities, and is completed by direct care nursing staff (Shin & Scherer, 2009). A third study utilized secondary data collected during a previously conducted study (Norton et al., 2010).

A cross-sectional secondary data analysis used longitudinal data from the Minimum Data Set Resident Assessment Instrument (MDS-RAI) to analyze data on nursing home residents over the age of 65 (Burfield et a., 2012). A total of 52,196 residents were included in the study with a mean age of 83.7 years (79.6% female). All residents in the records who were over the age of 65, other than those discharged during the data collection period, were included in the study. The researchers wanted to know if self-report was an effective method of determining whether a resident with dementia was experiencing pain.

When using only the staff-reported frequency and intensity of pain measures, residents with moderate to severe dementia appeared to have significantly less pain than resident without dementia. The analysis showed that 31.2 percent of the residents without

dementia experienced pain, compared to 29.4 percent of moderately demented, and 18.2 percent of individuals with severe dementia. When the researchers factored in behaviors such as affect/non-verbal cues (e.g., persistent anger, crying, withdrawal, reduced social interaction), verbal cues (e.g., repetitive questions and verbalizations, health and anxious complaints, and verbal abusiveness), and physical cues (e.g., disruptive sounds, screaming, self-abuse, restlessness, and pacing) as signs of pain, the prevalence of pain among the residents with dementia significantly increased. The results supported the findings of previous research that staff reports of pain among residents with moderate to severe dementia are under-reported. The authors suggested that staff education that includes strategies to incorporate behaviors into the pain assessment process may provide more accurate medical assessments and lead to higher quality of care for residents (Burfield et a., 2012).

Ahn et al. (2014) used an exploratory cross-sectional design to conduct a secondary data analysis of Florida nursing home resident data from the 2009 Minimum Data Set (MDS) data set. A total of 56,577 residents were included in the study, 67.7 were female, with an average age of 84.37 years. All nursing home residents over the age of 65 with a dementia diagnosis were included unless they were comatose. The residents were divided by dementia severity (mild, moderate and severe) and aggressive behaviors (verbally abuse behavioral symptoms, physically abusive behavioral symptoms, socially inappropriate behavioral symptoms, and resisting care) were assessed based on pain levels as the independent variable. For the group assessed, pain level was not found to be a proximal factor for residents with mild or moderate dementia, but for those in the

severe dementia group who experienced severe pain, the rate of aggressive behaviors was significantly higher (Ahn & Horgas, 2014).

Norton et al., (2010) also conducted a secondary data analysis using pain as a proximal factor. The researchers originally recruited 162 nursing home residents (mean age 83.43, 83% female) who were at least 55 years old, had a diagnosis of dementia, and a history of verbal disruption to participate in a randomized controlled trial of an unspecified multisensory intervention. Background factors for the secondary analysis were race, gender, cognitive function, medical co-morbidities and functional disability as background data. Pain intensity was considered the proximal factor. The dependent variables were memory-related behavior problems, depressive behaviors, disruptive behaviors, sadness, hallucinations, and resistiveness to care for the residents, and caregiver burden for the caregiving staff.

The researchers used multiple regression models to identify the factors most likely to explain the presence of unwanted behaviors among residents and caregiver burden. Background factors of cognitive function, functional disability, race, and gender and the proximal factor of pain were most associated with the presence of NDB. Caregiver burden was most closely associated with medical co-morbidities and pain intensity (Norton et al., 2010). Because proximal factors are the items most easily manipulated to reduce behavior problems, the researchers concluded that care plans in nursing homes should be developed that include behavioral history as part of pain assessments to improve resident well-being and reduce caregiver burden (Norton et a., 2010).

Physical needs. Two studies using the NDMB model were conducted to understand the relationship between the environment and NDB. Both studies used an observational approach, with the first watching residents in real-time, and the other utilizing video of the residents in everyday activities.

Researchers used the NDBM to identify associations between environmental proximal factors and wandering among nursing home residents with dementia (D. L. Algase et al., 2010). Older adults with dementia living in nursing homes or assisted living facilities located in Michigan and Pennsylvania were recruited for the study. The inclusion criteria allowed for selection of residents who were English speaking, had a dementia diagnosis, were ambulatory and had a stable medication regiment. A total of 94 residents (77% female, mean age 83.7 years) were included in the observational study using a cross-sectional, correlational design. Background factors for the study were age and cognitive ability, and proximal factors were physical location, sound, light, temperature and humidity. The data were collected three times each day for a total of 36 observations per participant.

The researchers found that wandering was most likely to occur when the environmental factors were at their highest, in an attempt to escape areas that were undesirable. This was found to be true for sound, light, temperature, humidity, and crowding, but with ambiance, when the soothing aspect was at its highest wandering was significantly lower. The researchers concluded that nursing homes that avoid environmental extremes in the living areas may be able to control wandering behaviors among residents with dementia to a higher degree (Algase et al., 2010).

Beck et al., (2011) conducted a multisite descriptive study to identify environmental and personal proximal factors related to problematic vocalization of nursing home residents with dementia. Residents at least 65 years old with a dementia diagnosis, at least one arm free from tremors, and a stable psychiatric medication history were recruited. A total of 138 residents (74.6% female) from 17 nursing homes in Central Arkansas with an average age of 85.3 years were included in the study. Cognitive status, demographic data and co-morbidities were background factors, and affect, psychological needs, sleep disturbances, temperature and humidity were proximal factors. Data were collected on problem vocalization/nonaggressive (agitated) behavior and aggressive behavior, and positive and negative affect (facial display, vocalizations, and body movement). Participants wore an activity band for seven days to register sleep/waking patterns prior to the video portion of the study. The researchers videotaped the residents during 20-minute periods, seven sessions a day over two non-consecutive days for a total of 14 videos of 20 minutes each. The videos were taken during normal daily activity including mealtimes and scheduled bath/shower time and used to detect proximal factors leading to the targeted behaviors.

The proximal factors that had a significant association with non-aggressive vocalization were positive and negative affect and discomfort. For aggressive vocalization, only positive and negative affect were significantly associated with the behaviors. Interestingly, higher levels of either positive or negative affect were both associated with higher levels of vocal behaviors, which the researchers attributed to the assumption that people with dementia who express emotions are more likely to be prone to vocal agitation. The effect of negative affect on aggressive vocalizations was found to

be mediated with age, with every five-year increase in age reducing the likelihood of the behavior (Beck et a., 2011). This is an example of the reciprocal relationship of background and proximal factors on behaviors (Beck et a., 2011).

Engagement. Three NDBM studies focused on engagement as a proximal factor that created needs among people living with dementia residing in a nursing home. Unlike the previous studies discussed, these studies involved interventions that involved multisensory elements such as lifelike baby dolls (Moyle et al., 2018), and personalized activities (Bedard et al., 2011; Kolanowski et al., 2011).

In a 2018 study, Moyle et al. conducted a quasi-experimental mixed-methods pilot study with an intervention and control group to determine the association between engagement and positive and negative affect on the behaviors associated with anxiety, agitation and aggression (Moyle et al., 2018). The intervention involved the use of a life-like baby doll in non-facilitated sessions lasting 30-minutes three times a week (MWF) for three weeks. Thirty-three nursing home residents (mean age 87.8, 100% female) were recruited for the study. The inclusion criteria required residents to have a dementia diagnosis, and a documented history in the past 4 weeks of anxiety, agitation or aggression. Residents who were already using dolls as part of their therapy routine were excluded from the study. The intervention group consisted of 18 residents (100% female, mean age 86.1), and the control group, which participated in usual care, consisted of 15 residents (100% female, mean age 89.7). Video recordings were taken during the activity times and used to measure the number of times that the targeted behaviors were present. In the qualitative portion of the study, five staff members who participated in the

intervention were interviewed by phone to provide their perceptions of the intervention in a qualitative thematic analysis.

A comparison of the scores from the baseline and intervention date revealed no within group differences due of the intervention, and a comparison between the intervention and control group also revealed no significant differences. While the statistical analysis of the data failed to reveal significant changes in the targeted variables, the qualitative piece, while small, revealed perceived value in the program. Staff supported the program, but only if the resident was open to the idea. An important consideration was personal preference, and the recognition that not all persons with dementia would find doll therapy helpful or positive. The authors stressed the importance of attention to clinically meaningful results, even when the quantitative results, which are often largely objective, do not reveal that the intervention is a success (Moyle et a., 2018).

Kolanowski et al., (2011) conducted a double-blind randomized clinical trial to compare three intervention designs to determine which was more likely reduce NDB by providing opportunities for activity and engagement/alertness while considering the background factor of personality style. To be included in the study, the nursing home residents had to be English speaking, aged 65 or older, have a diagnosis of dementia and an MMSE score between 8 and 24, not be taking new psychiatric drugs, and have a history of behavioral symptoms as reported by staff. A number of co-morbidities were included in the exclusion criteria including delirium, Parkinson's disease, Huntington's disease, seizure disorder and stroke. A total of 128 residents meeting the inclusion criteria were recruited and placed into one of four groups.

Group One, comprised of 32 participants with a mean age of 85.3 years (75% female), participated in activities that were specifically adjusted to meet the participant skill level, but not necessarily thier personal interests. The 33 individuals in Group Two (mean age 87.2, 75.8% female) received activities that were tailored to personal preferences (personality style of interest), but not their functional level. Thirty-one participants (mean age 86, 74.2% female) were placed in Group Three, where activities that were both tailored to participant's functional level and personal interests were provided. A fourth control group who attended usual activities at the facility was comprised of 32 residents (mean age 85.9, 81.2% female). Background factors were cognitive function, medical co-morbidities, and functional abilities. Proximal factors for the study were activity, engagement and personality style, and behaviors examined were agitation, passivity, affect, and mood.

The researchers had hypothesized that activities that were tailored to both functional level and personal interests would show higher levels of the proximal factors, and reduced memory-related behavior problems. What they found is that all three of the intervention groups had significantly higher engagement and alertness than the control group. Behaviors improved for all of the intervention groups with no significance between the three groups. The positive affect variable of pleasure was significantly higher during the intervention for the group that had activities that were tailored to functional level and personal preferences. Additionally, the researchers noted that all four groups returned to baseline levels one week after the intervention, with the exception of positive mood improvements among the group with functional and personal preference-tailored activities. The authors suggested that any type of activity that promotes

engagement may be successful in meeting the proximal needs identified in the study, so nursing homes do not necessarily need to tailor activities in order to see a positive outcome (Kolanowski et al., 2011).

Verbal agitation was the focus of a study by Bedard et al., (2011). A total of 26 residents of six nursing homes with a mean age of 84.54 years (61.5% female) were recruited for the quasi-experimental single group repeated measures study. Inclusion criteria for the study were residents aged 60 or older who had been living in the same facility for at least three months with no plan to move during the intervention, a dementia diagnosis, and demonstrated vocal agitation several times per day for the past two weeks. Residents who had vocal agitation only when doing things that could not be addressed by the intervention (e.g., while using the toilet) were excluded. Background factors were cognitive function, demographic factors and comorbidities, and proximal factors were a diagnosis of depression and resident engagement during the intervention.

The researchers delivered thirty-minute sessions that included comfort, attention, and stimulation six times a week for two weeks to see if engagement had an effect on vocal agitation, which was defined as swearing and verbal aggression; constant demands for attention; repetition of phrases or questions; making strange noises; screaming; moaning; negativity; and verbal sexual advances. The researchers found that the background factor of gender and cognitive ability mattered when it came to vocal agitation, with men and those with higher cognitive function significantly more likely to respond to the intervention. Increasing engagement among the participants resulted in changes in vocalizations. The overall vocalization scores were significantly improved over the course of the study, with about half of the participants showing improvement

during the intervention, 23 percent showing improvement at the end of the intervention, and 35 percent showing improvement five days post-intervention. Frequency of vocalizations was only significant in the period following the intervention, while duration of vocalizations went down at all phases, but was only statistically significant during the intervention. Consistent with other studies, the researchers noted that the problem vocalizations returned after the intervention period, reinforcing the idea that interventions should not be considered a one-time cure, but rather part of an ongoing program to meet the need for engagement among nursing home residents (Bedard et al., 2011).

Design and results of multi-sensory technology studies. Multi-sensory technology is used in a variety of research strategies. Four main types of interventions were identified for this review: Snoezelen rooms, robotic animals, reminiscence therapy, and projected images.

Snoezelen room. The most common form of multisensory activity among the literature was the use of a Snoezelen room (n=5). A Snoezelen room is a staged room that includes items and activities designed to satisfy sensual needs through self-directed interaction (Collier et al., 2010; Sanchez et al., 2016). Snoezelen rooms were first designed for children and adults with autism but has grown in popularity as a dementia intervention (Goto et al., 2014). The sensual activities offered in a Snoezelen room vary, some use bubble tubes, fiberoptic lights, music, aromatherapy devices, projectors, vibrating water beds, tactile devices, or mirror balls (Collier et al., 2010; Goto et al., 2014; Maseda et al., 2014; Sanchez et al., 2016; Sposito et al., 2017). Participants are led to the room, which is usually separate from everyday spaces, and allowed to interact with the items in an undirected session usually lasting about 30 minutes (Maseda et al., 2014).

Researchers have used Snoezelen rooms to detect changes in agitation, memory-related behavior problems, depression, positive affect, cognitive function, and levels of engagement (Collier et al., 2010; Goto et al., 2014; Maseda et al., 2014; Sanchez et al., 2016; Sposito et al., 2017).

Maseda et al. (2014) conducted a quasi-experimental controlled longitudinal study using a Snoezelen room among residents with dementia in a Spanish nursing home. The only inclusion criteria cited was a depression score indicating moderate to severe dementia. Residents with sensory disorders that would impede involvement in the activities were excluded. Thirty residents were randomly placed into one of three groups. The control group (n=10, 80% female mean age 86.7 years) were measured doing usual activities. An activity group (n=10, 90% female, mean age 87.9) participated in one-on-one activities, and the intervention group (n=10, 100% female, mean age 87.2) visited a Snoezelen room. All group sessions lasted 30 minutes and were held 2 times a week for 16 weeks.

The independent variables included in the study were dementia severity, agitation, memory-related behaviors (defined as agitation, aggression, delusions, hallucinations, anxiety, apathy, disinhibition, irritability, aberrant motor behaviors, sleep and nighttime behaviors), mood and depression. According to the authors, the biggest benefit of the intervention activity was a reduction in agitation, especially physically non-aggressive behavior. There were significant improvements in agitation scores for both the intervention and activity groups, and the differences between the two groups was also statistically significant. A comparison between the intervention and control group also saw significant differences. None of the effects were observed at the follow-up period.

For the memory-related behaviors, significant time effects were found when comparing the intervention group to both the activity group and the control group, but again the effect did not continue into the follow-up period. In fact, there was a significant increase in negative behaviors among all of the groups post-intervention. Both the intervention and the activity group showed improvements in mood scores, but they were not statistically significant, and mood scores at the post-intervention were worse. The researchers measured functional scores to perform ADL activities, which improved during the intervention, but returned to baseline by the follow-up period. The authors suggest that the downturn following the intervention period could be attributed to the fact that the participants were no longer receiving high levels of attention (Maseda et al., 2014).

A Snoezelen room was used in a pilot randomized controlled trial involving 32 residents of a dementia care nursing home located in Spain (Sanchez et al., 2016). Residents with severe dementia were included with the group; exclusion criteria ruled out residents who were bedridden, or who had a sensory impairment that would interfere with the activities. Two comparison groups were formed: a control group (n=10, 50% female, mean age 82.3 years) participated in normal activities at the facility, while an activity group (n=11, 100% female, average age 87.5 years) engaged in one-on-one activities in 30-minute sessions twice each week for 16 weeks. A third intervention group (n=11, 81.8% female, mean age 86.4 years) visited a Snoezelen room set up in the facility for 30 minutes twice per week for 16 weeks.

The researchers collected data at the baseline, the middle of the intervention period (week 8), post-intervention (week 16), and again 8 weeks later as a follow-up. The

variables investigated were agitation, behavior (defined as the presence of delusions, hallucinations, agitation, dysphoria/depression, anxiety, euphoria, apathy, disinhibition, irritability, aberrant motor behavior, sleep and night-time behavior disturbances, changes in appetite and eating behaviors), mood, cognitive function, and dementia severity.

The researchers found that aggression was reduced for the intervention group, but the improvements decreased between the end of the intervention and the 8-week follow up period. Some improvement in agitation was seen with the activity and intervention groups but it was not statistically significant. The memory-related behaviors were statistically significantly improved among the intervention group when compared to pre-tests, and also when compared to the activity group. Consistent with many multisensory studies, the authors noted that the improvements in behaviors for the participants did not last long after the activities stopped and suggested that the best approach would be to integrate the activity into normal care instead of a short intervention (Sanchez et al., 2016).

In another Snoezelen study, researchers conducted a quasi-experimental to investigate changes in motor interaction, eye contact, verbal communication and mood among 45 residents with dementia (78% female, mean age 86.54 years) living in one of four nursing homes (Sposito et al., 2017). Residents with a history of needing staff assistance to complete ADLs, a clinical diagnosis of moderate to severe dementia, no psychiatric diagnosis, who had been living in the facility for at least 2 months were included. The only exclusion criteria was refusal to participate. The group of thirty residents were randomly placed in one of two groups with 17 participating in the intervention (58% female, average age 80), and 13 in the control group (76% female,

average age 83). Participants attended 90-minute Snoezelen sessions once per week for eight weeks. Each of the sessions were videotaped and used for the observational study. Three times each week for four weeks the groups either visited the Snoezelen room or participated in an indoor gardening activity.

The researchers measured physical, intellectual, emotional and cognitive engagement before, during and after the intervention period. At the end of the intervention the frequency and duration of engagement in tasks had increased significantly, as had eye-to-eye contact and appropriate verbal communication. Sadness and inappropriate verbal communication were statistically reduced in both frequency and duration. and while not statistically significant, there was an increase in the number of times that the participants smiled or laughed during the activities (Sposito et al., 2017).

Collier et al. (2010) conducted a quasi-experimental study using a single-blind strategy to compare behaviors between an intervention and control group of nursing home residents with dementia in South England. All residents of the participating nursing homes were eligible provided they had dementia scores indicating the presence of moderate to severe dementia. The thirty residents were randomly placed in one of two groups, with 17 participating in the intervention (58% female, average age 80), and 13 in the control group (76% female, average age 83). Three times each week for four weeks the groups either visited the Snoezelen room or participated in an indoor gardening activity.

The researchers measured physical, intellectual, emotional and cognitive engagement before, during and after the intervention period. Both groups showed statistically significant improvements in motor and process skills, although the amount of

change was more significant for the intervention group. On average, the intervention group showed a greater improvement in motor skills for more sessions than those in the control group. The authors suggest that multi-sensory technology activities may significantly improve motor and process skills when regularly offered.

In a two-part quasi-experimental pilot test, 36 nursing home residents with an average age of 88 (gender was not reported) were introduced to both a Snoezelen room and a staged Japanese garden to determine whether there were similar results from the two interventions (Goto et al., 2014). Residents living in the New Jersey nursing home at least 6 months with a diagnosis of dementia were eligible; no exclusion criteria were cited. In part one of the study the participants visited a Snoezelen room for 15 minutes twice per week for 3 weeks. Part two of the study involved 15 minutes visits twice per week for 4 weeks to a room staged with a Japanese garden. The time variation between the two activities was due to room availability. In both case the individuals were allowed to interact with the contents of the rooms without direction.

This study is notable because it is the only one that used biometric data collection methods. A fingertip heart rate monitor was used before, during and after the session to detect stress, and behavior problems were detected through use of a behavioral assessment checklist and field notes. The participants responded with greater engagement to the Japanese garden than the Snoezelen room. When the participants engaged in the Snoezelen room at all, it was mostly to view the nature scenes projected on the wall that changed every two minutes. Heart rates were stable, and there was little verbal engagement. Conversely, in the Japanese room, the residents moved around and had a

significantly greater amount of verbal interaction, sharing recollections of gardens and interacting with the garden and people in the room.

Goto and colleagues suggested one reason the Japanese garden received a better response from the residents is that it encouraged movement and physical engagement, while the Snoezelen by design is meant to be self-directed, which may be difficult for people in the advanced stages of dementia. They suggest that the unique nature of the Japanese installation, and the familiarity of nature, may have also been a factor. The authors were not clear whether half of the participants used the Snoezelen room and half used the Japanese garden, or if they all participated in both activities (Goto et al., 2014).

Robotic Animals. Three studies were found that involved the use of robotic animals to encourage engagement. Two studies used a robotic seal (Joranson et al., 2015; Moyle et al., 2017), and a third study used a robotic cat that utilized similar technology (Gustafsson et al., 2015).

In a cluster-randomized controlled trial, researchers recruited residents from 10 different nursing homes in Norway, randomly allocating residents at each of the locations into one of two groups to investigate the efficacy of the PARO seal in reducing memory-related behavior problems (Joranson et al., 2015). Residents with cognition scores indicating the presence of dementia were included in the study; no exclusion criteria were provided. A control group consisting of 26 residents (63.3% female, mean age 84.1 years) engaged in usual care, while another group of 27 residents (70% female, mean age 83.9 years) attended group sessions with a PARO seal for 30 minutes twice a week for a total of twelve weeks. Data was collected at baseline, post-intervention and 3-month follow-up periods to measure changes in agitation, depression, and use of

medication. There were changes in agitation and depression scores when comparing intervention group scores from baseline to intervention, but it was not statistically significant.

Agitation and depression scores decreased significantly among the intervention group between the baseline and follow-up period, and the differences between the control group and the intervention group were statistically significant. The authors attribute some of the positive outcomes among the intervention group to the calming effect of the activity. They also noted the social and physical interaction as meaningful, citing it as a way to meet unmet needs among the residents. Additionally, allowing the residents to decide how they personally wanted to interact with the PARO was considered important (Joranson et al., 2015).

Moyle et al. (2017) devised a cluster randomized-controlled trial that compared a subject group that used the PARO with the robotic features turned on, and a group that used the PARO with the robotic featured disabled to illustrate the difference between a standard plush animal and the robotic mechanism. Residents over the age of 60 with a diagnosis of dementia were included provided they had not been admitted to the nursing home for respite care, had a diagnosis of a serious mental or terminal illness, or symptoms of an illness that resulted in continual, disruptive symptoms. A total of 415 residents located near Brisbane, Australia were recruited and placed into one of three groups. The control group (n=137, 99% female, mean age 85) engaged in usual care. The plush group (n=114, 81% female, average age 86) participated in in unstructured play sessions with PARO seals that had all of the robotic features deactivated. Fifteen-minute sessions were held three times a week for 10 weeks. The PARO robotic group (n=138,

73% female, average age 84) followed the same format as the plush group, but the robotic features of the PARO seal were activated.

In a comparison between the PARO and plush group, statistically significant differences were found in positive verbal engagement at week 10, visual engagement was significant at weeks 1, 5 and 10, anger was significant at week 5, and pleasure was significant in week 1. When compared to the regular care group, again the PARO group showed significantly greater changes in anger and pleasure during weeks 1 and 5, and pleasure in weeks 1 and 10. The positive effects of the PARO did not extend for very long after the end of the intervention. The authors suggest that perhaps greater frequency and longer sessions may make a difference. The authors also had trouble getting the care staff to complete the measures, especially at week 10.

The JustoCat was used in a pilot study using a quasi-experimental design with a purposive sample to measure its effect on aggressive behaviors and quality of life (Gustafsson et al., 2015). Four residents living in a nursing home with a diagnosis of dementia and no fear of cats (50% female, age range 82-90) were selected to participate in the intervention. Additionally, three family members and eleven direct care staff members were recruited to participate in interviews for a qualitative thematic analysis of the activities.

An initial session with the JustoCat was held where trained facilitators showed the residents, family members and staff how to activate and interact with the device. Following the training, the residents were given the JustoCat to use for seven weeks, primarily through prompted interactions from family members and staff. During the course of the 12-week program (baseline, intervention and follow-up), 18 measurements

were taken (9 taken before the intervention, six taken during the intervention, and 3 at the follow-up). The authors note that the four participants exhibited fluctuations in agitation throughout the program.

The qualitative interviews revealed perceptions of increased interactions and communication opportunities due to the use of the robotic cat. Family members indicated that there were opportunities for more meaningful discussions, and staff members indicated that in one case a resident avoided the use of medication because of the cat. Both family members and staff members felt that the cat added to the quality of life and happiness for residents. The authors recognized that small sample size made it difficult to generalize the findings. They suggested that the small number of participants may result in quantitative results that aren't very useful but point to the qualitative data as evidence that the intervention was successful (Gustafsson et al., 2015).

Reminiscence. Reminiscence therapy is a recreational therapy that creates an opportunity for sharing and connection through auditory prompts such as music, photographs, or movies, or other items that evoke memories (Nijhof et al., 2013). This type of activity works well with people who have dementia, because while short-term memory is impacted by dementia, long-term memories are often intact and can be elicited through guided prompting of discussions (Garlinghouse et al., 2018). Technology such as digital photography, online resources and multimedia presentations have shown some potential in reminiscence therapy programs, providing unique and engaging experience opportunities (Garlinghouse et al., 2018).

A multimedia game called Chitterchatters was used in a mixed-methods quasi-experimental reminiscence therapy intervention (Nijhof et al., 2013). Ten nursing home

residents with dementia (60% female, average age 69) played two games four times each over the course of a two-month period. The intervention game involved four computer-driven items: a TV (played videos), a radio (played music), a telephone (recited poems or a story), and a treasure box (revealed various objects when opened). The group sat in a circle and participants took turns manipulating the items as directed by a facilitator. After viewing or listening to the multimedia portion of the game, the group spent time discussing it before moving on to the next item.

The control game was similar in nature, but without the multimedia component. The Question Game was a board game that included colored dice that matched question cards such as proverbs, songs, language, nature, and other topics. The facilitator read the card to the group for discussion, but the person who threw the dice had to answer the question first. The participant played the Chitterchatters game in the morning and the Question Game in the afternoon, each for 45 minutes, except for one group comprised of people with severe dementia, who only played for 25 minutes. A total of 16 activity sessions were held over two activity sessions in a 2-month period. Additionally, after the intervention five staff members (100% female, average age 27) participated in 21-question interviews lasting about 25 minutes. The study used observational methods to measure social engagement, which was defined as verbal/non-verbal behavior and social/non-social behavior.

For both types of activities, the most common social behaviors were comments, yes/no responses, laughing, sentence responses and smiling. Participants with less severe dementia were more active than those with severe dementia, and female participants scored higher for social behaviors during the intervention than men, especially for yes/no

answers. While there were few quantifiable differences between the two activities, in the interviews all of the staff indicated that the intervention helped them with their work because it made it easier to come up with topics to discuss. It also gave the younger staff members something to do, because they indicated that they often didn't know how to initiate activities. Staff who were unfamiliar with computers were less likely to find the Chitterchatters game easy to use, but most indicated that it was not difficult. The staff liked the Chitterchatters game over the Question Game because it gave the residents a way to initiate personalized conversations. The TV was identified as the item that triggered more social behavior than the other items. The authors suggested that one of the strengths of their intervention over others with similar goals was that it was focused on leisurely activities that encouraged social interaction among participants (Nijhof et al., 2013).

A 3-D printer was used in another reminiscence therapy study using a quasi-experimental within-subject design, and thematic analysis for the qualitative portion (Garlinghouse et al., 2018). Fifteen residents of a nursing home in Minnesota with dementia (60% female, mean age 86), eighteen family members (61% female, mean age 60), and six direct care staff (100% female, mean age 44) were recruited for the study. Exclusion criteria were not provided. A one-on-one reminiscence therapy session was held with each resident (with a family member present) to identify meaningful items such as pets, musical instruments and other objects that might be of interest to the resident. The items were printed by the researchers using a 3-D printer and presented to the participants. The staff, family members and residents were given 2 weeks to use the 3-D items any way they chose. A researcher-developed 15-item checklist was used to measure

feasibility and utility of the activity, and field notes and interviews were utilized to report participant behaviors and reception of the intervention.

The staff and family members reported that residents who participated in the study were more engaged. The tactile element of the activity was meaningful because the residents could hold the object and use it to elicit memories. The 3-D items were considered superior to photos. One resident was more willing to participate in other activities such as trivia questions after participating in the study. In the interviews, family and staff felt that the objects increased pleasure and happiness. They also reported that discussions with the participants were more focused. The objects gave staff and family members an easy way to start discussions and have something to focus conversations on, which increased social engagement. Quantitively, 72.3% of the family and staff said that the residents were more engaged after the intervention. 83.4% of the staff and family member indicated that interactions had increased in both quantity and quality after the intervention. 76.5% of the family and staff indicated that the resident enjoyed the intervention, and 83.3% felt that the activity helped the resident engage in reminiscence more effectively (Garlinghouse et al., 2018).

Projected Images. Three studies were found that delivered multisensory stimulation through the use of projectors or video screens. Modern technology offers researchers the opportunity to deliver unique methods for encouraging interaction and engagement for people with dementia (Luyten et al., 2018). The three articles included in the current review have a “magic” element to them that encourages people to engage with the activity and with others around them (Bruil et al., 2018).

Video screens were used in a single blind randomized controlled trial that utilized two pieces of technology to encourage passive activity among residents of a nursing home in the Netherlands (Heesterbeek et al., 2019). The devices both had a platform, one with a chair (TMSim), the other with a platform for a wheelchair (WBV). Inclusion criteria were a diagnosis of dementia, over 65 years old, and on average not physically active more than 10 minutes per day. Residents with a medical condition that prevented them from participating in passive exercise, had an auditory disorder, were color blind, or had a substance abuse problem (alcohol or drugs) were excluded from the study.

A total of 120 residents (64.5% female, average age 85.3 years) were randomly placed into one of four groups for the intervention that was delivered four times a week for six weeks. The control group received usual care, while the remaining three groups utilized the multimedia devices. The first group used only the TMSim, which involved watching 3 short, real-life videos lasting about 4 minutes each. The videos showed activities such as horseback riding, diving, walking, dancing, snowboarding, skiing, etc. Music and sounds were played to match the video and the platform moved along with the action. The second group utilized the WBV to interact with a 4-minute motorcycle video (3 videos for variation), and the platform moved along with the video. The fourth group randomly used one of the two devices at each session in 12-minute sessions.

The researchers used an instrument that they developed to measure enjoyment and affect. The purpose of the study was to determine whether the intervention would be feasible for the intended population (would there be high attendance and compliance, would experience scores show that it was considered peasant, would drop-out rates be

low, and would there be serious adverse events as a result of the intervention. The authors suggest that the novelty of the interaction was a draw for the participants. They also suggest that the fact that participants were able to select which videos they wanted to use during the intervention was a positive influence. This is relevant to the proposed study because it is a novel approach, and there are a variety of games, so letting residents select their preferred game may make a difference in outcomes (Heesterbeek et al., 2019).

The VENSTER (Dutch "Window") was an interactive art installation using two large screens mounted on a wall and connected to a computer that randomly projected scenes that react to the location of viewers in the room (Luyten et al., 2018). The software was designed to detect when people entered the room and would respond with music that corresponded with the video categories (calming, activating and interactive).

Thirty-five Dutch nursing home residents participated in the observational exploratory study, but the authors gave few demographic details other than the fact that they had dementia. There were no exclusion criteria, any available residents with dementia were permitted to participate in the activity. Groups were brought into the room 6-8 at a time, and when the group began to lose interest, the session was ended (Luyten et al., 2018).

Observational techniques were used to measure engagement (human-human verbal responses, human-human physical responses, human-artwork verbal responses, human-artwork physical responses). The greatest number of recorded responses were human-to-human, which were mostly verbal. Human-artwork responses were mostly physical. The content that was coded as calming generated the fewest responses, while interactive scenes had the greatest number of interactions. The authors made suggestions

for use of each of the three types of video: calming as the default when not in use, activating for one-on-one interaction and as a catalyst for interactions, and interactive for specific activating therapy (Luyten et al., 2018).

Bruil et al., (2018) conducted an exploratory quasi-experimental observational study to investigate a device called the Tovertafel (Dutch "Magic Table"). The Tovertafel is a device that projects images onto a flat surface. The device has sensors that give the device the ability to detect hand and arm movement and adapt the projections, resulting in an interactive gaming experience (Anderiesen, 2017). Residents over the age of 65 with advanced Alzheimer's disease were included in the study provided they were able to sit at a table and have sufficient vision to see the projections and had lived in the nursing home at least one month.

Thirty-four older adults with a mean age of 86.5 years (61% female) and a diagnosis of dementia were recruited from a Dutch nursing home to participate in the study, which involved 15 minutes of play with the Tovertafel on five consecutive days. The researchers measured quality of life using nine subscales: caring relationships, positive affect, negative affect, restlessness edgy behavior, self-esteem, social relationships, social isolation, feel at home, and have nothing to do. They also used an instrument to record problem behaviors defined as audible/noisy breathing, negative vocalizations, satisfied facial expression; sad and fearful facial expression; frowning face; relaxed body language; tense and nervous movements/movement unrest. The researchers reported increased positive self-image (self-efficacy) and reduced negative effect. The effect was smaller from the intervention period to follow-up, but even after one week the improvement was still statistically significant (Bruil et al., 2018).

Summary. One of the challenges of reporting such varied studies is that each research project utilized a different data collection method, different data collection instruments, and a vast array of operational definitions of behaviors. For example, articles that used the Cohen-Mansfield Agitation Inventory Instrument (CMAI) defined "problem behaviors" as aggressive physical, non-physical, and verbal behavior" (Beck et al., 2011; Gustafsson et al., 2015; Maseda et al., 2014; Moyle et al., 2018), while researchers who used the Neuropsychiatric Inventory (NPI) collected data on delusions, hallucinations, agitation/aggression, depression/dysphoria, anxiety, elation/euphoria, apathy/indifference, disinhibition, irritability/liability, motor disturbances, nighttime behaviors, appetite/eating behaviors (Bedard et al., 2011; Sanchez et al., 2016).

Some researchers relied on observational data notated in live sessions (Bruil et al., 2018; Goto et al., 2014; Heesterbeek et al., 2019), using videotapes (Luyten et al., 2018; Moyle et al., 2017; Nijhof et al., 2013; Sposito et al., 2017), or reports from staff or family members (Garlinghouse et al., 2018; Gustafsson et al., 2015). Sessions with the activities ran the gamut from casual self-directed exposure of any length (Luyten et al., 2018), 15 minutes every day for 5 days (Bruil et al., 2018), to 30 minutes twice per week for 16 weeks (Sanchez et al., 2016). This wide variety of study designs, measurements, activities and methods of interpretation make it difficult to create a synthesis that accounts for all of the nuances of the studies.

How can one determine whether multisensory stimulation interventions overall are effective in reducing agitation, when each report is based on such varied data? The following section is an attempt to summarize the overall findings of the 9 NDBM studies

and 13 technical multi-sensory technology studies that with the stated aim of reducing behavior problems among older adults with dementia living in nursing homes.

Interpretation of the Literature

Efficacy of the interventions. Researchers seeking to learn the usefulness of the Need-driven Dementia-compromised Behavior Model reported a number of positive results. When using pain as a proximal factor, researchers found that resident behaviors can be an effective way to detect the presence of physical discomfort (Burfield et al., 2012), especially among people living in the later stages of (Ahn & Horgas, 2014). Norten et al., (2010) suggested that because proximal factors are easy to manipulate, nursing homes should include care plans that feature behavioral history as part of pain assessment to improve resident well-being and reduce caregiver burden.

The majority of the multi-sensory studies reported positive findings when comparing the multisensory stimulation intervention with a baseline score, a control group/activity, or both (Collier et al., 2010; Heesterbeek et al., 2019; Joranson et al., 2015; Luyten et al., 2018; Maseda et al., 2014; Moyle et al., 2017; Sanchez et al., 2016; Sposito et al., 2017). Researchers reported decreased agitation (Joranson et al., 2015; Moyle et al., 2017; Sanchez et al., 2016), aggression (Sposito et al., 2017), depression (Joranson et al., 2015), anger (Moyle et al., 2017), negative affect (Bruil et al., 2018), and sadness (Sposito et al., 2017).

Additionally, the studies showed increased engagement (Luyten et al., 2018; Sposito et al., 2017), appropriate verbal communication (Moyle et al., 2017; Sposito et al., 2017), motor skills (Collier et al., 2010), pleasure (Moyle et al., 2017), and self-

efficacy (Bruil et al., 2018). As varied as the behaviors are, they were all impacted by interventions with similar qualities, pointing to the adaptability of the multisensory approach when addressing nursing home populations. Only one study reported better results with an alternative activity (Goto et al., 2014). Methodological issues with this study make it difficult to determine whether the findings are meaningful, however: the researchers were unsure whether participants were included in both activities; the dosages of the two activities were uneven (three weeks for the Snoezelen room, and four weeks for the garden), and both of the activities were centered around participants visiting a room and interacting with the contents in a self-directed fashion (Goto et al., 2014).

It is possible, as the authors claim, that the Japanese garden was more effective in reducing NDB than the Snoezelen room, but it is also possible that the two activities were too similar in nature, or that there were flaws in the project design or delivery (Goto et al., 2014). Because this study stands out as an anomaly to the others, it deserves its place as a reminder that there are many approaches to addressing the needs of individuals, and no approach is one-size-fits all. This concept was supported by other researchers who suggested that personal choice and customization were related to positive results in their studies (Joranson et al., 2015; Kolanowski et al., 2011; Moyle et al., 2018).

Time effect of the interventions. While many of the studies found statistically significant results from their interventions, many noted that the results were not long-lasting (Bruil et al., 2018; Kolanowski et al., 2011; Maseda et al., 2014; Moyle et al., 2017; Moyle et al., 2018; Sanchez et al., 2016). In a study using a Snoezelen room, mood and behaviors scores worsened following the intervention period (Maseda et al., 2014). Sanchez et al. (2016) reported similar findings with aggression scores but found that

improvements in cognitive function were still statistically significant 8 weeks after the intervention. Bruil et al. (2018) reported that improvements in self-image scores and reductions in negative affect scores went down in the week following the Tovertafel intervention, but even one week later the comparison to the baseline data was still statistically significant. Moyle et al. (2017) found that the positive effects of their 10-week intervention using a PARO seal did not extend for very long after the end of the intervention. The authors suggested that perhaps greater frequency and longer sessions may have resulted in longer-lasting effect (Moyle et al., 2017). The findings of these studies suggest that multi-sensory interventions are effective in meeting the immediate needs of people living with dementia but may be most useful when they are included in ongoing, regular nursing home care plans (Moyle et al., 2017).

The importance of clinically meaningful findings. Gustafsson et al., (2015) conducted a study using just four participants, and not surprisingly, the changes that were detected were not statistically significant with such a small sample. However, the authors caution readers that quantitative results should not be the only method of determining the efficacy of an intervention. Interviews with staff and family members revealed perceived value because of the increased opportunities for meaningful interactions and social engagement (Gustafsson et al., 2015). Similarly, staff expressed appreciation for the Chitterchatters game because it helped them find topics to discuss with residents, especially for younger staff members (Nijhof et al., 2013).

When introducing 3-D printing to reminiscence activities, Garlinghouse et al. (Garlinghouse et al., 2018) relied on staff and family reports to determine the efficacy of the program and reported positive outcomes. The insight from previous research points

out the danger in relying strictly on quantitative results to determine the efficacy of a program, and further support the importance of including direct care staff in the planning and implementation of interventions, as described below.

The importance of staff involvement. A final NDBM study was included in the review to explore the value of involving care staff in the development and execution of interventional studies. Twelve professionals working in Japanese nursing homes met for 5-6 hours once per month for two years to participate in a roundtable as part of a qualitative study by Fukui et al. (2011). No demographic data were provided on the participants, but the group included social workers, direct care workers, nurses and nutritionists, and all had worked in their fields for a minimum of eight years.

The group used the roundtable sessions to discuss scenarios related to the relationship between memory-related behaviors and unmet needs and find real-world solutions. For example, for residents who had a desire to "go home" the group found ways to help residents feel more at home at the facility as a means to satisfy the underlying need for comfort and belonging. Methods such as this provide health care workers with meaningful strategies to provide higher levels of care while reducing behaviors that make the task of caregiving difficult (Fukui et al., 2011).

The findings of this study are supported by other research, for example Ahn et al. (2014) suggested that involving direct caregivers in the identification of resident needs may result in more accurate diagnoses of pain, and as a result, higher levels of well-being. When introducing lifelike baby dolls in an effort to encourage engagement, Moyle et al. (2018) noted that initially many of the staff members were resistant to the intervention. The researchers conducted interviews following the intervention and

discovered that the staff expressed mostly positive attitudes toward the study and offered helpful perspective on the importance of tailoring interventions to the personality and preferences of residents.

The lessons learned from previous research can help guide future projects, including this proposed study. Paying attention to the successful aspects of previous studies, while being mindful of limitations such as time effects are important factors to consider when designing a study. Likewise, when determining how a study will be interpreted, it is important to recognize the importance of both quantitative results and more qualitative results that may indicate clinically meaningful outcomes. This is best achieved through the involvement of direct care staff, who have intimate knowledge of the needs and behaviors of nursing home residents. The next section provides a review of the identified gaps in the literature, which can also provide insight into the design of our study.

Gaps in the Literature

While a review of the literature reveals a number of advantages to using the NDBM and multi-sensory technology interventions to reduce NBM, there are a few gaps in the knowledge that bear investigation.

The primary gap lies in the lack of theory utilized in multi-sensory technology. While two authors referenced theory in the literature review or discussion (Gustafsson et al., 2015; Sanchez et al., 2016), not one of the thirteen multi-sensory technology projects utilized theory in the design of the studies, or in the interpretation of the findings (Bruil et al., 2018; Collier et al., 2010; Garlinghouse et al., 2018; Goto et al., 2014; Gustafsson et al., 2015; Heesterbeek et al., 2019; Joranson et al., 2015; Luyten et al., 2018; Maseda et

al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sanchez et al., 2016; Sposito et al., 2017).

Studies do document] that theories such as the NDBM are useful in addressing proximal factors that create unmet needs, so the fact that researchers are not including them in their studies represents a gap in the literature. Identifying proximal factors in the development process of a study helps guide researchers in the selection of activities, duration and dosage, and targeted behaviors to measure. This has the potential to make research projects more efficient and their findings more valid.

Some of the techniques have been studied by more than one research team, such as Snoezelen rooms (Colllier, 2010; Goto, 2014; Maseda et al., 2014; Sanchez et al., 2016; Sposito et al., 2017) and robotic animals (Gustafsson et al., 2015; Joranson et al., 2015; Moyle et al., 2017), but the findings of other novel interventions have not had the benefit of reports from more than one researcher. Only one study has been published to provide data on the efficacy of the Tovertafel to reduce NDB (Bruil et al., 2018). The current study presents an opportunity to add to the body of knowledge regarding the efficacy of the Tovertafel to increase engagement and reduce NDB. Additionally, this is the first study to include feedback from nursing assistants, which will provide new information about the technology.

Summary

This chapter presented a summary of nine studies that utilized the Need-based Dementia-compromised Behavior Model to investigate the role that unmet needs play in the development of problematic behaviors among people living with dementia. The literature

demonstrates the value of identifying the background and proximal factors that result in NDB. Researchers seeking to design meaningful interventions can use the knowledge from these studies to apply the theory to the design of their programs, and staff can use the model to identify unmet needs that impact the well-being of residents. Additionally, thirteen articles illustrating the use of multi-sensory technology to reduce NDB were reviewed.

The literature shows that in most cases multi-sensory technology can be effective in reducing NDB, and is well-received by residents, staff and family members. Understanding the methodological decisions that were made by researchers, as well as the outcomes of those decisions, will help guide the development of the present study. The next chapter provides information regarding the proposed study in greater detail including the aims of the study, and research design, procedures and analysis.

Chapter Three

Methods

Introduction

This chapter describes the methods involved in the execution of the research study. The sections included in this chapter are Aims, Research Design, Setting and Sample, Methods, Data Collection and Analysis, Data Preparation, Summary, and the COVID-19 Global Pandemic Response.

Aims

Existing literature points to the potential impact that multi-sensory activities can have on the lives of institutionalized individuals and their caregivers. The purpose of this study is to improve scientific understanding of the effectiveness of a multi-sensory technology called the Tovertafel. The primary goal is to increase physical, social, and cognitive engagement for people with cognitive impairment through multi-sensory interactive games. The investigation will seek to learn whether the intervention reduces NDB by addressing the unmet needs of nursing home residents and as a result, improves their well-being. Additionally, the study seeks to understand nursing assistants' experiences when using the device as part of daily enrichment activities for residents. Comparisons of data collected before, during and after the intervention will be made to determine whether there are significant changes in residents' psychological well-being, memory-related behavior problems, and apathy.

Additionally, this study seeks to determine whether nursing assistants believe that residents' memory-related behavior problems and apathy affect their ability to provide

care and impact the well-being of other residents and staff. Finally, nursing assistants' satisfaction with the use of the Tovertafel and intentions to use the device as part of regular care will be examined.

Research Design

The study will utilize a quasi-experimental between subjects and within-subjects design using a convenience sample of older adults with moderate to severe dementia living in one of two retirement communities located in northwest Ohio. While usually considered less genereralizable than random sampling, the use of convenience samples in exploratory behavioral research is common and can be beneficial when used to determine the feasability and effetiveness of an intervention (Jager et al., 2017).

Observational reporting using instruments proven to be both reliable and valid will be used to report changes in engagement, behavior, and well-being among the participants. Observational methods are appropriate for populations with moderate to severe dementia because self-reporting is often impossible or unreliable (Lawton et al., 1996). A number of measures have been developed to detect changes in positive and negative affect and utilize the results as a measure of quality of life (Algar et al., 2016).

Setting and Sample

Setting. With university Institutional Review Board approval, residents living in the nursing home sections of two retirement communities located in northwest Ohio will be recruited to participate in the study. The two retirement communities offer progressive levels of housing and assistance ranging from independent living to long-term nursing and hospice care. Both facilities serve older adults with a variety of physical and

cognitive conditions. Facility A is located in a metropolitan city and accepts Medicare, Medcaid and private pay residents (Ohio Living, 2019). Facility B is located in a suburban setting and also accepts private pay, Medicare and Medicaid (Ohio Department of Aging, nd.). At both facilities nursing assistants spend a significantly greater amount of time with each resident than registered nurses or physical therapists (U.S. Centers for Medicare & Medicaid Services, 2019). A comparison of the two facilities as well as state and national data are provided in Table 1 below.

Table 1

Participating nursing home comparisons (U.S. Centers for Medicare & Medicaid Services, 2019)

	Facility A	Facility B	State Average	U.S. Average
# certified beds	34	50		
Average number of residents per day	31	46.4	75.7	86.1
Nursing assistant hours per resident per day	2 hours 50 minutes	3 hours 31 minutes	2 hours 2 minutes	2 hours 17 minutes
RN hours per resident per day	31 minutes	34 minutes	38 minutes	41 miutes
pysical therapist hours per resident per day	2 minutes	2 minutes	4 minutes	5 minutes

Sample. A convenience sampling of residents living in these two facilities will be recruited to participate in the study. Residents over the age of 60 living in the nursing home section and diagnosed with moderate to severe dementia will be eligible to

participate in the study. Cognitive ability will be determined using Brief Instrument of Mental Status (BIMS) scores of 12 or less to determine the presence of moderate (scores of 12-8) to severe (scores below 8) dementia. BIMS scores are recorded at the time of admission to the nursing home, and then repeated quarterly. The most recent BIMS scores on record will be used to determin eiligility of residents. The BIMS is a common tool used by both nursing homes to record cognitive ability, and therefore will ensure consistency across the two locations.

Residents who are unable to sit at the table, or who lack sufficient vision to detect the Tovertafel projected images will be excluded. Residency in a specific unit of the facility will not exclude a participant, provided she or he meets all other requirements. In some case, residents may have to be transported to where the games will be played to participate in the activity. A minimum of 30 and maximum of 60 residents will be recruited to attend play sessions with the table. The recruitment goal accounts for potential attrition due to death, illness, or non-compliance.

A convenience sampling of nursing assistants at each facility will also be recruited to take part in the Tovertafel intervention. To be included in the study, nursing assistants must be registered in the State of Ohio and not have any violations with the state. Only nursing assitants who are expected to work at least two days during the Tovertafel intervention will be considered eligible for the study. Nursing assistants under the age of 18 will be excluded from the study. Both facilities schedule 4-5 nursing assitants to work during the 6:00 am – 2:00 pm shift each day. Staff work varied shifts, so it is unlikely that the same nursing assistants will work each of the five days of the Tovertafel intervention. Based on feedback from the nursing home directors, the

expected sample size will be 12 nursing assistants from each of the facilitites for a total of 24 potential participants.

Recruitment. Family members of residents and nursing care staff will be invited to attend an open house and demonstration of the Tovertafel. The invitation will be sent by the retirement communities using email, and flyers will also be posted in the common areas of the facilities. A separate open house will be held on the premises of each of the two retirement communities participating in the study, in a location away from the residents to prevent early exposure to the device.

During the open houses a demonstration of the device will be given, and the details of the study will be provided to attendees. Nursing assistants and family members will be provided with an information sheet, and if interested, the appropriate informed consent forms necessary to enroll in the study. Additionally, the nursing home dirctor and social worker at each facility will contact individuals who meet the eligibility requirements to seek approval for a member of the research team to contact them for recruitment purposes.

Ethical considerations. Informed consent that includes notification of video recording for residents will be obtained from a family member or legal representative prior to the beginning of the study. Residents who do not have a consent form completed by a family member will not be permitted to participate in the activities. Residents will have the option of refusing to participate at any point in the study. Partipating residents will wear a button on their shirts so that the researchers know that they are consented to be included in the study. Any other residents who are captured on the cameras will be

disregarded. Both nursing homes have family consent forms on file that give consent for videotaping within the facility.

Nursing assistants who wish to participate in the staff survey will be provided with informed consent forms which must be completed prior to the completion of the survey. While both the first and second shift nursing assistants will be required to complete resident information sheets (the RMBC-NH and AES-10), the staff survey will be comprised of only those employees who particpated in the actual Tovertafel intervention. Because of this, the staff who complete the data collection forms may be different from the staff that participate in the survey.

Methods

Staff training. Three weeks prior to the control activity, nursing assistants who are interested in participating in the Tovertafel activities will attend a 30 minute training session held at the facility during a scheduled shift. The Tovertafel will be erected in a temporary location away from residents for the training sessions. All attendees will be shown how to turn the projector on and off, initiate games, change games, and engage in general play with the residents. A reference guide created by the researchers will be provided to each nursing assistant. Additionally, two Nursing Assistants assigned by the facility will be designated as "super users" and supplied with additional reference material and the contact information of the researchers in the event of a problem with the device. Following the training, three 30-minute sessions will be held using 5 non-participating residents from a different area of the nursing home so that nursing assistants can feel confident using the device. The research team members involved in coding will

videotape the sessions using two cameras and utilize the data to practice using the observational tool (GCWBT) and coding resident behaviors.

Two separate training sessions lasting approximately 30 minutes each will be held to instruct nursing assistants who will complete the assessment forms. The training session will be held during the first and second shift, and include examples of completed assessment forms, a description of the drop off and collection process, and background information to ensure that the staff understand why the data is being collected.

Facility preparation. The study will be conducted first at one nursing home and then the other to ensure proper attention is paid to data collection and staff support. Each of the facilities will designate an area for use during the control and intervention activities. The area will be separate from common areas where a television, computer or other items might interfere through noise or light. The area should be easily accessible, and allow others to detect the activity and request to join a session if they desire (provided a consent form is on file).

Study phases. The study consists of three phases: a pre-intervention control activity (one week), the Tovertafel intervention (one week), and a post-intervention control activity (one week).

Control activity (pre-intervention). After conferring with nursing home staff, it was discovered that residents engage in a variety of activities in the morning hour: some particpate in group activities such as sing-alongs, word puzzles and coloring books, and games such as BINGO; others return to their rooms or to the day room to read newspapers or rest. Making the residents change their routines so that they attend group activities at 10:00 was considered, but because this would be outside of the normal

routine, it was rejected. For five consecutive days (Monday through Friday) in the week prior to the intervention week, the residents will be videotaped for 30 minutes while eating lunch. Lunch is a regularly scheduled activity at both facilities, and unlike breakfast which is provided as residents naturally wake up, lunch is served in a common area where residents are encouraged to attend as a group. A research team member will ensure that the sessions are video recorded for observational coding.

Tovertafel intervention. The Tovertafel will be installed in a quiet area of the facility using temporary scaffolding that holds the device securely above a table. The Tovertafel intervention will begin on the Monday following the week of the control activity. Beginning at approximately 10:00 AM on five consecutive days, residents will be invited to play Tovertafel games for 30 minutes. Residents who will be included in the study will be encouraged to participate, but the games may include residents who are not participants in the study. Sessions will be comprised of four to six residents sitting at a table in a room of the facility, with two nursing assistants managing the activity.

The nursing home staff will reference a menu of physical, social, and cognitive games and during the session will choose games to play from each category. A typical 30-minute session will include between three and six games. The staff are free to choose the games and may decide when to end one game and begin another based on feedback from the residents. Sessions will be repeated until all residents who are interested in playing have had a chance to participate on that day. The Tovertavel sessions will be recorded using two video cameras to ensure that everyone seated at the table is visible. A research team member will ensure the sessions are video recorded and note the length of

time each session lasts. The name of the games and order in which they were played will be logged as well.

Control activity (post-intervention). For five consecutive days (Monday through Friday) in the week following the intervention week, the residents will be videotaped for 30 minutes while eating lunch. A research team member will ensure that the sessions are video recorded for observational coding.

Procedures. Each of the control and Tovertafel sessions will be video recorded and subsequently behaviors will be coded using the Greater Cincinnati Well-Being Tool (GCWBT) by one researcher at the end of the week. The video sessions will be divided into five minute segments, and for each segment, the frequency of seven behaviors will be rated on a five-point Likert scale (0=never, 4=always) by one member of the research team. A second member of the team will spot check the work of the primary resesarcher by viewing and rating minutes 11-20 of each video and comparing the ratings.

Because the coding conducted by the spot checker will not be used for data analysis, the decision was made to limit coding for this person to 10 minutes. While this means that the spot checker will view the video with fresher eyes, it also presents the possibity that personal or behavioral traits of the participants may not be taken into consideration. When discrpeancies between the primary reivewer and the spot checker arise, a discussion will take place to ensure that the coding adheres to the agreed upon guidelines as possible.

During the three weeks of the study, all on-duty first and second shift Nursing Assistants assigned to residents included in the study will be asked to complete the Revised Memory and Behavior Problems Checklist-Nursing Home (RMBPC-NH) and

the Apathy Evaluation Scale (AES-10) daily (about 8:00 PM). First shift nursing assistants, who may in some cases be involved in the Tovertafel sessions, work from 6:00 am to 2:00 pm. Because first shift nursing assistants see the residents before and after each session, they will be able to report on short-term responses to the activity. Second shift nursing assistants, who generally work 2:00 to 10:00 PM, will be asked to complete the two assessments each day because they are most likely to observe behaviors in residents following the intervention,. They may also largely be unaware of which residents participated in the activities, which reduces the potential for bias. Data collection sheets with the two assessments will be placed in patient charts by the activities director at the beginning of each day; completed forms will be collected at this time as well. Researchers assisting with the videotaped control and intervention sessions will obtain the completed forms from the activities director after the sessions.

On the final data collection week (week 3), the Nursing Assistants who participated in the Tovertavel activities will be asked to complete a survey related to their experience during the study. The researchers will visit the facility and distribute the Nursing Assistants survey in person. An envelope will be included so that staff can seal the completed surveys before placing them in a box located in an easy to access area. The researchers will collect the completed surveys in the following week.

Data Collection

Instruments.

Well-being. Working with the original authors of the instrument, a modified version of the Greater Cincinnati Well-Being Tool (GCWBT) will be used. The GCWBT

is an observational instrument based on Lawton's framework of psychological well-being (Rentz, 2002). The instrument has been used to measure changes in behaviors among older adults with dementia using interactive activities such as art and pottery activities and music interventions (Gross et al., 2015; Perez-Saez et al., 2018; Rentz, 2002; Tan et al., 2019; Windle et al., 2018). The original instrument includes seven domains: interest, attention, pleasure, negative affect, sadness, self-esteem, and normalcy (Rentz, 2002). Observations are rated by indicating frequency of behaviors using a 5-point observation scale with a range from zero, meaning the behavior is never observed, to 4, meaning the behavior is always observed on the video (Algar et al., 2016). The instrument developed for this study will include six of the seven original domains, with physical activity/engagement replacing the normalcy subscale. For this study, interest is an operationalization of social engagement, and attention is an operationalization of cognitive engagement.

The researchers who developed the GCWBT reported Kappa coefficient of concordance of 0.654 (Kinney & Rentz, 2005). Another study indicated acceptable inter-rater reliability of >0.70 (Windle et al., 2018). A strength of the GCWBT is the fact that up to three subjects can be observed at a time, making it especially useful for group activities (Algar et al., 2016). Additionally, the instrument includes space for raters to provide qualitative information about the subjects and the session being observed. Composite scores of the GCWBT sub-domain and domain variables will be created for each of the phases of the study (pre-intervention control activity, intervention, and post-intervention control activity) for both nursing homes.

Memory-related behavior problems. The Revised Memory and Behavior Problems Checklist-Nursing Home (RMBPC-NH) asks staff to recall the frequency of resident behaviors (Allen et al., 2003). The instrument consists of 24 items using a five point Likert scale (4=daily, 0=never) (Roth et al., 2003), and includes three subscales: memory-related behavior problems, depressive behaviors and disruptive behaviors (Johnson et al., 2001; Neville & Byrne, 2001). Additionally, the RMBPC-NH includes questions about the impact that these behaviors have on the caregiving staff (Johnson et al., 2001). If the answer to the behavior item is greater than zero, the staff member is asked to rate the impact using a five point Likert scale (4=extremely, 0=not at all) (Allen et al., 2003; Roth et al., 2003). For example, one of the memory-related questions asks "How often has your resident been unable to follow verbal directions?" and if the staff reports the resident has exhibited this behavior (responds 1, 2, 3, or 4), two additional questions are asked: 1)"how much does this behavior affect your ability to give care to the resident?" and 2)"How much does this behavior affect the well-being of other residents and staff on the unit?" (Allen et al., 2003).

When used by researchers, Johnson et al. (2001) reported good reliability (Cronbach alpha >.080) for the three subscales. Another study reported that the behavior frequency portion of the instrument had high reliability (Cronbach alpha 0.84), and the caregiver reaction was even higher at 0.90 (Jackson et al., 2014). Subscale reliability has been reported as ranging from 0.67-0.89 (Teri et al., 1992), and between 0.84 and 0.92 in another study (Jackson et al., 2014). Roth et al. (2003) reported adequate convergent scores when compared to other instruments. Composite scores will be created for each of the three domains of the RMBC-NH (depression, disruption and memory-related

problems) and the resulting scores will be used to calculate frequencies at the three data collection points. Composite scores will be created for questions with responses to the two supplemental bother questions ("How much does this behavior affect your ability to give care to the resident?" and "How much does this behavior affect the well-being of other residents and staff on the unit?" to measure staff perceptions about the extent that behavior problems are a "bother."

Apathy. A 10-item version of the Apathy Evaluation Scale (AES) specifically designed for nursing home residents with dementia will be used (Lueken et al., 2007). The original AES-18, which comes in one of three formats (self-assessment, informant assessment, and clinician assessment), is frequently used to identify and measure levels of apathy among research subjects (Clarke et al., 2011). Since not all of the questions included in the 18-item scale are appropriate for people living with dementia who live in a nursing home, Lueden and colleagues (2007) analyzed each of the items to identify those most applicable and relevant for research conducted with this population (Lueken et al., 2007). The resultant 10-item instrument measures apathy based on four categories: cognitive, behavior, emotional, and "other" using a 4-point Likert scale (1=not at all true, 4=very true) that allows staff members to quickly assess the presence of apathy (Clarke et al., 2011).

The original AES-10 was intended to collect observations over the past four weeks, but for the purpose of the current study, the questions will be asked based on observations in the past week. The shortened recall period, while a change to the original procedure, may reduce the potential for recall bias on the part of the staff. Psychometric analysis of the revised tool (AES-10) revealed high correlation with the original AES-18

(0.97), and internal consistency was high (Cronbach's alpha r=0.922) (Lueken et al., 2007). Similar to the original AES-18, the AES-10 had high convergent and discriminant validity when compared to the Neuropsychiatric Inventory apathy subscale (NPI-Apathy) and Neuropsychiatric Inventory depression subscale (NPI Depression) scales (Lueken et al., 2007). A composite score using the 10 questions will be created for each of the phases of the study (pre-intervention control activity, intervention, and post-intervention control activity) for both nursing homes.

Cognitive impairment. The BIMS is a tool commonly utilized by nursing homes because it is included in the federally mandated Minimum Data Set (MDS) reports that are completed for residents who receive Medicare/Medicaid benefits (Chodosh et al., 2008; Saliba et al., 2012). During a short interview, residents are assessed on a number of cognitive abilities including repetition, recall (with and without prompting), and temporal orientation (Eleden et al., 2019). Composite scores ranging from 0-15 are compiled from the 7-item BIMS assessment, and used to indicate impairment ranges: cognitively intact (scores 15-13), moderatly impaired (scores ranging from 12-8), or severely impaird (scores 7-0) (Mace et al., 2016). The BIMS was designed as a brief on-site assessment easily administered by nursing assistants with little training (Chodosh et al., 2008).

Inter-rater reliability of the BIMS has been reported ranging from 0.83 to 0.93 (Eleden et al., 2019). Convergent validity ranged from 0.54 when compared to the Cognitive Performance Scale (CPS), to 0.79 when compared to the Modified Mini Mental State Examination (3MS) (Chodosh et al., 2008). The BIMS is generally well accepted by nursing assistants because it is brief (usually taking between 2-4 minutes per resident), easy to administer, and clinically useful in day-to-day care planning (Chodosh

et al., 2008; Eleden et al., 2019). BIMS assessments are taken on all residents of the facilities at intake and then every three months; the most recent score for each resident will be used to compare the samples from the two facilities and compare changes in behavior based on cognitive ability.

Demographic/co-morbidity data. De-identified data from resident medical records will be provided by the nursing homes as an ASCII file that will be imported into IBM SPSS v.25 (IBM Corp., Released 2019). The data will include age, gender, race/ethnicity, education, length of time at the nursing home, MMSE scores, and co-morbidities. The information will be used to provide descriptive statitstics and compare residents between the two facilities.

The nursing assistant survey will include a request for self-reported demographic information including age, gender, race/ethnicitiy, education, and length of time spent as a nursing assistant that will be used to provide descriptive statistics and compare nursing assistants between the two facilities.

Staff feedback on the Tovertafel activity. Because proper and continued use of the Tovertafel as an intervention requires staff involvement and support, perceived benefits of the device among nursing assistants who participate in the study will be determined. The constructs used to develop the Nursing Assistants' survey were behavioral capability, expectations (anticipated outcomes of the behavior) and personal attitudes.

Questions will be presented to the staff members in the form of 5-point Likert scales (strongly agree and strongly disagree as the anchors). Five questions related to behavioral capability will be asked (e.g., "I feel confident that I know how to turn on the

Tovertafel and initiate a game.") The results of the five questions will be combined to create a composite score for the construct of behavioral capability. Following this section, a follow-up question will be supplied: "If you indicated "disagree" or "strongly disagree" for any of the items above, what do you feel might help you gain more confidence using the Tovertafel (select all that apply) with possible responses provided: a one-on-one session with a trainer, more practice with the Tovertafel, videos for help or reference, or other with space to provide more details. Six questions related to the SCT construct of expected outcomes will be asked (e.g., "Residents who use the Tovertafel in a group setting are likely to be more socially engaged with staff and other residents."), and the results will be combined to create a composite score for the construct of expected outcomes.

Following the expected outcomes questions, lined space is provided for staff to respond to the prompt "Please list any additional changes in resident behaviors or routines that you believe are related to participation in the Tovertafel activity." The construct of personal attitudes is represented by four questions (e.g., "I enjoyed using the Tovertafel") that will be combined to create a composite score. Following these questions, participants will be asked to list the three games that they found most enjoyable, and then identify games that they did not enjoy and an explanation of why. The survey ends with a prompt asking staff members to share any aspects of the Tovertafel that they felt worked well or did not work well, including suggestions for improvements.

Data Preparation and Analysis

Data preparation. IBM SPSS v.25 (IBM Corp., Released 2019) will be used to perform all analyses. Data will be entered by one member of the research team. A second team member will review the data entry by radomly checking entries. The data will be sorted by min/max and frequencies for each item for the identification of outliers that may be entry errors and for missing data.

All resident data will be included, provided the participant took part in at least one session each of the three weeks. An analysis will be run to determine the dosing threshold needed to make an impact. For residents who have particpated in three or more sessions, but may have missing data, the method of imputation by most freuqent value will be used.

Data analysis. The demographic data will be used to report descriptive statistics. Continuious variables such as age and MMSE scores will be reported using means and standard deviations. Gender and co-morbidities, as nominal data, will be reported using frequencies and percentages. Additionally, a between-groups analysis will be run to compare residents at the two nursing homes for significant differences in the populations.

T-tests will be run to compare normally distributed continuous variables across nursing homes. Continuous variables that are not normally distributed will be analyzed using Mann-Whitney tests. A comparison of categorical variables between the nursing homes will be analyzed using Chi Square tests.

The composite scores derived from the GCWBT, RMBPC-NH and AES-10 will be used to perform two-way repeated measures multivariate analysis of variance (MANOVA) to test for the presence or absence of changes over time in the dependent

variables of well-being, memory-related behavior problems, and apathy, and to measure changes in staff "bother". Using the same methods, difference in change across nursing homes will be analyzed.

The three composite scores from the staff survey will be used to report descriptive statistics such as frequencies and mean scores for each of the constructs. The follow-up questions will be used for a qualitative descriptive discussion of the attitudes of nursing assistants regarding the Tovertafel intervention.

A review of the missing data will be made prior to data analysis to ensure that there is enough data to ensure that the results are statistically significant and meaningful. If this is not the case, other methods of statistical analysis will be considered.

Power and sample size. Because a convienece sample of residents in two nursing homes will be used, the expected sample size will be 40 particpants. Assuming an effect size of 0.25 and an alpha of 0.05 for within and between interaction repeated measures MANOVA tests, a G*Power analysis indicates an anticipated power of 0.25. While the low anticipated power limits the ability to make statistical assumptions, it is not uncommon among conveience samples (Cresswell, 2013).

Chapter 3 Addendum

Ramifications of the COVID-19 global pandemic.

November 2019 - February 2020. The first three chapters of this dissertation were defended in the fall of 2019, after which the necessary application was submitted to the university Institutional Review Board (IRB) for evaluation and approval. As the research team awaited word from the review board, reports began to appear in the news of a new virus in China. The virus, eventually labeled COVID-19, spread into parts of Europe and reached U.S. shores just as the review for the planned research project neared completion. By the time the final approval from the IRB was granted, nursing homes were being ravaged by COVID-19, and access to long term facilities was coming under ever increasing restrictions.

March – May 2020. While administrators and staff at both of the facilities who had agreed to be part of the original study remained supportive, it became clear that the project could not proceed as originally planned. Amendments were submitted to the university IRB that eliminated contact between the researchers and staff/residents at the facilities. Training would be handled through a combination of written instructions and video lessons between the researchers and the staff members. Recruitment would be conducted through telephone and video discussions with family members, and the distribution and management of data collection forms would be completed by facility administrators. Approval from the IRB was issued relatively quickly, and plans were made for training and recruitment procedures to begin in mid-May provided the facility administrators received approval from their superiors. Before these plans could be implemented, administrators at the corporate level decided that all student rotations,

internships and research projects would be discontinued for the foreseeable future to protect the health and safety of their residents and staff.

June – July 2020. Since it was not possible to conduct the original research study with the long-term care facilities, the researcher contacted the administrative director of a local dementia day center to determine whether the research activities might be conducted at her site. Their operations were still closed due to COVID-19, however, and the expected date to resume services was ever-changing. The administrator was favorable to a proposal to train her staff to use the Tovertafel, but potential furloughs and increased burden on remaining staff prevented further discussions.

August-September 2020. By August it appeared that COVID-19 would continue to interfere with the researchers' ability to work with staff or residents at any care facilities, and there was no end to the global pandemic in sight. Consequently, the decision was made to adapt the research project to something that could be conducted during the pandemic and resulting restrictions. A review of the research goals suggested that the project would be improved by expanding and formalizing the staff training. Originally planned as an informal training session between employee shifts, the researcher decided to create an online training course to cover key dementia concepts, introduce the Tovertafel, and provide information about facilitating Tovertafel game sessions.

The next portion of this chapter provides additional details about the updated research plan including a review of pertinent literature and a description of the methods and materials utilized in the revised project plan.

Background. As discussed in Chapter 2, direct care workers are traditionally low-paid and under-trained, which often leads them to struggle with the demands of dementia care (Elliott et al., 2018). The diverse tasks performed by direct care workers, which often include assistance with ADLs, medical care, nutritional services, and emotional support for both residents and family members, often leads to high levels of stress and burnout (Elliott et al., 2018). Providing opportunities to learn new skills can be an effective way to improve morale and increase feelings of self-efficacy among direct care workers, and lead to improved care for residents (Elliott et al., 2018; Melhuish et al., 2017). Patient-centered care, with its emphasis on adapting to the needs of the resident, requires that direct care workers receive continual training to use newly developed approaches to care (Cheng, 2012; Melhuish et al., 2017). Finally, ensuring that direct care workers are comfortable with new practices and technology is crucial to their success, as they are usually the staff who implement new programs (Kloos et al., 2020; Williams et al., 2016). When staff members are trained using consistent methods, they are more likely to understand the intended activities and results, which increases the success of the program (Vernooij-Dassen & Moniz-Cook, 2014).

Barriers to continuing education or training include lack of staffing to allow for time away from job duties, difficulty traveling to and from classrooms, and staff members' low motivation to attend courses or adapt to changes (Mills et al., 2019; Williams et al., 2016). Web-based training can be an effective way to deliver training to direct care workers, provided it is properly evaluated and perceived as useful by its audience (Cheng, 2012). When Williams and colleagues (2017) pilot tested an online version of a communication improvement intervention aimed at nursing home staff, they

found the online delivery method more cost-effective than a previously utilized classroom version of the course. They also found the online course easier for busy staff to complete at their convenience and ensure that new staff received consistent and timely training (Williams et al., 2017).

While direct-staff training has been acknowledged as an important element in the success of a multi-sensory technology intervention, it is often not addressed in published literature. Of the 11 experimental or quasi-experimental studies identified for the original research project, only a handful acknowledged the need for staff training prior to the initiation of control or intervention activities. The most detailed description of staff training prior to the onset of the intervention was provided by Joranson et al., (2015), who explained that direct care staff members were required to attend training sessions in order to participate in the activities. A study reported by Sposito et al., (2017) discussed the importance of staff training and its role in patient-centered care, but did not elaborate on how training was accomplished for staff participating in their multi-sensory technology intervention. Similarly, three additional articles mentioned staff were trained prior to the beginning of activities but offered no details about who was trained or how the training was conducted or evaluated (Maseda et al., 2014; Nijhof, van Hoof, van Rijn, & van Gemert-Pijnen, 2013; Sanchez et al., 2016). Some researchers chose to enlist the services of outside trained caregivers (Gustafsson, Svanberg, & Mullersdorf, 2015) or trained research assistants (Heesterbeek, van der Zee, & van Heuvelen, 2019; Moyle et al., 2017) to ensure consistency of delivery, while others failed to mention staff training in their reports at all (Bruil, Adriaansen, Groothuis, & Bossema, 2018; Collier,

McPherson, Ellis-Hill, Staal, & Bucks, 2010; Garlinghouse et al., 2018; Goto, Kamal, Puzio, Kobylarz, & Herrup, 2014; Luyten, Braun, Jamin, van Hooren, & de Witte, 2018).

Purpose of the revised study. The purpose of this descriptive study was to evaluate an online training course designed to introduce direct care workers to a multi-sensory device called the Tovertafel and provide information about how to facilitate an interactive game session with older adults who have dementia. The results of the study will be used to deliver training to the staff who will participate in the planned intervention at two nursing homes after COVID-19 restrictions are lifted.

The study was conducted in two parts. In Part One, undergraduate students were invited to complete the training course and then respond to an evaluation survey. In Part Two of the study, recreation therapy undergraduate students who had completed the training course were invited to practice using the Tovertafel games and provide input on knowledge gained through the training and the applicability of the multi-sensory device to their future career. Both parts of this study utilized a non-experimental, descriptive research design and collected quantitative data through the use of two single-use online surveys consisting of Likert-style and open-ended questions.

Part One - Evaluation of training on a novel multi-sensory intervention for persons living with dementia: Online course.

Methodological framework.

New World Kirkpatrick Model. A review of 21 peer-reviewed studies that evaluated postgraduate medical education leadership curricula found that only nine (43%) used a specific conceptual framework in the design of the study (Sultan et al., 2019). Research suggests the use of a framework strengthens the design of the study and

ultimately results in more effective professional training (Liao & Hsu, 2019; Moreau, 2017). Part One of the revised study utilized the New World Kirkpatrick Model (NWKM) to evaluate the design and content of the training course. The NWKM is a training evaluation model originally developed in the 1950s to evaluate job-related continuing education and updated in 2016 to address modern training methods such as online courses (Kirkpatrick & Kirkpatrick, 2016; Liao & Hsu, 2019). According to the NWKM, there are three primary reasons to evaluate training: to improve the training materials; to increase the likelihood that students will utilize new knowledge and skills in the workplace; and to show that training endeavors are of value to an organization (Kirkpatrick & Kirkpatrick, 2019). The model focuses on four levels, each comprised of components that should be present in a successful learning environment:

Level 1: Reaction. The first level measures participant reactions to the training experience and is comprised of three components. C*ustomer Satisfaction* relates to the degree to which participants express positive attitudes about the learning experience (Kirkpatrick & Kirkpatrick, 2016). *Engagement* relates to how actively involved participates feel, and whether there were opportunities for the participant to contribute to their learning experience (Kirkpatrick & Kirkpatrick, 2019). The third component, *Relevance*, relates to participant perceptions that the training topics are related to knowledge and skills that can be used in the real-world workplace (Kirkpatrick & Kirkpatrick, 2016).

Level 2: Learning. This level is comprised of five components that together are identified as important to the learning process (Kirkpatrick & Kirkpatrick, 2016).

Knowledge relates to an understanding of concepts and information, while *Skills* refer to the ability to perform tasks (Kirkpatrick & Kirkpatrick, 2019). The third component, *Confidence*, relates to participant feelings of having the ability to apply new knowledge or skills on the job (Kirkpatrick & Kirkpatrick, 2016). *Attitude*, according to the model, measures the belief among participants that implementing new knowledge and skills to the job is worthwhile, while *Commitment* measures intention to actually follow through with the application of new knowledge and skills (Kirkpatrick & Kirkpatrick, 2016).

Level 3: Behavior. Once the training is complete, the third level measures the application of acquired knowledge and attitudes in the workplace (Kirkpatrick & Kirkpatrick, 2016). This level is comprised of two components. *Critical Behaviors* are the key behaviors that bring about the desired outcomes if they are consistently performed. *Required Drivers* are environmental factors that "reinforce, monitor, encourage, and reward performance of critical behaviors on the job" (Kirkpatrick & Kirkpatrick, 2019, p. 7).

Level 4: Results. Unlike the other levels, Results has no components; rather, it is associated with measuring indicators of successful adoption and desired outcomes (Kirkpatrick & Kirkpatrick, 2016).

Levels 1 (Reaction) and 2 (Learning) of the NWKM are primarily used to evaluate the quality of a training program, while Levels 3 (Behavior) and 4 (Results) are

used to evaluate the effectiveness of the training to achieve the goals of an organization (Kirkpatrick & Kirkpatrick, 2019). In theory, if the first two levels are effective, the result is that participants will use the newly attained knowledge, skills, and attitudes to adopt the behaviors and bring about the desired results (Liao & Hsu, 2019). Most exploratory pilot programs focus on the first two levels, especially when the training is in a mobile format, because evaluating behaviors and results requires observation over a longer period of time (Kirkpatrick & Kirkpatrick, 2016). Additionally, while the developers of the model suggest that trainers begin with Level 4 and work backward to ensure that the desired outcome is achieved, most evaluators find that they must first demonstrate positive user feedback with a pilot study prior to conducting larger studies (Kirkpatrick & Kirkpatrick, 2016; Liao & Hsu, 2019). The NWKM has been criticized for lack of association between Levels 1 & 2 and Levels 3 & 4 (Holdener, Gut, & Angerer, 2020). Research suggests that the only NWKM levels that directly interact with each other are Level 3 (Behavior) and Level 4 (Results), and therefore evaluations that focus on Levels 1 & 2 are limited in their ability to assume that positive results will translate to changed behaviors and the achievement of organizational goals (Liao & Hsu, 2019).

Relevant NWKM literature. Literature searches were performed in CINAHL Plus with full text, Academic Search Complete, PsychInfo, PUBMed, and Web of Science for peer reviewed research articles published since 2016 (the year NWKM was released) that utilized the NWKM to evaluate online healthcare training courses. Three articles utilizing the NWKM to evaluate pilot projects were identified. A summary of the databases and key words used is provided in Appendix A.

Study designs. Luo & Yang (2018) conducted a mixed methods case study involving nine nursing students (all female, mean age 38 years) who were enrolled in an online research course. The researchers used the results of an online survey and student feedback from reflective journals as well as notes from the course instructors to evaluate the course. The online survey was created by the researchers and guided by literature related to NWKM. The 25 items were presented with a 5-point Likert scale for responses. The survey was reviewed by three experts and a group of former students to ensure content and face validity. Descriptive statistics and qualitative themes were used to report participant reactions and learning after completing two online lessons and associated assignments. Levels of the NWKM were used to synthesize the qualitative and quantitative data and provide a context for the findings (Luo & Yang, 2018).

Patel and colleagues (2018) used two levels of the NWKM to evaluate online lessons designed to train employees working with a community behavioral health treatment program in New York State. Employees completed an online survey following the completion of each of three online lessons (lesson 1 n=523; lesson 2 n=312; lesson 3 n=127) designed to evaluate the training experience. The survey was created by the researchers with the course learning objectives as a guide and was comprised of Likert-style items and open-ended questions. Subsequent to conducting descriptive analyses, the researchers reported on participant reactions and learning after completing the lessons (Patel et al., 2018).

Walker et al., (2019) incorporated two NWKM levels into the evaluation of an online professional training course presenting lessons about weight management during pregnancy. Using a mixed-methods approach, 136 health practitioners provided both

qualitative and quantitative data for a descriptive analysis of the training course (Walker et al., 2019). The NWKM was used to measure the effectiveness of the online training course, looking at factors such as attitudes, confidence, and commitment to address weight management during pregnancy for patients in their practice. A review of relevant literature was utilized in the creation of a survey applied before and after the training session and reviewed by a panel of maternal nutrition and weight management experts to establish face validity (Walker et al., 2019).

NWKM levels studied. Consistent with many training evaluation studies (Kirkpatrick & Kirkpatrick, 2016), the three studies in this literature review focused on the first two levels of the NWKM: Reaction and Learning. Tables 2 and 3 illustrate the factors that each of the researchers included in their studies.

Table 2

NWKM Level 1 Reaction components evaluated

Study	Engagement	Relevance	Customer Satisfaction
Luo & Yang (2018)	X	X	X
Patel et al. (2018)		X	X
Walker et al. (2019)	X	X	X

Table 3

NWKM Level 2 Learning components evaluated

Study	Knowledge	Skills	Attitudes	Confidence	Commitment
Luo & Yang (2018)	X	X	X	X	X
Patel et al. (2018)	X				X
Walker et al. (2019)	X		X	X	X

The three pilot programs reviewed did not include evaluations of Levels 3 or 4 of the NWKM. Two studies addressed the decision to omit Levels 3 and 4 as possible limitations to their findings, acknowledging their inability to translate positive reactions (Level 1) and increased learning (Level 2) to changed behaviors (Level 3) and the achievement of targeted outcomes/results (Level 4) (Patel et al., 2018; Walker et al., 2019). Both studies cited difficulties in measuring behaviors and outcomes among online participants who practiced their professions at diverse locations as a reason for their research design (Patel et al., 2018; Walker et al., 2019). The third article (Liao & Hsu, 2019) offered no explanation for the exclusion of Levels 3 and 4 of the NWKM.

Findings.

Reaction. Luo & Yang (2018) found that more than half of the participants in their study reported that the training was engaging and interesting. Similarly, the participants in the study conducted by Walker et al. (2019) stated the content was engaging, however, the majority of participants also indicated that the engaging activities did not contribute to the learning process. All three of the studies found that participants reported high levels of agreement with statements related to relevance of the lessons (Luo

& Yang, 2018; Patel et al., 2018; Walker et al., 2019). Two of the studies presented quantitative and qualitative evidence of satisfaction with the learning experience (Patel et al., 2018; Walker et al., 2019). Conversely, Luo & Yang (2018) found that participants reported low levels of satisfaction, indicating that while they thought the activities were engaging and relevant, they were too long and not enjoyable.

Learning. Two of the studies found that knowledge scores improved and qualitative feedback from both participants and instructors indicated increased understanding of the topics covered (Luo & Yang, 2018; Patel et al., 2018). Walker et al., (2019) found no significant quantitative changes in knowledge, however qualitative feedback from participants indicated that they thought they learned new information related to key aspects of the lessons.

Patel et al., (2018) reported that about half (51%) of the participants in their study expressed a commitment to change or revise current practices to incorporate knowledge gained through the training, while the other half (49%) indicated that the training topics confirmed current practices and no changes were needed (Patel et al., 2018). While Luo & Yang (2018) included questions about skills, attitudes, confidence, and commitment in their training survey, and reported that the results showed improvements in all four of these components, the quantitative results were not provided in the publication. The researchers did use qualitative data to triangulate the findings, reporting that according to instructor notes, 95% of the participants were able to demonstrate the desired research skills following completion of the training course (Luo & Yang, 2018). Open-ended responses from course participants indicated positive attitudes, improved confidence, and a commitment to continue to use the acquired knowledge and skills, however

representative statements from the students were not included in the publication (Luo & Yang, 2018).

Walker et al., (2019) examined attitudes, confidence and commitment among healthcare professionals who completed an online course on weight management during pregnancy. A comparison of pre- and post-training responses showed an increase in attitudes about the importance of gestational weight gain ($p=0.01$), but not about the importance of preconception weight ($p=0.71$). Increases in confidence to advise and refer patients increased significantly ($p=0.01$), but changes in skills were not statistically significant for the two questions included on the pre- and post-training surveys ($p=0.63$ and $p=0.23$). Survey responses indicated a mixed level of commitment to incorporate new skills and knowledge (Walker et al., 2019). Participants indicated a significant increase in commitment to refer women to a specialist for dietary advice ($p=0.02$), but not significant changes in commitment to increase referrals for patients with maternal obesity ($p=0.55$) (Walker et al., 2019). A review of open-ended questions indicated a commitment to communication, with 3 sub-themes: a greater commitment to improve the way they communicate with patients; an elevated appreciation of the importance of communicating weight management information; and a commitment to incorporate new communication skills such as active listening into their patient interactions (Walker et al., 2019).

Summary of NWKM literature. The application of components of Reaction and Learning of the NWKM resulted in largely positive results from each of the three studies (Luo & Yang, 2018; Patel et al., 2018; Walker et al., 2019). Luo and Yang (2018) suggest that the use of Internet-based training has the potential to allow students to engage in the course work on cognitive and behavioral levels. These findings were

echoed by Patel et al. (2018), but the authors cautioned a need for additional research to ensure the translation of acquired knowledge and skills to behavior change in practice. According to the authors, the flexibility offered by online training is especially beneficial because the materials can be adjusted to address issues as they are identified (Patel et al., 2018). Walker et al. (2019) reported a significant drop-out rate among participants, which may pose problems for organizations wishing to adopt an online education program. Despite the limitations of their studies, all three authors concluded that online training, provided it is delivered in an engaging way that provides knowledge perceived as relevant to participants, has the potential to allow busy healthcare practitioners the opportunity to learn new skills that otherwise may have been unavailable or unrealistic to attain (Luo & Yang, 2018; Patel et al., 2018; Walker et al., 2019).

Application of the NWKM in the current study. Ideally, the current study would have incorporated all four levels of the NWKM to illustrate the translation of acquired knowledge, skills, and attitudes to new behaviors in practice as suggested by the originators of the model (Kirkpatrick & Kirkpatrick, 2016). The current research environment, which is vastly limited by the COVID-19 pandemic, prevented the researchers from accessing direct care workers for training and observation of behaviors post-training. For this reason, only elements of Levels 1 (Reaction) and 2 (Learning) were used in the current study.

Purpose and aims of Part One. Focused on the Reaction and Learning levels of the NWKM, the purpose of Part One of the revised study was to examine ratings of engagement, relevancy, knowledge, and skills gained after completing the online training

course. Specifically, the researchers sought to answer the following research questions:

- Do the majority of the participants report the training as engaging?
- Do most of the of participants report that the information provided is relevant to their discipline?
- To what extent do participants report that they gained knowledge and skills related to the topics covered by the lessons?

Setting. Because access to staff at long term care facilities was restricted, the researchers decided to test the training course using undergraduate students who were likely to interact with older adults with dementia in their careers. Following university Institutional Review Board approval, a convenience sample of undergraduate students enrolled in programs offered through the College of Health and Human Services at one state university were recruited to participate in Part One of the study. The College includes undergraduate programs that train students to be health care professionals who are likely to interact with individuals with dementia such as recreation therapy, respiratory care, social work, and public health ("College of Health and Human Services," n.d.).

Sample. Undergraduate students enrolled in academic programs offered by the College of Health and Human Services at the university were invited to participate in Part One of the study. The inclusion criteria were self-reporting that their academic program is related to a discipline or profession that uses or could use technology-based interventions aimed at improving the health/well-being of adults. Students who lacked access to a reliable Internet connection or who lacked sufficient proficiency in the English language

to complete the course were excluded from participating. Additionally, undergraduate students from the College who were enrolled in one of two Fall 2020 recreation therapy classes (Recreation Therapy Assistive Technology and Techniques; Geriatric Recreation Therapy) completed the online training course as an assignment. Students were excluded if they lacked sufficient proficiency in the English language to complete the course; did not have a reliable Internet connection; or completed the training but indicated that they did not want their data from the survey included in the research study.

Recruitment. An email was sent to all undergraduate students enrolled in programs offered by the College of Health and Human Services. The email, which was approved by the university Institutional Review Board (see Appendix B), provided a brief description of the project and a link to the training course. The initial email was sent by an employee of the Communication & Marketing Department in the College, and later forwarded to faculty members in the College to encourage student participation. For the recreation therapy students, the class instructor included the link to the training course in her Week 2 lesson using the Blackboard Learning Management System.

Ethical Considerations. For both groups, informed consent was presented online before the undergraduate students were granted access to the survey questions. Additionally, because the recreation therapy students were required to complete the training and survey as part of a class assignment, they were asked to authorize or not authorize the researchers to include their responses to the survey in the research study. The consent was presented after the completion of the training course so that participants could understand where the research portion of the activity began and recognize their option to opt out of the data collection if they so wished.

Materials.

Training course. An online training course was developed using the Rise 360 e-learning platform from Articulate ("Articulate Rise 360," 2021). This subscription-based service provides an interface for educators and corporate trainers to create online courses that incorporate interactive activities from templates provided by the vendor ("How Rise works," n.d.). Development was guided by pedagogical best-practices and the training materials were reviewed by four experts with experience in course design, behavioral theory, gerontology, and education to maximize the likelihood that the course would engage a diverse audience.

The course, which took 30-45 minutes to complete, consisted of four lessons: 1. Dementia Overview; 2. What is a Tovertafel?; 3. Using the Tovertafel; 4. Facilitating a Tovertafel session. Each of the lessons included activities such as flip cards, interactive graphics, videos, and a knowledge check. An outline of the specific topics covered in the course is provided in Appendix C.

When designing content intended for online learning, design and content choices should be made with the needs of the learner at the forefront (Mancilla & Frey, 2020). Using a Universal Design strategy that includes simple and consistent navigation, careful choice of colors and fonts, and assistive elements such as closed captioning and alternate text for graphics ensures that the material is available to all learners (Dell et al., 2015; Rockley, 1997). Attention to Universal Design to ensure accessibility of training materials aligns with core health education standards (National Commission for Health Education Credentialing, 2015) and was considered during the development of the materials used in this study.

Instrument Development. An online survey was designed and a link was provided at the end of the online course. The survey consisted of four sections, three of which included questions related to the NWKM Levels of Reaction and Learning, and a fourth to collect demographic information from the participants (e.g., age, gender, ethnicity/race, caregiving experience). A copy of the post-training survey is provided in Appendix D.

Survey Section 1: Engagement. The first section of the Part One survey contained questions related to the NWKM Level 1 Reaction component *Engagement*. This was measured using parts of the User Engagement Scale (UES), a 31-item survey instrument developed to measure self-reported reactions to interactive software applications and technologies (O'Brien & Toms, 2010). The UES has been used in part or in whole to evaluate engagement in a variety of online formats including online news services (O'Brien & Cairns, 2015) health apps for mobile phones (Holdener et al., 2020), online shopping, education, social networking systems, and video games (O'Brien et al., 2018).

The survey-based instrument asks the participant to respond to a series of statements related to aesthetics, novelty, perceived usability, focused attention, felt involvement, and endurability using a 5-point Likert scale ranging from 1=strongly disagree to 5=strongly agree. Psychometric properties of the UES indicate it is both reliable and valid when the full set of questions for each section utilized is included (O'Brien & Toms, 2010; O'Brien & Toms, 2013; Wiebe, Lamb, Hardy, & Sharek, 2014). While some studies have suggested that reliability might be increased with a realignment of statements (i.e., movement of statements from one item to another and/or combining items) (Holdener et al., 2020; Wiebe et al., 2014), the originator of the instrument

conducted comparison factor analyses across studies and determined that each of the 6 items are distinct factors (O'Brien et al., 2018). Generalizability has been reported for the six items, with three (Perceived Usability, Focused Attention, and Aesthetic Appeal) demonstrating stability across several studies, while Novelty, Felt Involvement, and Endurability were less conclusive (O'Brien & Toms, 2013). The authors suggest that the tool is appropriate for use in exploratory studies seeking to evaluate engagement levels experienced in online environments (O'Brien & Toms, 2013).

After carefully reviewing the 31 items on the full instrument, the researchers determined that two sections, endurability and focused attention, were not relevant to the course topics or the intended audience. Statements such as "*During this experience I let myself go*" and "*I blocked out things around me when I was reading on this website*" in these two sections of the instrument are not likely to relate to professional training, whereas others such as "*I consider my experience a success*" and "*My experience was rewarding*" were similar to statements in other sections of the instrument. The instructions for use of the UES allow for the exclusion of a section, provided all questions in the section are removed (O'Brien et al., 2018). The remaining four sections of the instrument were included in the post-training survey:

> Aesthetics – This section is measured using five statements related to the visual appeal and attractiveness of the materials. Subscale reliability using Cronbach's alpha has ranged from 0.88 to 0.89 in previous studies (O'Brien & Toms, 2010; O'Brien & Toms, 2013; Wiebe et al., 2014). Aesthetics accounted for 7.36% of the variance, with factor loadings for the five items ranging between 0.71 and 0.80 (O'Brien & Toms, 2010).

Novelty – Three statements are included related to the level that participants felt the interaction captured their interest and curiosity. Subscale reliability using Cronbach's ranges between 0.73 and 0.81in previous research (O'Brien & Toms, 2010; O'Brien & Toms, 2013; Wiebe et al., 2014). Analysis showed that the factor comprised 3.47% of the variance, with factor loadings between 0.518 and 0.650 for the three statements (O'Brien & Toms, 2010).

Ease of use (usability) – Eight statements presented primarily in the negative are included to measure ease of use and sense of control. Reliability of this subscale using Cronbach's alpha has ranged from 0.84 to 0.86 (O'Brien & Toms, 2010; O'Brien & Toms, 2013; Wiebe et al., 2014) Usability accounted for 15.63% of the variance, with factor loadings for the 8 statements ranging from 0.57 to 0.75 (O'Brien & Toms, 2010).

Involvement – This portion of the survey included three statements related to the level that participants felt that they were having fun and found the activity captured their interest. Cronbach's alpha subscale reliability ranged between 0.72 and 0.77 (O'Brien & Toms, 2010; O'Brien & Toms, 2013; Wiebe et al., 2014). Factor analysis of constructs shows that loadings for the three statements in this item ranged from 0.50 to 0.74, and the item accounted for 3.198% of the variance (O'Brien & Toms, 2010).

Survey Section 2: Relevance. The second part of the post-training survey contained statements related to the NWKM Reaction construct of *Relevance*. The creation of the items for this portion of the survey were modeled from a sample survey in *Kirkpatrick's Four Levels of Training Evaluation* (Kirkpatrick & Kirkpatrick, 2016). Participants responded to 5 statements using a 5-point Likert scale with 1=strongly disagree and 5=strongly agree as anchors. The statements addressed the applicability of the material to their profession; whether the material will help improve professional performance; whether the participant feels that the new knowledge/skills are worthwhile to apply in the performance of their job; the level of confidence that participants felt that they would be able to apply the new knowledge in the performance of their profession; and whether the participants were committed to using the knowledge, awareness and/or skills in their profession.

Survey Section 3: Knowledge and Skills. The third part of the survey contained statements related to NWKM Level 2 (Learning) construct *Knowledge*. The items were modeled from a sample survey in *Kirkpatrick's Four Levels of Training Evaluation* (Kirkpatrick & Kirkpatrick, 2016). Participants were asked to rate their knowledge of the topics before and after the training using a 5-point scale ranging from 1=no knowledge to 5=very high level of knowledge. Participants were presented with four topics covered in the training course: common dementia behaviors; ways that direct care workers can help improve the well-being of people who have dementia; the use of multi-sensory interventions with people living with dementia; and how to have a positive attitude about dementia caregiving.

Participants were also asked to rate their skills to perform indicated tasks before and after the training using a 5-point scale ranging from 1=no skill to 5=very high level of skill. Participants were presented with three tasks covered in the training course: leading a group activity with people living with dementia; using multi-sensory technology with a group; and improving the well-being of people living with dementia. Open-ended questions were asked at the end of the knowledge and skills sections for participants to provide any comments about the items.

Survey section 4: Demographic questions. The final section of the survey asked demographic questions about the participants. The items in this section asked for primary program of study, year of undergraduate studies, age, ethnicity and race, gender identity, and experience caring for an older adult with dementia.

Instrument testing and refinement. After the survey questions were developed, they were reviewed by four faculty members with expertise in qualitative and quantitative research, survey design, gerontology, and the long-term care environment. The feedback from the expert reviewers was used to revise the survey to improve content and face validity. The survey was next disseminated to 3 undergraduate and 6 graduate students at the university to ensure that all items were easy to understand. Finally, all of the individuals involved in the review of the materials were asked to complete the online version of the survey to identify any typographical errors or design issues.

Methods.

Data Collection. Clicking on the link to the training course presented students with the opening page and an invitation to proceed sequentially through the lessons. At

the end of the final lesson, the informed consent form was provided. After reading the informed consent statement, students indicated interest in participating in the study by selecting a "Yes" or "No" response to a statement that they were at least 18 years old, and an undergraduate enrolled in a program that is related to a discipline or profession that uses or could use technology-based activities aimed at improving the health/well-being of adults. Students who selected "Yes" were granted access to the survey. After completing the survey, participants had the option to print a certificate of completion. Students who received the invitation through the College of Health and Human Services email were given four weeks to complete the training course and survey. The recreation therapy students were limited to two weeks for completion because the activity was part of an assignment distributed by the class instructor.

Data preparation and analysis. Responses to the two versions of the Part One survey (HHS students and recreation therapy students) were exported from QualtricsXM (Qualtrics, Provo, UT) and combined into one file using SPSS for Macintosh, Version 26.0 (IBM Corp. 2019) for data analysis. Nominal data such as participant demographics were reported using frequencies and percentages. Ordinal data derived from the Likert scale items were reported with medians and interquartile ranges. The median is generally the preferred method of reporting central tendencies for ordinal data (Laerd Statistics, 2018). As a measure of central tendency, the median indicates the middle value in a sample, or the 50^{th} percentile (Kaliyadan & Kulkarni, 2019). The interquartile range (IRQ) indicates the spread of the responses and is calculated as the difference between the 75^{th} and 25^{th} percentiles (Kaliyadan & Kulkarni, 2019).

A comparison of before and after knowledge and skills were analyzed using Wilcoxon signed-rank tests for matched pairs. This approach is similar to a paired-samples t-test and is frequently used to detect median differences between nonparametric paired observations (Laerd Statistics, 2015; Rosner, Glynn, & Lee, 2006). An a priori calculation of power using G*Power software (Faul, Erdfelder, Lang, & Buchner, 2007) for a one-tailed Wilcoxon signed-rank test for matched pairs with an alpha level of $p<0.05$ and an effect size of 0.5 indicated a sample size of 38 participants was necessary to achieve a power of 0.90. Open-ended questions were presented for a quantitative descriptive analysis.

Part Two - Evaluation of training on a novel multi-sensory intervention for persons living with dementia: Hands-on experience.

Methodological and theoretical framework.

Social Cognitive Theory. The survey created for Part Two utilized constructs from Social Cognitive Theory (SCT) as a framework. The theory was developed by Albert Bandura in the 1960s to explore the role that the social environment has on behavior change (Glanz, Rimer, & Viswanath, 2015). The theory is comprised of three factors, each comprised of sub-constructs (U.S. Department of Health & Human Services, 2005). Because SCT is a social theory, it uses the three factors to address the ways that internal and external factors influence each other to support behavior and learning in a process referred to as reciprocal determination (Bensley & Bookins-Fisher, 2009).

Personal factors refer to intrinsic constructs that influence behavior such as:

- Self-efficacy: The confidence one has in his or her ability to perform a task

- Collective efficacy: The confidence in a group to perform a task
- Expected outcomes: The likely consequences of taking an action
- Knowledge: The information that one needs to perform a behavior

Behavioral factors refer to the actions that an individual may take to adopt a new behavior or eliminate an unwanted behavior. They include:

- Behavioral capabilities: The skills that are needed to perform a task
- Intentions: The goals that one makes to adopt a new behavior, or to cease an unwanted behavior.
- Reinforcing attitudes: Positive changes or outcomes that are likely to encourage an individual to continue the new behavior.

Environmental factors consider the external constructs, physical and social, that might influence behaviors including:

- Observational learning: The acquisition of knowledge and skills by watching others
- Normative beliefs: The social beliefs and habits that influence cultural norms
- Social support: The perception about social support that one is likely to receive

SCT is a useful theory for educational programs because it considers constructs that other behavioral theories do not address such as behavioral capability, collective efficacy and observational learning (Burke & Mancuso, 2012; Glanz et al., 2015). The use of SCT constructs in health-related professional training has been addressed in scientific literature.

Burke and Macuso (2012) used constructs of SCT to develop a simulation lab to educate students enrolled in an associate degree nursing program. In their pedagogy brief, the authors outline the value of using SCT to develop scenarios that promote collective efficacy and self-efficacy among nursing students (Burke & Mancuso, 2012). The value of observational learning was also emphasized as a way to develop a program that "supports participant mastery of technical skills, enhances sensitivity of assessment skills, promotes timely interventions to meet patient needs, grooms communication skills, and supports role identity and collaborative practice" (Burke & Mancuso, 2012, p. 548).

SCT constructs were used in a mix-methods feasibility trial performed by Sturgiss and associates (2017). The researchers enlisted 12 general practitioner physicians in Australia to participate in an exploratory weight loss program that involved patients in their clinics (Sturgiss et al., 2017). The physicians were provided with a training handbook designed to increase behavioral capability and self-efficacy in assisting patients in need of weight management training. At the end of the program, the physicians were asked to complete a survey and participate in interviews to determine changes in behavioral capability, self-efficacy, and expected outcomes. The researchers reported increases in all three areas following the completion of the program, and in a follow up with participants, found that the majority had incorporated new knowledge and skills into their daily practice (Sturgiss et al., 2017).

The value of constructs unique to SCT such as observational learning and behavioral capability were instrumental in the selection of the theory for the current study. The integration of these constructs into Part Two of the study will be further explored in the next portion of this chapter.

Purpose and aims of Part Two. With a focus on Social Cognitive Theory, the purpose of Part Two of the revised study was to solicit the perceptions of recreation therapy undergraduate students who completed the online training course (Part One of the study) and then participated in at least one session interacting with the Tovertafel games. Specifically, the researchers sought to answer the following research questions:

- Do most participants indicate they have the behavioral capability needed to operate the equipment to conduct a Tovertafel session with older adults with dementia?
- To what extent do participants report self-efficacy to facilitate a session with older adults with dementia?
- Do the majority of participants report expected outcomes that are relevant to their future career in recreation therapy?
- Do the majority of participants indicate reinforcing attitudes about the Tovertafel games such as having fun and recommending the activities to other recreation therapists?

Setting and sample.

Setting. Following university Institutional Review Board approval, a convenience sample of undergraduate students enrolled in a recreation therapy program offered through the College of Health and Human Services at one state university were recruited to participate.

Sample. Recreation therapy (RT) students enrolled in one of three classes for the Fall 2020 semester (Recreation Therapy Assistive Technology and Techniques; Geriatric

Recreation Therapy; Assessment and Documentation in Therapeutic Recreation) were invited to participate in Part Two of the study. These students were required to completed the online training course to be eligible to participate. Students who lacked sufficient proficiency in the English Language to complete the course; were unable to visit campus due to distance or COVID-19 protocol restrictions; or who indicated that they did not want their data from the survey included in the research study were excluded.

RT students were chosen because they often work with older adults in long term care environments and are likely to use multi-sensory interventions to improve well-being. Two of the five most common industries reported as employers of recreational therapists are nursing facilities or assisted living facilities for older adults ("Occupational employment and wages, May 2019: 29-115 Recreational Therapists," 2020). The National Council for Therapeutic Recreation Certification defines recreation therapy as "a systematic process that utilizes recreation and other activity-based interventions to address the assessed needs of individuals with illness and/or disabling conditions, as a means to psychological and physical health, recovery and well-being" ("About Recreational Therapy," n.d.). Certified Therapeutic Recreation Specialists (CTRS) use a variety of activities to improve the well-being of individuals by addressing physical, cognitive, emotional, social, and leisure needs of individuals in a variety of settings ("What is Recreational Therapy?," n.d.). Recreational activities, which are tailored to the needs and interest of the population being served, may include arts and crafts, sports, drama, music, or animals ("About Recreational Therapy," n.d.).

Researchers have investigated the use of multi-sensory interventions in recreational therapy sessions, finding that activities such as sing-a-longs or trivia DVDs

and Nintendo Wii sports games create the opportunity for meaningful activities that improved physical, social, behavioral, and mental well-being among older residents with dementia in long term care facilities (Clements-Cortés, 2014; Keogh, Power, Wooller, Lucas, & Whatman, 2014).

Ethical considerations. Not all students were able to visit the university campus to participate in the Tovertafel play sessions due to the COVID-19 pandemic. Some students taking online courses were not in the geographic area of the university, and others were either unable to come to campus or not comfortable with potential exposure to the corona virus. To ensure that students did not feel pressured to participate in play sessions, the class instructor offered an alternate assignment and allowed students to choose which to complete.

For students who accessed the survey after playing the Tovertafel games on campus, informed consent was presented by the web link before the undergraduate students were granted access to the survey questions. Additionally, because the RT students were completing the survey as part of a class assignment, they were asked to authorize or not authorize the researchers to include their responses to the survey in the research study.

Materials.

Instrument Development. An online survey was created to be administered after the participants experienced play sessions with the Tovertafel games. The survey consisted of five sections. The first section collected data related to the Tovertafel game sessions; three sections collected data related to the theoretical constructs; and a final

section collected demographic data (e.g., age, gender, ethnicity/race, caregiving experience). A copy of the Tovertafel Evaluation Survey is provided in Appendix E.

Survey Section 1: Session details. Three questions were included in the survey to learn more about the Tovertafel game sessions, asking for the number of sessions each participant was part of; the average amount of time spent with the games; and whether participants played the Tovertafel games alone or with a small group of people.

Survey Section 2: Behavioral capability/self-efficacy. The second portion of the survey presented 5 statements related to the SCT constructs *behavioral capability* and *self-efficacy*. Participants responded using a 5-point Likert scale with 1=no and 5=yes as anchors. Behavioral capability was measured using three statements related to the level of confidence participants felt turning on the Tovertafel and initiating a game, changing the games during a session, and resolving problems that night occur during a Tovertafel session. Self-efficacy was measured using two statements about participant confidence leading a Tovertafel session and feeling adequately trained to use the Tovertafel. An open-ended question was provided at the end of the section for participants who marked "no" or "I do not think so" to provide additional explanation for their answer.

Survey Section 3: Expected outcomes. The third section of the survey asked participants to respond to six statements related the SCT construct of *expected outcomes* using a 5-point Likert scale with 1=no and 5=yes as the anchors. The statements related to participant beliefs that the Tovertafel activities provide opportunities to increase social interactions between RT and older adults with dementia; increase physical and mental activity among older adults with dementia; and reduce behaviors related to dementia such as repeating questions, crying, aggression, or apathy. An open-ended question was

provided at the end of the section for participants who marked “no” or “I do not think so” to provide additional explanation for their answer.

Survey Section 4: Reinforcing attitudes. The fourth section of the survey was related to the *reinforcing attitudes* construct of the SCT. Using a 5-point Likert scale with 1=no and 5=yes as the anchors, participants were asked to provide feedback to five statements about whether they had fun playing the Tovertafel games; if they would use the Tovertafel if it were available at a facility where they worked; if they would recommend the Tovertafel to other RT; whether the Tovertafel games would improve the work experience of RT; and finally, whether the participants believed that residents who play the Tovertafel are likely to have fun during the activity. This section of the survey also included five open-ended questions to collect additional information. Participants were asked what games they believe residents might most enjoy; what games they enjoyed the most; to list games that they did not enjoy; whether there might be barriers that a RT might encounter when wishing to use the Tovertafel; and a final open-ended question inviting participants to share additional thoughts.

Survey section 5: Demographic questions. The final section of the survey asked demographic questions about the participants. The items in this section asked participants to select the RT course(s) in which they were enrolled, age, ethnicity and race, gender identity, and experience caring for an older adult with dementia.

Instrument testing and refinement. After the survey questions were developed, they were reviewed by four faculty members with expertise in qualitative and quantitative research, survey design, gerontology, and the long-term care environment. The feedback from the expert reviewers was used to adjust the survey to improve content and face

validity. The survey was next disseminated to 3 undergraduate and 6 graduate students at the university to ensure that all items were easy to understand and that there were no communication problems with the way that the survey questions were worded. Finally, all of the individuals involved in the review of the materials were asked to complete the online version of the survey to identify any typographical errors or design issues.

Methods.

Data collection. The lead researcher visited the university campus prior to the beginning of the study to deliver and set up the Tovertafel in a dedicated recreation therapy classroom. The Tovertafel was left on campus for four weeks, and students were encouraged to use the device as often as they liked either individually or in small groups. Scenarios were provided to help the students simulate likely situations found in long term care facility residents with dementia. The class instructor posted a link to the online survey on the class site in Blackboard Learn. To encourage participation, the survey was left open until the end of the week after the Tovertafel was removed from campus, allowing a total of five weeks for data collection.

Data preparation and analysis. Responses to the Part Two survey were exported from QualtricsXM (Qualtrics, Provo, UT) and analyzed using SPSS for Macintosh, Version 26.0 (IBM Corp. 2019). As described in Part One of the study, nominal data such as participant demographics were reported using frequencies and percentages. Ordinal data derived from the Likert scale items are reported with medians and interquartile ranges. Open-ended questions were presented for a quantitative descriptive analysis.

Summary

This chapter provided an overview of the methods and materials that were used to conduct the revised study. A full accounting of all findings are reported in Chapter 4.

Chapter Four

Results

Introduction

This chapter presents the findings of the data analysis. The results are reported separately for the two parts of the study. Each section includes the following: Response, Data Preparation, Demographic Characteristics, and Research Aims. A summary of the results is provided at the end of the chapter.

Part One - Evaluation of training on a novel multi-sensory intervention for persons living with dementia: Online course. Part One of this study utilized constructs from the New World Kirkpatrick (NWKM) model to evaluate the online training course. From Level 1 (Reaction), participants were asked to indicate perceptions of engagement (i.e., aesthetics, ease of use, novelty, and user involvement) and relevancy to their profession. Using the knowledge construct from Level 2 (Learning) of the NWKM, participants were asked to indicate self-reported changes in knowledge and skill as it relates to the use of multi-sensory technology in the care of older adults with dementia. Data were collected using a survey presented to participants at the completion of the online training course.

Response. Eighty records were retrieved from the Qualtrics system. Five were eliminated because they were incomplete, with no responses after the initial informed consent question. Three responses were eliminated because the individuals were not eligible to participate (one faculty member, one graduate student, and one student from a

program outside of the targeted college). After these adjustments, there were a total of 72 responses used in the analyses of the data.

Data Management. Prior to analyzing the data, it was prepared for use. A review of the data was conducted to identify entries that needed to be corrected, missing data was addressed, and negatively worded items were reverse coded. When this was completed, descriptive statistics and nonparametric tests were conducted. All data management activities were completed using SPSS for Macintosh, Version 26.0 (IBM Corp., Released 2019).

Data cleaning. Each of the variables were sorted by ascending and descending order to identify entries needing correction, such as changing one age response from 1994 to the corresponding age of 26 for a person born in 1994.

Missing data. A pairwise deletion strategy was employed to address missing data. In this approach, cases are only omitted from analysis when the particular value that is needed for calculation is missing but are used for all other variable analyses (Kang, 2013). As a result of this approach, the number of participants ranged from 66 to 72; the n for each variable is indicated in the tables that follow.

Recoding. According to the instructions provided by the researchers who developed the User Engagement Scale, the Ease of Use statements 1 - 6 & 8 were negatively worded (O'Brien et al., 2018). The responses to these items were reversed so that they corresponded with the other items for analysis.

Statistical analysis. Descriptive statistics were run for each variable. Wilcoxon signed-rank tests for match pairs were run for the knowledge and skill items to compare self-reported before and after scores.

Demographic Characteristics.

Participant Demographics. The majority of participants were female (88.9%), White (83.3%), and non-Hispanic (81.9%) with a mean age of 21.5 (SD ±2.57) years. Additional demographic details can be found in Table 4.

Table 4

Participant Demographics

Variable	N	%
Gender	n=71	
Female	64	88.9
Male	7	9.7
Age	n=72	
19-24	66	91.7
25-29	4	5.5
30+	2	2.8
Race	n=72	
African American/Black	4	5.6
Asian	3	4.2
Caucasian/White	60	83.3
Other	3	4.2
Prefer not to answer	2	2.8
Ethnicity	n=72	
Hispanic	3	4.2
Non-Hispanic	59	81.9
Prefer not to answer	10	13.9

Academic Description. While participants came from a variety of programs offered by the College of Health and Human Services, the majority were from Recreation Therapy (68.1%), followed by Respiratory Care (12.5%). Most students were either in their Junior year (44.4%) or Senior year (45.8%) of study. Additional academic details can be found in Table 5.

Table 5

Academic Description

Variable	N	%
Primary program of study	n=64	
Recreation Therapy	49	68.1
Respiratory Care	9	12.5
Social Work	2	2.8
Exercise Science	2	2.8
Biology/Public Health	1	1.4
Healthcare Administration	1	1.4
Year in program	n=71	
Second year (sophomore)	2	2.8
Third year (junior)	32	44.4
Fourth year (senior)	33	45.8
Other	4	5.6

Dementia Caregiving Experience. About half of the participants (55.6%) had no previous dementia caregiving experience. A small number of participants (5.6%) had both family and professional experience providing care. Additional details about previous dementia caregiving experience can be found in Table 6.

Table 6

Dementia Caregiving Experience

Variable	N	%
Caregiving experience	(n=71)	
No caregiving experience	40	55.6
Professional experience	16	22.2
Experience caring for a family member	11	15.3
Both family & professional experience	4	5.6

Survey results

Engagement. Engagement was measured using four relevant constructs from the User Engagement Survey, which was created to measure user engagement of online material. The four constructs used in this study were aesthetics (5 questions), perceived usability (8 questions), novelty (3 questions), and involvement (3 questions).

Aesthetics. There was a high level of agreement with the 5 aesthetic statements on the survey. While there were a few who disagreed, the variability between the responses at the 25th percentile and the 75th percentile was very small, as indicated in Table 7. One participant (1.4%) strongly disagreed to all of the statements in this portion of the survey. A review of the responses reveals the following:

A total of two participants (2.8%) strongly disagreed with the statement that the website was attractive, and an additional two participants (2.8%) were not sure. The remainder of the participants either agreed (n=40, 55.6%) or strongly agreed (n=28, 38.9%) with the statement.

Two participants (2.8%) either disagreed or strongly disagreed with the statement that the site was aesthetically appealing, and another two (2.8%) were not sure. The majority of the participants either agreed (n=35, 48.6%) or strongly agreed (n=32, 44.4%) that the site was aesthetically appealing.

One participant (1.4%) was not sure whether the graphics and images on the training website were appealing. The majority either agreed (n=29, 40.3%) or

strongly agreed (n=39, 54.2%) that the graphics and images were appealing, while two participants (2.8%) either disagreed or strongly disagreed with the statement.

One participant (1.4%) indicated strong disagreement with the statement that the site was visually appealing, and another participant (1.4%) disagreed with the statement. The remaining participants either agreed (n=30, 417=7%) or strongly agreed (n=39, 54.2%) that the website appealed to their visual senses.

Most of the participants either strongly agreed (n=30, 54.2%) or agreed (n=29, 40.3%) that the layout of the course was visually appealing. One participant (1.4%) strongly disagreed with this statement, and two participants (2.8%) were not sure.

Table 7

Aesthetics (n=71)

Statement	Median (IQR)	Min	Max
The training website was attractive	4 (1)	1	5
The training website was aesthetically appealing	4 (1)	1	5
I liked the graphics and images of the training website	5 (1)	1	5
The training website appealed to my visual senses	5 (1)	1	5
The layout of this training course was visually pleasing	5 (1)	1	5

All statements utilized a 5-point Likert scale for responses where 1=strongly disagree, 2=disagree, 3=I am not sure, 4=agree, and 5=strongly agree.

Ease of use. As indicated in Table 8, the majority of the participants indicated that the training website was easy to use, and there was little variability in the responses. There were, however, some participants who did find the site challenging.

While most of the participants either disagreed (n=15, 20.8%) or strongly disagreed (n=50, 69.4%) with the statement that they felt frustrated using the website, four participants (5.6%) agreed with the statement, and three (4.2%) were not sure.

Five participants (6.9%) agreed with the statement that the website was confusing to use, and an additional one participant (1.4%) was not sure. The majority, however, either disagreed (n=12, 16.7%)), or strongly disagreed (n=54, 75%) with the statement.

The majority of the participants disagreed (n=13, 18.1%) or strongly disagreed (n=53, 73.6%) with the statement that they felt annoyed using the website, but four participants (5.6%) were unsure, and two participants (2.8%) agreed with the statement.

Most of the responses to a statement that the participants felt discouraged while using the website indicate that they either strongly disagreed (n=54, 75%) or disagreed (n=12, 16.7%), but one participant (1.4%) was not sure, and five (6.9%) agreed with the statement.

Fifty-one (70.8%) of the participants strongly disagreed that the use of the website was taxing, and a further thirteen (18.1%) disagreed. Four participants (5.6%) were unsure, and a further four (5.6%) agreed with the statement.

There was a wide range of responses to the statement that the experience was demanding. One participant (1.4%) strongly agreed with this statement, three agreed (4.2%) , and one was unsure (1.4%); however, the majority either disagreed (n=17, 23.6%), or strongly disagreed (n=49, 68.1%) with this statement. When presented with the statement "I felt in control when using this training website," most either strongly agreed (n=27, 37.5%), or agreed (n=27, 37.5%), but six (8.3%) were unsure, four disagreed (5.6%), and a further seven (9.7%) strongly disagreed.

Sixty-eight percent (n=49) of the participants strongly disagreed with the statement that they were unable to complete some of the course activities (e.g., click on items or forward to the next session), and a further 17 (23.6%) disagreed, but five participants (6.9%) agreed that they were unable to complete some of the tasks presented in the course.

Table 8

Ease of use (n=71)

Statement	Median (IQR)	Min	Max
I felt frustrated with using this training website	5 (1)	2	5
I found this training website confusing to use	5 (1)	2	5

I felt annoyed while using this training website	5 (1)	1	5
I felt discouraged while using this training website	5 (1)	2	5
Using this training website was taxing	5 (1)	2	5
This experience was demanding	5 (1)	1	5
I felt in control while using this training website	4 (1)	1	5
I could not do some of the things I needed to do while using the training website (e.g., click on items, forward to the next section).	5 (1)	2	5

Items 1-6 and 8 were reverse coded so that all statements utilized a 5-point Likert scale for responses with lower numbered responses indicating low perceived ease of use, and higher scores indicating higher perceived ease of use.

Novelty. As indicated in Table 9, the majority of the participants agreed with the three novelty statements.

Three participants (4.2%) did not agree that they continued to read the material out of curiosity, while another three (4.2%) were not sure, however, 44 participants (61.1%) agreed, and 22 (30.6%) strongly agreed with the statement.

Forty-one participants (56.9%) agreed, and a further 27 (37.5%) strongly agreed with the statement that the website incited their curiosity. Three participants (4.2%) were unsure, and one participant (1.4%) disagreed.

An almost equal number either agreed (n=33, 45.8%) or strongly agreed (n=35, 48.6%) that they felt interested in the website, while three (4.2%) were usure, and one participant (1.4%) disagreed.

There was no disagreement with the statement that the experience was fun, although six (8.3%) were unsure. The remaining responses were either agree (n=34, 47.2%) or strongly agree (n=32, 44.4%).

Table 9

Novelty (n=72)

Statement	Median (IQR)	Min	Max
I continued to read the material on the training website out of curiosity	4 (1)	2	5
The content of the training website incited my curiosity	4 (1)	2	5
I felt interested in the training website	4 (1)	2	5

All questions utilized a 5-point Likert scale for responses where 1=strongly disagree, 2=disagree, 3=I am not sure, 4=agree, and 5=strongly agree.

Involvement. The median scores and IQR presented Table 10 indicate mostly positive responses to the three items related to involvement.

The majority of the participants either agreed (n=33, 45.8%) or strongly agreed (n=30, 41.7) with the statement that they were drawn into the experience, but seven (9.7%) were unsure, and two participants (2.8%) disagreed.

Two participants (2.8%) were not sure whether they felt involved in the experience, but the remainder either agreed (n=42, 58.3%) or strongly agreed (n=28, 38.9%) with the statement.

While 34 participants (47.2%) agreed that the experience was fun and a further 32 (44.4%) strongly agreed with the statement, there were six participants (8.3%) who were not sure. None of the participants disagreed with this statement.

Table 10

Involvement (n=72)

Statement	Median (IQR)	Min	Max
I was really drawn into this experience	4 (1)	2	5
I felt involved in this experience	4 (1)	3	5
This experience was fun	4 (1)	3	5

All questions utilized a 5-point Likert scale for responses where 1=strongly disagree, 2=disagree, 3=I am not sure, 4=agree, and 5=strongly agree.

Two open-ended questions were included in the survey to allow participants to provide suggestions for improving the design and content of the course. The full text of the responses is provided in Appendix F.

Twenty-two of the participants (30.6%) responded to the open-ended question about design improvements. Five participants (6.9%) provided suggestions for improvement including the use of more or brighter colors, and more videos. Eight of the responses (11.1%) were short indications that no changes were needed (i.e., “I have no suggestions”), and 9 (6.9%) participants used the space to express positive statements about the course. Some of the responses were specific, such as “I like how the lessons were broke out,” and “I like the design and layouts. It is very easy to read and navigate.” Other responses were more general such as “I thought everything was great and easy to use!”

There were twenty responses (27.8%) entered for the opened ended question about content improvements. Four participants (5.6%) included comments for improving the content of the course. Suggestions included the addition of resources for further learning, more details about the benefits of the game, and restructuring of the course content. Nine (12.5%) made positive comments such as “It was very insightful,” and “everything weas easy to identify and use.” Finally, seven participants (9.7%) provided simple comments such as “no” or “I have no suggestions.”

Relevance. Participants responded to five statements influenced by a sample survey published by the originators of the NWKM (Kirkpatrick & Kirkpatrick, 2016). The items related to participant perception of the relevance of the training course topics to their intended profession. As shown in Table 11, the median and interquartile ranges for all five items included in this portion of the survey indicated that the majority of the participants strongly agreed with the statements.

No participants disagreed with the statement that the content was relevant and applicable, although six (8.3%) answered “I am not sure.” The remainder of the participants either agreed (n=26, 36.1%), or strongly agreed (n=40, 55.6%) with the statement.

The majority of the participants strongly agreed with the statement that the training will help improve their professional performance, regardless of whether they work with older adults or another population (n=43, 59.7%), and another 27

(37.5%) agreed with the statement. Two participants (2.8%) were unsure about the statement, and none disagreed.

When presented with the statement "I believe it will be worth my effort to apply what I learned to my professional performance," no one disagreed, and only four participants (5.6%) were unsure. The remainder either agreed (n=28, 38.9%), or strongly agreed (n=40, 55.6%).

Most participants were confident that they could apply what they learned to the performance of their profession of working with older adults with dementia, with 41 (56.9%) strongly agreeing with the statement, and a further 29 (40.3%) agreeing. One participant (1.4%) was unsure, and one participant (1.4%) strongly disagreed.

Almost all of the participants agreed (n=20, 40.3%) or strongly agreed (n=39, 54.2%) that they were committed to using the knowledge, awareness and/or skills learned from the training course. No participants disagreed with the statement, but four (5.6%) were unsure.

Table 11

Relevance of the material (n=72)

Item	Median (IQR)	Min	Max

The content covered in this course is relevant and applicable to my professional discipline	5 (1)	3	5
This course will help me to improve my professional performance	5 (1)	3	5
I believe it will be worth my effort to apply what I learned to my professional performance	5 (1)	3	5
I am confident that I can apply what I learned to the performance of my profession	5 (1)	1	5
I am committed to using the knowledge, awareness, and/or skills I learned to the performance of my profession	5 (1)	3	5

All questions utilized a 5-point Likert scale for responses where 1=strongly disagree, 2=disagree, 3=I am not sure, 4=agree, and 5=strongly agree.

Knowledge and skills. Modeled after a survey from the New World Kirkland Model (Kirkpatrick & Kirkpatrick, 2016), participants were asked to rate statements about their knowledge and skills before and after the training. Rather than asking participants to take a pre- and post-test, the items on the survey included areas to assess before and after knowledge for each of the knowledge and skills items before the training and after the training using a 5-point scale (1=no knowledge, 5=very high knowledge). Some of the participants left portions of the items blank and were therefore excluded from analysis. The number of cases analyzed for knowledge and skills was 66 participants.

In this section, the results of the descriptive analysis of the self-reported responses are presented. Additionally, Wilcoxon signed-rank tests for matched pairs were conducted on the individual items to determine whether there was a significant difference in mean scores for self-reported knowledge scores before and after the training. Following data collection, a post hoc power analysis using G*Power software (Faul et al., 2007) with an alpha level of $p<0.05$ with an effect size of 0.5 for a one-tailed Wilcoxon

signed-rank test for matched pair was conducted. The analysis indicated the statistical power for this study was 0.988 with the sample size of 66 used in the data analysis, which exceeds the generally accepted threshold of 0.80 (Kaliyadan & Kulkarni, 2019). The post hoc analysis indicates that there is a 5% chance of a Type I error, meaning a difference was found by chance alone (Gupta, Attri, Singh, Kaur, & Kaur, 2016). The chance that differences between the before and after mean scores existed but were not detected, referred to as a Type II error, is less than 2% (Gupta et al., 2016).

Knowledge. Four items were included in the survey to measure changes in knowledge related to common dementia-related behaviors; how direct care workers can help improve the well-being of people who have dementia; the use of multi-sensory interventions with people living with dementia; and how to have a positive attitude about dementia caregiving.

Knowledge item #1: Common dementia-related behaviors

Prior to the training, the median knowledge score was 3 (IQR 1), indicating a moderate level of knowledge, while the median score after the training was 5 (IQR 1), indicating a high level of knowledge. Frequencies for the item are provided in Table 12 to further illustrate the changes in knowledge scores.

Table 12

Self-reported knowledge of common dementia-related behaviors (n=66)

Self-rated knowledge	Before training n(%)	After training n(%)
1 (none or very low)	4 (6.1%)	0
2	7 (10.6%)	0
3	24 (36.4%)	10 (15.2%)
4	22 (33.3%)	21 (31.8%)
5 (very high)	9 (13.6)	35 (53%)

As illustrated in Figure 5, Wilcoxon signed-rank test revealed a positive difference in self-reported knowledge scores for 50 of the participants (75.7%), remained the same (i.e., ties) for 15 (22%), and showed a negative difference for only one participant (1.5%). Most participants who demonstrated a change between before and after knowledge scores increased knowledge from 1-3 points, with the majority increasing by 2 points. The training resulted in a statistically significant increase in median self-reported knowledge about common dementia-related behaviors when comparing scores before (Mdn = 3) and after (Mdn = 5) the training $Z= 6.346$, $p<0.005$.

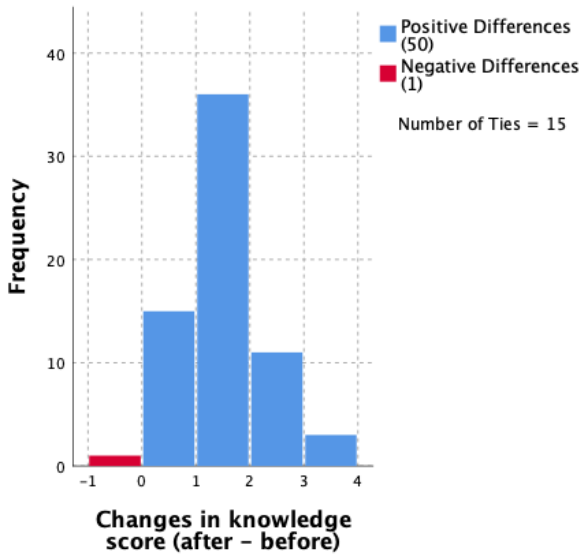

Figure 5. Distribution of the differences between the before and after knowledge scores: Self-reported knowledge of common dementia-related behaviors

Knowledge item #2: How to improve the well-being of people who have dementia

Prior to the training, the median knowledge score was 3 (IQR 2), indicating a moderate level of knowledge, while the median score after the training was 5 (IQR 1), indicating a high level of knowledge. Frequencies for the item are provided in Table 13.

Table 13

Self-reported knowledge of how to improve the well-being of people who have dementia (n=66)

Self-rated knowledge	Before training n(%)	After training n(%)
1 (none or very low)	5 (7.6%)	0
2	11 (16.7%)	0
3	24 (36.4%)	7 (10.6%)
4	17 (25.8%)	24 (36.4%)
5 (Very high)	9 (13.6%)	35 (53%)

The Wilcoxon signed-rank test indicated a positive difference in self-reported scores for 51 of the participants (77.2%), remained the same (i.e., ties) for 15 (22.7%), and showed no negative changes (see Figure 6). Most participants who demonstrated a change between before and after knowledge scores increased knowledge from 1-4 points, with the majority increasing by 2 points. The training resulted in a statistically significant increase in median self-reported knowledge about how direct care workers can help to improve the well-being of people who have dementia when comparing scores before (Mdn = 3) and after (Mdn = 5) the training $Z= 6.404$, $p<0.005$.

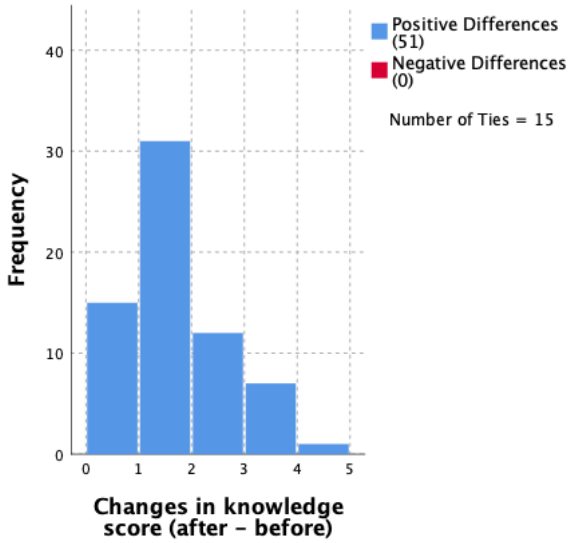

Figure 6. Distribution of the differences between the before and after knowledge scores: Self-reported knowledge of how direct care workers can help to improve the well-being of people who have dementia.

Knowledge item #3: The use of multi-sensory activities with people living with dementia

Prior to the training, the median knowledge score was 3 (IQR 1), indicating a moderate level of knowledge, while the median score after the training was 4 (IQR 1), indicating a moderately high level of knowledge. Frequencies for the item are provided in Table 14.

Table 14

Self-reported knowledge of the use of multi-sensory activities with people living with dementia before and after completing the training course (n=66)

Self-rated knowledge	Before training n(%)	After training n(%)
1 (none or very low)	7 (10.6%)	0
2	18 (27.3%)	1 (1.5%)
3	26 (39.4%)	8 (12.1%)
4	12 (18.2%)	25 (37.9%)
5 (Very high level)	3 (4.5%)	32 (48.5%)

The Wilcoxon signed-rank test indicated that self-reported knowledge scores positively changed for 60 of the participants (90.9%), remained the same (i.e., ties) for 4 (6.0%), and showed negative changes for two participants (3%). As indicated in Figure 7, most participants who demonstrated a change between before and after knowledge scores increased knowledge from 1-4 points, with the majority increasing by 2 points. The training resulted in a statistically significant increase in median self-reported knowledge about the use of multi-sensory activities with people living with dementia when comparing scores before (Mdn = 3) and after (Mdn = 4) the training Z= 6.757, $p<0.005$.

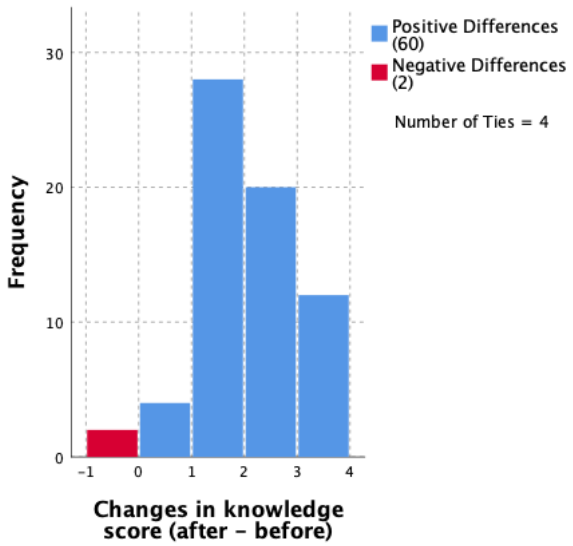

Figure 7. Distribution of the differences between the before and after knowledge scores: Self-reported knowledge of the use of multi-sensory activities with people living with dementia

Knowledge item #4: How to have a positive attitude about dementia caregiving

Prior to the training, the median knowledge score was 3 (IQR 3), indicating a moderate level of knowledge, while the median score after the training was 5 (IQR 1), indicating a high level of knowledge. Frequencies for the item are provided in Table 15.

Table 15

Self-reported knowledge of how to have a positive attitude about dementia caregiving (n=66)

Self-rated knowledge	Before training n(%)	After training n(%)
1 (none or very low)	6 (9.1%)	0
2	12 (18.2%)	1 (1.5%)
3	15 (22.7%)	8 (12.1%)
4	14 (21.2%)	19 (28.8%)
5 (Very high level)	19 (28.8%)	38 (57.6%)

The Wilcoxon signed-rank test revealed that self-reported knowledge scores showed a positive difference for 39 (59.1%) of the participants, remained the same (i.e., ties) for 26 (39.4%), and showed negative changes for one participant (1.5%). Most participants who demonstrated a change between before and after knowledge scores increased knowledge from 1-4 points, with the majority increasing by 2 points (refer to Figure 8). The training resulted in a statistically significant increase in median self-reported knowledge about how to have a positive attitude about dementia caregiving when comparing scores before (Mdn = 3) and after (Mdn = 5) the training $Z= 5.482$, $p<0.005$.

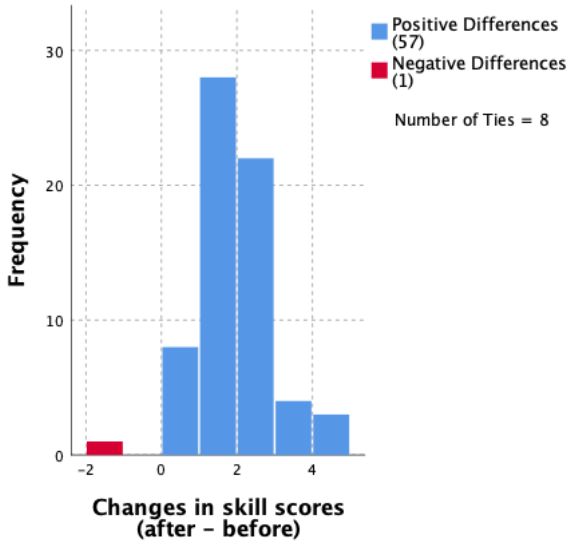

Figure 8. Distribution of the differences between the before and after knowledge scores: Self-reported knowledge of how to have a positive attitude about dementia caregiving.

One open-ended question was included in the knowledge portion of the survey to allow participants to provide additional information. Five of the participants (7.5%) provided feedback; the content of the comments can be found in Appendix F. One participant (1.5%) suggested an elaboration of how to have a positive attitude when caring for people with dementia; two participants (3%) provided positive comments about the training such as "*It helped me learn more about multi-sensory activities,*" and an additional participant (1.5%) expressed positive comments about the Tovertafel activities. Finally, one participant (1.5%) entered a comment indicating that there was no knowledge gained from the training course.

Skills. Three items were presented in the survey to measure before and after skills related to leading a group activity with people who are living with dementia; using multi-

sensory technology with a group; and improving the well-being of people living with dementia.

Skill item #1: Lead a group activity with people who are living with dementia

Prior to the training, the median knowledge score was 2.5 (IRQ 1), indicating a low level of skill, while the median score after the training was 4 (IRQ 1), indicating a moderately high level of skill. Frequencies for the item are provided in Table 16.

Table 16

Self-reported skills to lead a group activity with people who are living with dementia (n=66)

Before training n(%)	Before training n(%)	After training n(%)
1 (none or very low)	12 (18.2%)	0
2	21 (31.8%)	5 (7.6%)
3	22 (33.3%)	11 (16.7%)
4	7 (10.6%)	31 (47%)
5 (Very high level)	4 (6.1%)	19 (28.8%)

The Wilcoxon signed-rank test revealed a positive difference in self-reported skill scores for 57 of the participants (86.4%), remained the same (i.e.., ties) for 8 (12.1%), and showed negative changes for one participant (1.5%). As illustrated in Figure 9, most participants who demonstrated a change between before and after knowledge scores increased knowledge from 1-4 points, with the majority increasing by 2 points. The training resulted in a statistically significant increase in median self-reported skills about how to lead a group activity with people who are living with dementia when comparing scores before (Mdn = 2.5) and after (Mdn = 4) the training $Z= 6.453$, $p<0.005$.

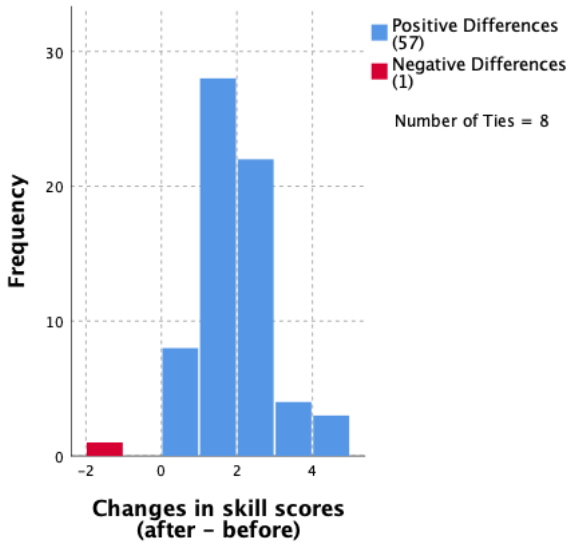

Figure 9. Distribution of the differences between the before and after skill scores: leading a group activity with people who are living with dementia

Skill item #2: Use multi-sensory technology with a group

Prior to the training, the median knowledge score was 2 (IRQ 1), indicating a low level of skill, while the median score after the training was 4 (IRQ 1), indicating a moderately high level of skill. Frequencies for the item are provided in Table 17.

Table 17

Self-reported skills to use multi-sensory technology with a group (n=66)

Self-rated knowledge	Before training n(%)	After training n(%)
1 (none or very low)	20 (30.3%)	0
2	18 (27.3%)	2 (3%)
3	18 (27.3%)	14 (21.2%)
4	7 (10.6%)	28 (42.4%)
5 (Very high level)	3 (4.5%)	22 (33.3%)

The Wilcoxon signed-rank test indicated that self-reported skill scores showed a positive difference for 58 of the participants (87.9%), remained the same (i.e., ties) for 7 (10.6%), and showed negative changes for one participant (1.5%). Most participants who demonstrated a change between before and after knowledge scores increased knowledge from 1-4 points, with the majority increasing by 3 points (refer to Figure 10). The training resulted in a statistically significant increase in median self-reported skills about how to use multi-sensory technology with a group when comparing scores before (Mdn = 2) and after (Mdn = 4) the training $Z= 6.539$, $p<0.005$.

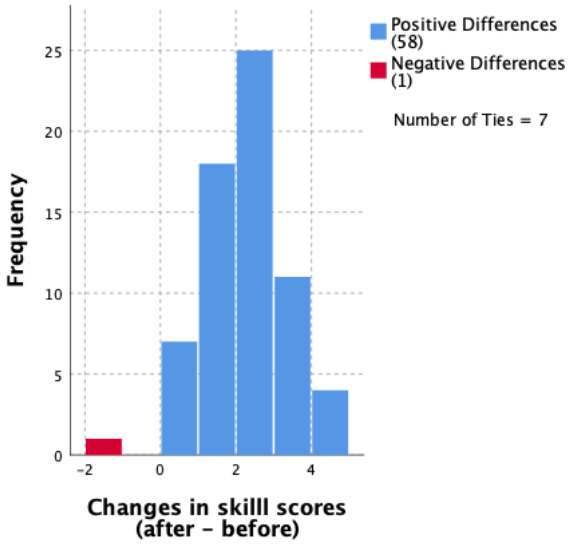

Figure 10. Distribution of the differences between the before and after skill scores using multi-sensory technology with a group

Skill item #3: Improve the well-being of people living with dementia

Prior to the training, the median knowledge score was 3 (IRQ 1), indicating a moderate level of skill, while the median score after the training was 4 (IRQ 1), indicating a moderately high level of skill. Frequencies for the item are provided in Table 18.

Table 18

Self-reported skills to improve the well-being of people living with dementia (n=66)

Self-rated knowledge	Before training n(%)	After training n(%)
1 (none or very low)	8 (12.1%)	0
2	14 (21.2%)	2 (3%)
3	25 (37.9%)	8 (12.1%)
4	14 (21.2%)	27 (40.9%)
5 (Very high level)	5 (7.6%)	29 (43.9%)

The Wilcoxon signed-rank test revealed that self-reported skill scores showed a positive difference for 54 of the participants (81.8%), remained the same (i.e., ties) for 11 (16.7%), and showed negative changes for one participant (1.5%). As illustrated in Figure 11, most participants who demonstrated a change between before and after knowledge scores increased knowledge from 1-4, points with the majority increasing by 2 points. The training resulted in a statistically significant increase in median self-reported skills about improving the well-being of people living with dementia when comparing scores before (Mdn = 3) and after (Mdn = 4) the training $Z= 6.267$, $p<0.005$.

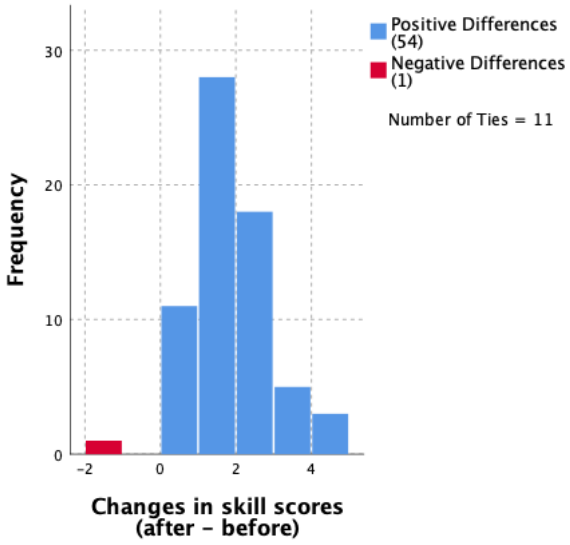

Figure 11. Distribution of the differences between the before and after skill scores improve the well-being of people living with dementia

One open-ended question was included in the survey to allow participants to provide feedback about the skills statements. Four of the participants (6%) provided comments, all of which were positive about the learning experience such as *"I feel more equipped and informed about dementia-patient care," and "Learned how to lead a group activity with people who are living with dementia!"* The full text of the comments can be found in Appendix F.

Part Two - Evaluation of training on a novel multi-sensory intervention for persons living with dementia: Hands-on experience. Part Two of the study solicited the impressions of undergraduate Recreation Therapy (RT) students who completed the online training course (Part One) and then participated in at least one session interacting with the Tovertafel games.

Response. The original intent was to require all students enrolled in the three recreation therapy courses to participate in the Tovertafel game sessions during regularly scheduled classes, but COVID-19 restrictions limited student access to the classroom and each other. Instead, students were invited to visit campus on a voluntary basis. Sixteen students signed up to come on campus to play with the Tovertafel, but not all followed through. After removing three blank survey responses, a total of eight students completed the online survey and were included in the analysis of the data.

Data Preparation. The 8 surveys were carefully reviewed to ensure that it was ready for use. There were no missing responses or obvious mistakes in the responses, so descriptive statistics were calculated.

Demographic Characteristics.

Participant Demographics. The students who played with the Tovertafel were all female, non-Hispanic Caucasians with a mean age of 20.4 (SD ±.744) years. Additional demographic details can be found in Table 19.

Table 19

Participant Demographics (n=8)

Variable	N	%
Gender		
Female	8	100
Race		
Caucasian/White	8	100
Ethnicity		
Non-Hispanic	8	100

Dementia Caregiving Experience. As indicated in Table 20, five of the participants (62.5%) reported no previous dementia caregiving experience. One participant (12.5%) reported experience caring for a family member, and two (25%) had professional dementia caregiving experience.

Table 20

Caregiving experience (n=8)

Variable	N	%
Caregiving experience		
No caregiving experience	5	62.5
Professional experience	2	25
Experience caring for a family member	12.5	25

Tovertafel Session details. Four of the participants (50%) reported playing one session, while the other four left the question blank. One participant (12.5%) reported spending 30 minutes playing the games during each session, one participant (12.5%) reported 5 minutes, and one participant (12.5%) reported one minute, suggesting potential confusion about whether they were being asked to provide the total time spent playing the games or the time spent playing each game. Five participants (62.5%) left the question blank. Three of the participants (37.5%) reported playing the Tovertafel games alone and five (62.5%) reported playing the Tovertafel games with other students.

Survey results. Using Social Cognitive Theory (SCT) as a framework, participants were asked to respond to statements related to behavioral capability, self-efficacy, expected outcomes, and reinforcing attitudes about the device when used to promote engagement among long-term care residents with dementia.

Behavioral capability. Responses to the three behavioral items indicated a generally high level of confidence regarding the targeted activities. As indicated in Table 21, median responses ranged from high to very high agreement with little variability among the participants.

Seven of the participants (87.5%) indicated that they felt confident about turning the Tovertafel on and initiating a game, while one participant (12.5%) indicated moderate confidence ("I think so"). All eight participants (100%) expressed high levels of confidence in their ability to change the games during a Tovertafel session.

There was a wide range of responses when participants were asked whether they felt confident resolving problems that might occur during a Tovertafel session. One participant (12.5%) selected "I don't think so," and one participant (12.5%) selected "I am not sure." Three participants (37.5%) expressed more confidence by selecting "I think so," and another three participants (37.5%) indicated that they were confident in their abilities. There was just one response to the open-ended question at the end of this section of the survey. The one participant who responded (12.5%) shared a lack of troubleshooting experience, particularly because the Tovertafel was already on when she arrived. The full comment can be found in Appendix G.

Table 21

Behavioral capability (n=8)

Item	Median (IQR)	Min	Max
I am confident that I know how to turn on the Tovertafel and initiate a game.	5 (0)	4	5
I am confident that I know how to change games during a session	5 (0)	5	5
I am confident that I can resolve problems that may occur during a Tovertafel session	4 (1.75)	2	5

All statements utilized a 5-point Likert scale (1=no, 2=I do not think so, 3=I am not sure, 4=I think so, and 5=yes.

Self-efficacy. The median responses to both of the self-efficacy items indicated that the majority of the participants felt high levels of self-efficacy. Interquartile ranks indicate very little variance in responses as shown in Table 22.

Six participants (75%) felt confident in their abilities to lead a Tovertafel session with older adults who have dementia. The remaining two (25%) participants were less confident, with one selecting "I think so" and another selecting "I am not sure."

When asked whether participants felt that they received adequate training to use the Tovertafel, six answered "yes" (74%), while two participants (25%) selected "I think so" as their response.

Table 22

Self-efficacy (n=8)

Item	Median (IQR)	Min	Max
I am confident that I can lead a Tovertafel session with older adults who have dementia.	5 (.75)	3	5
I believe that I received adequate training to use the Tovertafel	5 (.75)	4	5

All statements utilized a 5-point Likert scale (1=no, 2=I do not think so, 3=I am not sure, 4=I think so, and 5=yes.

Expected outcomes. There was very little variation in responses to the six statements provided about expected outcomes. With few exceptions, the responses were largely unanimous; in fact, the differences in responses for the last three items in this section were all from one participant (12.5%) who selected "I think so" as a response rather than "yes" as did the other seven (87.5%) participants.

Table 23

Expected outcomes (n=8)

Item	Median (IQR)	Min	Max
Increase the opportunity for recreation therapists and older adults with dementia to have more social interactions (e.g., talking, laughing, showing interest in others).	5 (0)	5	5

Increase physical activity for older adults with dementia (e.g., upper body movement)	5 (0)	5	5
Increase mental activity (e.g., attention) of older adults with dementia	5 (0)	5	5
Help reduce the number of memory problems that older adults with dementia have such as repeating questions, losing items, or forgetting names	5 (0)	4	5
Reduce the depressive behaviors that older adults with dementia have such as crying or being tearful	5 (0)	4	5
Reduce the number of disruptive behaviors such as being physically or verbally aggressive or arguing	5 (0)	4	5

All statements utilized a 5-point Likert scale (1=no, 2=I do not think so, 3=I am not sure, 4=I think so, and 5=yes.

Following these items, participants were again invited to provide comments, but none of the participants chose to do so.

Reinforcing Attitudes. As indicated in Table 24, the responses to the five reinforcing attitudes questions indicated a very high level of agreement with no variation. In fact, other than one person (12.5%) who indicated "I think so" for the statement "I had fun playing the Tovertafel games," all responses in this portion of the survey were the most positive response of "yes."

Table 24

Reinforcing attitudes (n=8)

Item	Median (IQR)	Min	Max
I had fun playing the Tovertafel games	5 (0)	4	5
If it were available at a facility where I worked, I would use the Tovertafel as a regular group activity	5 (0)	5	5

I would recommend the Tovertafel games to other recreation therapists	5 (0)	5	5
The work experience of recreation therapy staff will improve if the Tovertafel games were available	5 (0)	5	5
The residents who play the Tovertafel are likely to have fun during the activity	5 (0)	5	5

All statements utilized a 5-point Likert scale (1=no, 2=I do not think so, 3=I am not sure, 4=I think so, and 5=yes.

Assessment of the Tovertafel. The next portion of the survey included five open-ended questions to provide participants with the opportunity to share their thoughts about the Tovertafel games. The full responses are included in Appendix G.

The first question asked participants to share the games that might be the most enjoyable for older adults with dementia. Responses were provided by 6 participants (75%), with a variety of suggested games. One participant recommended the coloring game, suggesting "*clients get a lot of upper extremity movement with that one having to waive their hand back and forth until the picture is complete*." Similarly, another participant suggested the word games because "*they are short simple words but would really make the patients think.*" Still another recommended a music game, which would "*bring joy and happiness, and stimulate the individuals when they interact with the music notes*."

When asked to name their favorite games, all 8 participants (100%) provided enthusiastic responses. The bubble game, which involves popping bubbles, resulting in a popping noise, was named by several of the participants, with one explaining "*it was relaxing*" and another saying, "*it was satisfying when they popped*." Other games that were popular included sheet music, fireworks, leaves, and coloring. Most of the

participants enjoyed the rewarding aspects of the game and the combination of visual and audio elements, "*I loved the sound*," and "*it was like a little treat*." One participant summed up her experience with a desire to use the Tovertafel on her job: "*I loved this so much and I wish the nursing home I work at could afford it for our memory care patients!*" Participants were offered the opportunity to name games that were not enjoyable, but no responses were submitted.

Participants were invited to suggest potential barriers that might result in a recreation therapist not wishing to use the Tovertafel. Three barriers were suggested by the seven participants (87.5%) who responded: financial limitations of facilities, technical difficulties, and lack of ability/interest on the part of residents. "*If a person has a big deficit in using their arms*," explained one, "*the Tovertafel may be difficult for them*."

A final question on the survey invited participants to share any additional thoughts about their experience with the Tovertafel games. The two participants who responded to this item (25%), shared positive comments about the overall experience and expressed a wish to use the device in their professional practice.

Summary

In Part One, 72 undergraduate students, primarily from Recreation Therapy (68.1%) and Respiratory Care (12.5%) programs participated in the online training course and completed the survey. An analysis of the survey responses to Part One of the study indicate that participants found the online training course to be engaging and relevant to their intended professions. Statistically significant improvements in self-reported

knowledge and skills scores were identified through nonparametric analysis of the respondent mean ranks. Positive attitudes about the design, content and acquisition of knowledge and skills is supported by the responses provided to open-ended questions provided in the survey.

Eight Recreation Therapy students visited the campus during the COVID-19 pandemic and played at least one session of games, either alone or in small groups, and then completed the Part Two survey. The data from Part Two of the study indicates that recreation therapy undergraduate students who participate in the online training and then physically interacted with the Tovertafel games expressed high levels of behavioral capability and self-efficacy. Additionally, feedback indicates positive attitudes about the relevance of the Tovertafel games to the recreation therapy profession, and positive expectations about the outcomes for older adults with dementia who play the Tovertafel games. Responses to the open-ended questions about the Tovertafel sessions further emphasize the positive attitudes held by the participants who had hands-on experience with the games.

This chapter presented the results of a descriptive analysis of the survey data from Parts One and Two of the study. While the overall results were positive, there are opportunities for improvement. In the next chapter the results of the analysis are reviewed in the context of the research questions and compared to the findings of previously published studies, and limitations to the study are presented. Implications for the original study as well as for health educators and researchers are discussed.

Chapter 5

Discussion

Introduction

This chapter contains the following sections as they relate to the results of Part One and Part Two of the study: Introduction, Limitations of the Study, Implications, and Conclusions, as well as an Epilogue.

Interpretation of results

The purpose of this descriptive study was to evaluate an online training course designed to introduce a multi-sensory device called the Tovertafel and provide information on how to facilitate game sessions with older adults with dementia. Part One of the study was guided by the New World Kirkpatrick Model (NWKM), a training evaluation model, and explores participants' perceptions of engagement, relevancy, and knowledge and skills gained after completing the online training course. Part Two utilized constructs of Social Cognitive Theory (SCT) to analyze feedback from undergraduate recreation therapy students who participated in at least one session with the Tovertafel games. The results reported in the previous chapter will be discussed in this chapter with a focus on how they relate to previously published literature, and how the findings may impact future research with the Tovertafel. Ways this study may influence the practice and research of other health educators will also be explored.

Perception of engagement in the online training course. The results of Part One of the study confirm that the majority of the participants reported the training as engaging. While the positive responses are similar to those reported in previous studies

(Luo & Yang, 2018; Patel et al., 2018; Walker et al., 2019), the current study utilized a standardized instrument to measure engagement, which provided deeper insight into learner perception of the construct. As noted by the originators of the UES, there have traditionally been "disparate ideas about what constitutes engagement" (O'Brien & Toms, 2010, p. 50); this is evidenced by the ways that previous NWKM studies have addressed engagement. Walker and associates (2019) asked participants to rate their satisfaction with the course content as the single survey item used to evaluate engagement in their study. The survey developed by Patel and associates (2018) included three questions not directly related to the design of the course, but rather how many stars participants would rate the course, whether the course objectives were met, and confirmation that information new to the participant was provided. Luo and Yang (2018) included three items related to engagement with a focus on specific tools, including Google and literature and annotation tools, used to complete the course. In comparison, a total of 19 items related to four factors from the UES were included in the engagement portion of the survey used in the current study: aesthetics consisted of 5 statements; ease of use consisted of 8 statements; and there were 3 statements each for novelty and participant involvement.

Using a multiple-item assessment with subscales to measure the participants' perceptions of engagement allows for an understanding of the construct on a more "granular" level than a single-item assessment (Diamantopoulos et al., 2012), or the very specific items presented by previous researchers. The ability to assess engagement in more detail allows for the identification of areas for improvement; for example, by analyzing the individual subscales of engagement, the researcher can evaluate the concept

of ease of use, which might impact learning, as separate from novelty, which while desirable, may be less impactful. Additionally, the use of a multi-item measurement that has been psychometrically evaluated ensures reliability and validity of the results (Jones et al., 2013).

There are some methodological considerations to make when interpreting the results of the approach utilized in this study. A convenience sample of undergraduate students was used to evaluate the format and design of the course. While the choice of population is appropriate for a pilot study, it may be difficult to translate the results from the novelty and participant involvement constructs to the intended population of direct care dementia workers. Undergraduate students are often presented with learning material online, and during the pandemic almost all classes were virtual. These experiences may have lowered their scores on the novelty of the material. Additionally, the wording of some of the UES items (e.g., "*I continued to read the material on the training website out of curiosity*") may have seemed somewhat out of context for an academic environment and contributed to more negative responses on novelty. Similarly, when asking students about interactive elements included in an online course, ratings may have been lower simply because this population is more likely to be exposed to interactive materials on a regular basis. Additional research with direct care workers on whether they find these elements unique is necessary to further assess the use of the UES to measure engagement.

The UES has been reported to be a valid and reliable measurement tool for exploratory research (O'Brien & Toms, 2013). Its psychometric properties indicate that when all six constructs from the original instrument are utilized in a survey, the results typically account for 62.96% of the variance in responses (O'Brien & Toms, 2010). The

current study used four of the original constructs (perceived usability, aesthetics, novelty, and involvement) and omitted endurability and focused attention because they were not relevant to the course topics or intended audience of this study. Because of this, the results only account for approximately 29.57% of the variance (O'Brien & Toms, 2010), and capture a portion of the potential factors that might influence perceptions of engagement among participants. It is possible that utilizing another instrument may have resulted in different responses, but the current evaluation does provide insight into the design and content of the course site.

Opportunities to improve the design and content of the course. The generally positive responses to the open-ended questions about course content and design support the idea that participants found the course engaging and suggests using an online format to introduce the Tovertafel to direct care workers is appropriate.

Course content. An open-ended question was included to enable participants to make suggestions about improvements to the content of the course. Most of the comments were positive; for example, "*it helped me learn more about multi-sensory activities*" and "*everything was explained great*!" There were, however, suggestions that may improve the course content.

It was suggested that the lessons should provide more detail about the games and why they are beneficial for someone in a specific stage of dementia. This can be accomplished by creating a lesson that focuses on specific games and how and why they were developed. For example, the fish game, which projects lily pads and fish, does not include visible water. The Tovertafel manufacturers found in testing that the inclusion of water was visually disturbing to people with advanced dementia and therefore it was

removed. Including information such as this will help direct care workers understand the design elements and how they might enhance the therapeutic benefits of the Tovertafel games.

Another participant suggested that the order of the lessons might be changed, so that the Tovertafel is explained first, followed by a discussion of dementia. Because a goal of the training course is to ensure an engaging and relevant education experience, it is a valid concern that beginning the course with an overview of a topic familiar to experienced direct care workers may make the initial lesson less interesting. There may be direct care workers, however, who are new to dementia care, and who will benefit from an overview of the material prior to the introduction of the Tovertafel games. This issue will be addressed by revising the text at the beginning of the first lesson on dementia to indicate that learners can begin with the second lesson, if they think they are familiar with the topic and can also return to the first lesson at a later time if they desire.

One participant suggested that additional resources about the Tovertafel technology should be provided for those who want to learn more. When the course was created, it was assumed that participants were unlikely to seek additional information beyond that presented in the lessons, but based on the feedback, this may not be the case. Including links to videos and information developed by the Tovertafel manufacturer may add to the learning experience for those who are interested in knowing more. The researcher will identify resources and materials from the originators of the Tovertafel that would be appropriate to add to the course.

Finally, it was mentioned that there were instances of improper grammar in the course, but details were not provided to locate the errors. The course was reviewed by the

research team as well as student volunteers, but it is certainly possible that a grammatical issue was not detected. It may be beneficial to enlist the services of an outside editor, preferably someone not familiar with the material, to ensure that there are no spelling or grammar errors.

Course design. Participants reported that the site layout was "*easy to follow and navigate*" and it was "*an overall good experience*." Their feedback supports the use of the Articulate Rise eLearning platform, which features interactive elements and a uniform layout for the course. It is important to consider the study participants' feedback in light of Universal Design guidelines to ensure that suggested changes do not impact the accessibility of the materials (Dell et al., 2015). Some of the suggestions made by the participants can be implemented easily and may enhance the aesthetics and overall experience while maintaining the integrity of the Universal Design approach.

A participant suggested that the lessons should include videos of residents using the Tovertafel, despite there being two videos included in the course. This is a good example of why it is important to get feedback from the learners' perspective and identify course elements that may be obvious to the course designers, but not to a wider audience (Mancilla & Frey, 2020). A review of the lessons and the instructions to learners will be conducted to reassess whether it is clear when to click on course features to access the video content and if the directions for starting and pausing the videos are understandable. Additionally, the videos currently included in the lessons show older adults playing the games with narration from caregivers and Tovertafel representatives. It may be beneficial to include a video that features residents of a long-term facility playing the games with a facilitator, but without narration.

It was suggested that the course should include brighter colors. Some literature related to online learning suggests that color has little positive impact on learning, and over-use of color may in fact be distracting to some learners (Fahy, 2004). The generally accepted best-practice for online learning formats is a white background with color themes utilizing blue, black or red (Rockley, 1997). Articulate Rise only allows white page backgrounds, and the theme choices are limited to headers and transitional elements so that they pass accessibility requirements. The course was created in Articulate Rise using a blue theme out of preference by the researcher, but other color options are available for banners and transitional elements. A review of the theme options offered by Articulate Rise to determine if a different color option may brighten up the content will be conducted. The suggestion may be further achieved by the addition of more photographs to brighten up the lessons.

One participant suggested creating the text so that it changes color when selected. While this may help learners keep their place on the page, Universal Design guidelines generally recommend the use of black text on a white background to ensure that students using reading software or who cannot distinguish colors are not at a disadvantage when using the materials (Dell et al., 2015; Mancilla & Frey, 2020). The suggestion made by another participant, however, to bold key words would not violate this guideline, and may provide learners with an easy way to identify critical concepts contained in the lesson. A review of the materials by content experts familiar with dementia care and the Tovertafel will be conducted to determine the key words that could be emphasized by the use of bold text.

Perception of relevance to profession. The purpose of any professional training, including those delivered through an online format, is to inform and prepare professionals for tasks that are considered important to the organization and its employees (Kirkpatrick & Kirkpatrick, 2019). When developing the NWKM, the originators recognized that perceptions of relevance on the part of training participants are an essential element of successful programs (Kirkpatrick & Kirkpatrick, 2016). This is especially important in the case of direct care workers, who face a variety of barriers to continuing education (Mills et al., 2019; Williams et al., 2016), and therefore the current study sought to determine whether participants felt that the information provided was relevant to their discipline. Similar to previously published studies (Luo & Yang, 2018; Patel et al., 2018; Walker et al., 2019), most of the participants reported that the information in the online training was relevant to their discipline.

Luo and Yang (2018) utilized qualitative items on their survey to further evaluate perceptions of relevance, finding that participants were able to connect the lessons to personal and professional experiences. While there were no open-ended questions at the end of the relevance section of the survey for participants to elaborate on or clarify their responses, participants did share observations in other areas of the survey that support relevance to their work; for example, one participant shared *"I worked in a nursing home in the dementia unit and helped the activities director engage the residents in activities. This is a whole new level and I'm excited to see how much it benefits the residents in LTC facilities."*

Opportunities to improve the measurement of relevancy of the course. Further evaluation of the training course will benefit from the inclusion of open-ended options so

that learners have the opportunity to explain their answers and share suggestions for making the material more relevant to their profession. This would align with previous research that used qualitative responses to triangulate and apply context to responses (Patel et al., 2018; Walker et al., 2019). It can also be expected that the responses from direct care workers are likely to be different than those of undergraduate college students, therefore additional research with the intended population will be necessary to further assess this construct.

Changes in knowledge and skills. While it is generally accepted that exposure to new materials and techniques will result in some form of learning, it is important to assess whether the time spent results in meaningful improvements in knowledge and skills for participants (Liao & Hsu, 2019). An analysis of participants' self-reported before and after knowledge and skills scores suggest that the course succeeded in increasing learner knowledge and skills related to the use of the Tovertafel to create opportunities for engaging interactions among older adults with dementia.

The overall positive results of the self-reported changes in knowledge and skills suggest that online training may be an effective way to introduce techniques used to facilitate a Tovertafel group session when direct care staff do not have access to the device, and supports previous research supporting observational learning techniques (Burke & Mancuso, 2012). The online training course will be a useful tool for introducing the device prior to delivery on-site, ensuring that direct care workers have a general level of knowledge and skills prior to using the Tovertafel.

Opportunities to improve the learning experience.

Assessment of knowledge and skills. As might be expected, the shift in knowledge and skills was most evident in participants who entered the course with no or little knowledge of dementia care. The significant changes may be due to the fact that the majority of the learners began the training with little or no exposure to dementia care, rather than changes in knowledge among learners who had previous personal and/or professional experience caring for an older adult with dementia. Patel and associates (2018) utilized a similar approach, asking training participants to rate increases in knowledge using a 5-point Likert scale (1=strongly disagree and 5=strongly agree) and while they found that the majority of the participants tended to strongly agree to the statements about knowledge acquisition.

Another possible explanation is a hesitancy among some participants to reveal a lower level of knowledge in the survey. In their study among healthcare providers caring for prenatal women, Walker et al. (2019) reported little or no changes for the many of their items using quantitative survey data, but qualitative data suggested the acquisition of knowledge related to the lessons. Expanding the list of questions on the current survey to include more than the four knowledge and three skills items originally asked may provide additional understanding regarding participant learning. Another approach would be to incorporate a pre- and post-test into the course instead of asking participants to self-report both before and after learning at the end of the course. Walker and associates (2019) included multiple-choice and short answer questions in their pre- and post-test survey.

When the training course is used among the intended audience of direct care workers, it may be most effective to employ the technique utilized by Luo and Yang (2018), who supplemented participant self-reported increases in knowledge and skills with feedback from superiors (who were teachers in the case of their study). While the method employed for this exploratory study was appropriate to begin to learn more about knowledge and skill acquisition, a review of how best to evaluate the acquisition and application of knowledge and skills among working adults will be necessary. A combination of approaches including a pre- and post-test, follow up discussions with direct care workers after they have had time to utilize the Tovertafel in real work situations, and feedback from supervisors may be the best approach.

Expansion of topics. The significant gain in knowledge about using multi-sensory activities with people living with dementia reinforces the need to provide introductory materials in the training course to ensure that all participants have adequate exposure to the main concepts related to the use of the Tovertafel. In the open-ended responses one participant shared, "*I think ways to have a positive attitude could have been elaborated on more*." There was a significant change in knowledge scores on this topic but the after-training scores for some still indicated low or moderate understanding. A review of the lessons offered to the learners does support the fact that this topic was not covered in as much detail as other items included on the knowledge assessment. Expanding the lessons to discuss the importance of having a positive attitude when working with people who have dementia will be completed before the training course is used again

Translation of knowledge and skills to practice. The purpose of Part One of the study was to evaluate the online training course created to introduce a multi-sensory

technology intervention would determine whether participants found the course engaging and relevant. Additionally, the survey data were used to determine to what extent participants would report that they gained knowledge and skills related to the topics covered by the lessons. The results of this first part of the study confirm that the use of an interactive online course can be effective in the introduction of the Tovertafel to direct care workers.

What the results of Part One of the study do not illustrate, however, is whether participants are able to translate their newly acquired knowledge and skills to practice. This is a problem other researchers utilizing online training with healthcare workers have encountered in the past; in fact one of the reasons that the originators of the NWKM cite for low utilization of Level 3 (Behavior) and Level 4 (Outcomes) of their model is the time and expense involved in actually observing the application of new knowledge and skills over time (Kirkpatrick & Kirkpatrick, 2019).

In their study involving healthcare providers serving neonatal patients, Walker and associates (2019) conducted a thematic analysis of qualitative survey responses to determine whether course participants expressed an understanding of how to apply their new knowledge and skills in practice. Themes were organized around commitment to communicate ("*What will I communicate*," "*How will I get the message across*," and "*Make use of other avenues for communication*.") (Walker et al., 2019). Similarly, Patel et al., (2018) asked "*Where do you think you might use what you learned in this model?*" to evaluate whether participants understood how to apply their new knowledge. Both studies recognized their inability to follow up with participants post-training to ensure that learning translated into practice as limitations to their work and recommended

additional research to verify that this was occurring (Patel et al., 2018; Walker et al., 2019).

The current study included a second part designed to address this limitation by allowing study participants to operate the Tovertafel and provide their feedback regarding the experience. Utilizing constructs from the Social Cognitive Theory (SCT), a survey was developed to measure participant feelings of behavioral capability and self-efficacy related to the Tovertafel activities, determine whether learners perceived positive outcomes related to recreation therapy responsibilities, and learn whether the majority of participants expressed positive attitudes about the Tovertafel activities. While only eight students were able to visit campus during the pandemic, the results do provide preliminary insight into the research questions presented in Part Two of the study.

SCT constructs.

Behavioral capability. The participants in the current study first observed others using the Tovertafel in videos that were included in the online training course, and then were provided with an opportunity to use the device themselves. This approach, referred to as "modeling" in Social Cognitive Theory, is often used to increase behavioral capability which is then translated to behavior change (Glanz et al., 2015). Increasing behavioral capability as a method of professional development is supported by research conducted by Sturgiss and associates (2017), who found that physicians who reported high levels of behavioral capability after training also confirmed that they had incorporated skills learned in training into their daily practice.

Self-efficacy. A construct closely related to behavioral capability, self-efficacy is an important element in the adoption of new knowledge and skills and is therefore integrated into a variety of models and theories including the NWKM and SCT used in the current study (Glanz et al., 2015; Kirkpatrick & Kirkpatrick, 2016). Researchers have utilized the construct to predict the adoption of behaviors among healthcare workers after participating in professional training sessions (Burke & Mancuso, 2012; Luo & Yang, 2018; Sturgiss et al., 2017; Walker et al., 2019). The majority of the participants in the current study indicated that they had the behavioral capability and self-efficacy needed to operate the Tovertafel equipment and facilitate an activity session with older adults with dementia.

Expected outcomes. Research shows that individuals who express positive expectations about newly acquired skills are more likely to adopt care innovations and improve the well-being of residents (Elliott et al., 2018; Melhuish et al., 2017). As previously noted, researchers utilizing online courses to deliver training to healthcare workers have struggled to measure the translation of positive attitudes to adoption of behaviors (Luo & Yang, 2018; Patel et al., 2018; Walker et al., 2019). Sturgiss et al., (2017), however, did follow up with participants in their training course, and found that the majority of trainees who had expressed positive attitudes about new professional behaviors had found ways to incorporate them into their practices. The majority of the trainees in this study expressed positive attitudes related to objectives of recreation therapists working with older adults living with dementia. Open-ended responses support the positive expectations about the Tovertafel and its application to recreation therapy

(e.g., "*clients get a lot of upper extremity movement … having to wave their hand back and forth until the picture is complete*.").

Reinforcing attitudes. While it is possible for trainees to find training both unenjoyable and still relevant and useful as reported by Luo and Yang (2018), it is generally understood that activities that are positively received are the most effective. Introducing innovations that are fun for both direct care workers and residents can improve the work environment and reduce burnout and high turnover rates that are often reported by facilities while increasing the well-being of both workers and residents (Booth, Zizzo, Robertson, & Goodwin Smith, 2018; Institute of Medicine, 2008; Sposito et al., 2017). A review of learner comments illustrates their positive attitudes about using the Tovertafel during recreation therapy session. The participants all stated that they had fun with the games, agreeing that they would use the Tovertafel if it were available to them where they work, and would recommend it to other recreation therapists. Finally, all participants agreed that the Tovertafel games would improve the work experience of recreation therapists. The participants expressed enthusiasm for the activities, citing games that older adults might like as well as games they found enjoyable (e.g., "*it was a sensory experience that I enjoyed a lot*," and "*I could've stayed there all day playing it*.").

While it is difficult to determine whether direct care workers will express the same feelings of behavioral capability, self-efficacy, positive expected outcomes and reinforcing attitudes as the participants of the current study, the responses do suggest that sufficient information was provided in the training to allow the individuals to express confidence in their skills and ability to utilize the Tovertafel. Additional research with a

larger group of direct care workers will be necessary to confirm these findings among the intended audience.

Opportunities for improvement.

Addressing potential technical problems. The only participant who expressed doubt related to behavioral capability was unsure about her ability to resolve problems that occur while using the Tovertafel. In her open-ended response, the participant indicated that the Tovertafel was already on when she arrived, she did not encounter problems, and as a result she was not sure if she could resolve problems if they arise. This response exposes a limitation to the training course that can be addressed before using the materials with the intended population. When asking individuals about potential technical problems, one cannot anticipate the problems that a participant might envision, and how those imagined problems might impact confidence. It may be helpful to include a brief description of potential problems that might occur (e.g., power cord issues, changing the batteries in the remote, etc.) and/or a link to a resource providing additional assistance. The survey question should then specifically address the potential problems covered in the training course. This will provide the researcher with more specific information about problems that are likely to occur (such as needing batteries in the remote) and eliminate the possibility that participants may invent possible problems that would not occur when using the device (e.g., lack of internet access does not impact the operation of the Tovertafel).

Addressing potential barriers. The participants were asked to identify potential barriers or reasons why a recreation therapist may not wish to use the Tovertafel. While

some of the learners could not identify barriers, there were three potential issues suggested by the participants.

Recreation therapists may not have the opportunity to use the Tovertafel if the facility lacks the funding to purchase the device. This is a barrier that is largely out of the control of recreation therapists, and therefore not easily resolved. It will not be an issue with the originally planned project as the researchers will provide the Tovertafel during the research project, and therefore does not require immediate remediation. The concern among the participants, however, points out that recreation therapists are aware of institutional barriers that limit access to multi-sensory technology.

Technical issues may cause problems for recreation therapists who facilitate Tovertafel sessions. While it is difficult to anticipate all of the potential technical problems that can occur when using technology, it may be beneficial to provide a resource for direct care workers who use the Tovertafel. This change has the added benefit of addressing both a recognized barrier and increasing behavioral capability of direct care workers who utilize the Tovertafel as previously discussed.

Older adults with physical or cognitive difficulties may not have the ability or motivation to play the games. As noted by one of the participants, even older adults with limited mobility can benefit from watching others play the game. This is addressed in the training materials, but perhaps it should be explained in greater

detail so that direct care workers understand that the games are designed so that individuals with limited physical or cognitive abilities can participate. Similarly, the course explains the importance of facilitation to encourage and motivate individuals to participate. It may be beneficial to review the materials to ensure that this is clearly explained.

Limitations of the Study

Like all research, there are limitations to the study that may impact the interpretation and generalizability of the results of the current study. As Ioannidis asserts, "the notion of infallibility is not compatible with scientific thinking" (2007, p. 329). Additionally, scientific reporting that is devoid of a frank discussion about potential limitations leads the reader to suspect that the author lacks credible knowledge of the subject matter (Puhan et al., 2012). Acknowledging limitations is an important step in the research project, as it can point out potential sources of procedural errors, informs the reader of possible reliability and validity issues, places the findings in context of external factors, and suggests potential opportunities for future research (Ioannidis, 2007). In this section, potential limitations are discussed.

- The intended audience for the Tovertafel evaluation study is direct care workers who provide care for older adults with dementia in a long-term care setting. COVID-19 pandemic restrictions precluded the feasibility of offering the activities to the intended population, so the study was delimited to include students in the College of Health and Human Services. Using university students in a health-related program is appropriate for the pilot testing of the course and

provided the researchers with information about the strengths of the training and ways to improve the content and design of the training course. It will be necessary to test the materials with direct care professionals before the initial project is engaged.

- The COVID-19 pandemic limited the number of Recreation Therapy students who were available to come to the university campus and play the Tovertafel games for Part Two of the study, and as a result there were 8 surveys collected for this portion of the study. The small sample size limits the ability of the researchers to provide an in-depth report of hands-on experience with the Tovertafel . While the feedback provided was useful, data collection for this portion of the study will continue into the spring 2021 semester to increase the sample size.
- A standardized survey was utilized to collect measurements of engagement, defined as aesthetics, ease of use, novelty and user involvement. While the instrument was not developed specifically for the purpose of this study, it has been utilized for a variety of pilot studies and is considered valid and reliable. A review of the responses to this portion of the survey indicate some negative responses were related to ease of use. It is certainly possible that participants found the course site difficult to use, but there is also the potential that the reverse-coded items were confusing. Continued research with additional open-ended questions will be necessary to gain a deeper understanding of participant perceptions regarding the ease of use of the site.

- Portions of surveys used in Part One and Part Two of the study were developed by the researchers. The items for both surveys were guided by a review of literature. To measure relevance, the researchers utilized a format provided by the developers of the NWKM. For the Part Two survey, the items were created with constructs of the Social Cognitive Theory as a guide. Both of the surveys were reviewed by content experts with experience in course design, behavioral theory, gerontology, and education with dementia care, and tested by undergraduate and graduate students. Expanding the use of the surveys to include larger samples of direct care workers will allow the researcher to assess the reliability and validity of the instruments.
- In the case of both surveys, responses tended to have very little variability; the majority of learners responded with highly favorable ratings related to the training course and the Tovertafel activities. While it is possible that the participants enjoyed the training and had positive attitudes about the Tovertafel activities, we cannot rule out the possibility that participants responded favorably either to please the researchers to make themselves 'look good' (Rosenman, Tennekoon, & Hill, 2011). To encourage genuine responses from participants the surveys were provided in an online format and submissions were anonymous.

Implications

Implications for the original Tovertafel evaluation study. The original Tovertafel evaluation study was designed to be conducted on the premises of two long-term care facilities and involve both staff and residents. Research conducted to evaluate

multi-sensory technology indicates that interventions designed to increase physical, social, and cognitive engagement among long-term care residents with dementia can be effective in reducing memory-related behaviors (Bruil et al., 2018; Collier et al., 2010; Garlinghouse et al., 2018; Goto et al., 2014; Gustafsson et al., 2015; Heesterbeek et al., 2019; Joranson et al., 2015; Luyten et al., 2018; Maseda et al., 2014; Moyle et al., 2017; Nijhof et al., 2013; Sanchez et al., 2016; Sposito et al., 2017). While the onset of the COVID-19 pandemic prevented the execution of the proposal as planned, the original study will be conducted when the pandemic is under control and facilities re-open for research purposes. The results of the current study provide insight that will be used to improve the design of the Tovertafel evaluation study.

Adoption of online training. Some researchers have suggested that the support and involvement of direct care workers are key factors to the success of multi-sensory interventions (Ahn & Horgas, 2014; Fukui, Okada, Nishimoto, & Nelson-Becker, 2011; Moyle et al., 2018). The results of Parts One and Two of the current study support the idea that providing training to direct care staff that is perceived as enjoyable, engaging, and relevant result in positive attitudes about the Tovertafel games and their use in the care of older adults. Therefore, once it is revised, the online training course will replace the originally planned informal training sessions among facility staff when the original study is conducted.

Integration of additional NWKM and SCT constructs into the training and intervention evaluation process. Part Two of the study included a survey that was designed to evaluate the use of the Tovertafel activities by undergraduate recreation therapy students who participated in at least one in-person game session on campus. The

survey assessed four constructs from Social Cognitive Theory (SCT): behavioral capability, self-efficacy, expected outcomes, and reinforcing attitudes. The SCT constructs were included in the original study survey, and when the survey was modified for the current project, they were retained because they provided a method for contextualizing the responses from the participants within a health behavior theory. After the study was concluded and the results were reviewed, it became evident that the SCT constructs are complementary to the NWKM Levels as illustrated in Table 25.

Table 25

Relationship between NWKM levels and SCT constructs

NWKM Level	NWKM Construct	SCT Construct
Level 1: Reaction	Customer satisfaction	Reinforcing attitudes
Level 1: Reaction	Engagement	Reinforcing attitudes
Level 1: Reaction	Relevance	Reinforcing attitudes, Intentions
Level 2: Learning	Knowledge	Behavioral capability, Self-efficacy, Observational learning, Knowledge
Level 2: Learning	Skill	Behavioral capability, Knowledge
Level 2: Learning	Attitude	Intentions, Reinforcing Attitudes, Normative beliefs
Level 2: Learning	Confidence	Self-efficacy, behavioral capability, Intentions, Normative beliefs
Level 2: Learning	Commitment	Intentions, Reinforcing attitudes
Level 3: Behavior	Critical behaviors	Behavioral capability, Intentions
Level 3: Behavior	Required drivers	Normative beliefs, social support
Level 4: Results		Normative beliefs, social support

The immediate result of this newly realized connection between the learning evaluation model and behavioral theory will be the expansion of the original research project to incorporate all four levels of the NWKM and the integration of the identified

SCT constructs. The combined use of the NWKM and SCT will strengthen the analysis of the research and provide a method for contextualizing the findings within the practice of health education.

While beyond the scope of this dissertation, there are implications for this newly conceptualized evaluation model outside of the planned Tovertafel study. The development of a comprehensive educational evaluation model that utilizes constructs from both NWKM and SCT can be adopted for any intervention study to provide structure and context to the measurement of outcomes. The development of the model will be continued in a separate project using the findings of the original Tovertafel study as a reference.

Extending the timeframe of the study to include additional NWKM levels. The current study utilized elements from the New World Kirkpatrick Model (NWKM) in the design of the online training evaluation survey in Part One of the study. As discussed in Chapter 3, the full NWKM consists of four levels (Reaction, Learning, Behavior and Results), however COVID-19 restrictions limited access to direct care workers, and therefore only the first two levels were included in this research. Previous studies utilizing the NWKM have designed their investigations in similar fashion, citing difficulties in measuring behavior changes and organizational results among online participants as a limitation to their research plans design (Patel et al., 2018; Walker et al., 2019). While the originators of the NWKM recognize the benefits of evaluating training design and function through the Reaction and Learning levels, they stress that the second two levels, Behavior and Results, provide essential information related to the effectiveness of a training program and its usefulness to achieving organizational goals

(Kirkpatrick & Kirkpatrick, 2016). With the integration of the NWKM into the training portion of the project, we will expand the original project design to incorporate all four levels.

Evaluating participant reactions and learning can occur in a relatively short period of time following completion of the training but measuring behavior changes and achievement of organizational results require time to observe the application of new skills in the work environment and sustain personal and organizational expectations (Liao & Hsu, 2019). This suggests that integrating the NWKM into the study design will result in changes to the length of the original project to allow the researchers to monitor the behaviors of direct care workers as well as solicit feedback from facility administration. The original project utilized an intervention timeline of 3 weeks: one week of control activity, followed by one week of the intervention activity, and then a final week of control activity. It may be useful to return the Tovertafel to the facility following the second control activity week so that direct care staff have the opportunity to utilize the device as part of normal activities. This will provide the researchers with the opportunity to evaluate the use of the Tovertafel in a real-world setting and determine whether the intervention resulted in long-term adoption of the newly acquired skills and knowledge.

Focus group sessions with direct care workers. To achieve a better understanding of staff experiences with both the training course and the Tovertafel intervention, focus group discussions with direct care staff who participate in the Tovertafel games will be added to the project design. Feedback from direct care workers will provide valuable insights to further improve the Tovertafel intervention training and work experience in greater detail than the open-ended questions provided on the survey.

Implications for Health Education. This study presents several opportunities for health education professionals who are interested in developing or evaluating multi-sensory technology interventions aimed at older adults with dementia. In this section the implications for practice and research will be discussed.

Practice. The majority of the studies reviewed for the original study either did not address the educational approach taken for direct care staff (Bruil et al., 2018; Collier et al., 2010; Garlinghouse et al., 2018; Goto et al., 2014; Luyten et al., 2018) or acknowledged the importance of training but failed to provide details about the training approaches utilized (Maseda et al., 2014; Nijhof et al., 2013; Sanchez et al., 2016). The findings of this study support previous research suggesting that online training that is engaging, relevant and enjoyable, is an effective method to enhance the knowledge and skills of busy healthcare professionals (Luo & Yang, 2018; Patel et al., 2018; Walker et al., 2019). Formalized training should be integrated into the intervention design of programs developed for direct care workers who will utilize multi-sensory technology in the care of older adults with dementia. When evaluating the effectiveness of a program, health education professionals should carefully explain the training methods employed and discuss any limitations that arise because of the approach to direct care staff education.

The integration of a training evaluation model into the training course delivered in the current study illustrates the value of using a framework to ensure successful outcomes. Health educators should utilize training evaluation models such as the NWKM to ensure that the educational portions of their interventions are perceived as engaging, relevant and enjoyable among participants. Incorporating all or some of the NWKM

levels in health education endeavors, whether among students or members of the community, will positively influence the learning experience and result in better comprehension and retention of intended materials (Liao & Hsu, 2019).

Research. It is customary in behavioral health research to utilize theory in the design, interpretation and evaluation of health behavior intentions (Glanz et al., 2015). This study adds to the small body of literature related to health education endeavors that utilize the New World Kirkpatrick model in the delivery of professional training. The findings support previous research that have found the use of a training evaluation model effective (Liao & Hsu, 2019; Patel et al., 2018; Walker et al., 2019), and introduces a previously undocumented approach integrating a behavioral theory (i.e., Social Cognitive Theory) into the NWKM framework. A review of published research shows that the use of theory is less common in experimental research related to the use of multi-sensory technology. Of 13 published studies related to multi-sensory technology, only two mentioned theory either in the design of the study or interpretation of the results (Gustafsson et al., 2015; Sanchez et al., 2016). The results of the current study suggest that both a training evaluation model and behavioral theory are compatible and have the potential to positively impact both research and practice outcomes and evaluations.

Researchers interested in conducting exploratory research to evaluate multi-sensory technology should consider utilizing online training for the preparation of healthcare professionals. As illustrated by the current study and supported by previous research (Luo & Yang, 2018; Patel et al., 2018; Walker et al., 2019), online training is an effective way to deliver information about new skills and procedures.

The results of Part Two of the current study, while limited because of the small number of student participants, suggest that newly acquired skills and knowledge can be translated into practice. Additional research with larger numbers of direct care workers is needed to further strengthen this argument. While the focus of the current study is limited to multi-sensory technology interventions, the reported findings are translatable to other areas of direct care worker training and have the potential to increase job satisfaction and competency among employees and higher quality of care for residents in long-term care settings. Researchers should consider online training as an option when developing evaluator studies, and carefully explain the procedures employed when disseminating findings.

Conclusions

As a response to the global COVID-19 pandemic and the limitations that it placed on research involving long-term care facilities, it was not feasible to conduct the originally proposed research project. The decision was made to focus on developing online training for direct care staff on using the Tovertafel games with residents living with dementia. While the ideal situation would have been to pilot the training course with direct care staff, this also was not feasible due to the COVID-19 pandemic, so a convenience sample of undergraduate students were utilized to evaluate the design and content of the online course. While these decisions may at first appear to be unexpected deviations from the original plan, they have provided the researchers with valuable information that will strengthen the larger study.

The analysis of data collected during Parts One and Two of the study indicate that the online training succeeded in achieving the stated goals. Participants found the course engaging (i.e., aesthetically pleasing, easy to use, novel, and involved the individual); relevant to their intended profession; and resulted in increases in knowledge and skills related to the use of the Tovertafel to provide engaging activities for older adults with dementia. Additionally, the participants in Part Two confirmed high levels of behavioral capability and self-efficacy, and positive attitudes about the use of the Tovertafel in their profession. While it remains to be seen whether a non-student population will respond similarly, this study has aided in the development of an innovative training strategy.

Whereas the original study design acknowledged the value of staff support in the success of the Tovertafel intervention, the addition of the online training course that will be revised based on the results of this study will improve the project and provide added depth to the data that will be collected. Finally, incorporation of this training will ensure that the direct care workers are adequately trained and prepared to assist with implementation and evaluation of the Tovertafel intervention.

Epilogue

It will not be possible for future readers who did not live through the COVID-19 pandemic to appreciate the myriad ways that the COVID-19 pandemic disrupted the lives of just about everyone on the planet in one way or another. Writing in the second year of this unprecedented event, it is difficult to imagine a need to explain why the original research project was impossible to complete, or the complexities of asking healthy undergraduate students to do something as mundane as visit their classroom over a four-week period. During the majority of 2020, the safety restrictions imposed on facilities that offer care for older adults was a frustration and impediment to the completion of this dissertation (and a significant source of isolation and suffering for residents and families), but in retrospect, there are reasons to be thankful for the opportunity to pause and reflect on the project plans. From the beginning, the research team repeatedly discussed the importance of staff buy-in for the project and a clear understanding of the activities that they would be asked to undertake in order to ensure the successful completion of the study. The amended study presented the research team with an opportunity to develop a safe and effective training method to staff who will participate in the original study (post-pandemic), as well as future studies that have yet to be designed. The pause in activities was also an opportunity for the student researcher to learn about the New World Kirkpatrick Model and its application to evaluate training endeavors. Additional attention was applied to behavioral theory and the ways that Social Cognitive Theory in particular could be used to enhance the evaluation of staff training and implementation of multi-sensory technology. While frustrating, perhaps infuriating at times, the original project will be greatly improved by the findings from the amended study, and hopefully the

results of the amended study will contribute to the literature on applying evaluation models to professional healthcare training. This, perhaps, leads us to the final lesson that this dissertation has imparted: In the words of the Dalia Lama, "*Remember that sometimes not getting what you want is a wonderful stroke of luck*."

References

Ahn, H., & Horgas, A. (2014, Jun). Does pain mediate or moderate the effect of cognitive impairment on aggression in nursing home residents with dementia? *Asian Nursing Research, 8*(2), 105-109. https://doi.org/10.1016/j.anr.2014.03.003

Algar, K., Woods, R., & Windle, G. (2016, Jul). Measuring the quality of life and well-being of people with dementia: A review of observational measures. *Dementia (London), 15*(4), 832-857. https://doi.org/10.1177/1471301214540163

Algase, D., Beattie, E., Antonakos, C., Beel-Bates, C., & Yao, L. (2010, Jun). Wandering and the physical environment. *American Journal of Alzheimer's Disease & Other Dementias, 25*(4), 340-346. https://doi.org/10.1177/1533317510365342

Algase, D., Beck, C., Kolanowski, A., Whall, A., Berent, S., Richards, K., & Beattie, E. (1996). Need-driven dementia-compromised behavior: An alternative view of disruptive behavior. *American Journal of Alzheimer's Disease, 11*(6), 10-19. https://doi.org/10.1177/153331759601100603

Algase, D. , Yao, L., Beel-Bates, C., & Song, J. (2007). Theoretical models of wandering. A. L. Nelson & D. L. Algase (Eds.), *Evidence-based Protocols for Managing Wandering Behaviors* (pp. 19-51). Springer Publishing Company.

Allen, R., Burgio, L., Roth, D., Ragsdale, R., Gerstle, J., Bourgeois, M., Dijkstra, K., & Teri, L. (2003, Dec). The Revised Memory and Behavior Problems Checklist--Nursing Home: Instrument development and measurement of burden among certified nursing assistants. *Psychol Aging, 18*(4), 886-895. https://doi.org/10.1037/0882-7974.18.4.886

Alzheimer's Association. (2018). 2018 Alzheimer's disease facts and figures. *13*(3), 367-429. https://www.alz.org/media/homeoffice/facts%20and%20figures/facts-and-figures.pdf

Alzheimer's Association. (2019). *2019 Alzheimer's Disease Facts and Figures*. https://www.alz.org/media/documents/alzheimers-facts-and-figures-2019-r.pdf

Alzheimer's Association International, & World Health Organization. (2012). *Dememtia: A public health priority*.

Anderiesen, H. (2017). *Playful design for activation: Co-designing serious games for people with moderate to severe dementia to reduce apathy,* Delft University of Technology.

Azermai, M. (2015). Dealing with behavioral and psychological symptoms of dementia: a general overview. *Psychology Research and Behavior Management, 8*, 181-185. https://doi.org/10.2147/PRBM.S44775

Bamonti, P., Conti, E., Cavanagh, C., Gerolimatos, L., Gregg, J., Goulet, C., Pifer, M., & Edelstein, B. (2017, Jun 1). Coping, cognitive emotion regulation, and burnout in long-term care nursing staff: A preliminary study. *Journal of Applied Gerontology*, 733464817716970. https://doi.org/10.1177/0733464817716970

Beattie, E., Algase, D., & Song, J. (2004, Mar). Keeping wandering nursing home residents at the table: Improving food intake using a behavioral communication intervention. *Aging & Mental Health, 8*(2), 109-116. https://doi.org/10.1080/13607860410001649617

Beck, C., Richards, K., Lambert, C., Doan, R., Landes, R., Whall, A., Algase, D., Kolanowski, A., & Feldman, Z. (2011, Jun). Factors associated with problematic vocalizations in nursing home residents with dementia. *The Gerontologist, 51*(3), 389-405. https://doi.org/10.1093/geront/gnq129

Bedard, A., Landreville, P., Voyer, P., Verreault, R., & Vezina, J. (2011, Sep). Reducing verbal agitation in people with dementia: Evaluation of an intervention based on the satisfaction of basic needs. *Aging & Mental Health, 15*(7), 855-865. https://doi.org/10.1080/13607863.2011.569480

Bird, M., Anderson, K., MacPherson, S., & Blair, A. (2016, Dec). Do interventions with staff in long-term residential facilities improve quality of care or quality for life people with dementia? A systematic review of the evidence. *International Psychogeriatrics, 28*(12), 1937-1963. https://doi.org/10.1017/S1041610216001083

Booth, S., Zizzo, G., Robertson, J., & Goodwin Smith, I. (2018, Aug 13). Positive Interactive Engagement (PIE): A pilot qualitative case study evaluation of a person-centred dementia care programme based on Montessori principles. *Dementia (London)*, 1471301218792144. https://doi.org/10.1177/1471301218792144

Bruil, L., Adriaansen, M., Groothuis, J., & Bossema, E. (2018, Apr). Quality of life of nursing home residents with dementia before, during and after playing with a magic table. *Tijdschr Gerontology & Geriatrics, 49*(2), 72-80. https://doi.org/10.1007/s12439-017-0243-3 (Kwaliteit van leven van verpleeghuisbewoners met dementie voor, tijdens en na het spelen met de tovertafel.)

Burfield, A., Wan, T., Sole, M., & Cooper, J. (2012). Behavioral cues to expand a pain model of the cognitively impaired elderly in long-term care. *Clinical Interventions in Aging, 7*, 207-223. https://doi.org/10.2147/CIA.S29656

Burgener, S., Twigg, P., & Popovich, A. (2005). Measuring psychological well-being in cognitively impaired persons. *Dementia (London), 4*(4), 463-485. https://doi.org/10.1177/1471301205058303

Centers for Disease Control and Prevention. (2018). *QuickStats: Percentage distribution of long-term care staffing, hours, by staff member type and sector - United States, 2016*. Centers for Disease Control and Prevention. https://www.cdc.gov/mmwr/volumes/67/wr/mm6717a6.htm?s_cid=mm6717a6_e

Centers for Disease Control and Prevention. (2019a). *Alzheimer's disease*. Centers for Disease Control and Prevention. https://www.cdc.gov/aging/aginginfo/alzheimers.htm

Centers for Disease Control and Prevention. (2019b). *The truth about aging and dementia*. Centers for Disease Control and Prevention. https://www.cdc.gov/aging/publications/features/dementia-not-normal-aging.html

Cheng, Y. (2012, Mar). The effects of information systems quality on nurses' acceptance of the electronic learning system. *Journal of Nursing Research, 20*(1), 19-30. https://doi.org/10.1097/JNR.0b013e31824777aa

Chodosh, J., Edelen, M., Buchanan, J., Yosef, J. A., Ouslander, J. G., Berlowitz, D. R., Streim, J. E., & Saliba, D. (2008, Nov). Nursing home assessment of cognitive impairment: Development and testing of a brief instrument of mental status. *Journal of the American Geriatrics Society, 56*(11), 2069-2075. https://doi.org/10.1111/j.1532-5415.2008.01944.x

Clarke, D., Ko, J., Kuhl, E., van Reekum, R., Salvador, R., & Marin, R. (2011, Jan). Are the available apathy measures reliable and valid? A review of the psychometric evidence. *Journal Psychosomatic Research, 70*(1), 73-97. https://doi.org/10.1016/j.jpsychores.2010.01.012

Cohen-Mansfield, J., Dakheel-Ali, M., Jensen, B., Marx, M., & Thein, K. (2012, May). An analysis of the relationships among engagement, agitated behavior, and affect in nursing home residents with dementia. *Internationall Psychogeriatrics, 24*(5), 742-752. https://doi.org/10.1017/S1041610211002535

Cohen-Mansfield, J., Dakheel-Ali, M., & Marx, M. (2009, Apr). Engagement in persons with dementia: The concept and its measurement. *American Journal of Geriatrirc Psychiatry, 17*(4), 299-307. https://doi.org/10.1097/JGP.0b013e31818f3a52

Cohen-Mansfield, J., Dakheel-Ali, M., Marx, M., Thein, K., & Regier, N. (2015, Jul 30). Which unmet needs contribute to behavior problems in persons with advanced dementia? *Psychiatry Research, 228*(1), 59-64. https://doi.org/10.1016/j.psychres.2015.03.043

Cohen-Mansfield, J., Hai, T., & Comishen, M. (2017, May). Group engagement in persons with dementia: The concept and its measurement. *Psychiatry Research, 251*, 237-243. https://doi.org/10.1016/j.psychres.2017.02.013

Cohen-Mansfield, J., Marx, M., Freedman, L., Murad, H., Thein, K., & Dakheel-Ali, M. (2012, Mar). What affects pleasure in persons with advanced stage dementia? *Journal of Psychiatric Research, 46*(3), 402-406. https://doi.org/10.1016/j.jpsychires.2011.12.003

Collier, L., McPherson, K., Ellis-Hill, C., Staal, J., & Bucks, R. (2010, Dec). Multisensory stimulation to improve functional performance in moderate to severe dementia-interim results. *American Journal of Alzheimer's Disease & Other Dementias, 25*(8), 698-703. https://doi.org/10.1177/1533317510387582

Colling, K. (2004, Mar). Caregiver interventions for passive behaviors in dementia: Links to the NDB model. *Aging & Mental Health, 8*(2), 117-125. https://doi.org/10.1080/13607860410001649626

Cresswell, J. (2013). *Research Design: Qualitative, quantitative, and mixed methods approaches* (Fourth ed.). Sage.

Dell, C., Dell, T., & Blackwell, T. (2015). Applying Universal Design for learning in online courses: Pedagogical and practical considerations. *The Journal of Educators Online, 13*(2), 166-192. https://files.eric.ed.gov/fulltext/EJ1068401.pdf

Dettmore, D., Kolanowski, A., & Boustani, M. (2009, Jan-Feb). Aggression in persons with dementia: Use of nursing theory to guide clinical practice. *Geriatric Nursing, 30*(1), 8-17. https://doi.org/10.1016/j.gerinurse.2008.03.001

Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P., & Kaiser, S. (2012). Guidelines for choosing between multi-item and single-item scales for construct measurement: A predictive validity perspective. *Journal of the Academy of Marketing Science, 40*(3), 434-449. https://doi.org/10.1007/s11747-011-0300-3

Eleden, M., Rodriguez, A., Ahluwailia, S., Chen, E., Cohen, C., Dalton, S., Etchegaray, J., Huang, W., Karkos, B., Klein, D., Madrigano, J., Martineau, M., Moore, T., Orr, P., Phillips, J., Schalet, B., Shier, V., Paddock, S., & Angniel, D. (2019). *Development and evaluation of candiatestandardized patient assessment data elements: Findings from the National Beta Test (Volume 4: Cognitive function)*.

Elliott, K.-E. J., Scott, J. L., Stirling, C., & Martin, A. (2018). Developing resilience in the aged and dementia care workforce. *Resilience in Aging* (pp. 347-365). https://doi.org/10.1007/978-3-030-04555-5_19

Ellis, J., Doyle, C., & Selvarajah, S. (2016, Jul). The relationship between apathy and participation in therapeutic activities in nursing home residents with dementia: Evidence for an association and directions for further research. *Dementia (London), 15*(4), 494-509. https://doi.org/10.1177/1471301214527300

Evans, S., Garabedian, C., & Bray, J. (2017, Jan 1). 'Now he sings'. The My Musical Memories Reminiscence Programme: Personalised interactive reminiscence sessions for people living with dementia. *Dementia (London)*, 1471301217710531. https://doi.org/10.1177/1471301217710531

Fahy, P. (2004). Media characteristics and online learning. In *Theory and practice of online learning* (pp. 137-171). Athabasca University Press.

Fatehi, F., Gray, L., & Wootton, R. (2014, Jan). How to improve your PubMed/MEDLINE searches: 2. display settings, complex search queries and topic searching. *Journal of Telemedicine and Telecare, 20*(1), 44-55. https://doi.org/10.1177/1357633X13517067

Fields, B., Bruemmer, J., Gloeckner, G., & Wood, W. (2018, Aug). Influence of an equine-assisted activities program on dementia-specific quality of life. *American Journal of Alzheimer's Disease & Other Dementias, 33*(5), 309-317. https://doi.org/10.1177/1533317518772052

Fukui, S., Okada, S., Nishimoto, Y., & Nelson-Becker, H. (2011, Mar). The repeated appeal to return home in older adults with dementia: Developing a model for practice. *Journal of Cross-Cultural Gerontology, 26*(1), 39-54. https://doi.org/10.1007/s10823-010-9133-7

Garlinghouse, A., Rud, S., Johnson, K., Plocher, T., Klassen, D., Havey, T., & Gaugler, J. (2018, Dec). Creating objects with 3D printers to stimulate reminiscence in memory loss: A mixed-method feasibility study. *Informatics for Health and Social Care, 43*(4), 362-378. https://doi.org/10.1080/17538157.2017.1290640

Glanz, K., Rimer, B., & Viswanath, K. (2015). *Health Behavior: Theory, Research, and Practice* (5 ed.). Jossey-Bass.

Goto, S., Kamal, N., Puzio, H., Kobylarz, F., & Herrup, K. (2014). Differential responses of individuals with late-stage dementia to two novel environments: a multimedia room and an interior garden. *Journal of Alzheimer's Disease, 42*(3), 985-998. https://doi.org/10.3233/JAD-131379

Gross, S., Danilova, D., Vandehey, M., & Diekhoff, G. (2015, Jan). Creativity and dementia: Does artistic activity affect well-being beyond the art class? *Dementia (London), 14*(1), 27-46. https://doi.org/10.1177/1471301213488899

Gustafsson, C., Svanberg, C., & Mullersdorf, M. (2015, Oct). Using a robotic cat in dementia care: A pilot study. *Journal of Gerontological Nursing, 41*(10), 46-56. https://doi.org/10.3928/00989134-20150806-44

Gutierrez-Ibarluzea, I., Chiumente, M., & Dauben, H. (2017). The life cycle of health technologies. Challenges and ways forward. *Frontiers in Pharmacology, 8*, 14. https://doi.org/10.3389/fphar.2017.00014

Harris-Kojetin, L., Sengupta, M., Lendon, J. P., Rome, V., Valverde, R., & Caffrey, C. (2019). *Long-term care providers and services users in the United States, 2015-2016*. V. H. S. National Center for Health Statistics.

Heesterbeek, M., van der Zee, E., & van Heuvelen, M. (2019). Feasibility of three novel forms of passive exercise in a multisensory environment in vulnerable institutionalized older adults with dementia. *Journal of Alzheimer's Disease, 70*(3), 681-690. https://doi.org/10.3233/JAD-190309

IBM Corp. (Released 2019). IBM SPSS Statistics for Macintosh, Version 26. Armonk, NY: IBM Corp.

Institute of Medicine. (2008). *Retooling for an aging America: building the health care workforce*. N. A. o. Sciences. https://www.nap.edu/download/12089

Jackson, M., Fauth, E., & Geiser, C. (2014, Jun). Comparing the Neuropsychiatric Inventory and the Revised Memory and Behavior Problems Checklist for associations with caregiver burden and depressive symptoms. *International Psychogeriatrics, 26*(6), 1021-1031. https://doi.org/10.1017/S1041610213002421

Jager, J., Putnick, D., & Bornstein, M. (2017, Jun). More than just convenient: The scientific merits of homogeneous convenience samples. *Monograph of Social Research of Child Development, 82*(2), 13-30. https://doi.org/10.1111/mono.12296

Johnson, M., Wackerbarth, S., & Schmitt, F. (2001). Revised Memory and Behavior Problems Checklist. *Clinical Gerontologist, 22*(3-4), 87-108. https://doi.org/10.1300/J018v22n03_09

Jones, T., Baxter, M., & Khanduja, V. (2013, Jan). A quick guide to survey research. *Annals of The Royal College of Surgeons of England, 95*(1), 5-7. https://doi.org/10.1308/003588413X13511609956372

Jonker, C., Gerritsen, D., Bosboom, P., & Van Der Steen, J. (2004). A model for quality of life measures in patients with dementia: Lawton's next step. *Dementia and Geriatric Cognitive Disorders, 18*(2), 159-164. https://doi.org/10.1159/000079196

Joranson, N., Pedersen, I., Rokstad, A., & Ihlebaek, C. (2015, Oct 1). Effects on symptoms of agitation and depression in persons with dementia participating in robot-assisted activity: A cluster-randomized controlled trial. *Journal of the American Medical Directors Association, 16*(10), 867-873. https://doi.org/10.1016/j.jamda.2015.05.002

Joussain, P., Bessy, M., Fournel, A., Ferdenzi, C., Rouby, C., Delphin-Combe, F., Krolak-Salmon, P., & Bensafi, M. (2016). Altered affective evaluations of smells in Alzheimer's disease. *Journal of Alzheimer's Disease, 49*(2), 433-441. https://doi.org/10.3233/JAD-150332

Kales, H., Gitlin, L., & Lyketsos, C. (2015, Mar 2). Assessment and management of behavioral and psychological symptoms of dementia. *BMJ, 350*, h369. https://doi.org/10.1136/bmj.h369

Kinney, J., & Rentz, C. (2005, Jul-Aug). Observed well-being among individuals with dementia: Memories in the Making, an art program, versus other structured activity. *American Journal of Alzheimer's Disease & Other Dementias, 20*(4), 220-227. https://doi.org/10.1177/153331750502000406

Kirkpatrick, J., & Kirkpatrick, W. (2019). *An introduction to the New World Kirkpatrick Model*.

Kloos, N., Drossaert, C., Trompetter, H., Bohlmeijer, E., & Westerhof, G. (2020, May 24). Exploring facilitators and barriers to using a person centered care intervention in a nursing home setting. *Geriatric Nursing*. https://doi.org/10.1016/j.gerinurse.2020.04.018

Kolanowski, A., Litaker, M., Buettner, L., Moeller, J., & Costa, P., Jr. (2011, Jun). A randomized clinical trial of theory-based activities for the behavioral symptoms of dementia in nursing home residents. *Journal of the American Geriatrics Society, 59*(6), 1032-1041. https://doi.org/10.1111/j.1532-5415.2011.03449.x

Lawton, M. (1983, Aug). Environment and other determinants of well-being in older people. *The Gerontologist, 23*(4), 349-357. https://doi.org/10.1093/geront/23.4.349

Lawton, M., Kleban, M., & diCarlo, E. (1984, Mar). Psychological well-being in the aged. Factorial and conceptual dimensions. *Research on Aging: An International Bimonthly Journal, 6*(1), 67-97. https://doi.org/10.1177/0164027584006001004

Lawton, M., Van Haitsma, K., & Klapper, J. (1996). Observed affect in nursing home residents with Alzheimer's disease. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 51B*(1), 3-14.

Liao, S., & Hsu, S. (2019). Evaluating a continuing medical education program: New World Kirkpatrick Model approach. *International Journal of Management, Economics, and Social Sciences, 8*(4), 266-279. https://doi.org/10.32327/IJMESS.8.4.2019.17

Lueken, U., Seidl, U., Völker, L., Schweiger, E., Kruse, A., & Schröder, J. (2007). Development of a Short Version of the Apathy Evaluation Scale specifically adapted for demented nursing home residents. *The American Journal of Geriatric Psychiatry, 15*(5), 376-385. https://doi.org/10.1097/JGP.0b013e3180437db3

Luo, S., & Yang, H. (2018, Jun). Using technologies in nursing research education: A mixed methods case study. *Computer Informatics, Nursing, 36*(6), 293-304. https://doi.org/10.1097/CIN.0000000000000420

Luyten, T., Braun, S., Jamin, G., van Hooren, S., & de Witte, L. (2018, Jan). How nursing home residents with dementia respond to the interactive art installation 'VENSTER': a pilot study. *Disability and Rehabilitation: Assistive Technology, 13*(1), 87-94. https://doi.org/10.1080/17483107.2017.1290701

Mace, R., Mansbach, W., & Clark, K. (2016, Jan-Feb). Rapid cognitive assessment of nursing home residents: A comparison of the Brief Interview for Mental Status (BIMS) and Brief Cognitive Assessment Tool-Short Form (BCAT-SF). *Research in Gerontological Nursing, 9*(1), 35-44. https://doi.org/10.3928/19404921-20150522-05

Mancilla, R., & Frey, B. (2020). *Administrative supports for digital accessibility: Policies and processes*. Quality Matters.

Maresova, P., Tomsone, S., Lameski, P., Madureira, J., Mendes, A., Zdravevski, E., Chorbev, I., Trajkovik, V., Ellen, M., & Rodile, K. (2018). Technological solutions for older people with Alzheimer's disease: Review. *Current Alzheimer Research, 15*(10), 975-983. https://doi.org/10.2174/1567205015666180427124547

Maseda, A., Sanchez, A., Marante, M., Gonzalez-Abraldes, I., Bujan, A., & Millan-Calenti, J. (2014, Aug). Effects of multisensory stimulation on a sample of institutionalized elderly people with dementia diagnosis: A controlled longitudinal trial. *American Journal of Alzheimer's Disease & Other Dementias, 29*(5), 463-473. https://doi.org/10.1177/1533317514522540

Massimo, L., Kales, H., & Kolanowski, A. (2018). State of the science: Apathy as a model for investigating behavioral and psychological symptoms in dementia. *Journal of the American Geriatrics Society, 66*, S4-S12. https://doi.org/10.1111/jgs.15343

Melhuish, R., Beuzeboc, C., & Guzman, A. (2017, Apr). Developing relationships between care staff and people with dementia through music therapy and dance movement therapy: A preliminary phenomenological study. *Dementia (London), 16*(3), 282-296. https://doi.org/10.1177/1471301215588030

Mills, W., Pimentel, C., Snow, A., Allen, R., Wewiorski, N., Palmer, J., Clark, V., Roland, T., McDannold, S., & Hartmann, C. (2019, Jul). Nursing home staff perceptions of barriers and facilitators to implementing a quality improvement intervention. *Journal of The American Medical Directors Association, 20*(7), 810-815. https://doi.org/10.1016/j.jamda.2019.01.139

Moyle, W., Jones, C., Murfield, J., Thalib, L., Beattie, E., Shum, D., O'Dwyer, S., Mervin, M., & Draper, B. (2017, Sep 1). Use of a robotic seal as a therapeutic tool to improve dementia symptoms: A cluster-randomized controlled trial. *Journal of The American Medical Directors Association, 18*(9), 766-773. https://doi.org/10.1016/j.jamda.2017.03.018

Moyle, W., Murfield, J., Jones, C., Beattie, E., Draper, B., & Ownsworth, T. (2018, Nov 24). Can lifelike baby dolls reduce symptoms of anxiety, agitation, or aggression for people with dementia in long-term care? Findings from a pilot randomised controlled trial. *Aging & Mental Health*, 1-9. https://doi.org/10.1080/13607863.2018.1498447

National Commission for Health Education Credentialing, I. (2015). *The Health Education Specialist: A companion guide for professional excellence* (7th edition ed.). National Commission for Health Education Credentialing, Inc.

National Institute on Aging. (2017). *Residential Facilities, Assisted Living, and Nursing Hones*. https://www.nia.nih.gov/health/residential-facilities-assisted-living-and-nursing-homes

Neville, C., & Byrne, G. (2001). Behaviour rating scales for older people with dementia: Which is the best for use by nurses? *Australasian Journal on Ageing, 20*(4), 166-172. https://doi.org/10.1111/j.1741-6612.2001.tb00381.x

Nijhof, N., van Hoof, J., van Rijn, H., & van Gemert-Pijnen, J. (2013). The behavioral outcomes of a technology-supported leisure activity in people with dementia. *Technology and Disability, 25*(4), 263-273. https://doi.org/10.3233/tad-140398

Noone, S., Innes, A., Kelly, F., & Mayers, A. (2017, Oct). 'The nourishing soil of the soul': The role of horticultural therapy in promoting well-being in community-dwelling people with dementia. *Dementia (London), 16*(7), 897-910. https://doi.org/10.1177/1471301215623889

Norton, M., Allen, R., Snow, A., Hardin, J., & Burgio, L. (2010, Apr). Predictors of need-driven behaviors in nursing home residents with dementia and associated certified nursing assistant burden. *Aging &Mental Health, 14*(3), 303-309. https://doi.org/10.1080/13607860903167879

O'Brien, H., & Toms, E. (2010). The development and evaluation of a survey to measure user engagement. *Journal of the American Society for Information Science and Technology, 61*(1), 50-69. https://doi.org/10.1002/asi.21229

O'Brien, H., & Cairns, P. (2015). An empirical evaluation of the User Engagement Scale (UES) in online news environments. *Information Processing & Management, 51*(4), 413-427. https://doi.org/10.1016/j.ipm.2015.03.003

O'Brien, H., Cairns, P., & Hall, M. (2018). A practical approach to measuring user engagement with the refined user engagement scale (UES) and new UES short form. *International Journal of Human-Computer Studies, 112*, 28-39. https://doi.org/10.1016/j.ijhcs.2018.01.004

Ohio Department of Aging. (nd.). *Ohio long-term care consumer guide*. https://ltc.age.ohio.gov/NursingHomes

Ohio Department of Health. (2018). *How to become a State Tested Nurse Aide*. Ohio Department of Health. https://odh.ohio.gov/wps/portal/gov/odh/know-our-

programs/nurse-aide-training-and-competency-evaluation-program-natcep/resources/statetestednurseaidetraininghowto

Ohio Living. (2019). *Ohio Living Swan Creek*. https://www.ohioliving.org/communities/ohio-living-swan-creek/

Patel, S., Margolies, P., Covell, N., Lipscomb, C., & Dixon, L. (2018). Using instructional design, Analyze, Design, Develop, Implement, and Evaluate, to develop e-Learning modules to disseminate supported employment for community behavioral health treatment programs in New York State. *Frontiers in Public Health, 6*, 113. https://doi.org/10.3389/fpubh.2018.00113

Perez-Saez, E., Cabrero-Montes, E., Llorente-Cano, M., & Gonzalez-Ingelmo, E. (2018, Nov 27). A pilot study on the impact of a pottery workshop on the well-being of people with dementia. *Dementia (London)*, 1471301218814634. https://doi.org/10.1177/1471301218814634

Qualtrics. (Released 2020). Qualtrics, version November, 2020. Provo, Utah: Qualtrics.

Rentz, C. (2002, May-Jun). Memories in the making: outcome-based evaluation of an art program for individuals with dementing illnesses. *American Journal of Alzheimer's Disease & Other Demenias*, 17(3), 175-181. https://doi.org/10.1177/153331750201700310

Rockley, A. (1997). *Intranet Publishing*. The Rockley Group.

Roth, D., Burgio, L., Gitlin, L., Gallagher-Thompson, D., Coon, D., Belle, S., Stevens, A., & Burns, R. (2003, Dec). Psychometric analysis of the Revised Memory and Behavior Problems Checklist: Factor structure of occurrence and reaction ratings. *Psychology and Aging, 18*(4), 906-915. https://doi.org/10.1037/0882-7974.18.4.906

Ryff, C., & Keyes, C. (1995). The structure of psychological well-being revisited. *Journal of Personality and Social Psychology, 69*(4), 719-727.

Saliba, D., Buchanan, J., Edelen, M., Streim, J., Ouslander, J., Berlowitz, D., & Chodosh, J. (2012, Sep). MDS 3.0: Brief interview for mental status. *Journal of The American Medical Directors Association, 13*(7), 611-617. https://doi.org/10.1016/j.jamda.2012.06.004

Sanchez, A., Marante-Moar, M., Sarabia, C., de Labra, C., Lorenzo, T., Maseda, A., & Millan-Calenti, J. (2016, Jun). Multisensory stimulation as an intervention strategy for elderly patients with severe dementia: A pilot randomized controlled trial. *American Journal of Alzheimer's Disease & Other Dementias, 31*(4), 341-350. https://doi.org/10.1177/1533317515618801

Schall, A., Tesky, V. A., Adams, A., & Pantel, J. (2018, Aug). Art museum-based intervention to promote emotional well-being and improve quality of life in people with dementia: The ARTEMIS project. *Dementia (London), 17*(6), 728-743. https://doi.org/10.1177/1471301217730451

Sposito, G., Barbosa, A., Figueiredo, D., Yassuda, M., & Marques, A. (2017, Apr). Effects of multisensory and motor stimulation on the behavior of people with dementia. *Dementia (London), 16*(3), 344-359. https://doi.org/10.1177/1471301215592080

Tan, J., Wee, S., Yeo, P., Choo, J., Ritholz, M., & Yap, P. (2019, Jan). A new music therapy engagement scale for persons with dementia. *Intnational Psychogeriatrics, 31*(1), 49-58. https://doi.org/10.1017/S1041610218000509

Teri, L., Truax, P., Logsdon, R., Uomoto, J., Zarit, S., & Vitaliano, P. (1992). Assessment of behavioral problems in dementia: The Revised Memory and Behavior Problems Checklist. *Psychology and Aging, 7*(4), 622-631. https://doi.org/10.1037/0882-7974.7.4.622

The Alzheimer's Association and Centers for Disease Control and Prevention. (2013). *The Healthy Brain Initiative: The public health road map for state and national partnerships, 2013-2018*. https://www.cdc.gov/aging/pdf/2013-healthy-brain-initiative.pdf

U.S. Centers for Medicare & Medicaid Services. (2019). *Nursing Home Compare*. Medicare.gov. https://www.medicare.gov

U.S. Department of Health & Human Services. (2005). *Theory at a glance: a guide for health promotion practice* (Theory at a Glance, Issue. https://sbccimplementationkits.org/demandrmnch/ikitresources/theory-at-a-glance-a-guide-for-health-promotion-practice-second-edition/

Vernooij-Dassen, M., & Moniz-Cook, E. (2014, Sep). Raising the standard of applied dementia care research: addressing the implementation error. *Aging & Mental Health, 18*(7), 809-814. https://doi.org/10.1080/13607863.2014.899977

Walker, R., Bennett, C., Kumar, A., Adamski, M., Blumfield, M., Mazza, D., & Truby, H. (2019, Summer). Evaluating online continuing professional development regarding weight management for pregnancy using the New World Kirkpatrick Model. *Journalof The Continuing Education in the Health Professions, 39*(3), 210-217. https://doi.org/10.1097/CEH.0000000000000261

Wesenberg, S., Mueller, C., Nestmann, F., & Holthoff-Detto, V. (2018, Nov 4). Effects of an animal-assisted intervention on social behaviour, emotions, and behavioural and psychological symptoms in nursing home residents with dementia. *Psychogeriatrics*. https://doi.org/10.1111/psyg.12385

Williams, K., Abd-Hamid, N., & Perkhounkova, Y. (2017, Jul 1). Transitioning communication education to an interactive online module format. *Journal of Contining Education in Nursing, 48*(7), 320-328. https://doi.org/10.3928/00220124-20170616-09

Williams, K., Perkhounkova, Y., Bossen, A., & Hein, M. (2016). Nursing home staff intentions for learned communication skills: Knowledge to practice. *Journal of Gerontological Nursing, 42*(3), 26-34.

Windle, G., Joling, K., Howson-Griffiths, T., Woods, B., Jones, C., van de Ven, P., Newman, A., & Parkinson, C. (2018, Mar). The impact of a visual arts program on quality of life, communication, and well-being of people living with dementia: a mixed-methods longitudinal investigation. *Intational Psychogeriatrics, 30*(3), 409-423. https://doi.org/10.1017/S1041610217002162

Woodhead, E., Northrop, L., & Edelstein, B. (2016, Jan). Stress, social support, and burnout among long-term care nursing staff. *Journal of Applied Gerontology, 35*(1), 84-105. https://doi.org/10.1177/0733464814542465

World Health Organization. (2017). *Global action plan on the public health response to dementia 2017-2025* License: CC BY-NC-SA 3.0 IGO). https://www.alz.co.uk/dementia-plans/global-plan

Yamasaki, T., & Tobimatsu, S. (2018). Driving ability in Alzheimer disease spectrum: Neural basis, assessment, and potential use of optic flow event-related potentials. *Frontiers in Neurology, 9*, 750. https://doi.org/10.3389/fneur.2018.00750

Appendix A

Literature Search

Appendix A1: Keywords and databases searched for Need-driven Dementia-compromised Behavior Model

Database	Boolean string
CINAHL Plus with full text, Academic Search Complete, PsychInfo	need-driven dementia-compromised behavior model AND nursing home
PUBMed	need-driven dementia-compromised behavior model
Web of Science	TOPIC: (need-driven dementia-compromised behavior model) Refined by: PUBLICATION YEARS: (2017 OR 2011 OR 2016 OR 2010 OR 2014 OR 2009 OR 2012) AND DOCUMENT TYPES: (ARTICLE) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI.

Appendix A2: Keywords and databases searched for multi-sensory technology

Database	Boolean string
CINAHL Plus with full text, Academic Search Complete, PsychInfo	("multisensory" OR "multi-sensory" OR "stimulation") AND (dementia or alzheimers or cognitive impairment or memory loss) AND (intervention or treatment or therapy) AND (technology OR robotics) AND (nursing home or long term care or residential care or nursing homes) NOT (systematic review or meta-analysis OR review) NOT (psychometrics or validity or reliability)
PUBMed	TOPIC: ("multisensory" OR "multi-sensory" OR "multisensory") AND TOPIC: ("dementia" OR "alzheimer") AND TOPIC: ("technology") NOT TOPIC: ("community dwelling") NOT TOPIC: ("early onset" OR "Young onset")
Web of Science	"multisensory" AND "dementia" AND "nursing home" NOT "systematic"

Appendix A3: Keywords and databases searched for New World Kirkpatrick Model literature

Database	Boolean string
CINAHL Plus with full text, Academic Search Complete, PsychInfo	("Kirkpatrick") AND (“online”) AND (“intervention”) AND (“training”) AND (“health”) NOT (systematic review or meta-analysis OR review)
PUBMed	TOPIC: ("Kirkpatrick") AND TOPIC: ("online") AND TOPIC: ("intervention") AND TOPIC: ("training") NOT TOPIC: ("review" OR "systematic")
Web of Science	"Kirkpatrick" AND "online" AND "intervention" NOT "systematic"

Appendix B

IRB Approval Letters

The University of Toledo
Human Research Protection Program
Social, Behavioral and Educational IRB
Center for Creative Education – Suite 2102
3000 Arlington Avenue, Toledo, Ohio 43614
Phone: 419-383-6796 Fax: 419-383-3248
(FWA00010686)

IRB Exemption Granted Notification

To: Victoria Steiner Ph.D.

School of Population Health

From: Social, Behavioral and Educational IRB

IRB Number: 300787

Title:
Evaluating an online training course for the use of a novel multi-sensory intervention for people living with dementia.

Event Review Type: Exempt

Signed Wednesday, September 30, 2020 4:03:30 PM ET by Case, Patricia F.

The above named project was reviewed and determined to meet criteria for exempt research under the following category or categories:

Category 1

by the designee of the University's Social, Behavioral and Educational IRB. Exemption has been granted as of 09/30/2020. The full board will acknowledge this at its next convened meeting.

You are free to conduct your study without further reporting to the Social, Behavioral and Educational IRB unless major revisions make your research no longer eligible for the exemption approval or unless you need to make personnel changes. If you are unsure of whether any proposed changes would require IRB approval, please contact the IRB office. Upon completion of your study, you are required to submit a final report form to the Social, Behavioral and Educational IRB office.

Documents reviewed and approved as part of this protocol application submission:

- COI_Perion.pdf (Conflict of Interest Disclosure)
- RSP103saltzman.pdf (Conflict of Interest Disclosure)
- STEINER RSP103.pdf (Conflict of Interest Disclosure)
- Consent form - HHS Student evaluation of training.docx (Consent - Information Sheet)
- Email script.docx (Recruitment Materials)
- Online_Training_survey.docx (Surveys/Questionnaires/Interview Script)

Only the most recent IRB approved form(s) listed above may be used when enrolling participants into research.

The University of Toledo
Human Research Protection Program
Social, Behavioral and Educational IRB
Center for Creative Education – Suite 2102
3000 Arlington Avenue, Toledo, Ohio 43614
Phone: 419-383-6796 Fax: 419-383-3248
(FWA00010686)

IRB Exemption Granted Notification

To: Victoria Steiner Ph.D.

School of Population Health

From: Social, Behavioral and Educational IRB

IRB Number: 300791

Title: Evaluation of training on a novel multi-sensory intervention for persons living with dementia

Event Review Type: Exempt

Signed Tuesday, October 6, 2020 5:41:31 PM ET by Case, Patricia F.

The above named project was reviewed and determined to meet criteria for exempt research under the following category or categories:

Category 1

by the designee of the University's Social, Behavioral and Educational IRB. Exemption has been granted as of 10/06/2020. The full board will acknowledge this at its next convened meeting.

You are free to conduct your study without further reporting to the Social, Behavioral and Educational IRB unless major revisions make your research no longer eligible for the exemption approval or unless you need to make personnel changes. If you are unsure of whether any proposed changes would require IRB approval, please contact the IRB office. Upon completion of your study, you are required to submit a final report form to the Social, Behavioral and Educational IRB office.

Documents reviewed and approved as part of this protocol application submission:

- COI_Perion.pdf (Conflict of Interest Disclosure)
- RSP103saltzman.pdf (Conflict of Interest Disclosure)
- STEINER RSP103.pdf (Conflict of Interest Disclosure)
- Consent form - Part One Rec therapy student evaluation of training.docx (Consent - Information Sheet)
- Consent form - Part Two rec therapy student evaluation of Tovertafel.docx (Consent - Information Sheet)
- Recruitment messages.docx (Recruitment Materials)
- Online_Training_survey.docx (Surveys/Questionnaires/Interview Script)
- Rec_therapy_student_evaluation_survey.docx (Surveys/Questionnaires/Interview Script)

Only the most recent IRB approved form(s) listed above may be used when enrolling participants into research.

Appendix C

Training Outline

Duration: The training took between 30 and 45 minutes for students to complete.

Delivery: Lessons were created in Articulate Rise and delivered as a web-based course.

Introduction (5 minutes)
- Overview of the course
- Course objectives
- Who to contact for help

Lesson 1: Dementia Overview (15 minutes)
- What is dementia?
- Dementia-related behaviors
- Dementia-related behaviors impact well-being
  - Residents
  - Direct care workers
  - Family and friends
- Possible causes of dementia-related behaviors
  - Unmet needs
  - Lack of engagement
- Multi-sensory activities
  - Benefits of multi-sensory activities
- Knowledge check

Lesson 2: What is a Tovertafel? (5 minutes)
- Games designed to improve well-being
- Positive effects of Tovertafel games
- Knowledge check

Lesson 3: Using the Tovertafel (5 minutes)
- The Tovertafel playing field
- Using the remote
- Powering the Tovertafel on and off
- Manual selection of games
- Knowledge check

Lesson 4: Facilitating a Tovertafel session (15 minutes)
- The importance of facilitation
- Selecting games to promote engagement
- Ending a session
- Knowledge check

Appendix D

Part One Post Training Survey

Now that you have completed the training course, we would like to learn your thoughts about the lessons and the knowledge you gained from completing the lessons.

In this first section, we would like you to reflect on your experience using the training website and its lessons to learn about the Tovertafel games. For each set of statements, please mark the circle to indicate what is most true for you.

Part 1: Aesthetics	Strongly disagree	Disagree	I am not sure	Agree	Strongly agree
The training website was attractive					
The training website was aesthetically appealing					
I liked the graphics and images on the training website					
The training website appealed to my visual senses					
The layout of this training course was visually pleasing					

Part 2: Ease of use	Strongly disagree	Disagree	I am not sure	Agree	Strongly agree
I felt frustrated while using this training website					
I found this training website confusing to use					
I felt annoyed while using this training website					
I felt discouraged while using this training website					
Using this training website was taxing					
This experience was demanding					
I felt in control while using this training website					
I could not do some of the things I needed to do while using the training website (e.g., click on items, forward to the next section)					

Part 3: Novelty	Strongly disagree	Disagree	I am not sure	Agree	Strongly agree
I continued to read the material on the training website out of curiosity					
The content of the training website incited my curiosity					
I felt interested in the training website					

Part 4: Involvement	Strongly disagree	Disagree	I am not sure	Agree	Strongly agree
I was really drawn into this experience					
I felt involved in this experience					
This experience was fun					

Do you have any suggestions for design improvements (such as using different fonts or a different layout?)

No Yes, please explain

Do you have any suggestions for content improvements (such as using different words or adding or deleting information?)

No Yes, please explain

Now we would like to learn whether the topics covered in the training course are useful to your professional development.

The following statements ask you to reflect on what you learned from the lessons and how it relates to your profession. Please think about the activities that someone in your intended profession might expect to do, regardless of whether you personally plan to work with older adults or not. For each statement, please mark the box to indicate what is most true for you.

For each statement, please mark the box to indicate what is most true for you.	Strongly disagree	Disagree	I am not sure	Agree	Strongly agree
The content covered in this course is relevant and applicable to my profession					
This course will help me to improve my professional performance, whether I work with older adults or another population					
I believe it will be worth my effort to apply what I learned to my professional performance					
I am confident that I can apply what I learned to the performance of my profession if I were to work with older adults with dementia					
I am committed to using the knowledge, awareness, and/or skills I learned					

Next, we would like to ask you about the knowledge and skills you gained from completing the training course.

Knowledge: Please circle the rating of your knowledge of the topic before the training and now (after the training). For this section, please use the rating scale where 1= none or very low level and 5= very high level.

Before the training						Now				
1	2	3	4	5	Common dementia-related behaviors	1	2	3	4	5
1	2	3	4	5	How direct care workers can help to improve the well-being of people who have dementia	1	2	3	4	5
1	2	3	4	5	The use of multisensory interventions with people living with dementia	1	2	3	4	5
1	2	3	4	5	How to have a positive attitude about dementia caregiving	1	2	3	4	5

Use this space to provide any comments about the previous items.

Skills: Please circle the rating of your skills to perform the indicated tasks before the training and now (after the training). For this section, please use the rating scale where 1= none or very low level and 5=very high level.

Before the training						Now				
1	2	3	4	5	Lead a group activity with people who are living with dementia	1	2	3	4	5
1	2	3	4	5	Use multi-sensory technology with a group	1	2	3	4	5
1	2	3	4	5	Improve the well-being of people living with dementia	1	2	3	4	5

Use this space to provide any comments about the previous items.

Finally, we would like to know a little bit about you.

1. What is your primary program of study at the University of Toledo?

2. In what year of your undergraduate program are you?

_____ 1. First year student (freshman)
_____ 2. Second year student (sophomore)
_____ 3. Third year student (junior)
_____ 4. Fourth year student (senior)
_____ 4. Other (please specify)

3. What is your age? _____YEARS

4. Which best describes your ethnicity:

_____ 1. Hispanic or Latino
_____ 2. Not Hispanic or Latino
_____ 3. Prefer not to answer

5. Which categories do you identify with (select all that apply):

_____ 1. American Indian or Alaskan Native

_____ 2. Asian

_____ 3. Black or African American

_____ 4. Caucasian/White

_____ 5. Native Hawaiian or other Pacific Islander
_____ 6. Other _____

6. Which best describes your gender identity:

_____ 1. Male

_____ 2. Female
_____3. Trans-man
_____4. Trans-woman
_____5. Another, please specify _____
_____6. Prefer not to answer

7. Do you have experience (either personal or professional) caring for an older adult with dementia?

_____ 1. No experience

_____ 2. Experience caring for a family member

Your responses will be used in a research study to evaluate the Tovertafel training course. If you do not wish for your responses to be included in the study, indicate this here

- I authorize the researchers to include my responses to this survey in their study.
- I do not authorize the researchers to include my responses in this survey in their study.

Thank you for your participation!

Appendix E

Tovertafel Evaluation Survey

First, we would like to understand how much time you spent with the Tovertafel.

1. How many sessions did you have playing the Tovertafel games? _____

2. On average, how much time did you spend playing the games during each session (in minutes)?

3. When you played the Tovertafel games, were you: (check all that apply)

____ Alone

____ With other students

____ With other people who are not students

Now we would like to learn more about your experience using the Tovertafel games.

For each statement, please mark the box to indicate what is most true for you.	No	I do not think so	I am not sure	I think so	Yes
I feel confident that I know how to turn on the Tovertafel and initiate a game.					
I am confident that I know how to change games during a session.					
I am confident that I can resolve problems that may occur during a Tovertafel session.					
I am confident that I can lead a Tovertafel session with older adults who have dementia.					
I believe that I received adequate training to use the Tovertafel.					

If you marked "no" or "I do not think so" for any of the items above, please use this space to explain.

Now we would like to learn about your opinions potentially using the Tovertafel games as part of recreation therapy activities.

For each statement, please mark the box to indicate what is most true for you.

Based on your experience with the Tovertafel, if you worked at a facility where the device was available to use whenever you liked, do you think the games would…	No	I do not think so	I am not sure	I think so	Yes
Increase the opportunity for recreation therapists and older adults with dementia to have more social interactions (e.g., talking, laughing, showing interest in others).					
Increase physical activity for older adults with dementia (e.g., upper body movement).					
Increase mental activity (e.g., attention) of older adults with dementia.					
Help reduce the number of memory problems that older adults with dementia have such as repeating questions, losing items, or forgetting names.					
Reduce the depressive behaviors that older adults with dementia have such as crying or being tearful.					
Reduce their number of disruptive behaviors such as being physically or verbally aggressive or arguing.					

If you marked "no" or "I do not think so" for any of the items above, please use this space to explain.

Next, we would like to ask about your personal opinions regarding the Tovertafel games.

For each statement, please mark the box to indicate what is most true for you.	No	I do not think so	I am not sure	I think so	Yes
I had fun playing the Tovertafel games.					
If it were available at a facility where I worked, I would use the Tovertafel as a regular group activity.					
I would recommend the Tovertafel games to other recreation therapists.					
The work experience of recreation therapy staff will improve if the Tovertafel games were available.					
The residents who play with the Tovertafel are likely to have fun during the activity.					

4. What games do you believe older adults living with dementia will enjoy the most? Please list and provide any comments to explain your opinion.

5. What games did you enjoy the most? Please list and provide any comments to explain your opinion.

6. Was there a game or games that you did not enjoy?
   NO YES

   If yes, please list the game(s) and briefly explain (e.g., was the game too difficult; are there ways to improve the game, etc.).

7. Can you think of any barriers or reasons why a recreation therapist may not wish to use the Tovertafel?

8. Is there anything else that you would like to add?

Finally, we would like to know a little bit about you.

In which class are you enrolled?

_____ RCRT4680: Recreation Therapy Assistive Technology and Techniques

_____ RCRT4830: Geriatric Recreation Therapy

_____ RCRT4740: Assessment and Documentation in Therapeutic Recreation

_____ Other (please specify)

What is your age? _____YEARS

Which best describes your ethnicity:

_____ 1. Hispanic or Latino
_____ 2. Not Hispanic or Latino

Which categories do you identify with (select all that apply):

_____ 1. American Indian or Alaskan Native

_____ 2. Asian

_____ 3. Black or African American

_____ 4. Caucasian/White

_____ 5. Native Hawaiian or other Pacific Islander

_____ 6. Other _____

Which best describes your gender identity:

_____ 1. Male

_____ 2. Female
_____ 3. Trans-man
_____ 4. Trans-woman
_____ 5. Another, please specify _____
_____ 6. Prefer not to answer

Do you have experience (either personal or professional) caring for an older adult with dementia?

_____ 1. No experience

_____ 2. Experience caring for a family member

_____ 3. Professional experience

Your responses will be used in a research study to evaluate the Tovertafel training course. If you do not wish for your responses to be included in the study, indicate this here

- I authorize the researchers to include my responses to this survey in their study.
- I do not authorize the researchers to include my responses in this survey in their study.

Thank you for your participation!

Appendix F

Open-ended Survey Responses From the Part One Survey

Do you have any suggestions for design improvements (such as using different fonts or a different layout?)

"I liked that I could click on things to turn them and see more information. It felt interactive. Maybe you could include clicking on text to change the color."

"Maybe add more color to the overall website of the training experience."

"The photos of the patients using the Tovertafel were so cute! I would love to see a video of the Tovertafel in action with the patients. Not sure if this is possible, but it would make this presentation even more informative and adorable!"

"Use brighter colors"

"Bold the important information or vocabulary so it stands out"

"I don't have any suggestions, the layout worked with my learning style."

"I like the design and layouts. It is very easy to read and navigate."

"No I thought everything was great and easy to use!"

"No, I like how the lessons were broke out."

"No, I liked the set-up as it is."

"No, I really did enjoy this activity a lot I didn't have no problems at all!"

"No, it was very easy to read and understand!"

"None, it was an overall good experience."

"The layout was easy to follow and navigate."

Do you have any suggestions for content improvements (such as using different words or adding or deleting information?)

"Explain what the Tovertafel is first then explain Dementia and how it can help."

"I would add more resources for someone who wants to learn more about the Tovertafel technology."

"Possibly go into detail of more of the games and why it would be beneficial for someone in a specific dementia stage."

"Proper grammar I some areas of the course."

"I don't have any suggestions. I really enjoyed reading the material. It was very insightful."

"Looks great!"

"No everything was easy to identify and use!"

"No suggestions needed."

"No, everything was good."

"No, I don't think anything should change."

"No, I thought everything was very clear and understanding to me!"

"No, it was informative and understandable."

"The information provided was all beneficial and necessary."

Participant feedback about knowledge items

"I think ways to have a positive attitude could have been elaborated on more."

"I worked in a nursing home in the dementia unit and helped the activities director engage the residents in activities. This is a whole new level and I'm excited to see how much it benefits the residents in LTC facilities."

"It helped me learn more about multi-sensory activities!"

"No everything was explained great!"

"Nothing I didn't know before"

Participant feedback about skills items

"I feel more equipped and informed about dementia-patient care."

"Learned how to lead a group activity with people who are living with dementia!

"I learned more in this section compared to the first one."

"I think this provided ways to improve the well-being of people living with dementia but I think there are other ways this can be improved."

Appendix G

Open-ended Survey Responses from the Part Two Survey

Participant feedback about behavioral capability items

"Tovertafel was already on when I arrived. During my time I did not have any problems arise so I'm not sure I could resolve those if they do arise."

What games do you believe older adults living with dementia will enjoy the most? Please list and provide any comments to explain your opinion.

"I think all the games are fun and interactive. I enjoyed the dog game where you threw the dog toy. I think clients would enjoy this because they get to interact with a virtual puppy! The coloring game was also fun. Clients get a lot of upper extremity movement with that one having to wave their hand back and forth until the picture is complete."

"I think older adults living with dementia will enjoy the bubbles game the most. Int incorporates many different sensory components such as the tapping and sound effects. I found it very pleasing and actually addicting to play because it was cool! I also think the letter fill in the blank games would also be very beneficial. They are short, simple words but would really make the patients think."

"Puzzle games, the matching games, and the games with the growing flowers."

"Puzzles, coloring, or the fill-in the blank word games."

"Sheet music, this activity would bring joy and happiness, and stimulate the individuals when they interact with the music notes."

"The bubble game! It was so easy, fun and entertaining."

What games did you enjoy the most? Please list and provide any comments to explain your opinion.

"I enjoyed sheet music and color pop. The sounds provided when interacting with each game was enjoyable and there was an overall reward at the end- a song for sheet music and a picture for color pop."

"I enjoyed the bubble popping game"

"I enjoyed the bubbles game and the fireworks game the most. I loved the sound in the bubbles game when the bubbles were popped. I also loved the fireworks because the explosive ones were extra cool and more scarce than the regular ones. It was like a little treat to get the explosive one near me."

"I enjoyed the bubbles the most just because it was relaxing and it was the first game I played so it showed me just how cool this program is."

"I enjoyed the leaf game the most. It was a sensory experience that I enjoyed a lot."

"I forget what the game was called but it was the one where you had to try to get the balls into the holes to score points."

"I loved the coloring one where you drag you[r] finger along the table and colors would appear to make a picture. I also enjoyed the bubbles because it was satisfying when they popped."

"The coloring game was one I enjoyed the most."

Can you think of any barriers or reasons why a recreation therapist may not wish to use the Tovertafel?

"Financially unable to get one in their facility, or participants unwilling to participate/unmotivated."

"If a person has a big deficit in using their arms, the Tovertafel may be difficult for them. If it's strictly dementia patients, that may not be the case, but if they have arthritis as well im their shoulders, it may restrict their playing quality. They could still participate and watch the objects move around, but may not get the full experience if they cannot manipulate the games themselves."

"Not enough money in their budget."

"Since this game is solely based on technology, many problems can occur."

"Technological difficulties"

"There are no barriers I can think of right now."

"Nope! I think it covers a lot of bases."

Is there anything else you would like to add?

"I loved this so much and I wish the nursing home I work at could afford it for our memory care patients!"

"I really enjoyed using the Tovertafel! I could've stayed there all day playing it. I think it is such a cool invention and hope more facilities can utilize them soon."