2020

The Effects of Cognitive Training on Behavioral Functioning in Persons with Dementia

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By

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A Thesis Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Arts

In

Clinical Psychology

April 30, 2020

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This Master's thesis has been examined and approved by the following members of the student's committee.

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Mankato, Minnesota
May, 2020

Abstract

Lack of engagement in pleasant activities and negative mood are two factors that decrease quality of life (QoL) for older adults with moderate to severe cognitive impairment. As enhancing QoL has become a primary treatment outcome for individuals with cognitive impairment, investigation into the ability of nonpharmacological interventions to increase engagement and positive mood has come to the forefront of research. Cognitive training is a nonpharmacological intervention that utilizes manualized techniques with the primary goal of enhancing different areas of cognitive function. Although the cognitive benefits of the programs have been widely investigated and established, the potential benefits that cognitive training programs may have on increasing engagement in activities and reducing negative affect have been largely unstudied. This study investigated the effects of a cognitive training program on engagement in activity and affect for individuals with moderate to severe cognitive impairment through behavioral observation. An alternating treatment design was utilized to compare engagement and affect during cognitive training program sessions and regularly scheduled activities at a residential community for older adults. Results indicated the utility of cognitive training programs for increasing active engagement during the program sessions while affect and QoL remained unchanged.

Introduction

Despite significant efforts to the contrary, a cure for dementia has yet to be discovered. Although efforts continue to identify a definitive cure, researchers have paid increasing attention to creating interventions that improve quality of life (QoL). In fact, research suggests that improving QoL should be the primary goal of treatment for individuals with this disorder rather than focusing on cognitive outcomes (Whitehouse & Rabins, 1992; Whitehouse & George, 2008). Many different forms of nonpharmacological interventions exist for enhancing safety, increasing independence, and improving quality of life in persons with dementia (PwD; Douglas et al., 2004). One set of nonpharmacological interventions, called cognitive training, has received more attention in recent years and preliminary evidence suggests promise for improving QoL for PwD (Mate-Kole et al., 2006, Giovagnoli et al., 2017). As the number of individuals developing dementia increases, the importance of evaluating nonpharmacological interventions to promote their well-being also increases.

Overview of Dementia

The population of older adults in the United States is on the rise. The number of individuals over the age of 65 is projected to increase from 63 million currently to 114 million by 2060 (United States Census Bureau, 2017). As the age of the population increases, so too does the amount of people who experience cognitive decline as the likelihood of developing dementia increases with age (Murman, 2015).

Broadly, dementia describes a set of symptoms indicative of cognitive and psychological changes disrupting everyday functioning (World Health Organization, 2019). According to the World Health Organization, 50 million people currently suffer from dementia with nearly 10 million new cases every year (World Health Organization, 2019). In the United States, an

estimated 5 million people have a diagnosis of Alzheimer's disease, the most common type of dementia (Alzheimer's Association, 2020).

Dementia is a heterogeneous disorder involving several phenotypes with an array of etiologies that can be partitioned into three categories: degenerative, stable, and reversible (Rubbert et al., 2014). Degenerative dementia is the most common. Characterized by the progressive deterioration of cognitive functioning, degenerative dementia leads to significant functional disability (Ruppert et al., 2014). The most common form of dementia, Alzheimer's disease, is a degenerative dementia (Schwarz & Frolich, 2013; Ruppert et al., 2014). Stable or slow progressive dementias include disorders such as cerebrovascular dementia and Parkinson's disease with dementia, and they are different from degenerative dementia in that these disorders are characterized by stable cognitive deficits that gradually increase in severity over time (Ruppert et al., 2014). Lastly, reversible dementia involves medical conditions of which dementia is a symptom. These symptoms begin to abate once the cause of the disease is treated. Examples of reversible dementias are hypothyroidism, vitamin deficiencies, and depression (Ruppert et al., 2014). Regardless of the classification and mechanisms of the disorder, the symptomatology is generally consistent across dementias; although some deficits are more common in specific disorders.

Because of the overlap in symptomatology across the disorders, dementia is best understood through the conception of stages of severity. It is generally accepted in the literature that there are seven stages of dementia (Sclan & Reisberg, 1992; Reisberg et al., 1982) ranging from no dementia to extremely severe. The cognitive and functional deficits prevalent at each stage are similar across disorders.

In the first stage, no impairment is experienced, meaning the individual is mentally healthy for their age. The individual experiences no objective or subjective deficits to cognitive functioning or ability to perform instrumental of daily living (IADLs) or activities of daily living (ADLs; Reisberg et al., 1982).

The second stage involves healthy aging with no dementia diagnosis or cognitive impairment (Reisberg et al., 1982). To some degree, cognitive decline accompanying age is normal. Age associated cognitive decline, as termed in the literature, constitutes non-pathological cognitive changes that individuals experience with age (Story & Attix, 2010; Deary et al., 2009). Typically, older adults can expect to experience a decline in critical cognitive functions like processing speed (Salthouse, 1993), memory (Craik & Salthouse, 2008; Harada et al., 2013), and attention (Carlson et al., 1995; Salthouse et al. 1995) that do not interrupt their ability to perform IADLs and ADLs.

Mild cognitive impairment (MCI) is the term used to describe stage three. This term defines a cognitive state in which the individual is not demented but is experiencing impairment in cognitive functioning in one or more cognitive domains without the presence of disability in IADL/ADL performance (Smith & Bondi, 2013). The National Institute of Aging-Alzheimer's Association task force published four diagnostic criteria for MCI to distinguish it from dementia (Albert et al., 2011). The four criteria are: 1) Evidence of concern regarding a change in cognition; 2) Evidence of lower performance than what is to be expected on one or more cognitive domains; 3) Ability to independently perform IADLs and ADLs; and 4) Not meeting the criteria for dementia. Concerns regarding change in cognition can be observed in a variety of cognitive domains including memory, executive function, language, attention, and visuospatial skills (Smith & Bondi, 2013). Although concern about forgetfulness is not a necessary precursor

for a diagnosis of MCI, it is the most common and the most indicative of an eventual conversion to dementia (Schmidtke & Hermeneit, 2008). When MCI includes concern about memory loss, it is referred to as amnestic MCI (Schmidtke & Hermeneit, 2008). Hallmarks of this stage include forgetfulness, decreased ability to concentrate, insufficient work performance, and word finding problems (Reisberg et al., 1982).

Early stage cognitive impairment, stage four, is difficult to distinguish from MCI at times (Smith & Bondi, 2013). Limitations in the ability to perform IADLs is the main distinguishing factor between stages three and four. For example, in stage four, it becomes more difficult to manage finances and drive in unfamiliar places without getting lost (Reisberg et al., 1982). Behavioral changes also occur. Across dementias, verbal aggression becomes more prominent (Nagaratnam et al, 1998; Weiner et al., 2005). Individuals with Alzheimer's disease may experience less energy, become more socially withdrawn, be more apathetic and have a greater dependence on others (Schoenberg & Scott, 2011; Weiner et al., 2005) while dementia with Lewy bodies patients are more likely to experience visual hallucinations and depression (Borroni et la., 2008). Generally, withdrawal from family is evident as communication becomes more difficult and the PwD is becoming more aware of their deficits (Reisberg et al., 1982). Neuropsychologically, memory impairment and dyssomnia are the first indicators of Alzheimer's disease while psychomotor slowing, impaired attention/concentration, and constructional skills deficits are prevalent in vascular dementia (Schoenberg & Scott, 2011). Memory loss is typically reserved for recent episodic memories, or memory for past events and their details, while semantic memory, or memory that aids in the understanding of words, objects and events, remains unscathed (Almkvist et al., 1998; Rogers et al, 2006). A hallmark of Alzheimer's disease in this stage is the inability to gain from recognition cueing (Tuokko et al.,

1991). Individuals in this stage will sometimes try to minimize their cognitive problems and confabulate to cover memory deficits (Schoenberg & Scott, 2011).

The next stage, moderately severe cognitive decline, or stage five, illustrates more predominate and readily observed cognitive and behavioral deficits. In this stage, memory loss becomes exceptionally prominent and deficits in semantic memory are readily observable (Reisberg et al., 1982; Rogers et al., 2006). Additionally, functional communication becomes difficult and, in some cases, impaired (Fromm & Holland, 198). Independence in ADLs also decreases significantly to the extent that at least some assistance is generally necessary to complete routine tasks like bathing or dressing (Galasko et al., 2005). Behaviorally, depressive and anxious symptoms begin to arise more prominently, especially for individuals with vascular dementia (Schoenberg & Scott, 2011).

Stage six, severe cognitive decline, involves complete dependence on others to perform activities of daily living (Reisberg et al., 1982). Memory deficits increase and expand to include forgetfulness of family members and very recent events (Reisberg et al., 1982). However, memories of early life are generally intact. Language deficits are more pronounced with significant difficulty in verbal comprehension and participation in communication with some dementias showing decline in non-verbal communication (Rousseaux, 2010). In Alzheimer's disease, confrontation naming becomes markedly impaired along with verbal fluency and semantic fluency (Schoenberg & Scott, 2011). Behaviorally, personality and emotional changes become more prevalent. Agitation, confusion, wandering, apathy, and emotional blunting are common manifestations of symptoms for Alzheimer's disease at this stage (Schoenberg & Scott, 2011).

The last stage, stage seven, is indicated by the inability to communicate with others and complete assistance in activities of daily living (Hendryx-Bedalov, 2000). For individuals with Alzheimer's disease, psychomotor deficits appear, and individuals experience the hallmark of global cognitive impairment for Alzheimer's dementia: agnosia, apraxia, and aphasia (Kramer & Duffy, 1996). Behaviorally, individuals with Alzheimer's dementia may begin to experience hallucinations and delusions (Schoenberg & Scott, 2011).

Dementia treatment is economically brutal. Caring for individuals with dementia has a national cost of $305 billion a year with $244 billion worth of unpaid care provided by a family caregiver (Alzheimer's Association, 2020). Because of the economic and emotional burden that accompanies caring for a loved one, many family members elect to place their loved one in residential communities (Etters et al., 2008). In fact, about 40% of individuals residing in nursing homes have a diagnosis of Alzheimer's disease or another dementia (Caffrey et al., 2010). The role of nursing home caregivers is to provide a caring and stimulating environment to their residents in an effort to increase their QoL despite significant cognitive changes (Allen, 2011).

Quality of Life for PwD

Quality of life is best understood as the combination of three domains: social, psychological, and physical (Brod et al., 1999). It is an evaluative term to understand the perception of one's life in general (Brod et al., 199). Therefore, this multidimensional concept has different implications for individuals of different backgrounds. When asked subjectively about what factors are most important for QoL, PwD reported improved mood, engagement in pleasant activities, and the ability to perform ADLs (Logsdon et al., 2008). Interestingly, when caregivers were asked the same question for their loved one, caregivers selected improved mood, engagement in pleasant activities, and cognitive functioning as the most important (Logsdon et

al., 2008). The overlap in answers implicates the role of mood and engagement in pleasant activities as important means to improve QoL.

Mood. As mentioned above, one factor that greatly influences QoL for PwD is mood. Emotional changes, including increased depression and anxiety, are common symptoms of dementia during all stages (Reisberg et al, 1982). PwD also experience higher rates of loneliness and sadness than their less cognitively impaired peers (Holmen et al., 1999). Moreover, when investigating individuals residing in nursing homes over a period to time, reductions in QoL were predicted by increases in depression, anxiety, and cognitive deterioration (Hoe et al., 2009). Because of the overwhelming role mood plays in QoL, intervention efforts have shifted toward understanding how nonpharmacological interventions increase mood, and thus QoL, for PwD.

Engagement in Pleasant Activities. Engagement in purposeful and stimulating activities was also noted as a significant domain for increasing QoL for PwD. The need to engage in meaningful and stimulating activities is innate to all humans, related to health and survival, and does not dissipate with age or cognitive deterioration (Wilcock, 1993). In fact, for PwD, engagement in activities is positively correlated with pleasure and unrelated to affect and agitated behavior (Cohen-Mansfield et al., 2012). Furthermore, meaningful participation in activities indicates independence, the development of satisfying relationships, and the maintenance of positive well-being (Chung., 2004).

Cognitive functioning plays a significant role in frequency and range of engagement. Individuals with lower levels of cognitive impairment actively engage in activities for a longer amount of time, are able to attend to the stimuli longer, and have a more positive attitude toward stimuli compared to their more cognitively impaired peers (Cohen-Mansfield et al., 2010). Furthermore, the activities of which PwD attend to differ depending on cognitive functioning.

Mildly impaired individuals spend most of their time involved in therapeutic or leisure activities with less time spent engaging in passive activities (Chung, 2004). However, PwD exhibiting severe cognitive deficits demonstrate higher frequencies of engagement in socially withdrawn behaviors, negative behaviors, and self-stimulation (Chung, 2004). Furthermore, behaviors that promote socialization and well-being are generally sparse (Chung, 2004). Taken together, the evidence suggests that as cognitive impairment increases, engagement in activities decreases, leaving more severely impaired individuals vulnerable to the negative effects of reduced engagement, such as lower QoL.

Cognitive Training Programs

One non-pharmacological intervention that has been substantially studied in the literature is cognitive training. These programs involve the standardized presentation of tasks designed to increase the functioning of cognitive domains typically impaired by dementia such as memory, attention, and problem solving (Bahar-Fuchs et al., 2013). The theory behind these programs is that the effects of practice will generalize to different settings beyond the training courses (Bahar-Fuchs et al., 2013).

The research on the effectiveness of these programs has generally been geared demographically toward PwD experiencing mild to moderate impairment. Additionally, primary outcome measures tend to focus on how these programs improve cognitive functioning with less regard to behavioral changes. A wide body of literature suggests increases in global cognitive functioning are relatively common while improvements in specific domains are less reliable (Kallieo et al., 2017).

However, some researchers have investigated the impact that these programs have on both cognitive and behavioral outcomes for individuals with mild to moderate impairment.

Giovagnoli and colleagues (2017) randomized 64 participants into three treatment groups: cognitive training, music therapy, and neuroeducation. Neuropsychologically, the cognitive training group showed clinical improvements for verbal initiative and episodic memory. The music therapy and neuroeducation groups showed no changes to any cognitive measures. Behaviorally, self-reports on anxiety, depression, and socialization indicated improvement in all groups for trait anxiety and depression while the music therapy and neuroeducation groups showed a significant increase of interpersonal relationships. This study suggests that for individuals with mild to moderate impairment, a cognitive training program was able to positively impact mood, thus potentially increase QoL.

Significantly less research has been conducted on the cognitive and behavioral outcomes for individuals with moderate to severe cognitive impairment. A study conducted by Mate-Kole and colleagues (2007) investigated the effects of a cognitive training program on six older adults with a diagnosis of moderate to severe dementia. Participants were administered a variety of neuropsychological assessments measuring overall cognitive ability along with specific cognitive domains including attention and concentration, memory, language, spatial skills, reasoning, and visual motor speed and tracking. Additionally, behavioral outcomes were assessed to measure depression, quality of life, and functional activities through caregiver report. All participants were administered the battery of tests before and after the six-week intensive training course which used a combination of two established cognitive training programs. One program was an interactive group training class utilizing hands-on activities focused on memory, attention, cognitive flexibility, manual dexterity and problem solving. In conjunction with this, a computerized training program was used to train attention, visual spatial and motor-skills, problem solving, memory, and visual discrimination. Results indicated improvements in global

cognitive functioning along with short-term memory, visual motor coordination, psycho-motor speed, cognitive flexibility, and attention. Furthermore, positive behavioral changes were observed with improved socialization and initiation, alertness, and affect reported qualitatively by nursing home staff. These, taken with improvements in functional activities, signify a positive impact to QoL (Mate-Kole et al., 2007).

A similar study conducted by Buchanan and colleagues (2019) aggregated data from four facilities who independently implemented the same cognitive training program. Twenty-three individuals experiencing moderate impairment participated in the study. Cognitive factors including global cognitive ability, attention, visual and verbal memory, visual spatial skills, processing speed, executive functioning, and language along with behavioral factors encompassing depression, QoL, agitated behavior, and daily functioning were measured prior to and after the implementation of the cognitive training program. Results indicated improvements in general cognitive functioning, divided attention, immediate verbal recall, immediate visual recall, visual recognition, perceptual speed, and executive functioning. No improvements to behavioral outcomes were found. Moreover, small declines in agitated behavior, QoL, and daily functioning were observed. The authors report that this is consistent with previous research suggesting that the benefits gained from an increase in cognition do not always generalize everyday functioning (Buchanan et al., 2019).

The ambiguity and inconsistency in outcome measures regarding behavioral functioning after participation in a cognitive training program makes it difficult to conceptualize the behavioral effects of the program. However, it is important to approach the question of changes to behavioral function through different methodologies to truly determine the effects. A different

methodology and means of data collection may better capture behavioral changes resulting from engagement in these programs than caregiver and self-report measures would.

Purpose of the Current Study

Most studies investigating the effects of cognitive training primarily measure the effects these programs have on cognition with a secondary emphasis on measuring important non-cognitive constructs such as affect, QoL, or engagement. When non-cognitive constructs are measured, they typically rely on caregiver reports, given that PwD may be unable to complete self-report measures reliably and accurately. Although caregiver reports are valuable sources of information, they may be biased and thereby inaccurately report the experience of the PwD. For example, research suggests that patient/caregiver agreement is impacted by several patient factors including functional and cognitive level, years of education, and severity of depression (McPhail et al., 2008; Williams et al., 2006), while caregiver factors impacting patient/caregiver agreement are caregiver age, financial situation, and valuation of life as a whole (Arons et al., 2013).

Understanding the effects of cognitive training on measures of cognition is important but may only capture some of the potential benefits of these programs, particularly for more severely impaired individuals. For example, it may be unrealistic to expect that cognitive training will greatly affect cognitive functioning in more severely impaired PwD. Alternatively, cognitive training programs may have benefits on non-cognitive outcomes such as affect or increased engagement in activity, which are important factors related to QoL. Therefore, it is important to determine if cognitive training programs produce benefits on measures of behavior and affect. In addition, it is important to determine if cognitive training programs produce greater

improvements on these measures of behavior and affect compared to less expensive and less time-consuming activities typically offered in long-term care settings.

Consequently, the purpose of this study was to investigate the effect of a cognitive training program on mood and engagement for older adults with moderate to severe cognitive impairment. One novel aspect of this study was that it utilized direct observation methods to measure affect and engagement during activities as they were occurring. The use of direct observation allowed for the collection of direct samples of participant behavior during activities to determine how participants responded to the content of the program. The methodology has the advantage of minimizing the problems associated with retrospective caregiver reports of participant behavior during the cognitive training classes. Another purpose of the study was to determine if cognitive training programs produced greater engagement and positive affect compared to activities typically offered in long-term care facilities. There were two main hypotheses. First, it was hypothesized that the cognitive training program would elicit more active engagement, thereby reducing passive and no engagement, compared to engagement observed in normally scheduled activities. Second, it was hypothesized that the cognitive training program would increase positive affect, thereby decreasing negative and neutral affect, compared to affect observed in normally scheduled activities.

Methods

Participants

Participants were recruited from an assisted living facility in Southern Minnesota. Prior to recruitment, facility staff familiar with the resident community were asked to identify individuals they believed met inclusion criteria. To qualify for the study, participants had to be either experiencing moderate to severe cognitive impairment as evidenced by a score of 77 or below on

the Modified Mini Mental State Examination (Teng & Chui, 1987) or have a diagnosis of dementia established by a review of medical records by staff. Additionally, participants had to regularly attend activities presented by the activities department. Participants were not considered for the study if they met any of the following exclusion criteria:

1. The presence of a serious health problem, other than dementia, that could compromise their ability to participate in the cognitive training classes.
2. The presence of a significant disabilities (e.g. blindness, deafness, a significant language impairment) that could prevent the individual from participating.
3. The regular use of medications that could potentially affect functioning such as narcotic analgesics. A caveat to this is that participants could participate if they were taking the medications specifically for dementia (e.g. cholinesterase inhibitors) and met the inclusion criteria.
4. If the individual's level of cognitive functioning was not severe enough (i.e. above a 77 on the 3MS).

Five participants met inclusion criteria and had a family member provide informed consent to participate in the study (See Appendix A for copy of consent form). All participants, four of which were female, identified as Caucasian. Four of the five participants resided in the memory care unit while one participant lived on the assisted living side of the same residential facility. Ages of the participants ranged from 87 to 91 (M = 89.2, SD = 1.48). Participant's 3MS score ranged from 23 to 66 (M = 39, SD = 19.92). Two participants had a medical diagnosis of unspecified dementia without behavioral disturbance while one had a diagnosis of unspecified dementia with behavioral disturbance. One participant had a comorbid diagnosis of unspecified dementia without behavioral disturbance and Alzheimer's disease. Lastly, one participant had no

dementia diagnosis, but scored in the severe range for cognitive impairment on the 3MS. See Table 1 for a summary of participant information.

Table 1

Participant Characteristics

Participant	Age	Gender	Diagnosis	3MS Score
Participant 1	90	Female	No Diagnosis	23 (severe range)
Participant 2	87	Female	Unspecified dementia without behavioral disturbance	42 (severe range)
Participant 3	91	Female	Unspecified dementia with behavioral disturbance	66 (moderate range)
Participant 4	89	Female	Unspecified dementia without behavioral disturbance and Alzheimer's Disease, Unspecified	N/A
Participant 5	89	Male	Unspecified dementia without behavioral disturbance	25 (severe range)

After the five participants were recruited, staff members familiar with the participants were recruited to complete questionnaires and interviews on behalf of the participants. In order to meet inclusion criteria, the staff member had to have worked with the resident nearly every day for at least two months. One staff member was identified as meeting the criteria. This staff member consented to participate in the study (see Appendix B for a copy of the consent form).

Materials

Cognitive Assessment. Severity of cognitive impairment was assessed using the Modified Mini-Mental State Examination (3MS; Teng & Chui, 1987), a widely used screening tool for dementia. This is a standardized measurement that assesses several cognitive domains (e.g. immediate and delayed memory, executive function, language, and visual spatial ability). Scores on the 3MS range from 0-100, with lower scores being indicative of more severe cognitive impairment. Key psychometric properties of the 3MS have been widely established. Internal consistency was high for individuals with dementia (α= 0.88; Tombaugh et al., 1996) with test-retest reliability being excellent (0.91 to 0.93; Teng et al., 1990). It is also a valid test with high sensitivity (.96) in differentiating individuals with severe dementia from their non-affected peers (Tombaugh et al., 1996).

Engagement. In order to measure the degree to which participants were engaged in activities, direct observation methods were used based on previous studies (e.g. Judge, Camp & Orsulic-Jeras, 2000). Three levels of engagement were assessed. *Active engagement* was the main outcome variable for engagement and was operationally defined as "any motor or verbal behavior exhibited in response to the activity in which the client was taking part" (Judge, Camp & Orsulic-Jeras, 2000, pg. 43). Examples of active engagement include singing-along during music therapy or placing a marker while playing Bingo. *Passive engagement* was operationally defined as, "listening and/or looking behavior exhibited in response to the activity the client was participating in" (Judge, Camp & Orsulic-Jeras, 2000, pg. 43). Examples of passive engagement include actively watching another person complete the activity or looking at a person talking during a discussion. *Non-engagement* was operationally defined as "staring off into space or another direction away from the activity, sleeping, or any motor and or/verbal behavior activity in response to an activity the client was not currently participating in" (Judge, Camp & Orsulic-

Jeras, 2000, pg. 43). Examples of non-engagement include staring at the floor or wall and playing with own clothing.

Affect. In order to measure affective responses to activities, direct observation methods were used based on previous literature (e.g. Lawton, Van Haitsma, & Klapper, 1996). Definitions of affective responses fell into two main categories: positive and negative. *Positive affect* was the primary outcome variable for affect and was operationally defined as the participant showing any overt signs of pleasure such as smiling, laughing, or nodding along. *Negative affect* was operationally defined as any overt signs of displeasure such as clenched teeth, physical aggression, furrowed brow, crying, moaning, or mouth turned down at the corners. If the participant did not demonstrate overt signs of positive or negative affect, neutral affect was recorded.

Quality of Life. The QUALIDEM is a 40-item questionnaire analyzing nine areas of functioning related to quality of life for individuals with dementia (Ettema, Droes, de Lange, Mellenbergh, & Ribbe, 2007). The nine areas assessed include: care relationship, positive affect, negative affect, restless tense behavior, positive self-image, social relations, social isolation, feeling at home, and having something to do. The QUALIDEM is completed by a staff member who works closely with the resident and has been found to have adequate internal consistency ($\alpha = 0.59$ to 0.89).

Qualitative data. In an effort to understand idiographic changes in participant engagement, affect, and quality of life, members of the assisted living home staff were asked open-ended questions regarding participant engagement in day-to-day activities, general communication with staff and peers, emotional expression, and general emotional state. To ensure the care member had acute knowledge of the participant's general functioning, only

caregivers who had a working relationship with the participant for at least two months were interviewed. Refer to Appendix C for interview questions.

Research Design

An alternating treatment design with a baseline phase was employed. The alternating treatment design utilizes rapid alteration of two conditions with a single subject where each time a client is observed they are receiving the opposite condition (Barlow & Hayes, 1979). In this case, the alternating conditions were the cognitive training sessions and regular activities.

Procedure

Observer training. Three research assistants were trained to collect data by the primary researcher. Procedures for observer training were adapted from Hartman & Wood (1990). The first step included orientation and learning the observation training guide. During this stage, all assistants met to discuss the setting, personnel to contact at the assisted living facility, number of participants, informed consent, and confidentiality. Assistants were also provided a manual that outlined the study design, operational definitions, and observation schedule as well as an example of the record form. Assistants memorized the operational definitions and observation schedule for a quiz the following week. The second step was the first criterion check. During this phase, assistants were quizzed on the operational definitions and observation schedule. The assistants and primary researcher also discussed different hypothetical observations and concluded how those situations would be recorded. Once informed consent was attained for the participants, all assistants began the third step which involved in situ practice. Practice observations were conducted during participant's participation in regularly scheduled activities. All assistants collected data in groups of two until all assistants felt comfortable with the observational process. All observers attended between one and four practice sessions.

Throughout the data collection process, retraining and recalibrating sessions occurred as needed to discuss discrepancies or questions in the data and to assess for observer drift and bias.

Baseline. Direct observation sessions were conducted over a two-week period during regularly scheduled activities at the assisted living facility. The activities director informed the researchers as to which regularly scheduled activities were frequented by participants. Behavioral observations were conducted for the entirety of each activity, which typically lasted between 15 and 60 minutes. Researchers recorded affect and engagement using a 10-second partial interval observation schedule, which included five seconds between each interval in order to record data. If more than one study participant attended the activity, the researcher recorded data for the individual closest to their right-hand first, then rotated clockwise until all participants had been observed. This procedure was repeated until the activity was completed.

During baseline, participants were administered the 3MS and a staff member was asked to complete the QUALIDEM and the qualitative interview.

Experimental Phase. The experimental phase involved collecting data during cognitive training classes as well as regularly attended activities. The cognitive training program was conducted three days per week over eight weeks. In order to obtain an adequate sample of data throughout the cognitive training class, data were scheduled to be collected during the following cognitive training classes: 1) classes 1 or 2; 2) classes 5 or 6; 3) classes 10 or 11; 4) classes 15 or 16; 5) classes 20 or 21; and 5) classes 23 or 24. Throughout the experimental phase, observations during regularly scheduled activities continued in the same manner as was done in baseline. Observations occurred in conjunction with cognitive training observations, and, when possible, occurred on the same day as cognitive training sessions. When this was not possible, regularly scheduled activities were observed one to two days after cognitive training sessions. Observation

procedures used during the baseline phase were also used during the experimental phase of the study.

Interobserver Agreement. A second observer independently collected data at 16% of the data observation sessions. Interobserver agreement (IOA) scores were calculated on the dependent variables of engagement and affect separately. Interval agreement was calculated by dividing the number of agreements per interval by the number of agreements plus disagreements and multiplying by 100. A score of 80% indicates standard agreement. The mean IOA for engagement was 88.9% (SD = 11.12; range, 75.4% - 100%) while the mean IOA for affect was 97.0% (SD = 4.80; range, 89.9% - 100%).

Intervention

Active Mind (AM) was the cognitive training program utilized in the experimental phase of this study. AM was developed by the New England Cognitive Center (NECC), a non-profit company with the goal of creating and disseminating innovative brain training programs to maximize mental functioning for older adults with and without cognitive impairment. AM was created for individuals with moderate to severe cognitive impairment. The program consists of 24, one-hour group training sessions that occurred three times a week for eight weeks. The manualized sessions incorporated a variety of paper and pencil activities targeting cognitive domains that are often impaired for individuals with dementia including reaction time, psychomotor speed, attention and concentration, memory, visual-spatial acuity and language along with problem solving and executive functioning. The activities were created to be challenging, enjoyable, social, and appropriate for adults. All in-session activities were constructed in a way that requires little time for teaching, so more session time can be devoted to engaging in activities. Each activity requires 5 to 12 minutes to complete. Additionally, all

activities incorporated key educational principles to promote learning including graduated challenge, repetition, and reinforcement.

Members of the activity staff at the assisted living facility attended a training presented by the NECC to ensure proper implementation of the program. The activities director of the assisted living facility and other activity staff led all AM sessions. NECC staff were available throughout the study to answer questions and provided additional training and support if necessary.

Results

Data collection was prematurely suspended due to extenuating global circumstances (see World Health Organization, 2020 for reference). In all, 20 of the 24 cognitive training sessions were administered, with access to participants being restricted prior to session 18. Therefore, observational data was collected for a maximum of seven baseline sessions (range, 2 - 7), four active mind sessions (range, 2 - 4), and four regularly scheduled activities (range, 0 - 4). A pre- and post-intervention questionnaire and interview was administered during the baseline phase and after session 20 of the AM program.

Data Analysis

Individual and aggregated data were analyzed across all participants. For all dependent variables, the percentage in which the behavior occurred during each data collection session was calculated. In order to determine the effects of the AM program on engagement and affect, a combination of visual inspection and statistical trend analysis was used. Visual analysis is a widely used method for understanding and interpreting results for small-n research (Barlow et al., 2009). Because the methodology in this study used an alternating treatment design, visual inspection was performed in two ways. First, baseline data was compared to the experimental

observations to determine contrasts between the phases. Second, the two conditions within the experimental phase were compared. To conservatively conclude that one condition is superior to the other, research suggests that the two conditions should be completely divergent (Barlow et al., 2009). However, because this data set also had overlap between the conditions, a statistical analysis was employed to provide information on the effect size. For this study, the percent of non-overlapping data (PND) was used (Scruggs et al., 1987). PND is calculated by first identifying the most extreme score in the baseline. Next, the researcher identifies the total number of scores in the experimental phase that exceeds the highest score in the baseline. Finally, the number of total scores exceeding the highest score in the baseline is divided by the total number observations in the experimental phase and multiplied by 100 to get the PND effect size. A PND of less than 50% reflects an unreliable treatment. A PND of 50% to 70% indicates questionable effectiveness, while a PND of 70% to 90% reveals that the treatment is fairly effective. A PND greater than 90% signifies a highly effective treatment.

Aggregated Results

Observational Data

Data was aggregated by taking the median percentage of the observation session across all participants. Individual data per observation session can be located in Appendix D. Participation in baseline varied. Baseline observations one and two were aggregated across all five participants. Baseline sessions three and four were aggregated across four participants. Baseline sessions five and six were aggregated across two participants, and baseline seven only had one participant. Participation within the experimental phase also varied. During the first AM observation session, all five participants were present, while data was only collected for three participants during the regular activities. During the second AM observation session, four

participants were present, while only two participants attended regular activities. Five participants attended the third AM observation as well as the regular activities. Finally, three participants attended the fourth AM observation and three attended regular activities.

Active Engagement. Figure E1 in Appendix E depicts the median percentage of active engagement across all participants. Active engagement occurred between 2% and 67.5% of intervals during baseline. During the alternating treatment phase, active engagement occurred between 50% and 58.8% of intervals during the AM classes and occurred between 5.3% to 50.9% of intervals during regularly scheduled activities.

A visual analysis of the data indicated an unstable baseline with an increase in active engagement at session five. It is clear from a comparison of baseline to the AM observations that AM elicited more active engagement. Furthermore, a comparison of the conditions within the experimental phase yields no overlapping data with higher rates of active engagement in the AM sessions. A PND analysis, however, indicated an unreliable treatment effect for AM (PND = 0.0%). Unfortunately, this statistic is highly influenced by outliers, which occurred in session six of baseline, leading to the results of the statistical analysis signifying an unreliable treatment, even though the visual analysis indicated clear superiority of the AM session.

Passive Engagement. The median percentage for passive engagement across intervals is depicted in Figure E2 in Appendix E. Baseline observations indicated the occurrence of passive engagement between 6.3% and 94.7% of intervals. During the alternating treatment phase, passive engagement occurred between 21.9% and 39.7% during the AM classes, while it occurred between 45.9% and 67.2% of the time during regular activities. It is important to note that a decrease in passive engagement is a hypothesized outcome.

A visual analysis of the data again indicated an unstable baseline. However, in the experimental phase, trends are readily established. A visual analysis between conditions indicated a clear divergence between the regular activities and AM sessions revealing that the AM sessions produce less passive engagement. A PND analysis, however, yielded an unreliable treatment effect for AM (PND = 0.0%). The high variability in the baseline sessions affects the statistical power of the PND. Although the PND indicated an unreliable treatment, a visual analysis of the experimental phase indicated clear divergence suggesting the superiority of the AM classes to decrease passive engagement.

No Engagement. The median percentage of no engagement is presented in Figure E3 in Appendix E. Seven baseline observations were observed with no engagement occurring between 8.7% and 78.7% of intervals. During the experimental phase, no engagement occurred between 2.6% and 13.7% of intervals in the AM classes while it occurred between 3.4% and 24.6% of intervals during the regularly scheduled activities. Similar to passive engagement, a decrease in no engagement was hypothesized.

A visual analysis again indicates an unstable baseline with an increase in no engagement at session six. Trends begin to establish during the experimental phase. Clear overlap is observed during the alternating treatment design phase. The AM classes revealed a greater decrease in no engagement. Furthermore, a PND analysis indicates that AM is a fairly effective treatment (PND = 75%) for reducing no engagement.

Positive Affect. Figure E4 in Appendix E depicts positive affect. Seven baselines were taken with positive affect occurring between 0% and 6.8% of intervals. During the alternating treatment phase, positive affect occurred between 1.8% and 10% of intervals during the AM classes and between 1.3% and 24.6% of intervals during regularly scheduled activities.

A visual analysis indicates minimal difference between the baseline sessions and the experimental sessions. The clear overlap of the AM classes and regular activities signified no difference between the conditions on positive affect. Statistically, a PND analysis indicated that the AM classes were an unreliable treatment (PND = 25%) for increasing positive affect.

Negative Affect. The median percentage of negative affect across all intervals is depicted in Figure E5 in Appendix E. Seven baselines were taken, all of which indicated a median percentage of 0% for negative affect. During the experimental phase, negative affect occurred during 0% of all intervals during the AM sessions while it occurred between 0% and 0.9% of intervals during regularly scheduled activities. The desired outcome is a decrease in negative affect. However, because negative affect was generally at 0%, a floor effect is in place.

A visual analysis reveals no changes in negative affect from baseline to the experimental phase. Additionally, no differences between the AM sessions and the regularly scheduled activities are readily observed. Moreover, a PND analysis signifies that AM is an unreliable treatment (PND = 0.0%) for negative affect.

Neutral Affect. Neutral affect was the most frequently observed affect across the participants and is depicted in Figure E6 in Appendix E. Seven baseline observations reveal that neutral affect occurred between 91.9% and 100% of intervals. Four AM session observations signify that neutral affect occurred during 90% to 100% of intervals while it occurred between 75.4% and 98.7% of intervals for regularly scheduled activities. The desired outcome for this dependent variable is a decrease in neutral affect.

A visual analysis suggested some overlap between the AM classes and regular activities. However, regular activities elicited less neutral affect than the AM classes. Statistically, a PND

analysis revealed that AM classes were an unreliable treatment (PND = 25%) for reducing neutral affect. Table 2 summarizes all findings for the aggregated data.

Table 2

Summary of Findings by Analysis for Aggregated Data

	Visual Inspection		PND Statistic	
	Baseline	Alternating Treatments	Effect Size	Summary
Active Engagement	+	+	0.0%	Unreliable Treatment
Passive Engagement	-	+	0.0%	Unreliable Treatment
No Engagement	+	+	75%	Fairly Effective Treatment
Positive Affect	-	-	25%	Unreliable Treatment
Negative Affect	-	-	0.0%	Unreliable Treatment
Neutral Affect	-	-	25%	Unreliable Treatment

Note. *Baseline* indicates a visual analysis comparing the baseline to the cognitive training program. *Alternating treatments* indicates the comparison of regular activities and the cognitive

training program within the experimental phase. *A* "+" indicates positive results while a "-" means there was no change

Questionnaires

The QUALIDEM is a measure of QoL in which high scores are indicative of a greater QoL. Because of the small sample size, inferential statistics were not appropriate. Therefore, descriptive statistics will be reported. Overall QoL decreased from a mean of 81.80 (*SD* = 19.15) pre-intervention to 67.40 (*SD* = 13.22) post-intervention. A Table 3 illustrates a summary of group findings. Individual results can be found in Appendix F.

Table 3.

Change in Scores of Aggregated Data for QoL Measure from Pre- to Post-Intervention

	Pre-Intervention		Post-Intervention		
Subscale	Mean	SD	Mean	SD	Difference
Care Relationship	18.6	3.8	17.4	4.2	-1.20
Positive Affect	12.6	3.9	11.6	3.0	-1.00
Negative Affect	6.0	2.5	4.0	1.6	-2.00
Restless Behavior	5.8	2.2	4.6	1.3	-1.20
Positive Self-Image	5.8	1.6	4.4	0.9	-1.4
Social Relationships	14.4	3.1	12.4	3.1	-2.0
Social Isolation	6.8	1.9	6.0	1.2	-0.8
Feeling at Home	8.4	3.9	4.0	3.2	-4.4
Something to Do	3.4	0.9	3.0	0.7	-0.4
Total	81.8	19.2	67.4	13.2	-14.4

Note. The "-" indicates a decrease in the quality of life score from pre- to post-intervention ratings.

Qualitative Data

An interview with the leader of the AM classes was conducted pre- and post-intervention to gain insight into changes in engagement, communication, emotional expression, and mood. In terms of engagement in regularly scheduled activities, it was reported that after the AM classes were concluded, activity attendance and engagement stayed the same. Regarding communication with peers, it was reported that participants communication between participants in the AM classes increased outside of the class; however, communication with nonparticipants stayed the same. Within the AM session, it was reported that negative affect was generally experienced in the expression of anxiety and doubt due to the difficulty of the classes. Participants would be upset, anxious and tearful prior to beginning the classes indicating the program may have been too challenging. Generally, emotional state did not change from pre- to post-intervention.

Individual Results

Participant One. Participant one attended 85% of the 20 total AM classes offered. During the data collection period, four baseline intervals along with four AM classes and four regular activities during the experimental phase observations were collected.

Clear differences were observed at all three levels of the dependent variable of engagement. For active engagement, depicted in Figure G1 of Appendix G, a visual analysis revealed no overlap between the AM classes and the regular activities indicating that AM produced more active engagement than the regularly scheduled activities. Additionally, a PND analysis signifies that AM is a highly effective treatment (PND = 100%) for increasing active engagement. For passive engagement, illustrated in Figure G2 in Appendix G, a visual analysis

indicated no overlap between the AM sessions and regularly scheduled activities showing that the AM sessions resulted in less passive engagement than the regular activities. A statistical analysis revealed that AM is a fairly effective treatment (PND = 75%) for reducing passive engagement. Finally, a visual analysis of no engagement, reveals a substantial decrease from baseline observations compared to AM sessions. There is minimal overlap between the AM sessions and regular activities in the experimental phase suggesting that AM is better able to reduce the percentage of no engagement. Moreover, a statistical analysis revealed that AM is a highly effective treatment (PND = 100%) for reducing the percentage of no engagement in the activity. Figure G3 in Appendix G depicts no engagement for participant one.

For the dependent variable of positive affect, shown in Figure G4 of Appendix G, a visual analysis revealed a decrease in positive affect during the AM sessions when comparing against the baseline observations. The experimental phase showed high overlap between the two conditions suggesting no difference between the AM classes and regularly scheduled activities. A statistical analysis reveals that AM is has an unreliable treatment effect for positive affect (PND = 0.0%). No differences across the baseline and experimental phases were observed in negative affect. Furthermore, the high overlap in conditions within the experimental phase signifies no difference in AM's ability to reduce negative affect. Statistically, a PND revealed that AM is an unreliable treatment (PND = 25%) for reducing neutral affect. Figure G5 in Appendix G illustrates negative affect for participant one. Lastly, a visual analysis of neutral affect, shown in Figure G6 of Appendix G, reveals minimal changes from baseline to the experimental phase. A high rate of overlap between the AM sessions and regular activities during the experimental phase signify no difference in the ability to reduce neutral affect.

Statistically, AM is an unreliable treatment (PND = 0.0%) for reducing neutral affect. Table 4 summarizes Participant one's results.

Table 4.

Summary of Findings by Analysis for Participant One

	Visual Inspection		PND Statistic	
	Baseline	Alternating Treatments	Effect Size	Summary
Active Engagement	+	+	100%	Effective Treatment
Passive Engagement	+	+	75%	Fairly Effective Treatment
No Engagement	+	+	100%	Effective Treatment
Positive Affect	-	-	0.0%	Unreliable Treatment
Negative Affect	-	-	0.0%	Unreliable Treatment
Neutral Affect	-	-	25%	Unreliable Treatment

Note. *Baseline* indicates a visual analysis comparing the baseline to the cognitive training program. *Alternating treatments* indicates the comparison of regular activities and the cognitive

training program within the experimental phase. *A* "+" indicates positive results while a "-" means there was no change

Participant Two. Participant two attended 70% of the AM sessions. However, it was noted that she either left early, declined to participate, was asleep, or otherwise disengaged for about 64% of the sessions she attended. Data was collected for seven baseline observations, four AM session observations, and two regularly scheduled activities.

For the dependent variable of active engagement, depicted in Figure H1 of Appendix H, a visual analysis signifies an unstable baseline with an outlier during observation 5. When comparing the baseline observations to the experimental phase, it appeared that the AM sessions generally elicited more active engagement. However, when compared within the experimental phase, overlap between the AM sessions and regularly scheduled activities reveals minimal difference between the conditions regarding active engagement. Furthermore, a PND analysis revealed that AM is an unreliable treatment (PND = 0.0%) for improving active engagement, although this is confounded by the outlier in baseline observation five. Figure H2 of Appendix H illustrates the observational data for passive engagement. A visual analysis of revealed an outlier in the baseline at session six. Additionally, when comparing baseline observations to the experimental phase, the baseline revealed less passive engagement than both regular activities and AM sessions. When comparing across conditions in the experimental phase, regular activities appears to have elicited less passive engagement than AM. A statistical analysis reveals that AM is an unreliable treatment for reducing passive engagement (PND = 0.0%). Finally, a visual analysis of no engagement, depicted in Figure H3 of Appendix H, signified an unstable baseline. However, AM appeared to elicit less intervals of no engagement than the baseline activities. When comparing within the experimental phase, the overlap in conditions implied no

difference in percentage of intervals with no engagement between AM and regularly scheduled activities. Furthermore, a statistical analysis revealed that AM is an unreliable treatment (PND = 0.0%) for reducing the percentage of no engagement.

Positive affect, shown in Figure H4 of Appendix H, was observed to have occurred during 0% of the intervals in the baseline observations. During the experimental phase, positive affect occurred at 0% of intervals for regular activities and between 0% and 2.4% of intervals for active mind. A PND analysis reveals that AM is an unreliable treatment (PND = 25%) for positive affect. No changes were observed in negative affect, illustrated in Figure H5 of Appendix H. All intervals during the baseline sessions revealed 0% negative affect. Additionally, negative affect was observed at 0% of intervals for both the AM sessions and regularly scheduled activities in the experimental phase. A PND analysis indicated an unreliable treatment (PND = 0.0%) for AM. Neutral affect, shown in Figure H6 of Appendix H, yielded similar results. Neutral affect was observed for 100% of baseline intervals. During the experimental phase, neutral affect was observed between 97.6% and 100% of AM session intervals while it was observed for 100% of intervals for regularly scheduled activities. Minimal changes between the baseline and experimental phases, as well as across the conditions in the experimental phase, indicate limited utility for AM to decrease neutral affect. Furthermore, a statistical analysis revealed that AM was an unreliable treatment (PND = 25%) for reducing neutral affect. Table 5 summarizes the results for Participant Two.

Table 5

Summary of Results by Analysis for Participant Two.

	Visual Inspection	PND Statistic

	Baseline	Alternating Treatments	Effect Size	Summary
Active Engagement	+	-	0.0%	Unreliable Treatment
Passive Engagement	-	-	0.0%	Unreliable Treatment
No Engagement	+	-	0.0%	Unreliable Treatment
Positive Affect	-	-	25%	Unreliable Treatment
Negative Affect	-	-	0.0%	Unreliable Treatment
Neutral Affect	-	-	25%	Unreliable Treatment

Note. *Baseline* indicates a visual analysis comparing the baseline to the cognitive training program. *Alternating treatments* indicates the comparison of regular activities and the cognitive training program within the experimental phase. *A* "+" indicates positive results while a "-" means there was no change

Participant three. Participant three attended 55% of the AM sessions offered. Four baseline sessions were observed. During the experimental phase, three AM sessions were observed while two regularly scheduled activities were observed. Of note, during the experimental phase only observation seven included an observation of both the AM session and a regularly scheduled activity.

Differences were observed across all three levels of the dependent variable engagement. For active engagement, shown in Figure I1 of Appendix I, a visual analysis revealed an increase in active engagement when comparing AM sessions against the baseline. Minimal overlap between the AM sessions and regular activities in the experimental phase suggests AM was somewhat effective in eliciting more active engagement. Statistically, a PND analysis revealed questionable effectiveness (PND = 60.7%) for active engagement. In the experimental phase for passive engagement, depicted in Figure I2 of Appendix I, no overlap is observed between the conditions indicating the AM produced less passive engagement. However, a PND analysis reveals that AM has an unreliable treatment effect (PND = 33.3%). Finally, a visual analysis of no engagement, shown in Figure I3 of Appendix I, illustrates a decrease in no engagement for AM sessions and regular activities when comparing them to baseline. When comparing across the experimental phase, overlap was observed suggesting that AM was somewhat able to decrease the percentage of no engagement. A PND analysis revealed questionable effectiveness (PND = 60.7%) for no engagement.

For the dependent variable of positive affect, illustrated in Figure I4 of Appendix I, a visual analysis showed minimal changes from baseline to the experimental phase. Additionally, when comparing within the experimental phase, regular activities elicited more positive engagement. A statistical analysis revealed that AM was an unreliable treatment (PND = 0.0%) for positive affect. Minimal variation in negative affect scores were observed, as evidenced by Figure I5 in Appendix I, suggesting that AM was not effective in reducing it. Similarly, a statistical analysis revealed AM was an unreliable treatment (PND = 0.0%) in this regard. Lastly, a visual analysis of neutral affect showed minimal differences in the baseline observations and AM sessions as seen in Figure I6 of Appendix I. During the experimental phase, regular

activities elicited less neutral affect than AM, although there is some overlap suggesting that AM was not able to reduce neutral affect beyond that of regular activities. Statistically, AM is an unreliable treatment (PND = 0.0%) for reducing neutral affect. Participant Three's results are summarized in table 6.

Table 6

Summary of Results by Analysis for Participant Three.

	Visual Inspection		PND Statistic	
	Baseline	Alternating Treatments	Effect Size	Summary
Active Engagement	+	+	60.7%	Questionable Treatment
Passive Engagement	-	+	33.3%	Unreliable Treatment
No Engagement	+	+	60.7%	Questionable Treatment
Positive Affect	-	-	0.0%	Unreliable Treatment
Negative Affect	-	-	0.0%	Unreliable Treatment
Neutral Affect	-	-	0.0%	Unreliable Treatment

Note. *Baseline* indicates a visual analysis comparing the baseline to the cognitive training program. *Alternating treatments* indicates the comparison of regular activities and the cognitive training program within the experimental phase. *A* "+" indicates positive results while a "-" means there was no change

Participant four. Participant four attended 55% of the AM sessions. Two baseline observations were conducted. During the experimental phase, three AM sessions were observed, and no regularly scheduled activities observations took place due to lack of attendance.

Because no regularly scheduled activities were observed during the experimental phase, a visual analysis of data only included a comparison of baseline to the AM sessions. For the dependent variable of active engagement, a visual analysis revealed that AM elicited more active engagement compared to baseline. Statistically, a PND analysis indicated that AM is a highly effective treatment (PND = 100%) for increasing active engagement. A graph of the active engagement can be found in Figure J1 in Appendix J. A visual analysis of passive engagement, shown in Figure J2 in Appendix J, illustrated a decrease in passive engagement from the baseline phase to the experimental phase. A PND analysis indicates that AM was a highly effective treatment (PND = 100%) for reducing passive engagement. No engagement, depicted in Figure J3 of Appendix J, also decreased during the AM sessions. A PND analysis reveals a highly effective treatment (PND = 100%) for AM's ability to reduce no engagement.

For the dependent variable of positive affect, shown in Figure J4 of Appendix J, a visual analysis reveals little change between the baseline and experimental phase. Statistically, AM is an unreliable treatment (PND = 0.0%) for increasing positive affect. No differences were observed in negative affect from baseline to the experimental phase as seen in Figure J5 of Appendix J. A PND analysis revealed an unreliable treatment (PND = 0.0%) regarding a

decrease in negative affect. Finally, a visual analysis of neutral affect, illustrated in Figure J6 of Appendix J, revealed that AM elicited more neutral affect than the baseline phase. A PND revealed an unreliable treatment (PND = 0.0%) suggesting that AM has no ability to reduce neutral affect. Table seven displays a summary of results for participant four.

	Visual Inspection		PND Statistic	
	Baseline	Alternating Treatments	Effect Size	Summary
Active Engagement	+	N/A	100%	Effective Treatment
Passive Engagement	+	N/A	100%	Effective Treatment
No Engagement	+	N/A	100%	Effective Treatment
Positive Affect	-	N/A	0.0%	Unreliable Treatment
Negative Affect	-	N/A	0.0%	Unreliable Treatment
Neutral Affect	-	N/A	0.0%	Unreliable Treatment

Table 7

Summary of Results by Analysis for Participant Four

Note. *Baseline* indicates a visual analysis comparing the baseline to the cognitive training program. *Alternating treatments* indicates the comparison of regular activities and the cognitive

training program within the experimental phase. *A* "+" indicates positive results while a "-" means there was no change

Participant five. Participant five attended 40% of the AM sessions overall. Six baseline observations were collected. In the experimental phase, data was collected during two AM sessions and four regularly scheduled activities.

An unstable baseline was observed for the dependent variable of active engagement, as evidenced in Figure K1 in Appendix K. However, more active engagement was generally observed in AM than baseline observations. When comparing within the experimental phase, minimal overlap occurred between the AM sessions and the regularly scheduled activities revealing that AM elicited more active engagement than the regularly scheduled activities. However, statistically, AM appeared to be an unreliable treatment (PND = 0.0%). An unstable baseline was also observed for passive engagement, illustrated in Figure K2 in Appendix K. Compared to the baseline, AM sessions generally exhibited less passive engagement. When comparing within the experimental phase, significant overlap between the two conditions suggests that AM was not able to reduce passive engagement below that of regularly scheduled activities. A statistical analysis also indicated an unreliable treatment (PND = 0.0%). Lastly, a comparison within the experimental phase for the dependent variable of no engagement, shown in Figure K3 of Appendix K, revealed some overlap between the two conditions. However, AM showed less intervals with no engagement than the regularly scheduled activities. Statistically, AM is a highly effective treatment (PND = 100%) for reducing no engagement.

Minimal variation in affect was noted across all three levels of the dependent variable. Positive affect, illustrated in Figure K4 of Appendix K, revealed significant overlap within the experimental phase suggesting that AM did not increase positive affect. Statistically, AM was an

unreliable treatment for increasing affect (PND = 50%). No differences across the baseline and experimental phase were noted for negative affect, as shown in Figure K5 in Appendix K. A PND analysis signified an unreliable treatment effect (PND = 0.0%) for reducing negative affect. Lastly, neutral affect, shown in Figure K6 of Appendix K, was observed to reveal overlap within the experimental phase suggesting that AM did not lead to changes in neutral affect. A PND analysis signified that AM is an unreliable treatment (PND = 50%) for reducing neutral affect. A summary of results for participant five is displayed in table eight.

Table 8

Summary of Results by Analysis for Participant Five

	Visual Inspection		PND Statistic	
	Baseline	Alternating Treatments	Effect Size	Summary
Active Engagement	+	+	0.0%	Unreliable Treatment
Passive Engagement	+	-	0.0%	Unreliable Treatment
No Engagement	+	+	100%	Effective Treatment
Positive Affect	-	-	50%	Unreliable Treatment
Negative Affect	-	-	0.0%	Unreliable Treatment

Neutral Affect	-	-	50%	Unreliable Treatment

Note. *Baseline* indicates a visual analysis comparing the baseline to the cognitive training program. *Alternating treatments* indicates the comparison of regular activities and the cognitive training program within the experimental phase. *A* "+" indicates positive results while a "-" means there was no change

Discussion

Overall, participation in the cognitive training program yielded promising results regarding engagement while affect remained unchanged. Active engagement was observed at higher percentages during the cognitive training program than during regularly scheduled activities. The increase in active engagement during these sessions in turn reduced the percentages of passive and no engagement.

Although overall increases in active engagement were observed, the interpretation of the data yielded different results depending on how it was analyzed. For aggregated data, a visual analysis indicated increased active engagement during the cognitive training sessions while a statistical analysis revealed an unreliable treatment effect. Similarly, visual interpretation of passive engagement showed decreases, but statistically an unreliable treatment effect was noted. Finally, aggregated data for the dependent variable of no engagement indicated that cognitive training programs were fairly effective in reducing no engagement when analyzed through visual and statistical interpretation.

The analysis of individual data also revealed mixed results. For active engagement, visual interpretation indicated improvement across all participants while a statistical interpretation revealed two effective treatments, one questionable treatment and two unreliable treatments. A

visual analysis of passive engagement revealed that four of five participants experienced a decrease in passive engagement. However, a statistical interpretation resulted in one participant showing an effective treatment, one indicating a fairly effective treatment, and three an revealing an unreliable treatment effect. Finally, individual interpretations of no engagement through visual analysis revealed all five participants exhibited a decrease in no engagement. Statistically, results for three participants indicated an effective treatment, one revealed a questionable treatment, and one signified an unreliable treatment effect.

Although based on visual inspection measures generally signified positive outcomes in terms of increases in active engagement and decreases in passive and no engagement, statistical analyses revealed few significant findings. Unfortunately, the statistical analysis utilized in this study is extremely sensitive to outliers. For the aggregated data related to active engagement an outlier was observed at session five of baseline, a data collection session that included only two participants. Interestingly, during this particular baseline activity both individuals were unusually active compared to other baseline sessions. The activities in which they were engaging were ones that naturally promote more active engagement (i.e. craft and an exercise class) than other activities (i.e. bible study or devotions) that evoke more passive engagement like listening or gazing toward the speaker. This may explain the increase in active engagement during this observation session. Additionally, several participants were observed to have variable baselines with no readily established trend prior to the implementation of the experimental phase. For example, participant two had a baseline ranging from 8.7% to 97% for no engagement. The variability in the baseline decreases the statistical power of the PND interpretation. Furthermore, due to the suspension of data collection, a smaller sample of data were collected during the AM

program than was originally intended. Because of these limitations, the visual analysis of the data may provide more accurate conclusions.

Results of this study with regard to active engagement are relevant given that previous studies have established that active engagement is positively correlated with the experience of pleasure, promotes independence, and increases well-being (Cohen-Mansfield et al., 2012; Chung, 2004). Residential care facilities are very aware of the importance of resident engagement as these facilities are required to provide activities to their residents that enhance their mental and psychosocial well-being (Allen, 2011). The results of this study suggest that, although commonly held activities in residential care facilities are eliciting some engagement, cognitive training programs are potentially able to evoke more engagement. Furthermore, these programs promote more active involvement in the activity rather than passively participating.

Affect remained consistent throughout the study. Neutral affect was observed at much higher percentages than negative affect and positive affect. One possible explanation for these findings is that PwD may experience blunted or flat affect as a symptom of their disorder or a side effect of their medication (Sultzer et al., 1993; Daly, 1999) making observing affect challenging. Furthermore, observations of momentary displays of affect are often interpreted as evidence of the individual's mood. Therefore, these findings are consistent with previous literature suggesting that mood remained unchanged after the implementation of cognitive training programs when assessed through caregiver report (Giovagnoli et al., 2017; Mate-Kole et al., 2007; Buchanan et al., 2019). The lack of change in affect exhibited by older adults with cognitive impairment may contribute to the inability for others to quantify mood through the observation of affect. The utility of assessing affect as a measure of mood for older adults with moderate to severe cognitive impairment is debated in the literature. Although a six-factor model

proposed three positive components, including happy mood, engagement, and clam, and three negative components, including sad mood/depression, apathy, and agitation, in their objective indicators of psychological well-being for older adults with moderate to severe cognitive impairment, the complexity of quantifying affect as a means of assessing mood is identified and merits several limitations (Volicer et al, 1999). Given that the model implicates engagement in positive psychological well-being and identifies it as a more outward behavior that can be readily observed, engagement in an activity may be the best variable to measure to assess QoL.

Although the cognitive training program promoted a greater percentage of active engagement, the positive effects of engagement in activity did not generalize to QoL. Results of the qualitative analysis indicated no change in participation in regularly scheduled activities and emotional state. Furthermore, some participants experienced distress prior to the beginning of the cognitive training sessions which generally subsided once the classes began. Interestingly, participants did begin to recognize each other outside of the cognitive training sessions, thereby increasing socialization. Nevertheless, in general, negative effects of the program were qualitatively reported, thereby decreasing the participants QoL. Qualitative reporting of a decrease in QoL was substantiated by scores on the QoL measure. All participants, except one, experienced a decrease in QoL after session 20 of the cognitive training program. This is an unexpected finding considering the research implicating the importance of engagement in activities in overall QoL (Cohen-Mansfield et al., 2012; Chung, 2004).

Several factors may account for the findings related to QoL. First, although all participants met the minimum qualifications for the class, it was reported that the class may have been too challenging for them due to severity of cognitive impairment resulting in increased distress and decreased QoL. Second, at the time the post-intervention questionnaire was

completed by the caregiver, a global pandemic was interrupting everyday functioning and may have resulted in the increased distress observed by caregivers. These extenuating circumstances may have influence post-intervention QUALIDEM observations, resulting in unrepresentative data. Finally, at post-testing, staff turnover at the facility interrupted typical routines and created a stressful work environment, which may have influenced observations of resident's QoL.

Limitations and Future Directions

As this study was the first to investigate the effects of a cognitive training program on behavioral functioning for individuals with moderate to severe impairment, several limitations were present. First and foremost, the study was prematurely suspended due to extenuating cultural circumstances at the time of data collection. With the discontinuation of the cognitive training program and the suspension of observations after AM session 15, data must be interpreted with cation. Future researchers should work to continue data collection until the completion of the program and include a follow-up assessment, as originally proposed.

Second, participant variables may have affected the outcome. To begin, although identified by staff as regularly attending scheduled activities, many participants chose not to attend the activities during the data collection period resulting in limited data. Furthermore, the homogenous and small sample limits the generalizability of the results. Future research should recruit participants who attend scheduled activities more regularly to provide stringent comparison of the cognitive training program to typically offered activities. Additionally, future research should establish a more heterogenous population with a larger sample size to garnish a better understanding of the results and promote generalizability.

Another significant limitation was the difference in participation elicited by the activities typically offered in the facility. Specifically, some regularly offered activities naturally elicit a

greater degree of active engagement while others do not. For example, some participants enjoyed attending bible study, an activity that results in more passive engagement like listening to the leader or gazing at the bible. Only occasionally would the participant be able to actively engage by discussing. However, other activities, like exercise, elicit more opportunity for active engagement as the full 30-minute session involves movement of the body which the participant can chose to actively engage in or not. Although it would have been ideal to choose only typically offered activities that potentially require more active engagement, practical constraints made this difficult. Therefore, the researcher chose to observer a wide range of typically offered activities that could be easily observed on a regular basis. Future research should examine more comparable activities in terms of the potential to evoke active engagement to understand if cognitive training programs elicit more active engagement above that of scheduled activities that provide ample opportunity to actively engage.

In addition, no control group was included in this study. The addition of a control group would allow for the comparison of the two groups to differentiate between changes that occurred due to the cognitive training program and changes that would have occurred naturally. This is especially relevant to this study as data collection ended in the middle of a global crisis making it difficult to determine how much the crisis contributed to the results compared to the cognitive training program. Future research should utilize a control group.

Finally, because this study is the first to attempt to investigate the impact of cognitive training programs on behavioral functioning in older adults with cognitive impairment, replication of the results is necessary.

Conclusions

Although no changes in mood were observed, the results of this study provide encouraging outcomes for the efficacy of a cognitive training program to increase engagement and reduce the frequency of passive or non-engagement in activity. However, more research surrounding the effects of cognitive training programs on behavior outcomes is necessary in order to more definitively conclude these programs positively affect engagement in activities and QoL. A challenge that many residential community directors face is providing their residents with stimulating activities that are fun, appropriate, and engaging. Cognitive training programs are promising activities that can be implemented in a residential group home setting to fulfill this need.

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Appendix A

Informed Consent for Participation in the Research Study (Legal Guardian)

Title: The title of this research study is, "The effects of cognitive training on behavioral functioning of persons with dementia."

Purpose
The purpose of the research study is to evaluate the effects of a cognitive training program for persons experiencing cognitive impairment.

Participants
The person for whom I serve as guardian has been asked to participate because they have been diagnosed with a condition that causes memory problems.

Procedure
First, the experimenter will ask the participant a series of questions to assess the severity of individual's cognitive impairment. These questions will take about 15 minutes to complete.

Next, experimenters will observe the individual during six activities they regularly participate in at the facility (e.g., Bingo, crafting). The experimenters will observe the individual's mood as well as how much the individual participates in the activity. These observations will be done twice a week for three weeks. Each observation will occur as long the activity lasts, which in most cases will be about 30 minutes.

The experimenter will then give the individual a series of tests (which will take about 45 minutes) to assess the individual's memory and other abilities. These tests will be given before starting the program and after completion of the program.

The individual will then participate in a series of 24, 1-hour cognitive training classes. There will be 2-3 classes per week for 8-12 weeks. These classes involve a number of activities that are meant to "exercise" various skills such as memory, language, and problem solving. The content of the activities is designed to be appropriate for adults, challenging, and enjoyable. The classes are conducted in groups, with 5-6 people participating in each group. Classes will be led by activities staff at the facility where the individual lives. During six of these cognitive training classes, the experimenter will observe the individual's mood as well as how much the individual participates in the class. In addition, six more observations will be done during activities the individual regularly participate in at the facility.

Risks
I understand that there are minimal risks associated with participation in this study. It is possible that an individual may become frustrated because they may not enjoy participating in the program. If this occurs, the individual will be allowed to leave the class.

Benefits

I understand that individuals will not be compensated for their participation. The results of this research study may yield useful information about the benefits of cognitive training on the behavior and mood of persons with memory problems.

Confidentiality

The findings of this study will be completely confidential. Confidentiality will be protected in that no identifying information will be included on any records collected during this study. Participants will be assigned an identification number that will be linked to the data collected during this study. All information collected during this study will be used for research purposes only and will only be accessible to the principal investigator, Dr. Jeffrey Buchanan, and the student investigator, Abby Dye. All information will be kept in a locked cabinet in the principle investigator's office and destroyed after three years.

Right to Refuse or Withdraw

Participation in this study is voluntary. You may refuse to participate or you may withdraw them from the study at any time without repercussions by contacting the principal investigator at the phone number below or telling a supervisor at your place of employment. The decision whether or not to participate will not affect your relationship with Minnesota State University, Mankato and refusal to participate will involve no penalty or loss of benefits.

Furthermore, withdrawal from the study may occur if the individual becomes agitated or fatigued during any part of the study. If the individual wishes to discontinue, the individual can inform facility staff, who will then inform with principle investigator.

Questions

If you have any questions, you are free to ask them. If you have any additional questions, you may contact the office of the principal investigator, Jeffery Buchanan, PhD at (507) 389-5824 or the student investigator Abby Dye at (317) 517-1995. If you have questions about participants' rights and for research-related injuries, please contact the Administrator of the Institutional Review Board at (507) 389-1242.

Closing Statement

My signature below indicates that I have decided to participate in a research study; that I have read this form; that understand it; that the participant is over the age of 18; that I have had all my questions answered; that I am the legal guardian of (please print): _____ and that I have received a copy of this consent form.

_____ _____

Printed name of legal guardian Date

_____ _____

Signature of legal guardian Date

_____ _____

Signature of Investigator Date

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Appendix B

Informed Consent for Participation in the Research Study (Staff)

Title: The title of this research study is, "The effects of cognitive training on behavioral functioning of persons with dementia."

Purpose
The purpose of the research study is to evaluate the effects of a cognitive training program for persons experiencing cognitive impairment.

Participants
You are being asked to participate in this study because you are a professional who provides care to individuals with memory impairment.

Procedure
The experimenter will ask you to complete two questionnaires about the daily functioning of individuals you regularly work with who are participating in a research study. These questionnaires will take approximately 20 minutes to complete and you will be asked to complete these questionnaires on 3 separate occasions (before the individual starts the cognitive training program, immediately after the program is complete, as well as 2 weeks after the program is completed).

Risks
There are minimal risks associated with participation in this study. If you are not comfortable answering any of the questions, you can choose not to answer them.

Benefits
The results of this study may yield useful information about the benefits of cognitive training programs on the behavior of persons with memory problems.

Confidentiality
The findings of this study will be completely confidential. Confidentiality will be protected in that no identifying information will be included on any records collected during this study. All information collected during this study will be used for research purposes only and will only be accessible to the principal investigator, Dr. Jeffrey Buchanan, and the student investigator, Abby Dye. All information will be kept in a locked cabinet in the principle investigator's office and destroyed after three years.

Right to Refuse or Withdraw
Participation in this study is voluntary. You may refuse to participate or you may withdraw them from the study at any time without repercussions by contacting the principal investigator at the phone number below or telling a supervisor at your place of employment. The decision whether or not to participate will not affect your relationship with Minnesota State University, Mankato and refusal to participate will involve no penalty or loss of benefits.

Questions

If you have any questions, you are free to ask them. If you have any additional questions, you may contact the office of the principal investigator, Jeffery Buchanan, PhD at (507) 389-5824 or the student investigator Abby Dye at (317) 517-1995. If you have questions about participants' rights and for research-related injuries, please contact the Administrator of the Institutional Review Board at (507) 389-1242.

Closing Statement

My signature below indicates that I have decided to participate in a research study; that I have read this form; that understand it; that I am over the age of 18; that I have had all my questions answered; and that I have received a copy of this consent form.

_____	_____
Printed Name of Participant	Date
_____	_____
Signature of Participant	Date
_____	_____
Signature of Investigator	Date

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Appendix C

Pre- and Post-Intervention Caregiver Interviews

Pre-intervention Interview with Resident Assistant

1. How often does the participant participate in regularly scheduled activities? What activities do they typically engage in? How engaged are they in the activities?

2. How does the participant generally communicate with their peers? With staff? Please provide details or examples. (*Do they say hi to people when they pass? Do they usually keep to themselves? Are they generally talkative?)*

3. Please describe the participants general emotional expression. (*Do they laugh/ smile a lot? Are they angry? Are they sad?)*

4. What is the participant's general emotional state? Please provide details or examples. *(Are the generally happy? Angry? Sad?)*

Post-intervention Interview with Resident Assistant

1. Did the participants attendance in other activities increase or decrease? What activities do they typically engage in? During the activities, how engaged are they?

2. Have you noticed any changes in the participants communication with peers? With staff? Please provide details or examples. (*Do they say hi to people when they pass? Do they usually keep to themselves? Are they generally talkative?)*

3. Have you noticed any changes to the participants general emotional expression? (*Do they laugh/ smile more? Are they angrier? Are they sadder?)*

4. Have you noticed changes to the participants general emotional state? Please provide details or examples. *(Are the generally happy? Angry? Sad?)*

Appendix D

Tables for Individual Raw Scores by Observation Session

Table D1. *Observed percentages of dependent variables at baseline one.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	36.7%	0.0%	63.3%	25.0%	61.6%	13.0%
Participant 2	0.0%	0.0%	100%	0.0%	2.6%	97.0%
Participant 3	8.1%	0.0%	91.9%	17.6%	35.1%	47.3%
Participant 5	21.3%	0.0%	78.7%	40.0%	54.7%	5.3%
Participant 6	6.8%	0.0%	93.2%	13.6%	67.8%	18.6%
Median	6.8%	0.0%	91.9%	17.6%	94.7%	18.6%

Table D2. *Observed percentages of dependent variables at baseline two.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	13.6%	0.0%	86.4%	49.2%	33.9%	16.9%
Participant 2	0.0%	0.0%	100%	3.5%	0.0%	96.5%
Participant 3	6.9%	3.4%	89.7%	6.9%	36.2%	56.9%
Participant 5	6.2%	0.0%	93.8%	26.2%	61.5%	12.3%
Participant 6	0.0%	0.0%	100%	23.3%	23.3%	53.3%
Median	6.2%	0.0%	93.8%	23.3%	33.9%	53.3%

Table D3. *Observed percentages of dependent variables at baseline three.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	4.0%	0.0%	96.0%	11.9%	69.3%	18.8%
Participant 2	0.0%	0.0%	100%	24.2%	3.0%	72.7%
Participant 3	0.0%	0.0%	100%	0.0%	18.2%	81.8%

Participant 5	-	-	-	-	-	-
Participant 6	0.0%	0.0%	100%	0.0%	70.1%	29.3%
Median	0.0%	0.0%	100%	6.0%	43.8%	51.0%

Table D4. *Observed percentages of dependent variables at baseline four.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	10.7%	0.0%	89.3%	20.0%	50.6%	29.3%
Participant 2	0.0%	0.0%	100%	2.7%	0.0%	97.3%
Participant 3	1.0%	0.0%	99.0%	44.3%	41.5%	14.2%
Participant 5	-	-	-	-	-	-
Participant 6	0.0%	0.0%	100%	71.4%	14.3%	14.3%
Median	0.5%	0.0%	99.5%	32.2%	27.9%	21.8%

Table D5. *Observed percentages of dependent variables at baseline five.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	-	-	-	-	-	-
Participant 2	0.0%	0.0%	100%	60.0%	0.0%	40.0%
Participant 3	-	-	-	-	-	-
Participant 5	-	-	-	-	-	-
Participant 6	4.2%	0.0%	95.8%	75.0%	12.5%	12.5%
Median	2.1%	0.0%	98.0%	67.5%	6.3%	26.3%

Table D6. *Observed percentages of dependent variables at baseline six.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	-	-	-	-	-	-

Participant 2	0.0%	0.0%	100%	0.0%	4.5%	95.5%
Participant 3	-	-	-	-	-	-
Participant 5	-	-	-	-	-	-
Participant 6	0.0%	0.0%	100%	3.9%	34.2%	61.8%
Median	0.0%	0.0%	100%	2.0%	19.4%	78.7%

Table D7. *Observed percentages of dependent variables at baseline seven.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	-	-	-	-	-	-
Participant 2	0.0%	0.0%	100%	18.3%	73.1%	8.7%
Participant 3	-	-	-	-	-	-
Participant 5	-	-	-	-	-	-
Participant 6	-	-	-	-	-	-
Median	0.0%	0.0%	100%	8.3%	73.1%	8.7%

Table D8. *Observed percentages of dependent variables at AM observation one.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	10.3%	0.0%	89.7%	71.8%	25.6%	2.6%
Participant 2	0.0%	0.0%	100%	33.3%	12.8%	53.4%
Participant 3	2.6%	0.0%	97.4%	50.0%	50.0%	0.0%
Participant 5	0.0%	0.0%	100%	69.2%	28.2%	2.6%
Participant 6	0.0%	0.0%	100%	50.0%	47.4%	2.6%
Median	0.0%	0.0%	100%	50.0%	28.2%	2.6%

Table D9. *Observed percentages of dependent variables at regular activity observation one.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	33.9%	0.0%	66.1%	17.8%	60.7%	19.6%
Participant 2	0.0%	0.0%	100%	0.0%	10.4%	87.5%
Participant 3	-	-	-	-	-	-
Participant 5	-	-	-	-	-	-
Participant 6	1.8%	0.0%	98.2%	5.3%	78.9%	15.8%
Median	1.8%	0.0%	98.2%	5.3%	60.7%	19.6%

Table D10. *Observed percentages of dependent variables at AM observation two.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	4.0%	0.0%	96.0%	79.5%	20.5%	0.0%
Participant 2	0.0%	0.0%	100%	43.2%	31.8%	25.0%
Participant 3	0.0%	0.0%	100%	36.4%	6.8%	56.8%
Participant 5	7.0%	0.0%	93.0%	74.4%	23.3%	2.3%
Participant 6	-	-	-	-	-	-
Median	2.0%	0.0%	98.0%	58.8%	21.9%	13.7%

Table D11. *Observed percentages of dependent variables at regular activity observation two.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	3.3%	1.7%	95.0%	51.7%	41.7%	6.7%
Participant 2	-	-	-	-	-	-
Participant 3	-	-	-	-	-	-
Participant 5	-	-	-	-	-	-
Participant 6	3.1%	0.0%	96.9%	50%	50%	0.0%

Median	3.2%	0.9%	96.0%	50.9%	45.9%	3.4%

Table D12. *Observed percentages of dependent variables at AM observation three.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	9.0%	0.0%	90.5%	52.3%	45.5%	2.3%
Participant 2	0.0%	0.0%	100%	15.9%	11.4%	72.7%
Participant 3	2.3%	0.0%	97.7%	58.1%	37.2%	4.7%
Participant 5	2.2%	0.0%	97.8%	55.5%	42.2%	2.2%
Participant 6	-	-	-	-	-	-
Median	2.3%	0.0%	97.8%	53.9%	39.7%	3.5%

Table D13. *Observed percentages of dependent variables at regular activity observation three.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	8.6%	0.0%	91.4%	18.0%	50.0%	32.0%
Participant 2	0.0%	0.0%	100%	12.8%	84.6%	2.6%
Participant 3	2.6%	0.0%	97.4%	46.2%	53.8%	0.0%
Participant 5	-	-	-	-	-	-
Participant 6	0.0%	0.0%	100%	11.6%	50.7%	37.7%
Median	1.3%	0.0%	98.7%	15.4%	52.3%	17.3%

Table D14. *Observed percentages of dependent variables at AM observation four*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	10.0%	0.0%	90.0%	77.5%	20.0%	5.0%
Participant 2	2.4%	0.0%	97.6%	43.9%	36.6%	19.5%
Participant 3	-	-	-	-	-	-

Participant 5	-	-	-	-	-	-
Participant 6	10.0%	0.0%	90.0%	52.5%	47.5%	0.0%
Median	10.0%	0.0%	90.0%	53.0%	36.6%	5.0%

Table D15. *Observed percentages of dependent variables at regular activity observation four.*

Participant	Positive Affect	Negative Affect	Neutral Affect	Active Engagement	Passive Engagement	No Engagement
Participant 1	43.9%	0.0%	56.1%	21.1%	75.4%	1.8%
Participant 2	-	-	-	-	-	-
Participant 3	24.6%	0.0%	75.4%	22.8%	52.6%	24.6%
Participant 5	-	-	-	-	-	-
Participant 6	5.2%	0.0%	94.8%	3.4%	67.2%	29.3%
Median	24.6%	0.0%	75.4%	21.1%	67.2%	24.6%

Appendix E

Aggregated Observational Data Results

Figure E1. *Median percentage of active engagement across observation sessions.*

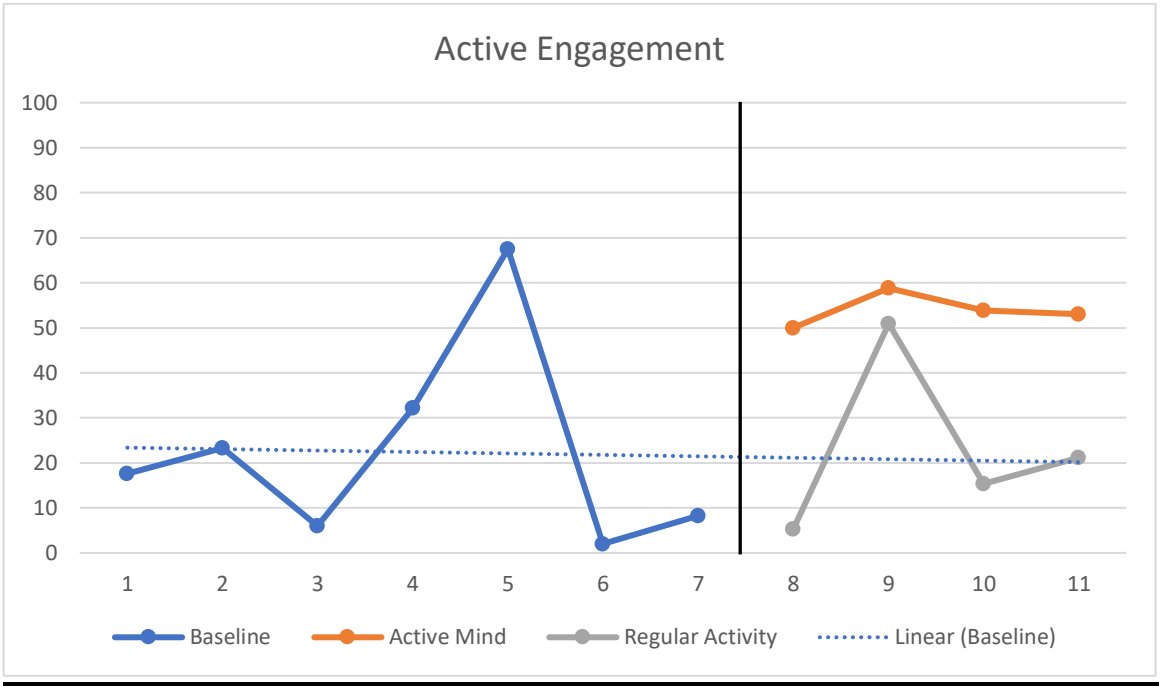


Figure E2. *Median percentage of passive engagement across observation sessions.*

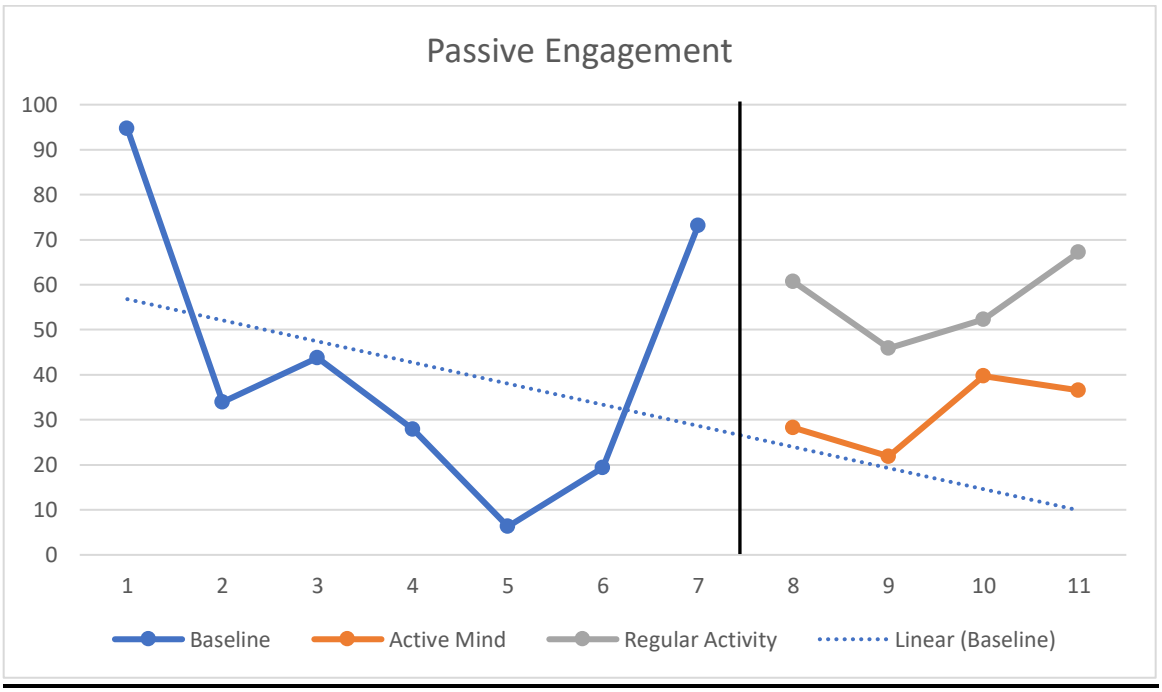


Figure E3. *Median percentage of no engagement across observation sessions.*

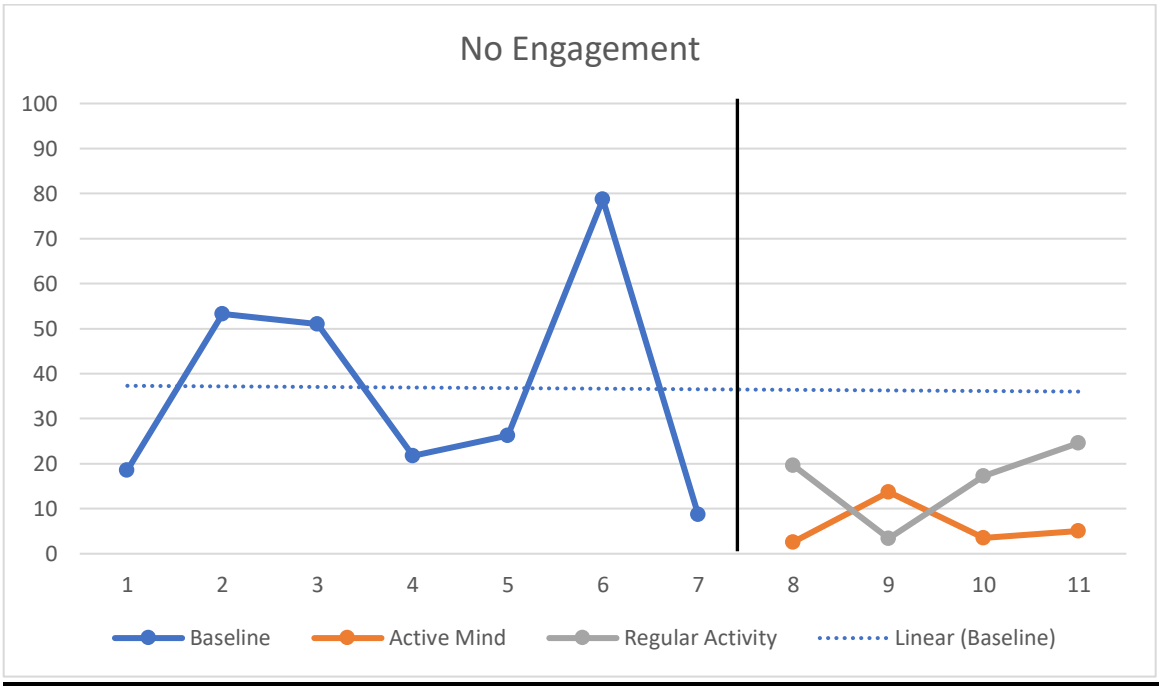


Figure E4. *Median percentage of positive affect across observation sessions.*

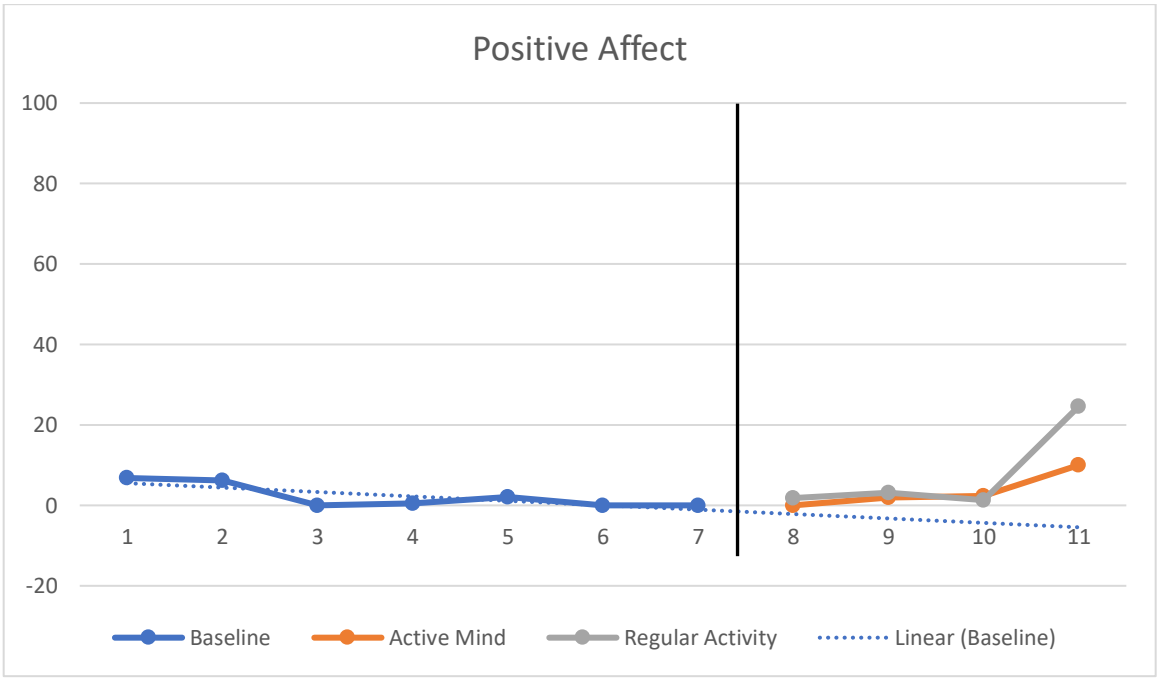


Figure E5. *Median percentage of negative affect across observation sessions.*

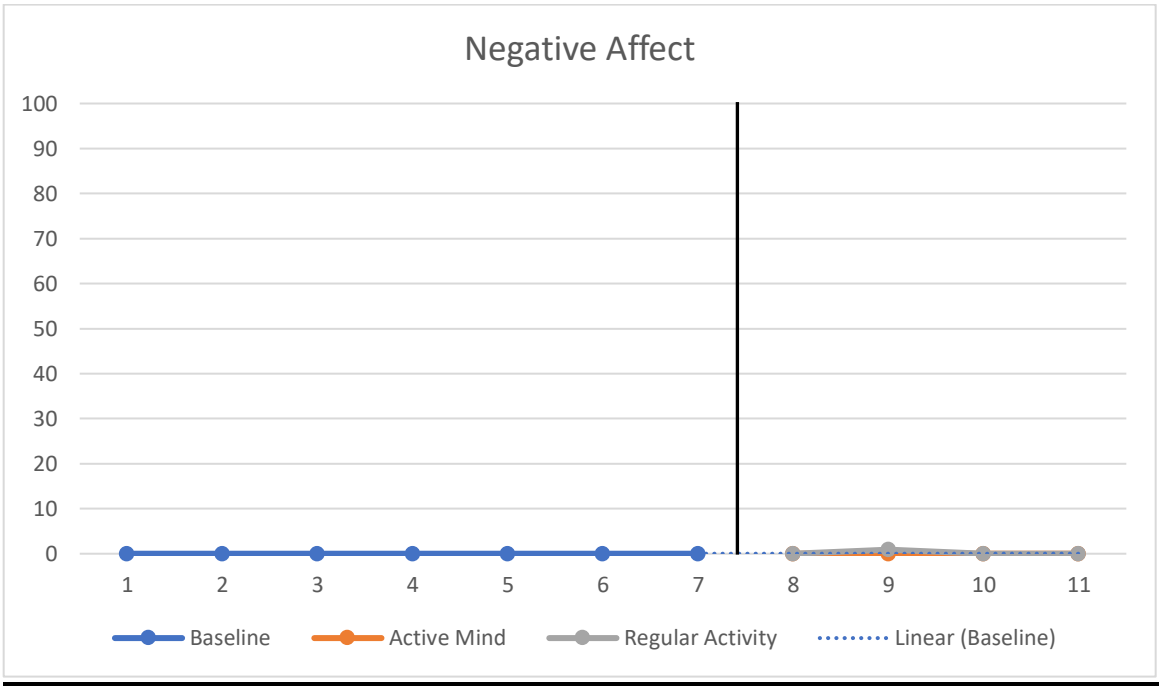
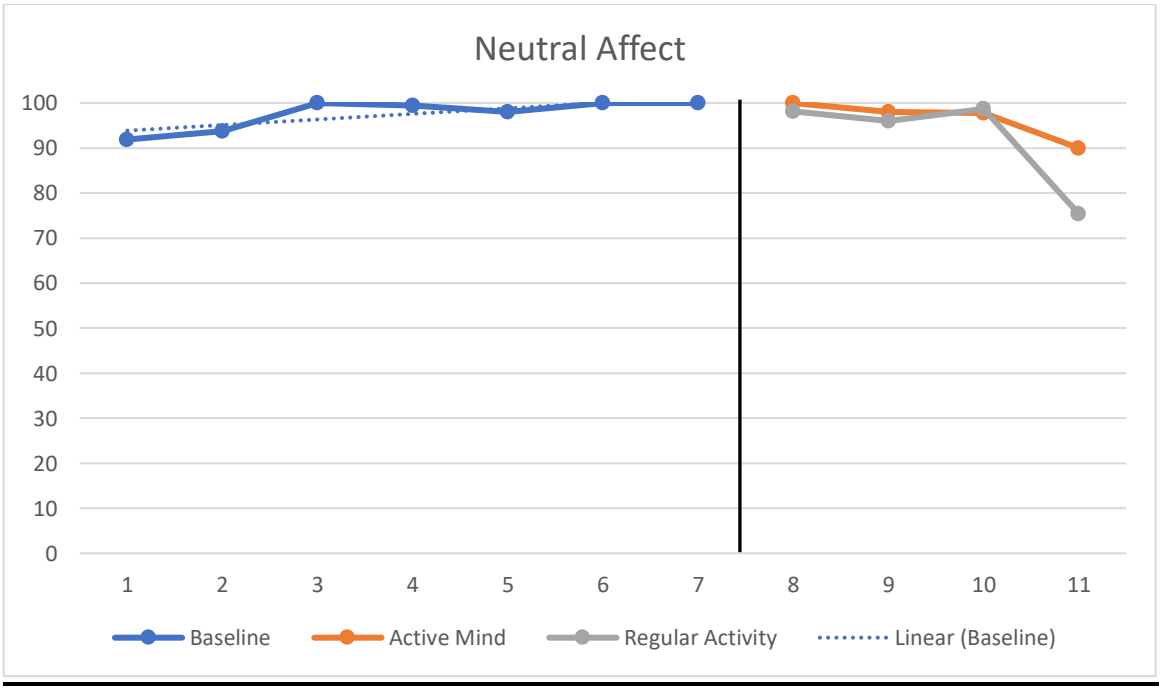


Figure E6. *Median percentage of neutral affect across observation sessions.*



Appendix F

Aggregated and Individual QUALIDEM Raw Scores

Table F1. *Pre- to post-intervention raw scores and change in scores for QoL measure for Participant One*

Subscale	Pre-Intervention Score	Post-Intervention Score	Difference
Care Relationship	21	21	0
Positive Affect	18	15	-3
Negative Affect	9	4	-5
Restless Behavior	7	4	-3
Positive Self-Image	6	3	-3
Social Relationships	18	16	-2
Social Isolation	9	8	-1
Feeling at Home	9	4	-5
Something to Do	4	3	-1
Total	101	78	-23

Table F2. *Pre- to post-intervention raw scores and change in scores for QoL measure for Participant Two.*

Subscale	Pre-Intervention Score	Post-Intervention Score	Difference
Care Relationship	21	21	0
Positive Affect	13	13	0
Negative Affect	4	2	-2
Restless Behavior	4	6	2

Positive Self-Image	7	4	-3
Social Relationships	17	14	-3
Social Isolation	7	6	-1
Feeling at Home	12	6	-6
Something to Do	3	3	0
Total	88	75	-13

Table F3. *Pre- to post-intervention raw scores and change in scores for QoL measure for Participant Three*

Subscale	Pre-Intervention Score	Post-Intervention Score	Difference
Care Relationship	19	19	0
Positive Affect	14	12	-2
Negative Affect	7	6	-1
Restless Behavior	9	6	-3
Positive Self-Image	7	5	-2
Social Relationships	14	13	-1
Social Isolation	8	5	-3
Feeling at Home	11	8	-3
Something to Do	4	4	0
Total	93	78	-15

Table F4. *Pre- to post-intervention raw scores and change in scores for QoL measure for Participant Four*

Subscale	Pre-Intervention Score	Post-Intervention Score	Difference
Care Relationship	12	12	0
Positive Affect	8	11	3
Negative Affect	3	3	0
Restless Behavior	4	3	-1
Positive Self-Image	3	5	2
Social Relationships	12	11	-1
Social Isolation	4	6	2
Feeling at Home	2	0	-2
Something to Do	4	3	-1
Total	52	54	2

Table F5. *Pre- to post-intervention raw scores and change in scores for QoL measure for Participant Five*

Subscale	Pre-Intervention Score	Post-Intervention Score	Difference
Care Relationship	20	14	-6
Positive Affect	10	7	-3
Negative Affect	7	5	-2
Restless Behavior	5	4	-1
Positive Self-Image	6	5	-1
Social Relationships	11	8	-3

Social Isolation	6	5	-1
Feeling at Home	8	2	-6
Something to Do	2	2	0
Total	75	52	-23

Appendix G

Graphs of Observational Data for Participant One

Figure G1. *Percentage of active engagement across all observational sessions.*

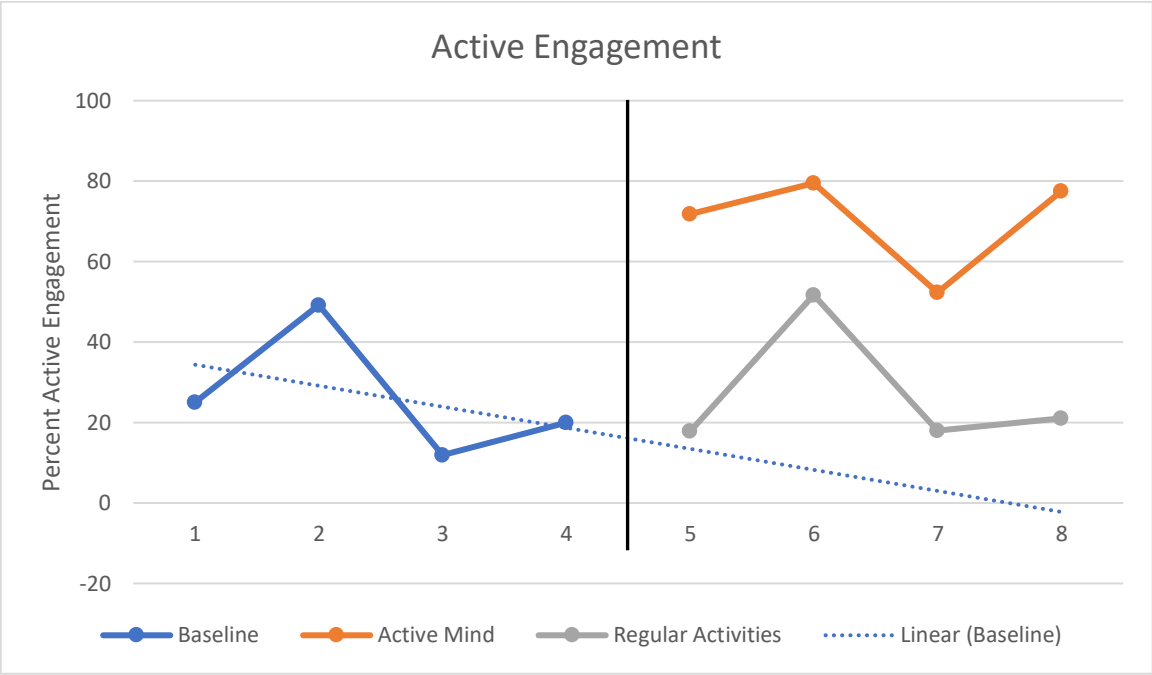


Figure G2. *Percentage of passive engagement across all observational sessions.*

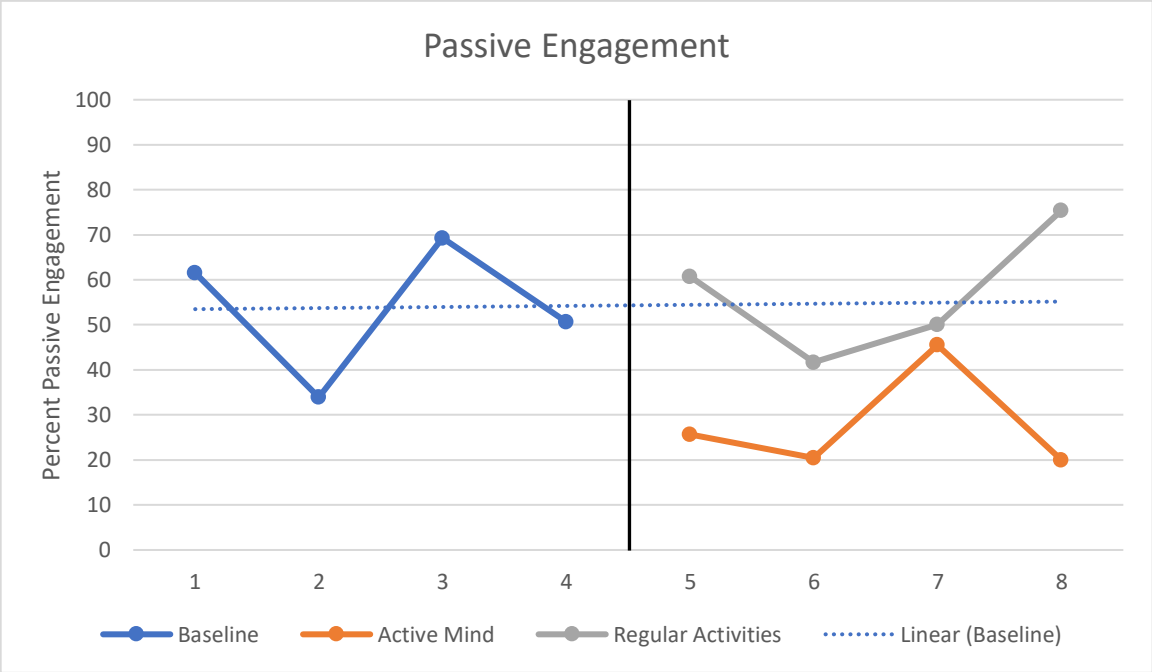


Figure G3. *Percentage of no engagement across all observational sessions.*

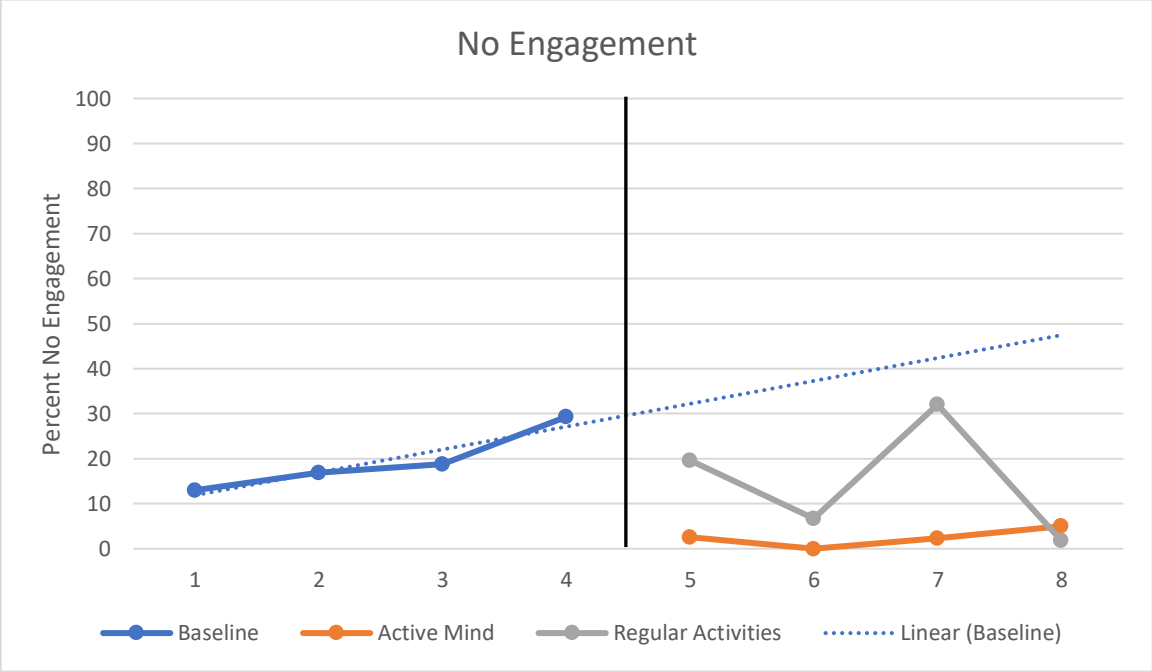


Figure G4. *Percentage of positive affect across all observational sessions.*

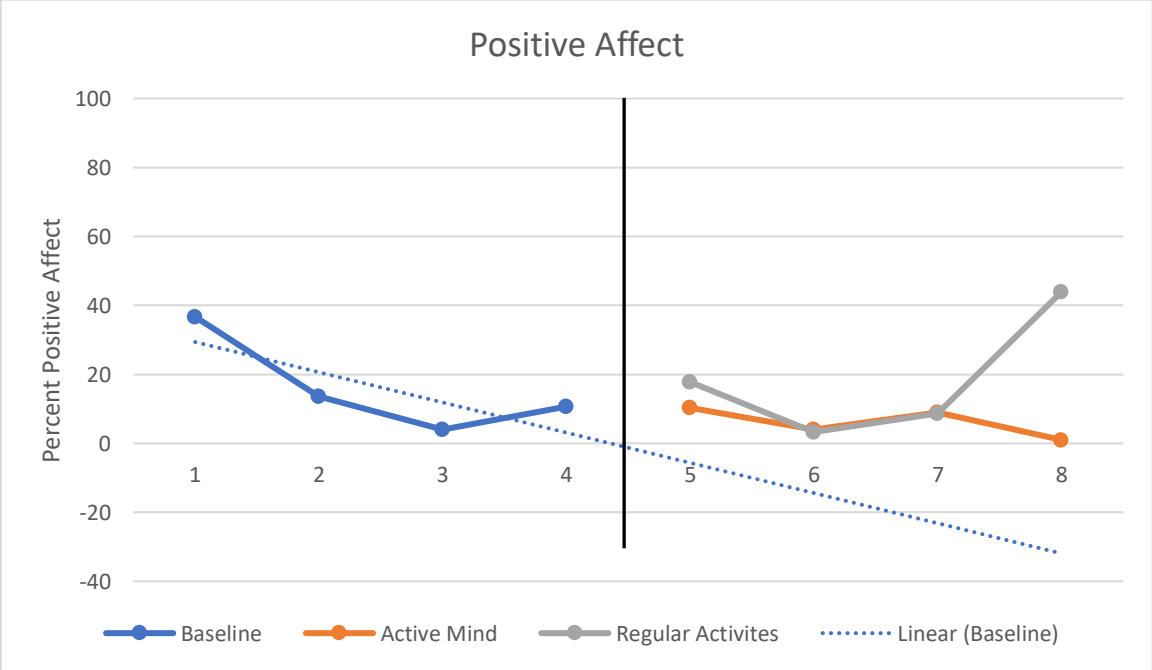


Figure G4. *Percentage of negative affect across all observational sessions.*

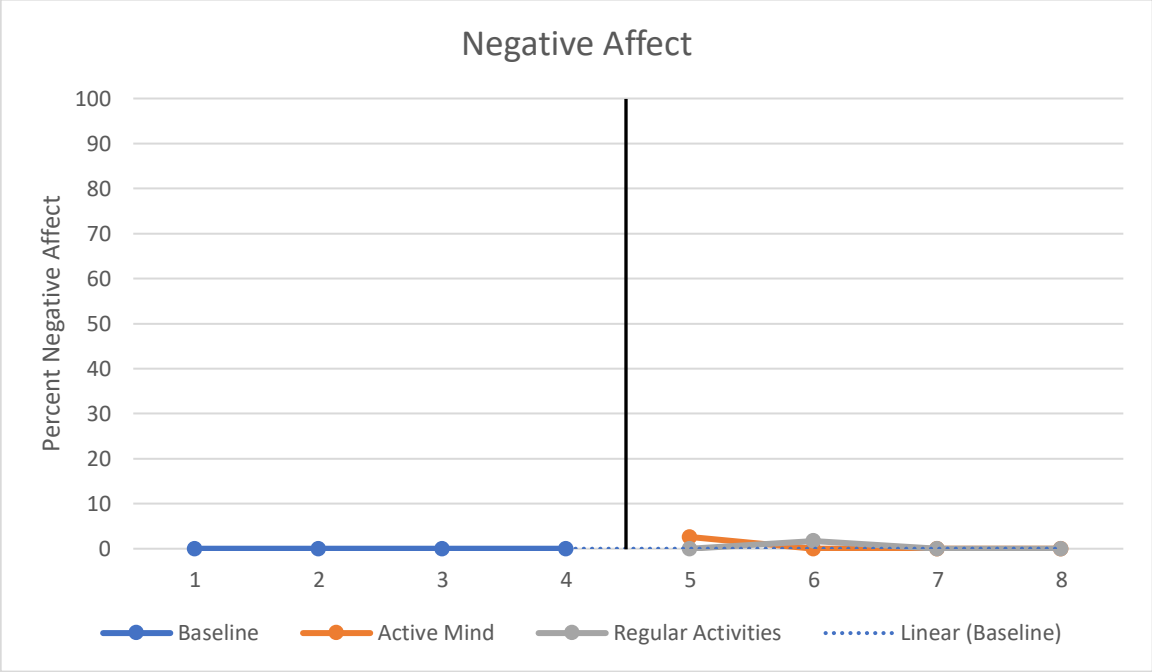
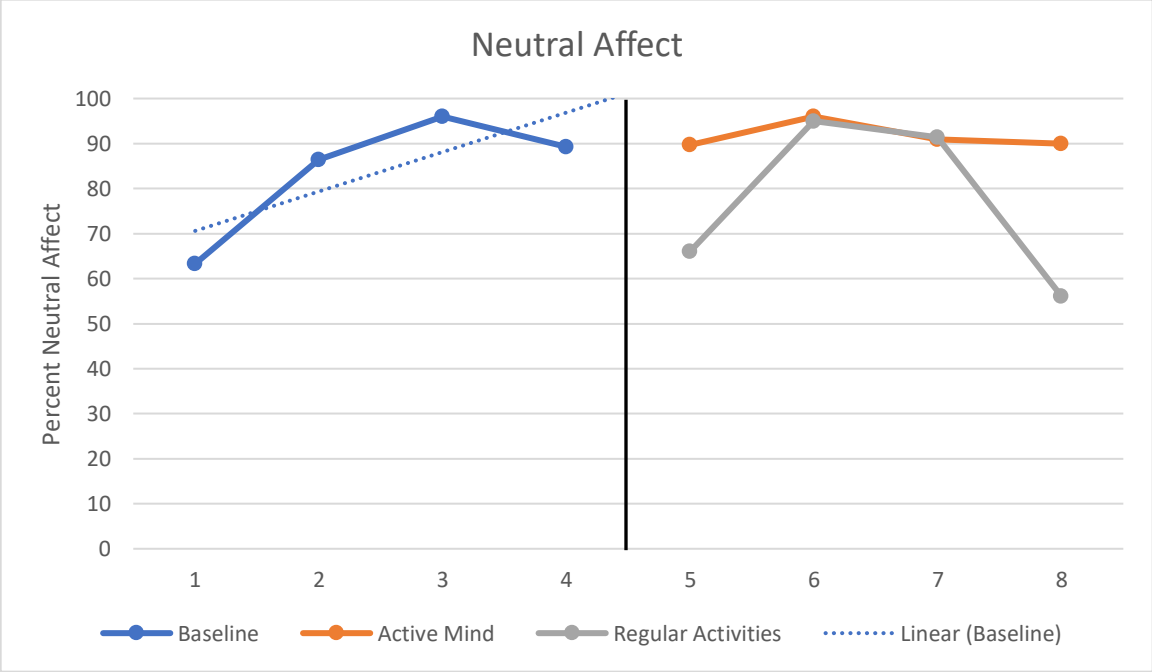


Figure G4. *Percentage of neutral affect across all observational sessions.*



Appendix H

Graphs of Observational Data for Participant Two

Figure H1. *Percentage of active engagement across all observational sessions.*

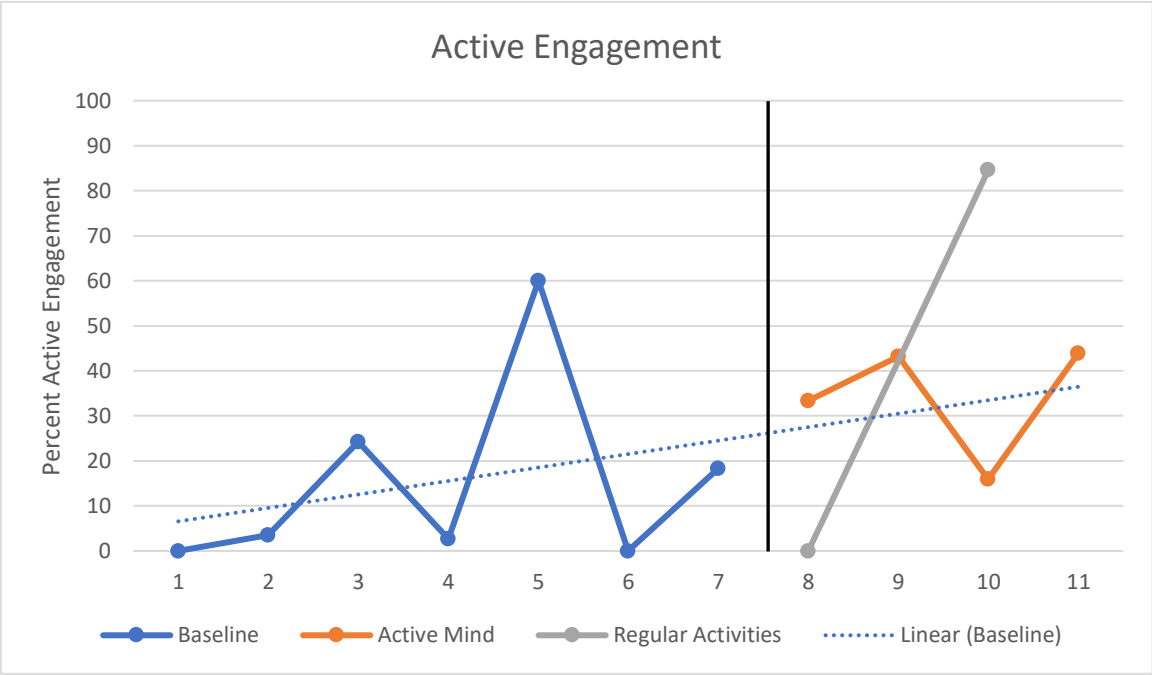


Figure H2. *Percentage of passive engagement across all observational sessions.*

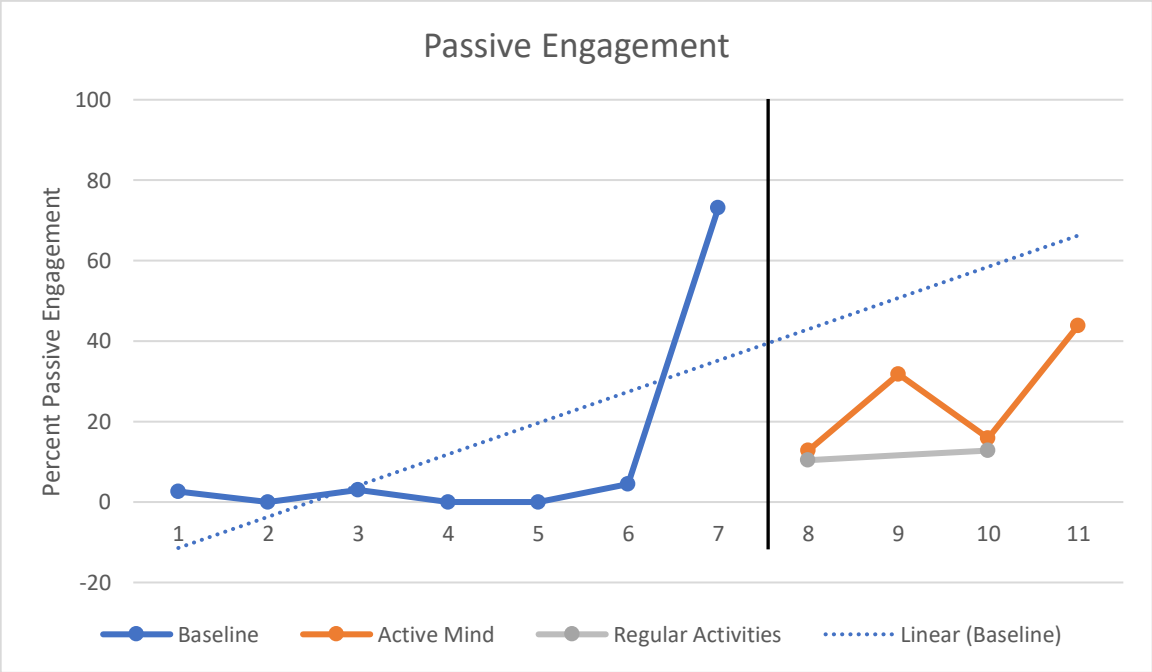


Figure H3. *Percentage of no engagement across all observational sessions.*

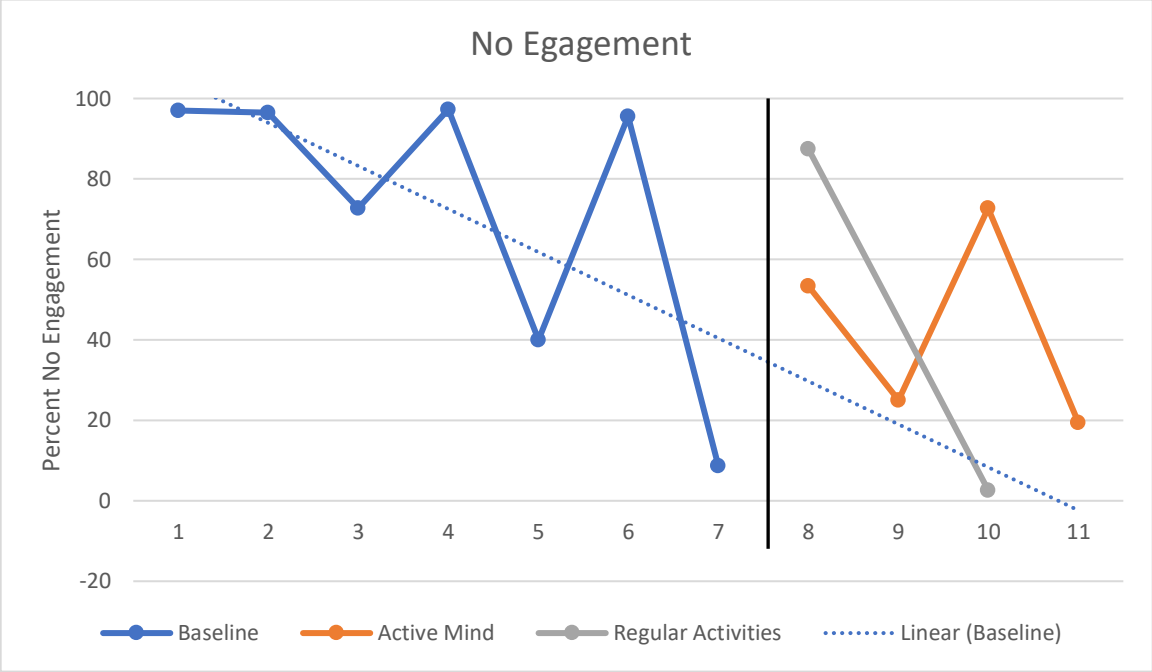


Figure H4. *Percentage of positive affect across all observational sessions.*

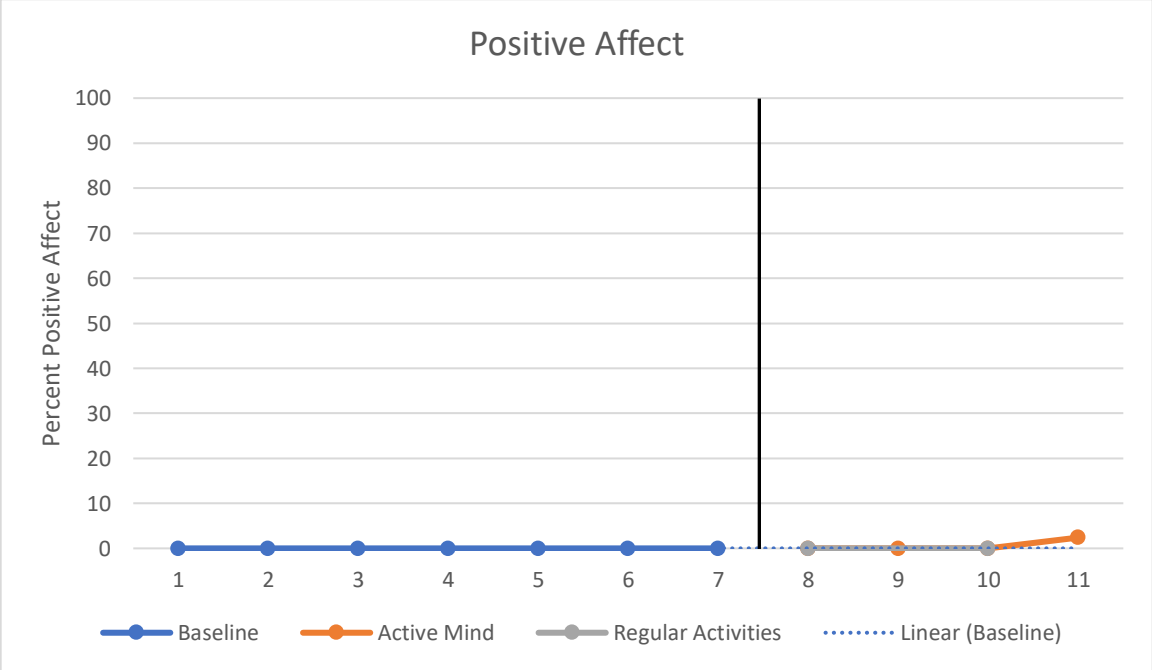


Figure H5. *Percentage of negative affect across all observational sessions.*

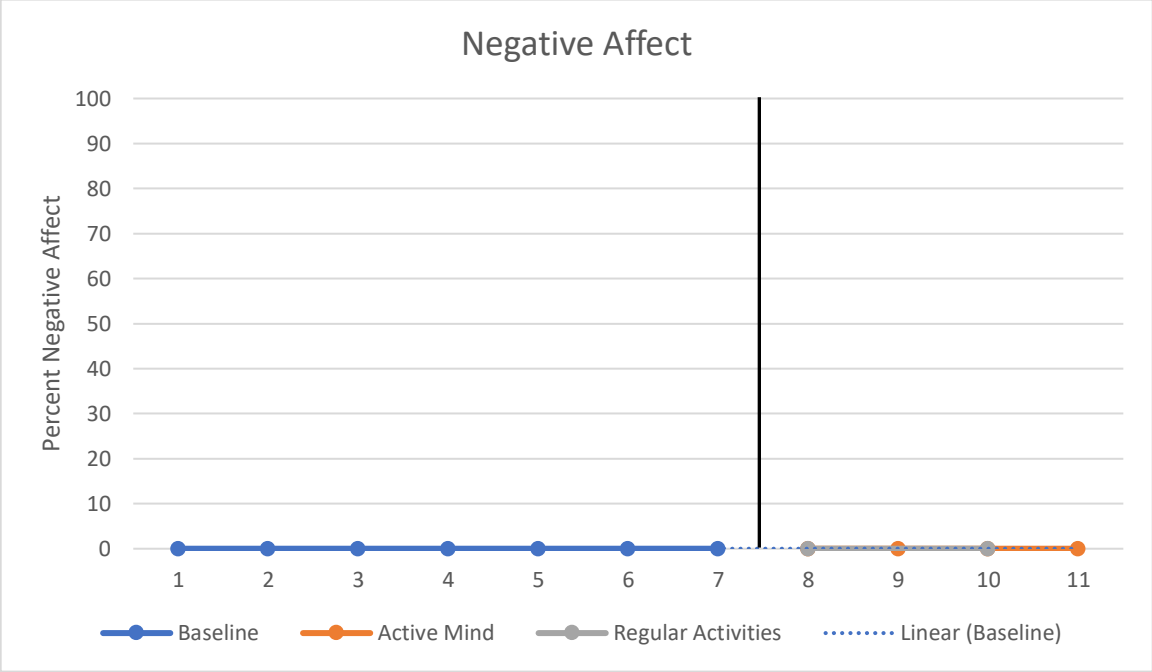
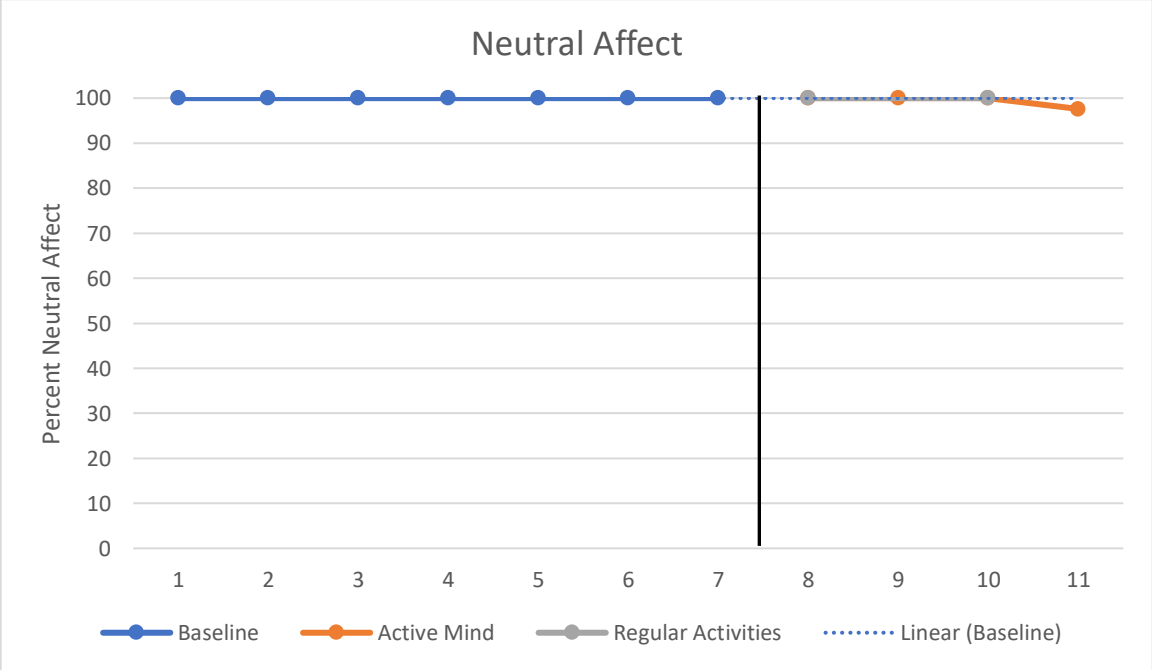


Figure H6. *Percentage of neutral affect across all observational sessions.*



Appendix I

Graphs of Observational Data for Participant Three

Figure I1. *Percentage of active engagement across all observational sessions.*

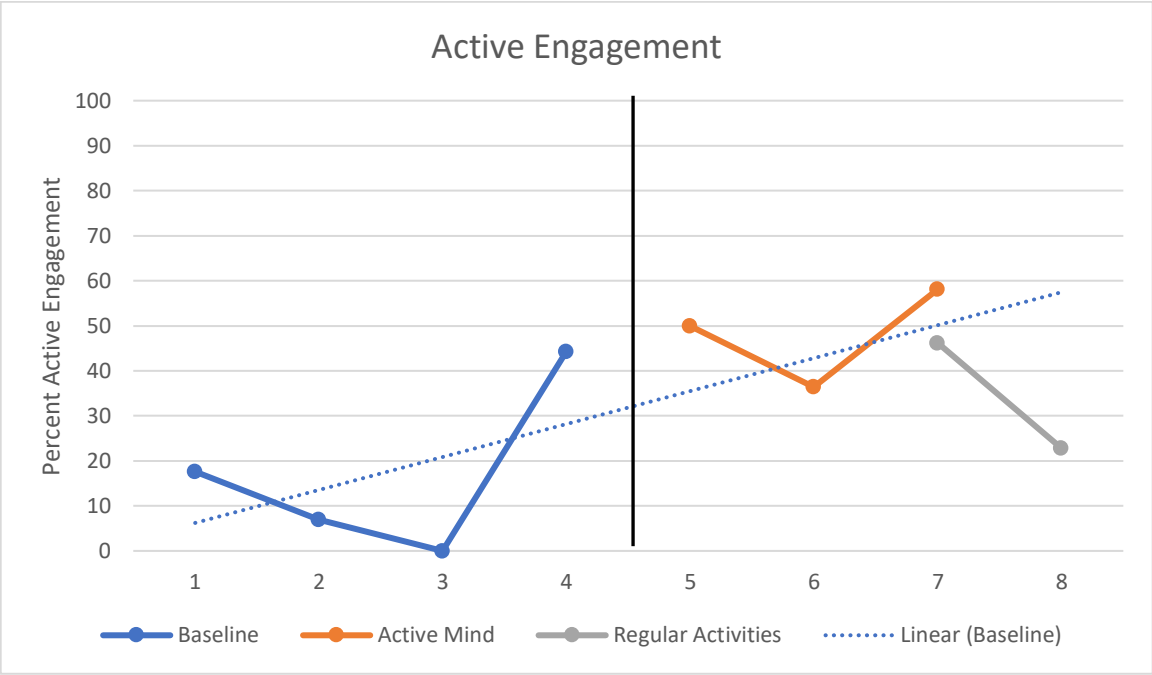


Figure I2. *Percentage of passive engagement across all observational sessions.*

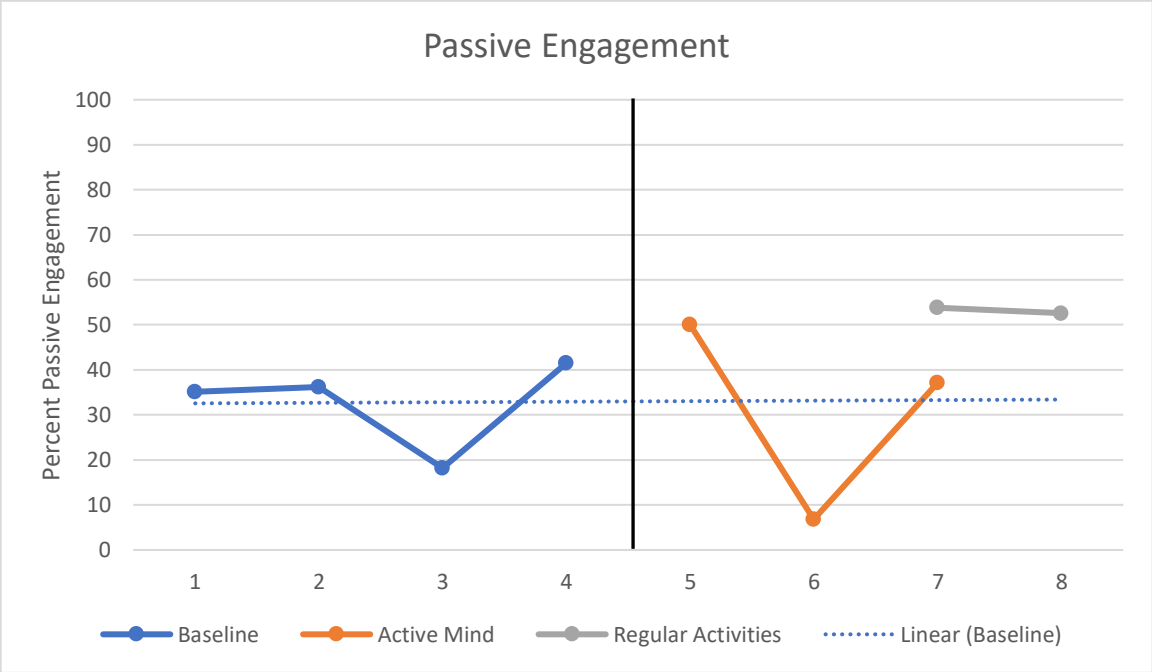


Figure I3. *Percentage of no engagement across all observational sessions.*

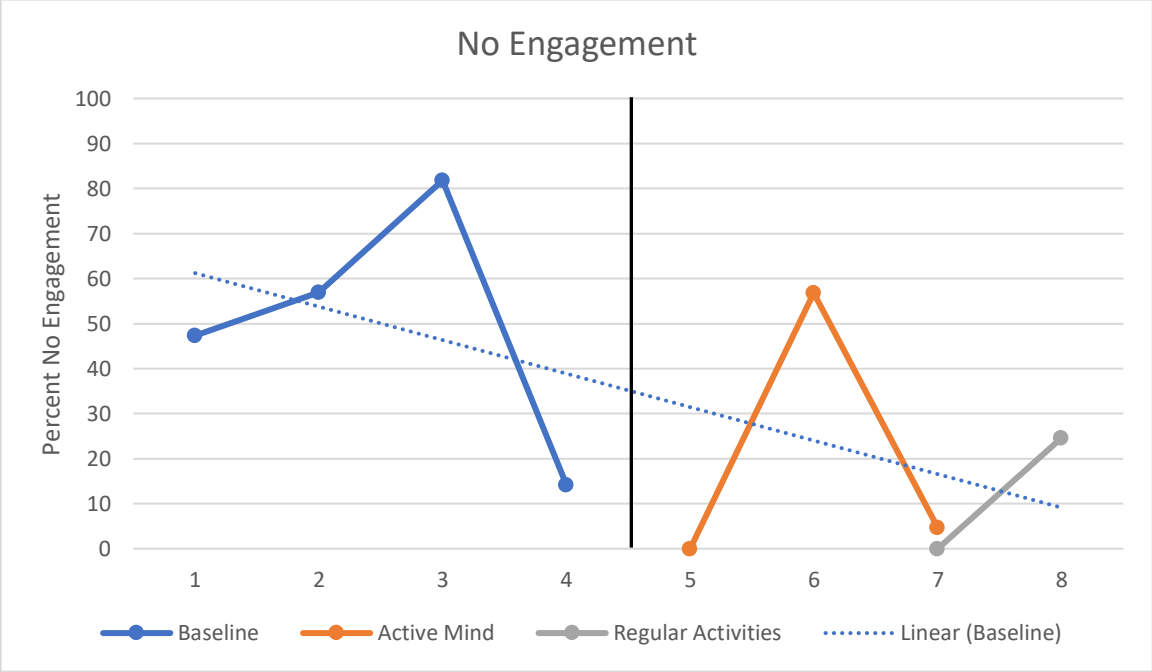


Figure I4. *Percentage of positive affect across all observational sessions.*

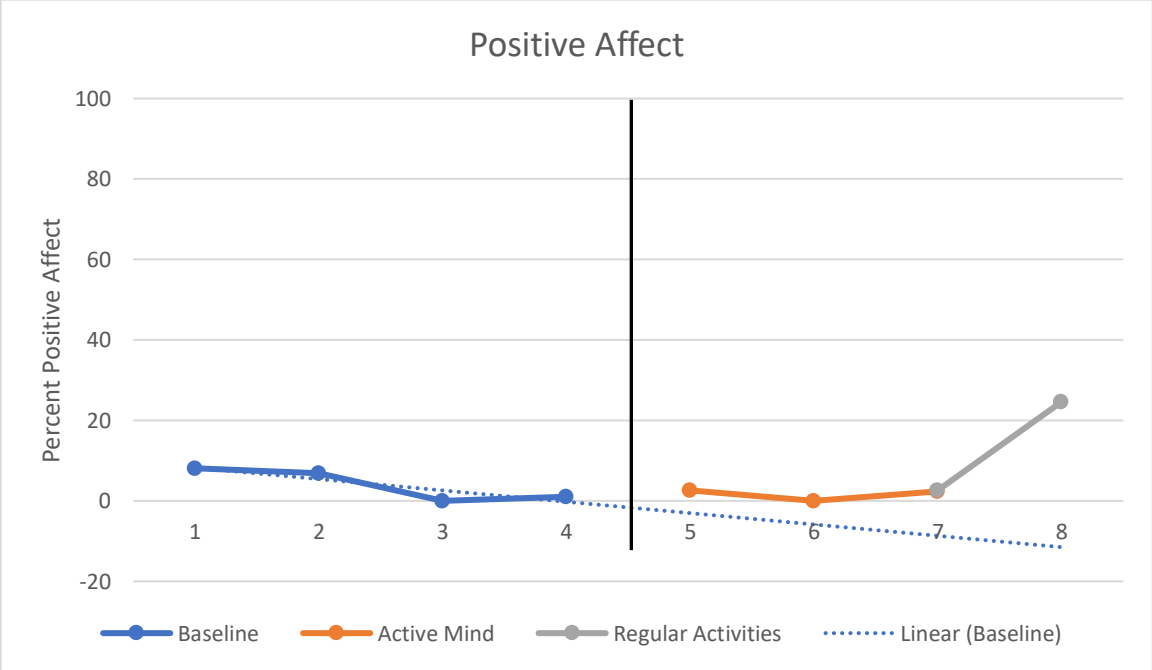


Figure I5. *Percentage of negative affect across all observational sessions.*

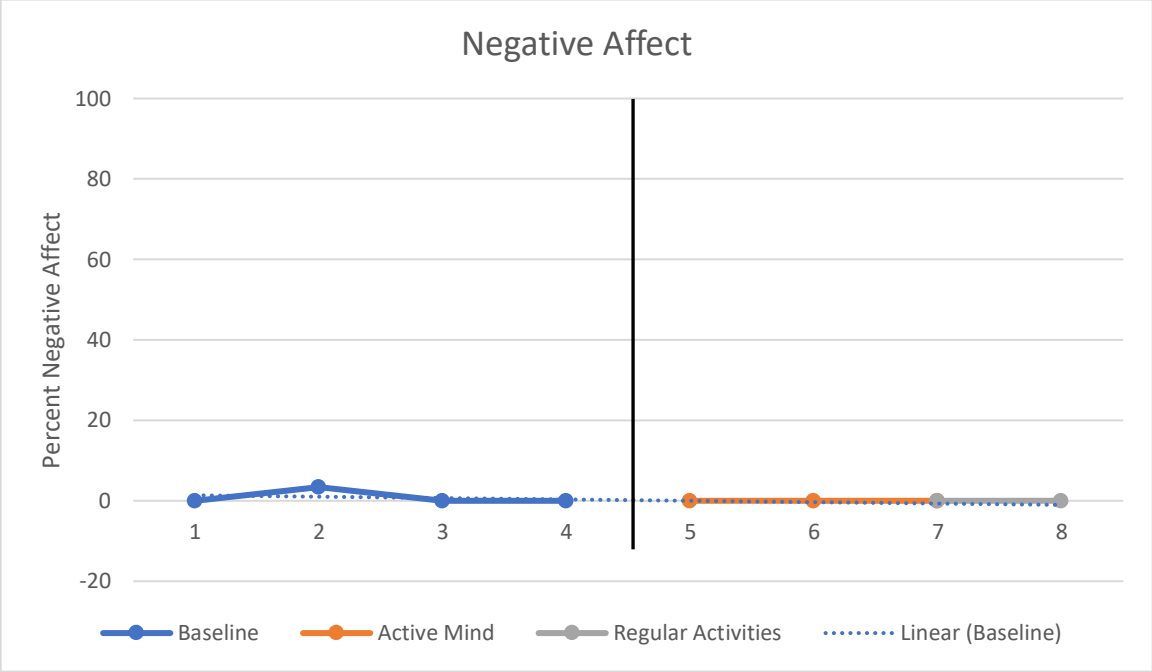
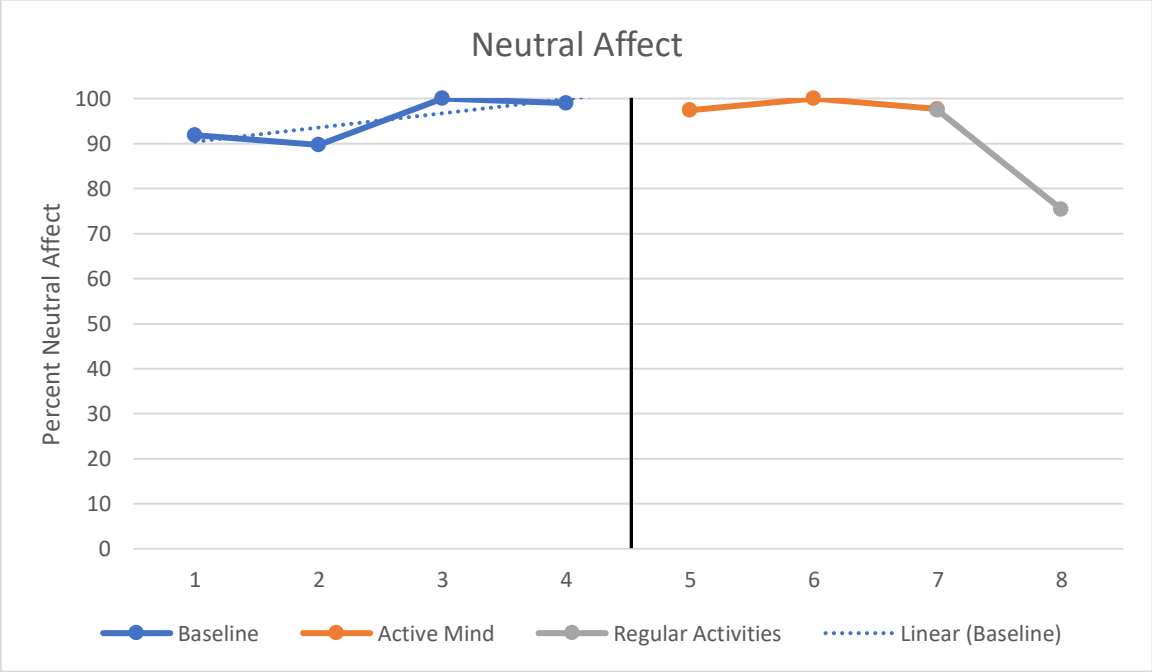


Figure I6. *Percentage of neutral affect across all observational sessions.*



Appendix J

Graphs of Observational Data for Participant Four

Figure J1. *Percentage of active engagement across all observational sessions*

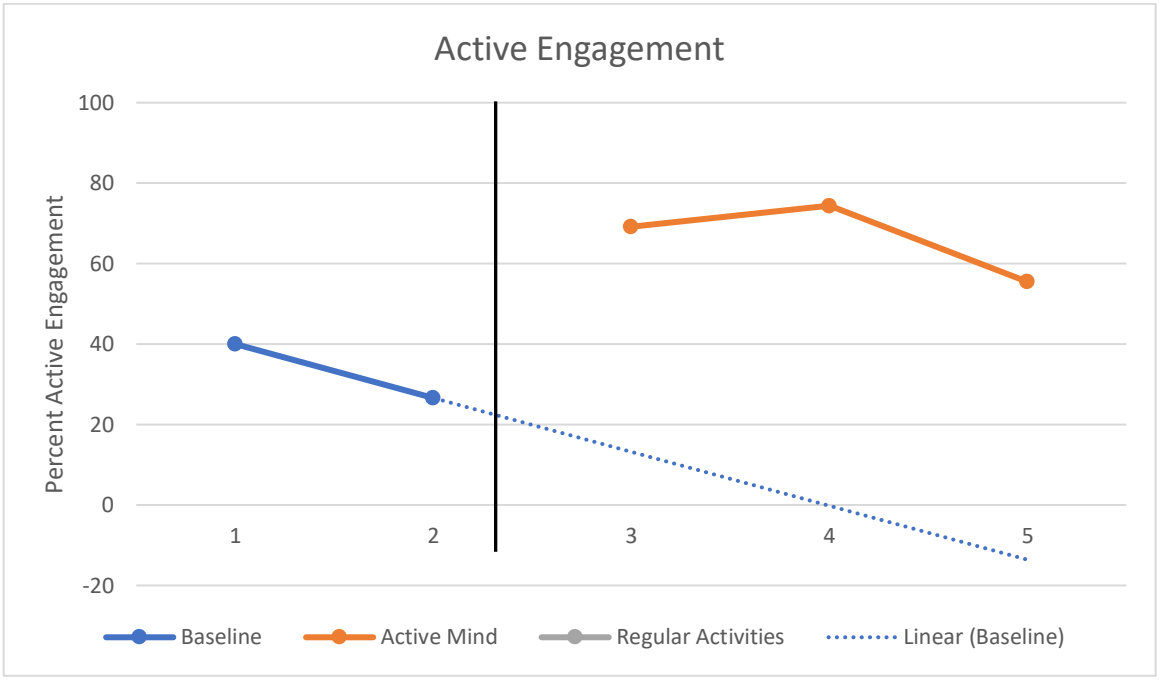


Figure J2. *Percentage of passive engagement across all observational sessions*

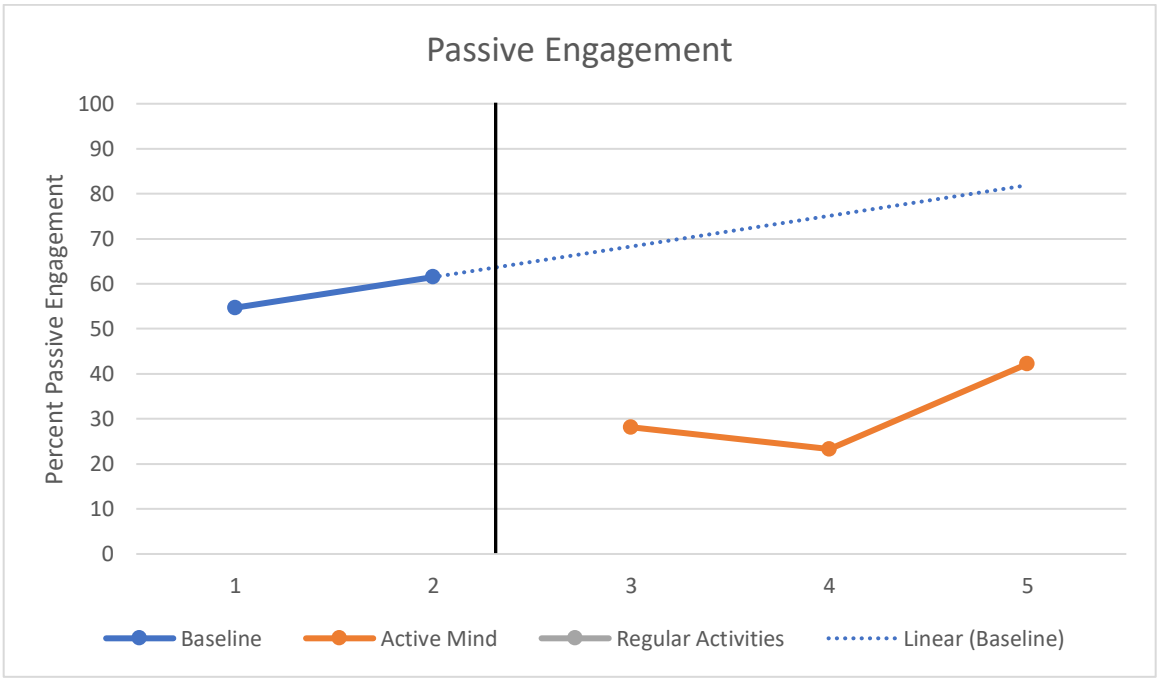


Figure J3. *Percentage of no engagement across all observational sessions*

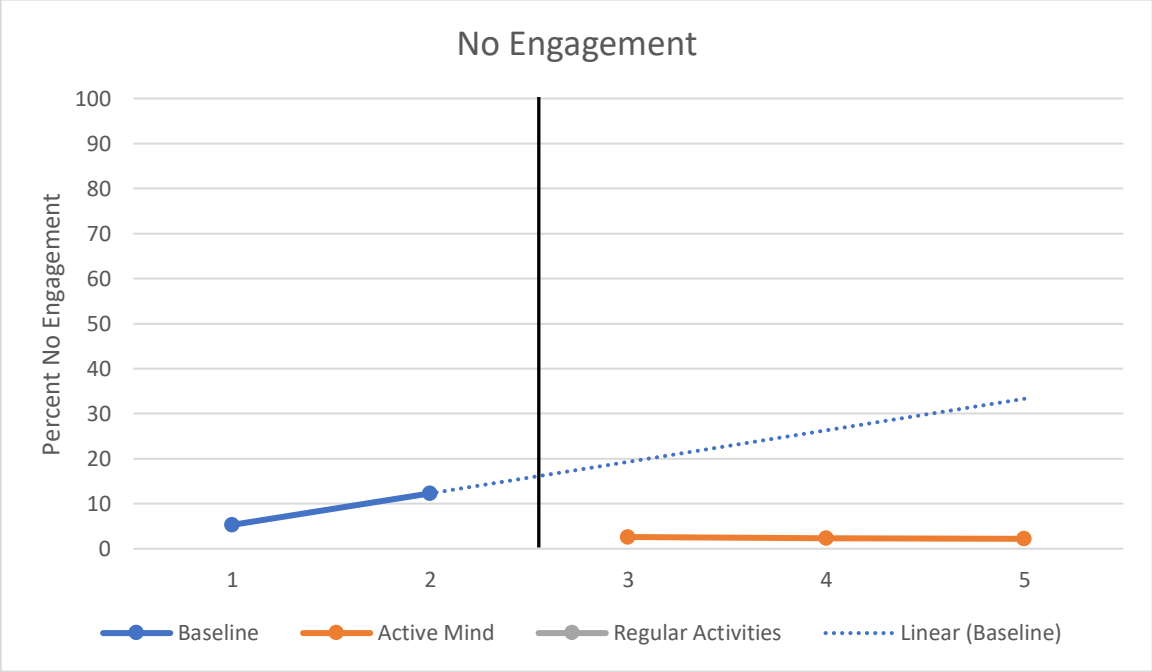


Figure J4. *Percentage of positive affect across all observational sessions*

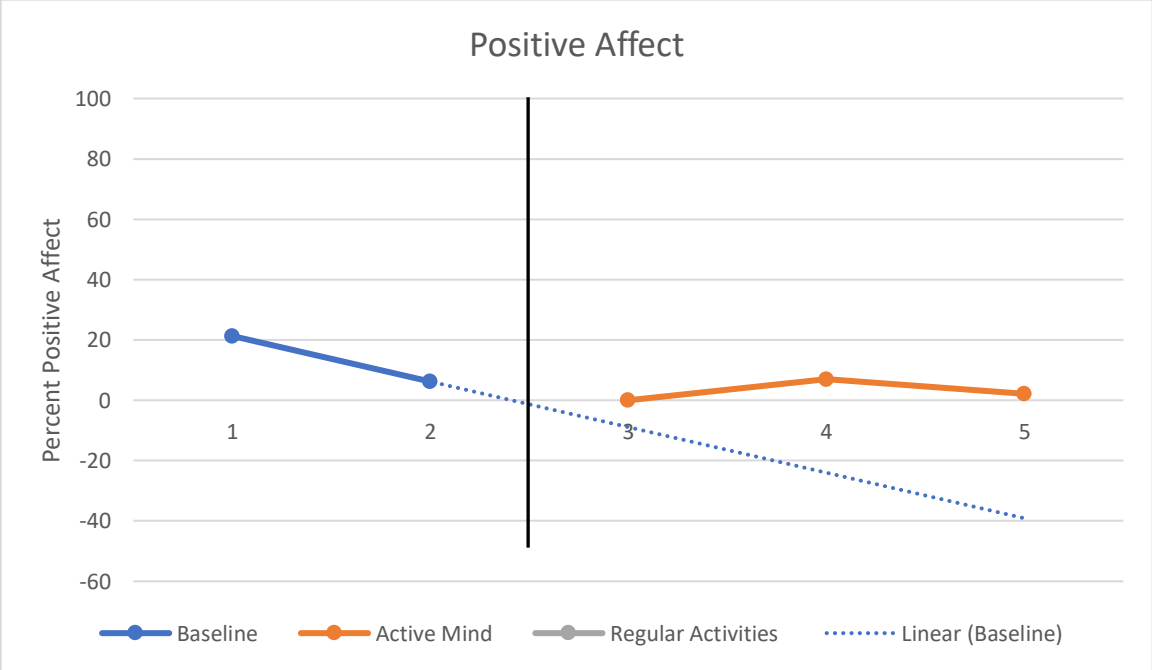


Figure J5. *Percentage of negative affect across all observational sessions*

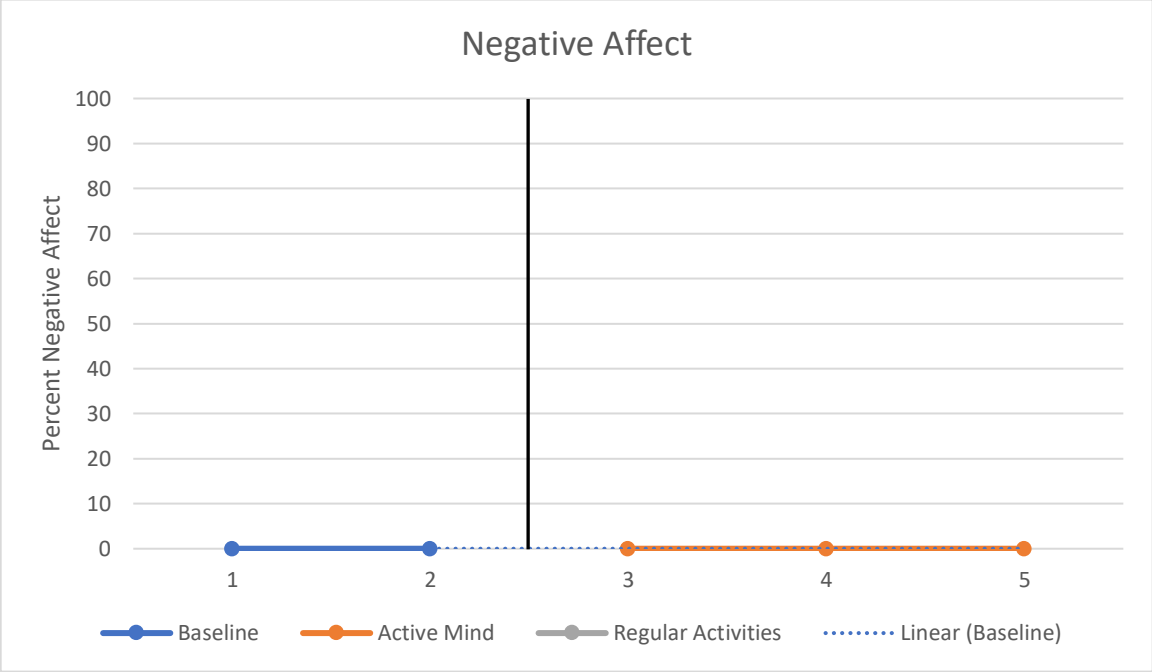
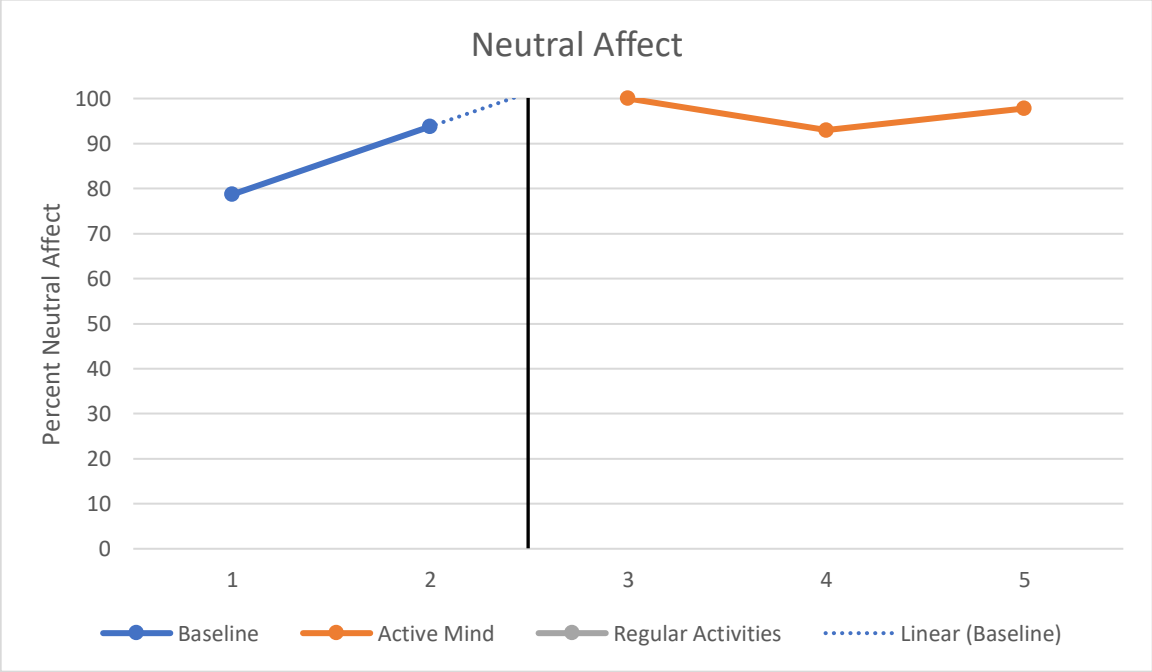


Figure J6. *Percentage of neutral affect across all observational sessions*



Appendix K

Graphs of Observational Data for Participant Five

Figure K1. *Percentage of active engagement across all observational sessions*

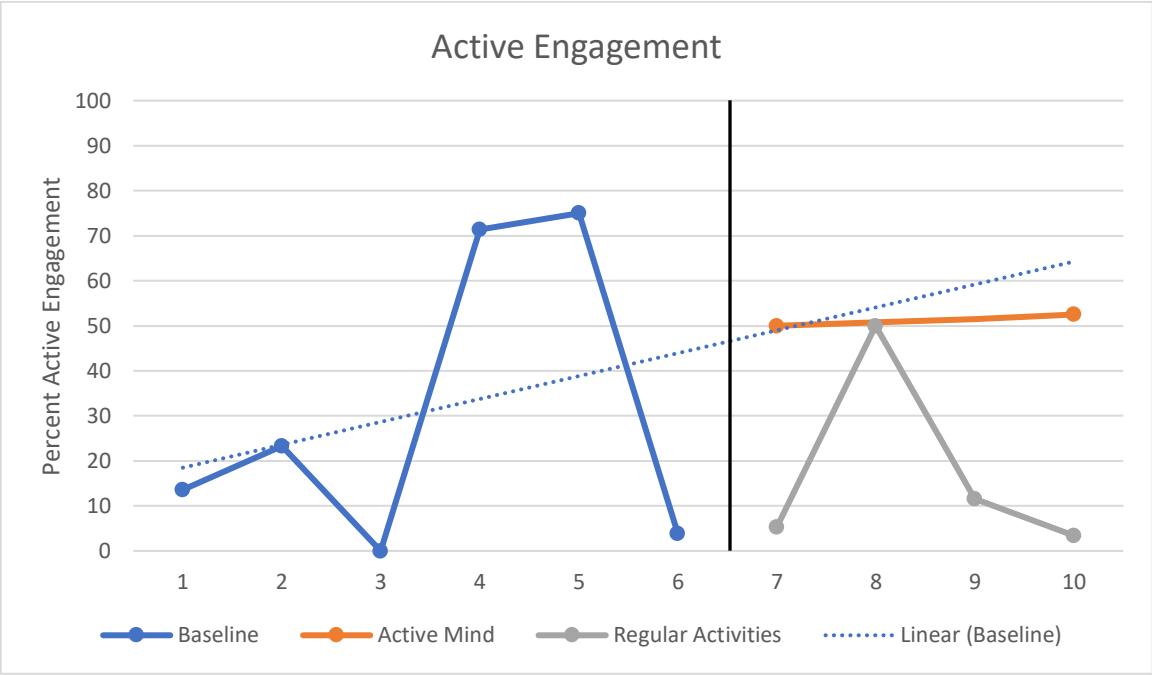


Figure K2. *Percentage of passive engagement across all observational sessions*

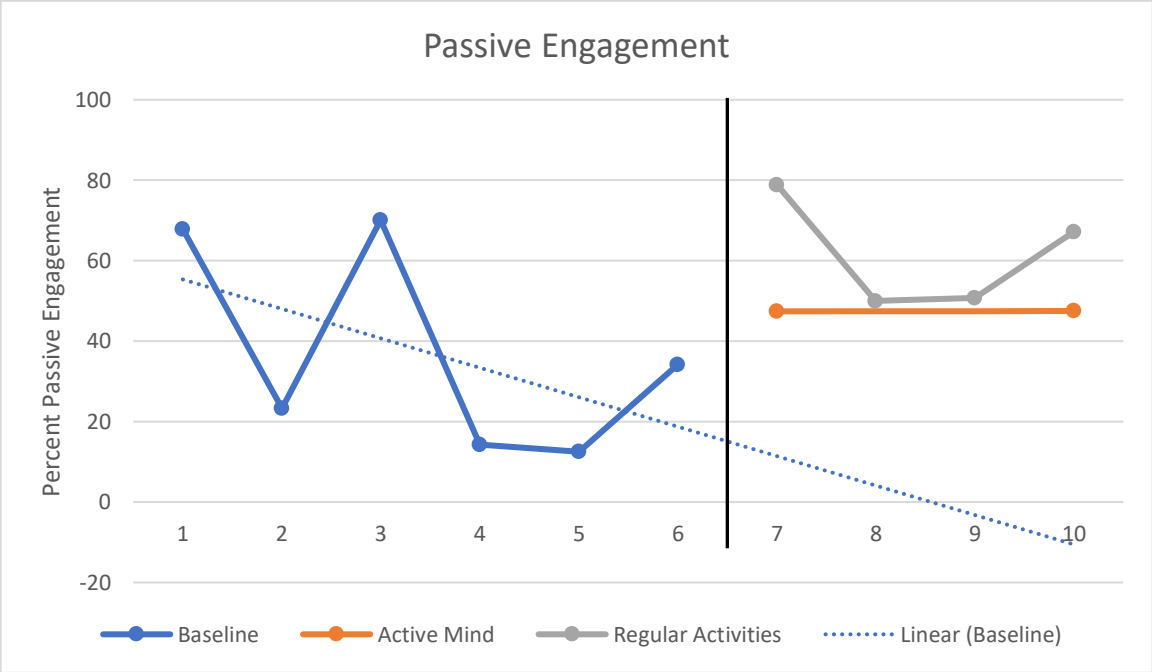


Figure K3. *Percentage of no engagement across all observational sessions*

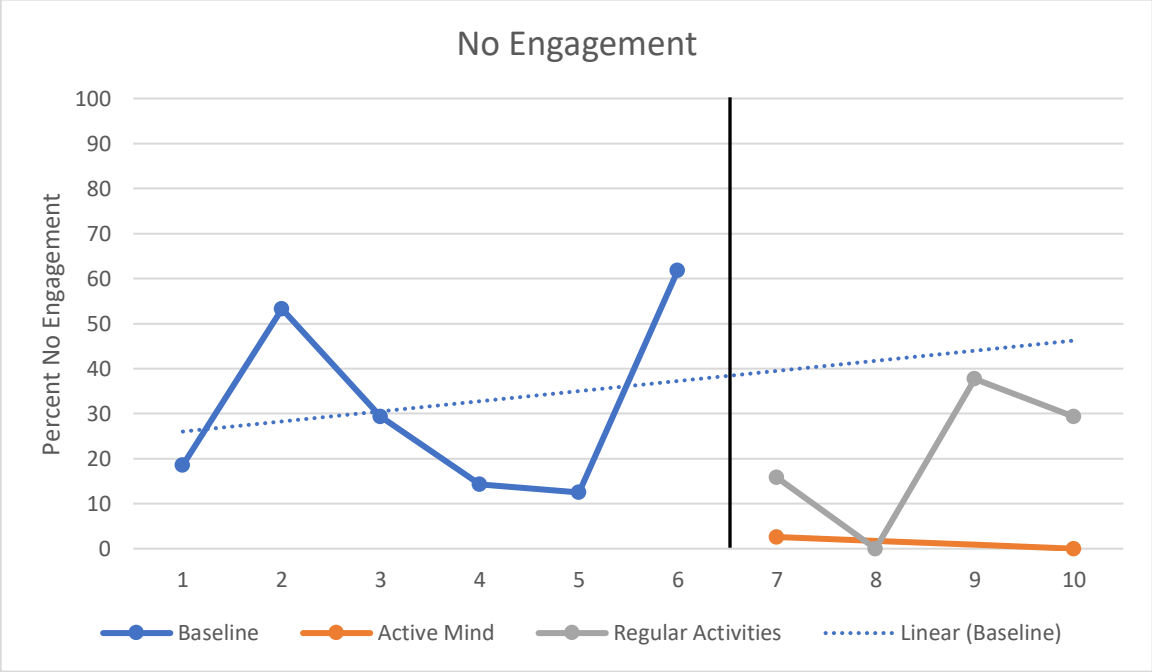


Figure K4. *Percentage of positive affect across all observational sessions*

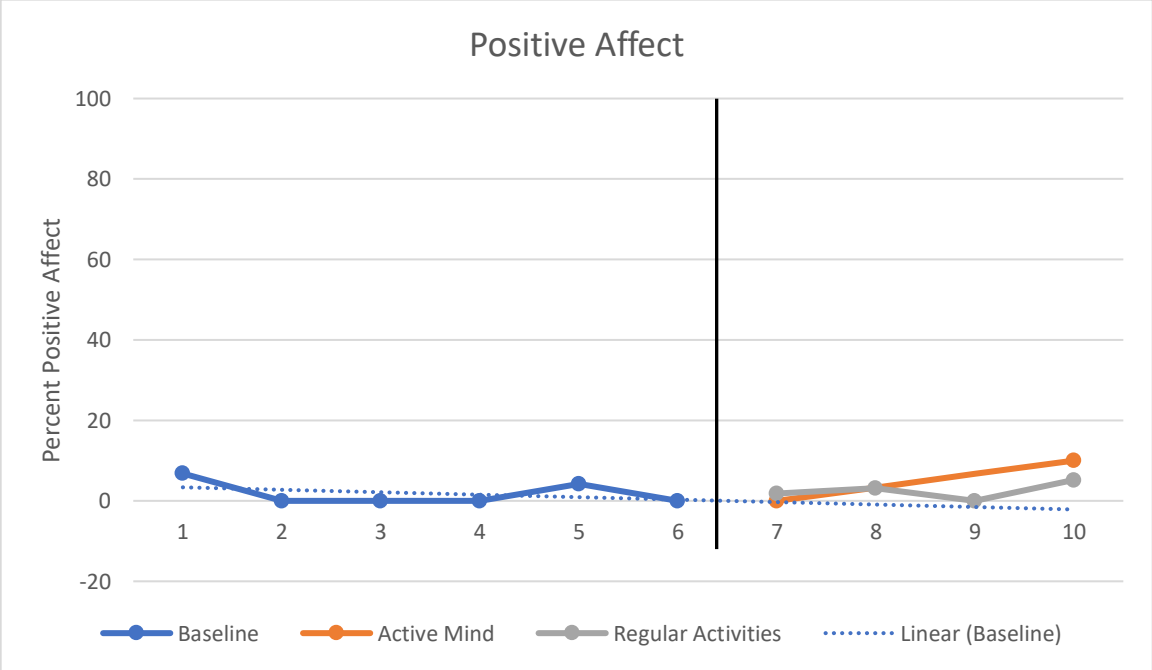


Figure K5. *Percentage of negative affect across all observational sessions*

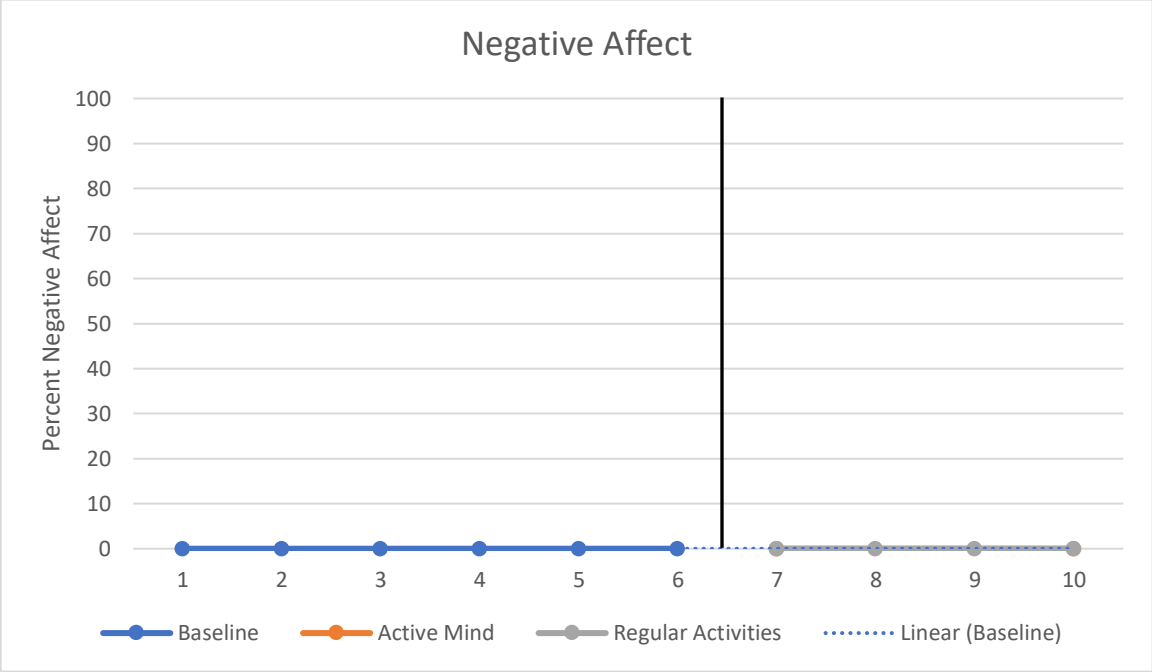


Figure K6. *Percentage of neutral affect across all observational sessions*