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# Comparing Responses to Horticultural-Based and Traditional Activities in Dementia Care Programs

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**Abstract**

Engaging persons with dementia in meaningful activities supports well-being; however, care staff are challenged to implement age- and ability-appropriate activities in a group setting. We compared a randomly assigned treatment group, who received horticultural therapy-based (HT-based) programming to a comparison group, who engaged in traditional activities (TA) programming, on engagement and affect. Horticultural therapy-based programming was implemented twice weekly at 4 treatment sites for 6 weeks, while regular TA were observed at comparison sites. Results revealed no differences between groups on affective domains. Levels of adaptive behavior differed between the groups, with the treatment group demonstrating higher levels of active, passive, and other engagement and the comparison group demonstrating higher levels of self-engagement. Our results highlight the value of HT-based programs and the importance of simultaneously capturing participants' affective and behavioral responses. Theoretical and practical considerations about the facilitation of and context in which the programming occurs are discussed.

**Keywords**

Alzheimer's disease, dementia, environmental press, horticulture, therapeutic activities

## Introduction

Persons with dementia in long-term care commonly spend their days inactive and isolated from meaningful social or individual activity.[1] Lack of activity opportunities proves particularly problematic for persons with Alzheimer's disease and related dementias (ADRD) who experience diminished capacity to engage independently in meaningful activity.[2]

Increasing prevalence of ADRD and continued evidence of problems in care environments point to the need for person-centered care, which supports individuals' dignity and well-being through supportive social interactions and meaningful activities.[3] Person-centered caregivers employ a *strengths perspective* that highlights competencies and minimizes deficits through an in-depth understanding of each person's abilities, interests, and social histories. Increasingly, the person-centered approach guides innovative interventions for persons with dementia.[4,5] We examined one such intervention, horticultural therapy-based (HT-based) activities, and its effects on the behaviors and affect of persons with dementia. We compared the outcomes of a treatment group receiving a 6-week dementia-specific HT-based program with those of a comparison group receiving traditional activities (TA) at 8 dementia-care programs.

### *Theory of Environmental Press*

The theory of environmental press[6] depicts a relationship between individual competencies and the environment, which interact to support or detract from individual well-being. Optimal person-environment fit (or adaptation level [AL]), characterized by positive affect and adaptive behavior is a balance between the individual's competence level and the level of demand, or *environmental press,* in his or her environment (See ref 6 (p661) for an illustration of the environmental press model). Persons unable to achieve such congruence display maladaptive behavior and negative affect. Because persons with ADRD possess limited ability to reduce environmental press by exerting their competencies, a person-centered approach mandates that others help them achieve a desirable person-environment fit. Caregivers can adapt the physical and social environment to suit the person's competence level or increase their competency by exercising intact skills and abilities.

*Enhancing competence to reduce press.* Caregivers who practice a strengths approach to dementia care engage individuals in activities that exercise intact abilities.[7] Tasks that tap

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emotional memory, procedural memory, sensorimotor function, and social skills enable persons with ADRD to engage in overlearned behaviors, which can slow decline and maximize functional competence, hence reducing environmental press.

*Modifying activities.* Other researchers modify activities and materials to foster meaningful engagement and positive affect.[8,9] Camp and colleagues[10] applied the *Montessori Method* to working with older adults with dementia. Facilitators use preplanned modifications termed *extensions* that simplify, add complexity to, or change the activity's materials or processes. *Extensions* enable persons to participate, sustain participants' interest in the activities, and enhance their competence level by tailoring tasks to suit existing abilities.[10] Research comparing Montessori-based activities to other approaches revealed more constructive engagement and more pleasure during Montessori-based programming.[8]

*Modifying the environment.* A variety of dementia-care researchers have noted the importance of the social and physical environments on the behavior and affect of persons with ADRD.[11,12] Considering the physical environment, researchers have associated access to the outdoors with decreased aggression and medication use.[13] Others emphasized the value of the natural environment to reduce agitation and aggression.[14]

Turning to the social environment, a person-centered perspective mandates that staff learn about the social histories of their participants. Activity professionals using other approaches often offer activities that are age-inappropriate; these result in maladaptive behaviors and decreased socialization.[15] Related research has demonstrated a complex relationship between staff behaviors, motivation, and levels of learned helplessness among persons with dementia.[16]

## Horticultural Therapy

Horticultural therapy represents 1 therapeutic alternative that reflects a person-centered approach to achieving person-environment fit by adapting the environment to exercise individuals' competencies.[17] Horticultural therapy professionals break down activities into smaller components and match them to clients' abilities, which enhances individuals' competence.[18] Environmental press is further reduced when professionals incorporate adaptive equipment. Finally, horticultural therapists incorporate knowledge of their clients and activity extensions to support a positive social environment that highlights the unique meaning that activities may hold for each participant.

Participants in HT work as independently as possible through modifications prepared by the therapist. For example, a horticultural therapist may present plant propagation through stem cuttings to a group of clients with dementia. Individuals who are more cognitively intact may engage in the entire sequence of steps, or they may be appointed to the most difficult step of the process; individuals with the greatest limitations may simply fill the pots with soil repeatedly or push cuttings into the filled pots. Participants may use specialized tools with elongated handles and enhanced safety features to compensate for limited range of motion and difficulties with discrimination. An extension to prolong engagement or add variety to the activity could involve taking cuttings from a wide variety of species and planting them in different-sized pots.

Although techniques of modifying the environment using a strengths-based approach can be used with a variety of interventions, the use of live plant materials is hypothesized to generate benefits that traditional activities may not.[19] Plants are an age-appropriate medium enjoyed throughout life by many people in varied contexts. As a familiar activity, they often stimulate reminiscence. Plants also provide tactile, olfactory, and optical stimulation, which benefits persons with dementia.[20] Cultivating live plant materials instills the role of caregiver to persons who depend on others for most of their daily needs.

Investigations of HT have demonstrated a wide range of benefits for diverse populations. Psychosocial outcomes included increased socialization[21] and reminiscence[20] as well as self-esteem[22] and life satisfaction.[23] Other outcomes attributed to participation of elders in HT programs included increased motivation, initiation, and physical functioning, resulting in greater levels of independence and autonomy.[24,25]

Although a wide range of populations have benefited from HT, empirical evidence of benefits to persons with dementia remains insufficient. We conducted 3 pilot investigations of HT-based activities for adults with dementia.[26-28] In each study, HT-based activities supported greater productive engagement in activities and less time non-engaged compared to the same participants' response to TA. The second and third investigations[26,27] revealed that participants also exhibited higher levels of positive affect during HT-based activities than during TA. Viewed together, the results of the 3 studies strongly indicated that HT-based activities can meet the needs of persons with compromised competencies, even when provided in a group context.

We applied Lawton and Nahemow's model of environmental press[6] to the practice of HT-based programming with persons with dementia. We enhanced internal validity by increasing and diversifying characteristics of previous HT-based study samples to include treatment and comparison group participants. Multiple measures demonstrating good psychometric properties were incorporated to capture outcomes elicited by the activities.

We tested 2 hypotheses concerning the type and level of engagement and affect during HT-based activities compared to TA programming.

- Participants in HT-based activities will exhibit higher levels of adaptive behavior (a greater percentage of time exhibiting high levels of active, passive, and other engagement) than participants in TA during the presented activities.
- Participants in HT-based activities will experience more positive affect (a greater percentage of time exhibiting higher levels of pleasure and interest and a lesser percentage of time exhibiting higher levels of anxiety/sadness) than participants in the TA during the presented activities.

**Table 1.** Participating Sites' Descriptive Characteristics

| Site and Condition | Type of Program | Number of Participants Served by the Facility | Number of Participants Included in the Sample | For Profit/Not for Profit | Mixed Unit or SCU |
|---|---|---|---|---|---|
| T1[a] | ADS | 8-12 Daily | 7 Participants | Not for profit | Mixed group |
| T2[a] | Nursing home | 90-Bed facility | 23 Participants | For profit | Mixed unit |
| T3[a] | Nursing home | 60-Bed facility | 25 Participants | For profit | SCU[b] |
| T4[a] | Nursing home | 100-Bed facility | 20 Participants | State veterans care facility | Mixed unit |
| C1[c] | Nursing home | 30-Bed facility | 13 Participants | Federal veterans care facility | SCU[b] |
| C2[c] | ADS | 30 daily | 13 Participants | Not for profit | Mixed group |
| C3[c] | ADS | 10-16 Daily | 11 Participants | Not for profit | Mixed group |
| C4[c] | Nursing home | 226-Bed facility | 17 Participants | Not for profit | Mixed unit |

[a] T1-T4 = treatment groups 1-4.
[b] C1-C4 = comparison groups 1-4.
[c] SCU = Special Care Unit to describe units that specifically cater to persons with dementia.

**Table 2.** Demographic and Background Characteristics of the Participants

| Characteristic | Entire Group | Treatment Group | Comparison Group | df | T-Statistic | $\chi^2$ |
|---|---|---|---|---|---|---|
| Percentage female | 53.10 | 56.80 | 49.10 | 1 | – | 0.74 |
| Percentage Caucasian | 93.00 | 94.60 | 90.60 | 1 | – | 0.76 |
| Mean age in years (SD) | 80.09 (8.05) | 81.34 (7.17) | 78.36 (8.92) | 96.53 | −2.01[a] | – |
| Mean mini mental status exam (MMSE) score (SD) | 9.62 (7.76) | 10.77 (7.08) | 8.12 (8.41) | 81.63 | −1.66 | – |

[a] Indicates significance at the <.05 level.

## Methods

### Participants

The sample contained 129 persons with a diagnosis of dementia from 8 care programs in rural southwest Virginia (5 nursing homes and 3 ADS programs). Following IRB approval from the investigators' university and authorization to conduct the study from each of the study sites, 4 programs were randomly assigned to the treatment condition of twice-weekly HT-based programming for six weeks. The other programs served as comparison sites providing TA. Programs ranged in size from small ADS programs (10-12 clients daily) to large nursing homes (up to 226 residents; see Table 1).

Inclusion criteria for individuals included a diagnosis of dementia, the ability to attend activities in the common area, and verbal assent from participants. Participants must have attended at least half of 1 observed HT-based or TA session. The mean length of time observed was 50 minutes. The decision to include participants who attended at least half of 1 session was made to increase the sample size to enhance statistical power.

*Background characteristics.* Seventy-five participants comprised the treatment group with 54 in the comparison group. Table 2 presents demographic data and background characteristics. Independent sample *t tests* and *chi-square* analyses indicated that the treatment and comparison groups possessed similar characteristics except age; the treatment group was older than the comparison group ($t$ (96.53) = −2.01, $P$ = .05).

### Procedures

Treatment sites agreed to provide space for the HT-based activities and staff to transport participants and support physical care needs during activities. Each facility received a cash donation and a manual of HT-based activities.

Two facilitators developed and facilitated HT-based activities at the treatment sites. Activities were selected for anticipated therapeutic benefits within social, physical, psychological, and cognitive domains. In addition, activities were simple, cost-effective, and versatile. Plant materials were researched to ensure safety.

Group sizes at HT-based activities ranged from 4 to 20 participants; the average number of participants varied at each site. When group size exceeded 8 participants, the facilitators divided participants into 2 groups to provide step-by-step instructions, physical and verbal assistance, and a steady supply of materials to each participant. Participation was always voluntary and elders were informed that the focus of the activities would be gardening.

Horticultural therapy-based activities ranged from sowing seeds and training topiaries to craft activities that incorporated horticultural materials or themes. Activities were designed to support both individual and collective engagement. Facilitators encouraged social interaction and reminiscence by asking questions about participants' social histories and experience gardening, farming, and cooking. These practices reflected a person-centered philosophy and enhanced the social environment.

To achieve treatment fidelity, all activity plans were reviewed by the second author, a horticulture therapist and

gerontologist, to insure use of a person-centered approach across sites. Activity content varied slightly depending on what plants were in season and whether the group had access to facilitate activities in an outside space. Adaptations for activities (ie, to simplify, make more complex, or extend an activity with different materials) were preplanned to insure inclusion of all participants wishing to join the horticulture sessions.

Treatment site staff were asked to join the sessions to provide transit and ADL assistance, but staff provided this support at only 2 sites. The physical environment varied across facilities; each group participated in a designated area, and several sites had outdoor spaces that were accessible in good weather.

*Data collection.* Two teams (treatment group and comparison group) collected data over 6 weeks; observations took place twice a week during weeks 1, 2, 5, and 6. Observers tried to code participants in the first 2 weeks and again in the last 2 weeks; when available, observations were averaged to account for differences in participants' responses. Each observer was responsible for a different scale (the Apparent Affect Rating Scale or Menorah Park Engagement Scale). Teams identified which participants they would observe in tandem and coded up to 6 participants at each 30-minute activity. Observers positioned themselves to have a full view of participants' faces and bodies while attempting to remain as unobtrusive as possible.

At each site, observers collected data in the morning. Within a given group, activities were facilitated during the same time and day; however, between groups there were slight differences in the days and times that HT-based activities and TA took place.

## Instrumentation

Information gathered on each participant included demographic information and cognitive status. Observational data were used to address the study hypotheses.

## Participant Characteristics

*Demographics and diagnosis.* Information obtained from facility staff included, age, race, and diagnosis. We distributed a survey regarding treatment participants' gardening history; however, the low return rate precluded use of this information for activity facilitation or data analysis.

*Mini mental status exam.* Level of cognitive impairment was assessed using the mini mental status exam (MMSE),[29] which was administered by trained research assistants during the 6 weeks of data collection.

*Measure of affect.* Affect was assessed using a modified version of the Apparent Affect Rating Scale (AARS).[30] We used the scale to assess pleasure, anxiety/sadness, and interest. We eliminated the category of anger because previous research with similar populations demonstrated infrequent instances of anger.[31,32]

**Table 3.** The Menorah Park Engagement Scale Coding Categories

| Category | Description of Behavior |
|---|---|
| Active (AE) | Active Engagement in presented activity: motor or verbal response to the activity |
| Passive (PE) | Passive engagement in presented activity: listening to or observing the activity |
| Self (SE) | Repetitive or self-stimulating behaviors: excessive rubbing, wringing hands, wandering |
| Non (NE) | Asleep or disengaged from an activity: "zoned out" or blank stare |
| Other (OE) | Doing or attending to an activity other than the target activity presented |

[a] Each of the categories was coded as 0 = *not at all*, 1 = *up to ½ of the 5-minute observation*, 2 = *>½ of the 5-minute observation.*

Observers coded affective states using guidelines for facial and vocal expressions indicating participants' emotions. Each observer rated the length of time (0 = *not at all*, 1 = *up to ½ of the observation*, 2 = *More than ½ of the observation*) the emotion was exhibited by each participant for each 5-minute interval during the 30-minute activity sessions. Observers reached 95% coding agreement before beginning data collection.

*Measure of engagement.* The Menorah Park Engagement Scale (MPES)[32] was used to capture 5 types of engagement (Table 3) commonly displayed by persons with dementia in the activity setting. Codes reflect the amount of time spent in a category of engagement (0 = *not at all*, 1 = *up to ½ of the observation*, 2 = *more than ½ of the observation*). The observer coded time spent in each type of engagement at 5-minute intervals. If 2 or more behaviors took place at the same time, observers used a coding hierarchy to make decisions (see Figure 1). This scale has not yet been assessed for validity in large-scale studies; however, the scale developers report a 95% interrater agreement and high content validity.[8] Prior to data collection, observers demonstrated 95% interrater agreement.

## Analysis

*Coding procedures.* The measures provided categorical information about the amount of time participants displayed a given affective or behavioral state. With 8 possible behavioral and affective states (passive, active, self, none, other, pleasure, anxiety, and interest) and 3 possible values representing the amount of time each participant exhibited each state (0 = *not at all*, 1 = *up to ½*, 2 = *more than ½*), 24 coding categories were generated. To convert categorical data into continuous scores for analysis, we calculated the percentage of time each participant was observed exhibiting each value in each state.

This method of converting the categorical data into continuous values was selected over the alternative of averaging the data across time frames because an average of a categorical value decreases measurement specificity. However, presenting

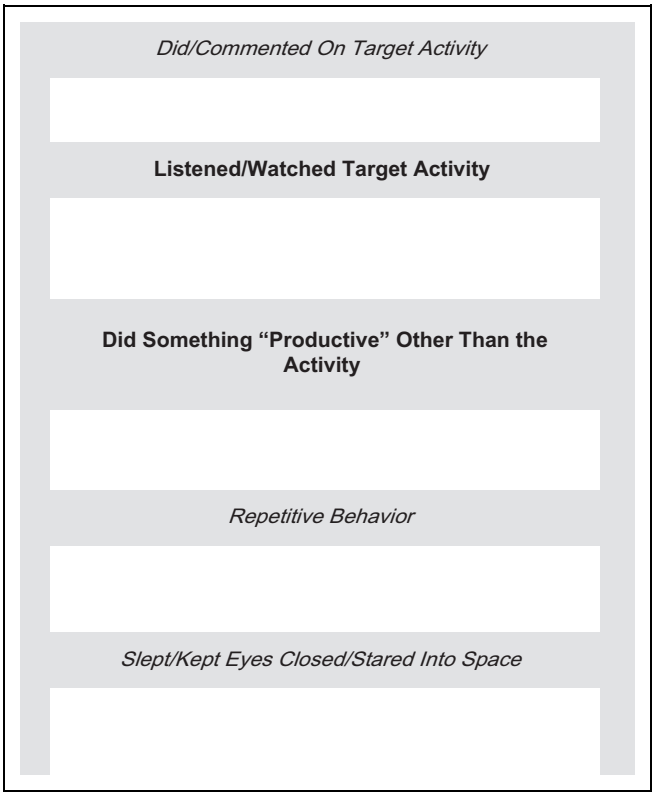


**Figure 1.** Menorah Park Engagement Scale hierarchy ladder. Coding directions indicated that if 2 or more behaviors are taking place at the same time, code the behavior that is higher on the "ladder."

the percentage of time participants spent exhibiting each value retains the original intent of the scale.

The calculated percentages for the engagement and affect data exhibited nonnormal distributions, which were not corrected by transformations. Thus, we used a nonparametric test, the Wilcoxon-Mann-Whitney $U$ test to test the study hypotheses. We decided to only use the percentage of time each behavior or state was exhibited more than half of the observation period, which indicated how participants were spending the majority of their time. This decision limited our ability to make comparisons about behaviors and emotions that were expressed infrequently, but reducing the number of variables analyzed increased statistical power. Power analyses revealed that power levels were primarily acceptable,[33] ranging from 0.53 to 1.0 with the exception of pleasure, which had low power of 0.175, indicating the increased likelihood of committing a type II error.

## Results

### *Wilcoxon-Mann-Whitney U* Results

Significant differences between the treatment and comparison groups were found in 4 of the 5 engagement categories; thus our analyses partially supported the first hypothesis. The HT-based group spent a significantly greater percentage of time than the comparison group exhibiting active engagement (AE) more than half of the observation ($z = -2.90$, $P = .00$), indicating that horticultural activities better solicited high levels of participation than TA. Although findings indicated that the comparison group was more likely to be self-engaged (SE; $z = -4.60$, $P = .00$), the HT-based group was more likely to be passively engaged (PE; $z = -2.72$, $P = .01$) and also more likely to be engaged in an activity other than the HT-based activity (OE; $z = 3.47$, $P = .00$). No differences were found between groups on the percentage of time nonengaged (NE) for more than half of the observation ($z = -1.45$, $P = .15$; Table 4).

The results of the Mann-Whitney test did not support the second hypothesis. There were no significant differences between the treatment and comparison groups on the 3 affective coding categories, including pleasure ($z = -1.544$, $P = .123$), anxiety ($z = -.086$, $P = .932$), and interest ($z = -1.26$, $P = .208$).

Because treatment group members were older than comparison group members, we analyzed correlations between age and outcome variables. Interest was the only significant relationship, with older participants expressing less interest ($r = -.19$; $P = .034$), which increases the chance of a Type II error. Because we rejected the second hypothesis, we are not at risk of making a Type II error interpreting our analysis of interest.

## Discussion

The current study was part of a larger mixed-method investigation of the effects of HT-based programming on persons with dementia in institutional care programs. Our findings, interpreted through the theory of environmental press, suggest that neither the HT-based nor TA programming supported participants' attainment of the adaptation level (AL), which is characterized by optimal person-environment fit.

The HT-based group demonstrated higher levels of adaptive behaviors such as active, passive, and other engagement and lower levels of maladaptive behaviors such as self-engagement than the comparison group. Despite these differences, participants did not differ in terms of nonengagement or exhibited affective states. This may suggest that the HT-based group attained the zone of maximum performance potential, depicted just to the right of the AL, where press slightly outweighs personal competence. The fact that the HT-based programming was new to the participants and was introduced for a relatively short period of time may explain why the HT-based group appeared to fit in this zone of the model, which induces adaptive behavior. Future research should examine programming over time to determine whether behaviors and exhibited affect change, suggesting that press is weakening though practice and the development of associated procedural memory.

Conversely, the TA group appears to be situated just to the left of the zone of maximum comfort, which lies to the left of the AL. These activities and facilitators were familiar to participants; therefore, press from the activity context may have been lower. This group exhibited higher levels of self-engagement and lower levels of active engagement, which

**Table 4.** Wilcoxon-Mann-Whitney Test Results

| | HT Group (N = 75) | | Comparison Group (N = 54) | | Mann-Whitney | |
|---|---|---|---|---|---|---|
| Dependent Variables | Mean | Median | Mean | Median | z | *P* |
| Percentage of time exhibited pleasure ">1/2 of the observation" | 8.6 | 0.0 | 9.4 | 0.0 | −1.54 | .12 |
| Percentage of time exhibited anxiety/sadness "> 1/2 of the observation" | 1.2 | 0.0 | 0.9 | 0.0 | −0.09 | .93 |
| Percentage of time exhibited interest ">1/2 of the observation" | 58.0 | 71.4 | 65.1 | 82.6 | −1.26 | .21 |
| Percentage of time exhibited AE ">1/2 of the observation" | 35.6 | 33.3 | 20.7 | 16.7 | −2.30 | .00 |
| Percentage of time exhibited SE ">1/2 of the observation" | 2.5 | 0.0 | 11.7 | 8.3 | −4.60 | .00 |
| Percentage of time exhibited NE ">1/2 the observation" | 13.7 | 8.3 | 9.5 | 0.0 | −1.45 | .15 |
| Percentage of time exhibited PE ">1/2 of the observation" | 41.5 | 41.7 | 28.8 | 25.0 | −2.72 | .01 |
| Percentage of time exhibited OE ">1/2 of the observation" | 24.8 | 17.0 | 11.1 | 0.0 | −3.47 | .00 |

Abbreviations: HT, horticultural therapy; AE, active; SE, self; PE, passive; NE, non; OE, other engagement.

suggests that participants may have been underchallenged. If this imbalance between press and competence was sustained, participants would eventually exhibit maladaptive behavior and negative affect.

## *Adaptive Behavior*

Our first hypothesis that participants in HT-based programming would exhibit higher levels of adaptive behavior than participants in TA was partially supported. The HT-based group was significantly more actively and passively engaged (in HT-based and other activities) than the traditional activity group, which suggests that the HT-based activities were appealing and sustained participants' attention, even in the group context. Persons with dementia representing a wide range of cognitive and skill levels were able to participate in the HT-based activities, which enabled them to exercise intact abilities and may have contributed to long-term biopsychosocial benefits that can be achieved through maintenance of those skills. The creation of an environment that affords participants a choice to engage on a variety of levels illustrates the person-centered nature of HT-based programming guided by the theory of environmental press.

Our hypothesis that the HT-based group would spend less time self-engaged than the traditional group was also supported. These maladaptive behaviors were more pervasive during TA programming, which indicates that participants were unable or unwilling to engage in presented TA. High levels of self-engagement indicate poor person-environment fit and may reflect a lack of person-centered programming and environmental modifications.[6]

In contrast to our previous studies,[27,28] nonengagement did not differ between settings. The percentage of time in which nonengagement accounted for more than half of the observation was low for both the HT-based (13.7%) and traditional groups (9.5%). This finding is encouraging considering previous research that demonstrates high levels of inactivity among persons with dementia in care programs.[34] Because observations only occurred during scheduled programming with persons who voluntarily joined activities, these findings indicate that when individuals voluntarily participate in activities, incidences of nonengagement can be minimized.

We might have expected greater levels of engagement had we been able to build the HT-based programming around social history data related to participants' previous horticultural experiences, which we intended to gather through the surveys sent to family caregivers. Even without caregivers' survey responses, however, facilitators employed other person-centered practices by engaging elders voluntarily and exercising their intact abilities using preplanned modifications to increase or decrease demand placed on individuals. Additionally, HT-based programming reflected common activities participants would have completed caring for home gardens and houseplants. Achieving higher levels of active engagement and lower levels of passive engagement suggest that our person-centered approach was effectively implemented even if we lacked full details on participants' horticulture history.

## *Affective States*

The second hypothesis that HT-based activities would elicit higher levels of pleasure and lower levels of anxiety was not supported. No group differences were observed on any affective states. Interest was the most commonly observed affective state, accounting for greater than half of the observations for both groups. Pleasure was less commonly observed, which may be due to the flattening affect that occurs in persons with dementia. Anxiety was the least commonly exhibited state in both groups, which may speak to the importance of activities programming regardless of content. Although not supported in this investigation, our pilot research revealed that HT-based activities elicited more positive affect than traditional activities.[26,27] Because the observational measure differed in the current study, it is impossible to speculate whether this discrepancy was a function of the measure or the programming. The theory of environmental press recognizes that a *person-environment fit* between the environment and competence of each individual results in positive affect due

to a sense of mastery and esteem that results from adaptive behavior. Because levels of positive affect were not higher during the HT-based programming, we cannot infer that the HT-based group reached the desired AL despite the fact that behaviors were adaptive. The model's intermediary zones that lie between the AL and the zone characterized by a poor person-environment fit are characterized by tolerable affect and marginally adaptive behavior; this zone appears to best capture the HT-based programming participants' status.

Reflecting on the types of activities presented in the HT-based programming, it makes sense that not all of them would elicit pleasure, though participants demonstrated adaptive behavior across sessions. We might expect more positive affect when participants reminisced during the activity and less exhibited positive affect while engaged in work-based activities that required concentration and effort (eg, mixing soil or deadheading flowering plants). Engagement in these activities without outward expression of pleasure need not indicate lack of enjoyment.

## Limitations

The current study advances HT and dementia care research, but limitations of the investigation need to be considered. The quasi-experimental design made it impossible to control environmental factors and confounding variables that may have influenced observed outcomes. Although we reviewed activity plans and facilitators' journals throughout the course of the study to promote and insure adherence to a person-centered approach using horticulture therapy principles, the variation in client number and characteristics, physical space, and even growing season could have resulted in differential facilitation of activities than if we had been able to conduct a true experiment simultaneously at the 4 treatment sites.

Because our measures focused on participants as sources of information, we did not assess environmental characteristics that may have affected participants' experiences (see Jarrott & Gigliotti, IN PRESS, for an in-depth analysis of the role of the social environment in the current study).[35] For example, the facilitators of TA differed at each traditional site; their diverse approaches to facilitating programming may have affected participants' outcomes. Another staffing difference was that TA facilitators were the regular facility staff; facilitators of HT-based programming reported that their brief tenure at each site influenced their ability to implement a person-centered approach. Further, one of these facilitator was training to be a horticultural therapist but did not have experience working with persons with dementia. The second facilitator had person-centered care training for work with dementia but no horticultural training. Although their skills complemented each greatly in the full group setting, when the facilitators worked individually with smaller groups, their lack of cross-training may have affected their ability to support participants' achievement of optimal fit.

Despite its limitations, the current study contributes to the fields of HT and dementia care programming. It helps fill a gap in the HT research concerning persons with dementia.

## Future Research

The design and methods used in the current investigation represent an improvement in HT research; however, further changes could enhance the magnitude and use of the findings. Subsequent studies must examine innovative therapeutic practices with more attention to the contextual factors. For example, all TA programming occurred indoors, while some HT-based programming occurred outside and may have an effect on participants' well being beyond activity content. Future research might consider the influence activity setting (indoors versus outdoors) for both HT-based and TA programming. When aspects of the physical and social environment cannot be controlled, they must be measured and statistically accounted for to ensure an accurate interpretation of the findings.

Similarly, measures that assess the facilitator should be included. An analysis of the facilitators' interaction style, knowledge of dementia-care practices, and facilitation techniques would inform findings and subsequent practice. For example, Burgio and colleagues used a checklist to count specific communication skills used to support client well-being. Attention to procedures and processes employed by facilitators would also increase the ability of others to replicate an approach that is associated with documented benefits.[16]

Researchers need measures that assess emotions of persons with dementia. Standardized observation scales are useful, but observers remain challenged to interpret affective expression in a population experiencing normative and disease-influenced changes in skin tone and facial muscles. Research demonstrating that persons with dementia can express preferences[36] indicates that observation may be complimented by direct participant report.

Future research in this area should also seek to understand the dosage of the intervention that is necessary to achieve desired outcomes. Thus far, resources and collaborative agreements between researchers and facility administrators have determined the intervention dosage. Achieving high rates of engagement with twice-weekly activities presented by facilitators who were strangers to participants, the challenge now is to determine how to provide greater exposure to this and similar effect producing programming. Systematically assessing the dosage of the therapeutic programming needed to achieve desired outcomes will help program planners maximize benefits.

Continued use and refinement of theory is essential. Although the theory of environmental press provides a useful framework for understanding what conditions influence behavioral and affective outcomes, it does not indicate how to alter the environment or enhance competencies to achieve a good fit for participants. In addition, the theory of environmental press does not explain how 2 approaches using similar techniques contribute differentially to participants' experiences. Synthesizing the theory of environmental press with theories relevant to HT may explain observed differences when both activities use similar strategies. Theories that address human-nature

interactions and the value of caring for living plants have been put forth in the literature, but these theories have not been applied to persons with dementia.[37]

## Conclusions

The current study demonstrates that HT-based activities are a viable and desirable choice for dementia-care programs because they successfully engage groups of participants who are often difficult to engage in activities that elicit high levels of adaptive behavior. Horticultural therapy-based programming also facilitates lower levels of self-engaging behaviors that may be indicative of distress and are often viewed as problematic by caregivers. These findings can inform practitioners and program administrators in their quest to identify programming that can successfully engage groups of individuals with dementia possessing a range of abilities.

Partial attainment of the criteria that are indicative of a person-environment fit led the investigators to further explore those procedural and contextual factors that may have influenced the observed outcome variables. We identified factors in the physical and social environment, including the powerful influence of the facilitator that affected implementation of the intervention and participants' subsequent behavior and affect.[35] Practitioners must acknowledge these contextual factors and consider their influence as they plan for the facilitation of activities programming, including HT, for persons with dementia.

Practitioners should be encouraged by the current study; HT-based activities represent a generationally and developmentally appropriate outlet for older adults with dementia that promotes positive engagement. We demonstrated meaningful outcomes in a real-world group care setting with facilitators who were not certified as therapeutic specialists. Horticultural therapy-based activities should be incorporated into the therapeutic programming schedule of persons with dementia to diversify group-programming options in care settings that effectively support personhood by facilitating a good person-environment fit.

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