

THE EFFECT OF HORTICULTURAL PROGRAM WITH LIFE CONTEXTS ON THE COGNITIVE FUNCTION OF THE ELDERLY IN TAIWAN

Ya-Ling Wu, Shan-Ru Chao

National Pingtung University of Science & Technology, Taiwan

E-mail: sw7735@yahoo.com.tw

Wei-Fang Tsai

Agency of Correction, Justice of Ministry, Taiwan

Mei-Lun Chen

Wanlun Elementary School, Taiwan

E-mail: c2114433@gmail.com

Abstract

Based on the reminiscence therapy, the research aimed to develop the horticultural program with life contexts for the elderly in southern Taiwan, and to explore the effect on overall cognitive function of the elderly. The participants were 17 seniors in one community care center. The research adopted quasi-experimental research of one group pre-test and post-test design of time series, and data were collected by questionnaire surveys and semi-structured interviews. The objective of the program was to maintain cognitive function of the elderly. Twelve activities of the program were implemented once a week and 2 hours for each activity. The program included manual activity, group activity, and outdoor planting activity. The program content was based on farming experience of the elderly and integrated with diverse cognitive function trainings. It was found that the program showed immediate effect and two-week delay effect on promoting overall cognitive function of the elderly. Also, the elderly obtained new planting experience and their learning motivation was enhanced. Additionally, because of integrating with life contexts, the program was meaningful and encouraged the elderly to be engaged in the activities and recall the past. In the process, the elderly enjoyed the exchange of horticulture and life experience.

Keywords: horticultural program, the elderly, cognitive function, quasi-experiment

Introduction

Population ageing is a severe issue, being faced by most of the countries. Taiwan has become an aged society since the percentage of its population above 65 years of age was about 14% in 2019. In an ageing society, the negative effect caused by cognitive function degeneration of the elderly is an important issue. Cognition degeneration not only influences individuals' quality of life, independence and social ability, but it might also cause dementia. Individuals with dementia require medical and daily life care. The prevalence rate of dementia is 5% in the aged population of Taiwan. In Taiwan, the direct medical cost of treating a patient with mild dementia is about US\$ 1,400 per year. The cost of treating a patient with severe dementia is around US\$ 1,600 per year. The indirect cost of caring each patient of dementia is about US\$ 14,000 per year, which increases as the disease deteriorates (Leong, et al., 2014). Because of the

rapid increase of aged population, Taiwan is facing the burden of taking care of the elderly with cognitive function degeneration. Hence, the Taiwan government has to make and implement the policies of preventing and delaying cognition degeneration of the elderly. These policies would also benefit the quality of life of the elderly and their caregivers, and also avoid the burden on care services and have a positive effect on the society and the economy development.

In recent years, the countries with the aged population, have implemented various programs to prevent and delay cognitive function decline of the elderly. Some argue that cognitive function training for the elderly and those with mild cognition impairment would delay cognitive function degeneration. The cognitive function training includes memory training, time training, etc. (Chaikham, et al., 2016; Cheng, et al., 2013). However, in most of the existing studies, cognition training designed for the elderly has been decontextualized. Further, the cognition training activities have been repetitive and static. Moreover, some studies have adopted various media, such as horticulture, board games, music and physical activities, to enhance cognitive function of the elderly. Although the activities have improved the cognitive performance of the elderly, they have not shown meaningful association with the elderly, who thus lacked interest and could not join in the activities for long. According to the reminiscence therapy of geriatrics, the elderly possess abundant life experience, and they tend to be fixed to familiar experiences. By using objects, such as familiar photos and music, to systematically guide the elderly to recall and share past meaningful life experience, the elderly are willing to participate in the activities in which they can recognize themselves. In this way, their cognitive function is enhanced (Wang, 2007).

Many countries are proactively providing various cares and services for the elderly to delay their ageing with the help of community organizations. Taiwan also encourages community organizations to take care of their elderly persons by providing them with diverse activities. The number of the elderly in Europe, America and Taiwan who participate in horticultural programs is increasing. Besides, in the field of elderly care, horticultural programs are frequently applied to maintain physical and mental health of the elderly or delay their ageing. It is evident from the research that horticultural programs enhance cognitive function of the elderly (e.g., Kojima & Kunimi, 2013; Liu & Chu, 2018). Taiwan's economy had relied on agriculture. Many of the elderly in Taiwan had made their living by agriculture during their young age. Most of their life experience is about growing and taking care of plants. Therefore, horticultural programs associated with plants can be applied to enhance the cognitive function of the elderly in Taiwan. In this study, based on the Reminiscence therapy, we aimed to design and implement Horticulture Program with Life Contexts for the elderly, and simultaneously to explore the effect of the program on improving cognitive function of the elderly. The elderly who had made a living with agriculture in southern Taiwan have been taken as the participants of the study.

Literature Review

Cognition is the psychological process of the individuals to receive, perceive, comprehend and recognize the stimulus by consciousness. Hence, cognition includes two dimensions: cognitive process and cognitive function. Cognitive function refers to perception attention, memory acquisition, thinking and reasoning, logic judgment, plan monitoring, problem solution and imagination. Cognitive function is influenced by humans' neural function of the brain, mental stress or adaption to things. With age, the elderly show significant degeneration of cognitive function; for instance, they show slow response and decline of memory (Johnson, et al., 2007).

It mainly relies on the medical treatment and non-medical treatment to delay or prevent cognitive function degeneration of the elderly. Non-medical treatment also enhances physical health through exercises and strengthens cognitive function, including various types of training to maintain the operations of brains (Chaikham et al., 2016).

Reminiscence Therapy

Reminiscence therapy is applied as a social-psychological intervention to prevent and delay cognition degeneration of the elderly. Reminiscence therapy focuses on the elderly who can recall and share their experiences by exploring meaningful and influential events in lives to get satisfied, identify with themselves, lower anxiety, and improve the quality of life (Wang, 2007). Reminiscence therapy is developed on the basis of Atchley's Continuity Theory and Erikson's Development Theory in social psychology. It suggests that even when the individuals are aged and reach to the phase of dementia, their remote memory is still complete, which can serve as a tool to communicate with themselves (Thorgrimsen, et al., 2002). Thus, reminiscence therapy allows the elderly to develop sustainable self-concept and continue the development of different phases. The elderly possess rich memories, and reminiscence therapy allows the elderly to adapt to the change in their current lives by recalling memories. Reminiscent objects include pleasant stuff that results in positive outcomes. Reminiscent topics include the process of growth, childhood, holidays, entertainment, work experience, hometown, etc. Reminiscence therapy can be implemented in individuals or groups (Paker, 1995).

Evidence exists for different studies which have shown that cognitive function degeneration of the elderly can be prevented by reminiscence therapy. In these studies, music and photos were used as reminiscent objects. However, these studies could not tap long-term accumulative effect because they adopted one-off static activities. Further, due to the limited materials, the elderly could not experience diverse sensory stimulus and particular physical activities. Also, some studies could not elaborate the activity contents and process of reminiscence therapy applied (Cotelli, et al., 2012; Peng, et al., 2009). Therefore, appropriate objects and long-term implementation of reminiscence therapy can be more effective to prevent and delay cognitive function decline of the elderly.

Horticultural Activity

Horticultural activity is one of the non-medical treatments to prevent and delay cognition degeneration of the elderly. Horticultural therapy reinforces the participants' physical and mental health through horticultural activities (Bassen & Saltazar, 1997). From horticultural programs, the elderly obtain three kinds of benefits: physical health, treatment and rehabilitation of chronic diseases, and prevention from dementia (Tseng, et al., 2007). Horticultural program content can be simple or complicated, such as indoor potted culture planting and outdoor garden landscaping. Horticultural program results in the participants' benefits to cognition, social life, emotion and physical improvement. Types of cognition benefits and their sources are provided in Table 1 (Rothert & Dauber, 1981; Tseng, et al., 2007). The effect of horticultural therapy is associated with the three factors, including interaction, action and reaction (Phibbs & Relf, 2005). Relf (1973) has classified horticultural therapy activities into five types, including manual activity, group activity, excursion, outdoor planting, and outdoor trip.

Only a small number of studies have implemented horticultural programs on the elderly to prevent or delay their cognitive function degeneration (e.g., Kojima & Kunimi, 2013; Jarrott, et al., 2002). Most of these studies did not specifically elaborate on the contents and methods of horticultural programs. Therefore, the types of horticultural programs and the related benefits are uncertain and of very little use to further research. Although these programs could guide the elderly to plant effectively, their designs were decontextualized. Thus, they could not trigger the participation, interest, and motivation of the elderly. Besides, the elderly may have to spend more time in learning the unfamiliar activity contents.

Therefore, based on reminiscence therapy, this study designed and implemented the horticultural program with familiar life experience of the elderly to prevent and delay their cognitive function degeneration.

Table 1
Analysis of cognition benefits of horticultural program

Types of benefits	Sources of benefits
Acquisition of new skills	Individuals obtain horticultural skills, such as planting.
Increase in vocabulary	Individuals learn new terms,
Stimulation of curiosity	Individuals think of the growth of plants and experiment it.
Increase of observation	By observing plants, individuals can enhance the comprehension, planning, and decision-making competencies.
Sensory stimulus	Individuals experience visual, taste, touch and hearing stimulation.

Note. From *Horticultural Therapy at a physical rehabilitation facility*, by E. A. Rothert, & J. R. Daubert, 1981, Glencoe, IL: Chicago Horticultural Society.

“The therapeutic effects of horticultural programs on disable elderly in nursing home,” by T-H Tseng, W-S Lu, & C-L Ho, 2007, *Journal of the Taiwan Society for Horticultural Science*, 53(3), 345-360.

Research Methodology

Research Design

To explore immediate and follow-up effects of Horticultural Program with Life Contexts on the cognitive function of the participants, this study applied one-group time-series design. Research design is shown in Table 2.

Table 2
One-group time-series design model

Group	Pre-test	Intervention	Post-test	Follow-up test
Experimental group	O ₁	X ₁	O ₂	O ₃

Note: O1: Pre-test of the participants. One week before the program, this study administered the Montreal Cognitive Assessment (MoCA) on the participants. O2: Post-test of the participants. On the next day after the program, this study administered MoCA on the participants. O3: Follow-up test of the participants. Two weeks after the program, this study administered MoCA on the participants. X1: Intervention. The participants received Horticultural Program with Life Contexts implemented by the instructors.

Research Participants

The participants of the study were the seniors of the care center for the elderly in one community of Pingtung County in southern Taiwan. In recent years, Taiwan government has invested a lot to build care centers for the elderly that are managed by local communities. The residents in these communities provide the seniors with local preliminary care service

to maintain their physical and mental health. Pingtung in Taiwan is an agricultural county. In the research site of this study, in particular, more than 80% of the population make a living by farming. Almost all seniors aged 65 or above relied on agriculture when they were young. Thus, agricultural life is the shared life experience of the participants.

In this study, the community care center provides services for the elderly on Friday morning. Around 40 seniors usually participated in the service activities. The 17 participants were recruited voluntarily from the elderly of the community care center. The oldest was 90 years old, and the youngest was 67 years old. Their average age was 73.4 years, and they were all females. They were all the community residents, who had been living in the community for more than 35 years. After marriage, they all made their living by agriculture. Although some senior participants were aged, they occasionally assisted their family in farming. The senior participants were those in subhealth, who had chronic diseases, including high blood pressure and diabetes. As to cognitive function, they did not show severe dementia characteristics, such as incompetence of familiar tasks, the difficulty of expressing, and lack of sense of time or direction. Although they occasionally showed temporary memory gap, they could recall after they were reminded.

In the study, two instructors took turns guiding the activities of the horticultural program with the help of two assistants and two local community volunteers. This study was approved by the Research Review Committee of Pingtung County after the screening. With the study members' oral explanation, informed consent in writing was obtained from the participants before the start of the intervention.

Horticultural Program with Life Contexts

By taking into account life experiences of the elderly in Pingtung County, the horticultural program of this study integrated with life contexts which were familiar to them. In this study, 12 sessions of Horticultural Program with Life Contexts were designed and implemented. The objective of the program was to maintain or improve the overall cognitive function of the elderly. The outline of the program was shown in Appendix. Each session of the program included warm-up, main activity and integration as the guideline of the whole session. Warm-up phase aimed to enhance the attention and concentration of the elderly. It guided the elderly to be prepared for the session and to review the previous one. It triggered their cognition, memory and social interaction. Thus, warm-up activity focused on reviewing the content of the previous session, sharing afterthoughts of growing the plants at home, and reminding the date and weather of that day. In the phase of main activity, the program instructor explained and demonstrated the activity and the elderly were divided into four groups for practicing. Each group was supported by one volunteer or assistant. In the integration phase, the instructor guided the participants to integrate and review the activity content. Sharing and questioning enhanced the interaction among the elderly, encouraged them to appreciate the unique creation of each other, strengthened their self-identification, and reinforced their memory.

The horticultural program content was designed based on rural life experience of the participants and integrated with diverse cognitive function training. The participants of this study were the elderly with average age of 73.4 living in Pingtung County of southern Taiwan, who had been making a living by farming for years. Thus, the program content included leisure agriculture of Pingtung County and local agricultural features. Also, in this study, the horticultural program, which aimed to enhance the cognitive function of the elderly, integrated with multiple cognitive training, including counting, identifying, design, experience sharing, planning, and problem-solving. The horticultural program included manual activity, group activity, and outdoor planting to encourage the participants to engage. Furthermore, themes of sessions were designed according to familiarity of the elderly to the content of activities and

difficulty of cognition training. The contents of the program were presented stepwise; that is to say, first, what were introduced to the elderly were the familiar plants, gardening materials, care for plants, planting methods, and basic potted culture design. Subsequently, the cultural and creative design of plants as well as use of plants were experienced. Additionally, all types of cognitive training were implemented from simple to complicated ones; in other words, this study first arranged simple cognitive trainings for the elderly, followed by more complicated trainings.

Period of Implementation

Horticultural Program with Life Contexts lasted for 12 weeks. Twelve sessions of the program were implemented, one session a week and 2 hours for each session. The study members entered the research site to administer the pre-test of MoCA on June 22, 2018. From June 23 to September 8, 2018, Horticultural Program with Life Contexts was implemented. The post-test of MoCA was administered on September 9. Two weeks later, The follow-up test of MoCA was administered on September 22.

Program Instructors and Assistants

In this study, Horticultural program with Life Contexts was guided by two instructors, in turns, with the assistance of two trained assistants and two trained volunteers in the community care center. The program instructors implemented the warm-up and introduced the horticultural activities. They also demonstrated the horticultural work and guided the elderly to do it and then integrated the session. The assistants and volunteers distributed the horticultural materials and helped the elderly to do work. The instructors both specialized in horticulture and horticultural therapy. They instructed the participants of different ages to do horticultural work in order to get empowered, improve living habits, and facilitate their psychological capacity.

Table 3
Information of program instructors

Name	Gender	Education level	Specialty	Experience
Instructor Amy	Female	Master Degree of plant industry	<ul style="list-style-type: none"> ● Making Potted culture ● Making Garden landscaping ● Instructing horticultural program 	<ul style="list-style-type: none"> ● Teacher of the Department of Plant Industry in vocational schools ● Instructor of horticultural programs for the elderly ● Horticultural therapy instructor of prisoners
Instructor Betty	Female	Ph.D.in tropical agriculture	<ul style="list-style-type: none"> ● Making potted culture ● Instructing horticultural program 	<ul style="list-style-type: none"> ● Elementary school teacher ● Horticultural therapy instructor of children ● Instructor of horticultural programs for the elderly

Data Collection and Analysis

This study applied the questionnaire surveys and interviews to collect the data.

1. Questionnaire survey

This study administered the Montreal Cognitive Assessment (MoCA) scale to assess overall cognitive function of the elderly. With the ability to assess some cognitive domains, MoCa scale is a proven and useful cognitive screening tool for cognitive illnesses. The scale is simple, brief, and precise and can be done in a short time. It has been commonly applied to clinical tests (Smith, et al., 2007). MoCA scale has been translated in about 20 languages. To be consistent with cultural backgrounds and language use in different areas, the translation versions are adequately adjusted. MoCA has 8 subscales, including visuospatial and execution function, naming, working memory, delayed recall, attention, language, abstraction and orientation on time and space. The assessment can be done for around 10 minutes. MoCA scores range between 0 and 30. A score of 26 or over is considered to be normal. For the test-taker with 12 years or less of formal education, 1 point is added to their score (Luis, et al., 2009).

Before the horticultural program, this study administered the pre-test on the participants. One day after the horticultural program, the post-test was done. Two weeks later, the follow-up test was done. The MoCA scale was administered based on one-to-one practice between the study team members and the participants. The team members first explained the item of the scale to the elderly, and then they answered by painting, oral expression, or motion. This study analyzed the scores using the means, standard deviations, and dependent sample t-test. SPSS software was used for the analysis.

2. Interview

Semi-structured interviews were conducted one week after the horticultural program. By interviewing the elderly, care center volunteers and program instructors, the study aimed to understand the learning experiences of the elderly who participated in Horticultural Program with Life Contexts. By critical case sampling (Patton, 2002), the study members interviewed three seniors who had participated in the activities of the center for the long term and were familiar with other elderly participants. Information of the elderly, volunteers and activity instructors interviewed is shown in Table 4.

The interview transcripts were analyzed applying within- and cross-case analyses (Patton, 2002). First, the study team members separately coded each interview's transcripts as a single case. The researchers then compared the coding of the transcripts and generated emerging categories and properties. Second, the researchers conducted the cross-case analysis applying a constant comparative analysis to search for or validate patterns that emerged in the within-case analysis and identify common patterns across the cases (Wu, 2014).

Table 4
Information of interviewees

Name	Identity	Gender	Educational level	Age
Volunteer Apple	Volunteer	Female	Junior high school	56
Volunteer Belle	Volunteer	Female	Senior high school	61
Elderly Ann	The elderly	Female	Senior high school	92
Elderly Beth	The elderly	Female	Elementary School	73
Elderly Cindy	The elderly	Female	None	70
Instructor Amy	Program instructor	Female	Master Degree	46
Instructor Betty	Program instructor	Female	Ph. D	44

Research Results

Analysis of MoCA Scores

This study administered MoCA on the participants to assess the effect of Horticultural Program with Life Contexts on their overall cognitive function. Total score of MoCA with 8 subscales ranges between 0 and 30; if a score is 26 or above, it means the cognitive function of the test-taker is normal. If a score is below 26, the test-taker might have abnormal cognitive function. As shown in Table 5, the means of pre-test, post-test and follow-up test of the participants were all lower than 26. In other words, the participants showed the possibility of cognitive function damage or decline. As Table 5 shows, the means of post-test ($M=21.18$) was significantly higher than that of pre-test ($M=15.06$) ($t=-6.63, p<.001$). The means of follow-up test ($M=20.12$) was also significantly higher than that of pre-test ($M=15.06$) ($t=-4.59, p<.001$). Nevertheless, the means of follow-up test did not show significant difference from that of post-test.

Table 5

Means, standard deviations, maximum, minimum and dependent-sample t-test of pre-test, post- test, and follow-up test (N=17)

Group	Total score of MOCA	M	Maximum	Minimum	SD	t
Pre-test	Pre-test	15.06	26	7	5.91	-6.63***
Post test	Post test	21.18	28	12	4.67	
Pre-test	Pre-test	15.06	26	7	5.91	-4.59***
Follow-up test	Follow-up test	21.12	30	10	5.21	
Post test	Post-test	21.18	28	12	4.67	0.05
Follow-up test	Follow-up test	21.12	30	10	5.21	

*** $p<.001$

Overall, the means of post-test and the means of follow-up test were both significantly higher than that of pre-test. In other words, after participating in Horticultural Program with Life Contexts, the overall cognitive function of the participants was immediately and significantly improved. Additionally, two weeks after the program, the improved cognitive function sustained. The results suggest that for the elderly who might have cognitive function decline, the horticultural program has effect on improving their overall cognitive function, and this effect may sustain.

Analysis of Interview

The research interviewed the two program instructors, two volunteers of community care center, and three seniors who participated in the horticultural program. The interview focused on the interviewees' observation, experience, and feelings of the participation of the horticultural program.

By the horticultural program, the elderly obtained new planting experience. In a broader sense, horticultural activities are part of farming. However, the seniors felt that the horticultural program focused on potting and recreation, which was a little different from agriculture on which the elderly relied on for a living. Therefore, the horticultural program was not only familiar but also strange to the elderly of the study. They had the agricultural experience and were familiar with soil, planting of economic crops and care for the plants. Nevertheless, in this horticultural program, they managed the potting plants so that they felt that horticulture was related to farming, but it was, in fact, a little different from farming. For the elderly of the study, farming and horticulture were both planting; however, the methods and materials of them were significantly different. Director Betty noted that, “I invited the elderly to make potted culture of nageia nagi seeds; however, some of them did not know how to plant the seeds. I was surprised that most of them never had the experience of flower arrangement or potted culture in their lives.”

In the elderly’s opinion, potting design, planting or flower arrangement were parts of leisure activities, which were the life experience of the rich. In the past, the elderly had to work hard on the farms and were too busy to participate in leisure activities. Horticultural program of this study allowed the elderly to approach delicate flowers and plants and learn to grow and take care of them. Ann, one of the participants, said, “when I was young, I worked hard on the farm and grew rice and betel nuts. Horticulture that we learnt recently included potted culture and growing flowers, and it is for those who are rich and have leisure time! It is different from our agricultural work in the past.” Cindy, one of the participants, said, “Horticulture is different from the plantation we made in the past. Although we planted the seeds and took care of plants both in farming and horticultural activities, the methods of them were different. In this horticultural program, I have learnt various methods of taking care of and growing the small plants!”

The curiosity of the elderly about horticultural program resulted in learning motivation. In the horticultural program of the study, the elderly learnt delicate and recreational horticulture on the basis of their farming experience. The horticultural activities were designed on the basis of their life experiences. For instance, the activity of making photo frames of succulent plants was associated with their experiences of leaving the hometown. Making cards of rubbing leaves was related to the plant landscape of the community of the elderly. Thus, these horticultural activities were strange yet familiar to them. On the basis of old agricultural work and daily life experience, the elderly became curious about horticulture and were motivated to learn something new.

Director Amy noted, “Once an old lady had to go to see a doctor. However, she asked me to wait for her to go back for the horticultural activity. She said that she would feel sorry by missing the class and these horticultural activities were interesting to her!” The senior Ann said, “These methods of taking care of the plants, seeds and flowers are new to me! They’re interesting! I enjoy the classes, and I don’t like to be late. If I miss the class, I would feel sorry, and it’s a pity that I cannot learn something new!”

Integrated with life contexts, the horticultural program was meaningful and encouraged the elderly to be engaged in the activities and recall the past. The horticultural program of this study did not merely guide the elderly to plant, take care of plants, or make cultural potted culture. Instead, the elderly’s life experience was integrated into the horticultural program. For instance, the elderly were invited to recall the experiences of leaving the hometown when making photo frames of succulent plants. Also, the participants made the garden landscaping with their old stuff. The seniors were also encouraged to connect their travel experiences with the seeds used as horticultural materials. Thus, in the program of the study, the horticultural activities were related to their current and past experiences, and the activities became more meaningful for them so that the seniors were more concentrated and engaged in the program. Beth, one of the

participants, said, “I had attended other horticultural classes before. Before I just learn to grow flowers. However, this program of the study is different! The teacher encouraged us to share our stories and experiences when doing the horticultural work! These horticultural activities reminded me of my past, and I became more attached to the plants that I grew in the program. In the program, I worked hard and carefully and concentrated!” Volunteer Apple noted, “When joining in other activities in the community center, these old ladies tended to be distracted and felt bored! However, in the horticultural program, they were very careful, concentrated, and quiet when growing the plants or do the horticultural work. They were engaged in these horticultural activities”

The instructors also guided the seniors to recall and share personal life experience when doing the horticultural work, and the seniors felt that they seemed to recollect the past more easily. Senior Beth said, “It is usually not easy for me to look back upon the past! However, in the horticultural program, the instructor invited us to share the stories related to horticulture so often. Surprisingly, it became less difficult for me to recall the past!”

Improving cognitive function of the elderly by multiple of intentional instructional methods. In this study, the instructors implemented the horticultural program by the methods which aimed to enhance cognitive function of the elderly. By intentional repetition and association, the elderly were more familiar with the operational process of horticultural work, and their memory could be enhanced by memorizing the characteristics of plants and methods of caring plants. For instance, the instructors guided the elderly to design cards with rubbing leaves in order to stimulate their planning competence. Director Betty noted, “When teaching the elderly to identify the plants, I helped them associate the names of plants with their characteristics. For instance, “nageia nagi” was associated with “cypress with curly hair”; “common dracena” resembled “red banana”. In this way, it was easier for the elderly to memorize the names of plants.”

In fact, the operational process of different kind of horticultural work was similar. When the seniors did the new horticultural work, the instructors would frequently remind the process and guide them to operate the steps again in order to improve their memory. “The elderly had learnt the basic steps of horticultural work, and they continued to operate the work according to what they learnt. In the process of doing the horticultural work, with the instructors’ reminder and their hand-on experiences, the elderly could memorize the steps more easily and would become more and more familiar with the work. In this way, the seniors’ memory would be improved,” said Director Amy.

The elderly enjoyed the interaction of horticultural and life experience. In the horticultural program of this study, the elderly not only did the horticultural work but also frequently shared and exchanged life experiences and horticultural acquisition. They shared the planting experience and their past life stories. By doing so, the seniors knew each other more and interacted more frequently, and they were more willing to share with each other. Experience sharing requires memory retrieval, organization of contents, and expression. The repetitive practice of experience sharing can strengthen individuals’ cognitive function.

In the program, the elderly helped each other do horticultural work while competent seniors assisted with those who acted slowly or with inferior comprehension. The assistance stimulated each other’s cognitive function. Volunteer Belle said, “The elderly interacted with each other when growing flowers or doing potted culture. They discussed about the successful work and the aesthetic positions of the plants in the work. They observed others’ work and exchanged opinions with each other and then were improving their floral design.” Thus, the group dynamics of the group members, including experience exchange and mutual assistance, would enhance the cognitive function of the elderly.

Overall, the analysis of MoCA test scores suggested that 12 sessions of Horticultural Program with Life Contexts had immediate and two-week follow-up effect on improving the

overall cognitive function of the elderly. Also, in the horticultural program, the elderly obtained new planting experience and became curious about horticulture with learning motivation. Furthermore, integrated with life contexts of the elderly, the horticultural program was more meaningful, and the elderly were engaged in the activities. By multiple intentional methods, the horticultural program would improve the cognitive function of the seniors. In the process of learning, the elderly enjoyed the exchange of horticulture and life experience.

Discussion

There were 3 phases in each session of Horticultural Program with Life Contexts, including warm-up, main activity and integration. In the warm-up phase, the instructor inquired the elderly about the date and reviewed the horticultural program of the previous session. The elderly were also invited to share their plant growing experience at home. The elderly developed meaningful set to the new horticultural activity by the warm-up activity. Also, they were prepared for the new activity and actively sought for new knowledge and the connection with their original cognitive structures. Previous and new activities were combined in the meaningful way (Dirksen, 2016). Furthermore, in the integration phase, the instructors rewarded the seniors because of their participation and special horticultural work. Additionally, the instructor invited the elderly to recall the content of main activity and share personal horticultural work and working experiences of that session. In this way, the elderly could organize, review, and synthesize the activities of the session and obtain complete and high-level meta-experience of the session.

Horticultural program with Life Contexts is different from other conventional activities in enhancing cognitive function of the elderly. These conventional studies (e.g., M. H. Kim & J. M. Kim, 2012) only included the main activities, and the elderly could not gradually develop meaningful set to learning, and they could not connect what they learnt with daily life. There were 3 phases in each session of the horticultural program with warm-up, main activity and integration, which guided the elderly to develop meaningful and high-level activity experiences. In turn, it would benefit the elderly's cognitive function. In addition, regular three-phase model allowed the elderly to be familiar with, to be prepared for, and to be engaged in the program.

Most of the existing studies which have had the effect of enhancing cognition of the elderly have only focused on cognitive function and neglected the association between activity content and life contexts of the elderly (e.g., Ball, et al., 2002). Although these activities of the existing studies could improve the elderly's cognitive function, they might lack motivation for participation. In fact, appropriate activities for the elderly should be designed based on their life contexts because they tend to be fixed to certain familiar experiences (Caffarella & Merriam, 2000).

The reminiscence therapy suggests that the group reminiscence process can encourage and support the elderly to systematically recall, discuss, and share experience, and it would delay their cognition decline (Parker, 1995). Horticultural Program with Life Contexts was designed based on reminiscence therapy with further extension. In other words, the horticultural program of the study was designed on the basis of the familiar farming experience of the elderly, and integrated with their environment, such as the plant landscape of their community. Additionally, the program also combined with the elderly's personal life experiences, such as leaving the hometown and travelling. Moreover, the program was extended to include the potted culture and garden landscaping that were strange to them. With life contexts, the program easily guided the elderly to recall their experience systematically and identify with the association and meanings between the activities and themselves. Thus, their motivation for participating in the program would be facilitated.

The seniors would obtain self-confidence and sense of achievement when they learn something new on the basis of their familiar experiences (Boulton-Lewis, 2010). Also, since the horticulture was unfamiliar to the elderly of this study, it was a little challenging for them to do the horticultural work and then they became curious about and concentrated on the program (Friebe & Schmidt-Hertha, 2013). Overall, Horticultural Program of Life Contexts that was of nostalgic, personal and challenging significance could facilitate the elderly to be engaged in the program; in turn, their cognitive function would be improved.

Horticultural Program with Life Contexts was developed on the basis of diverse cognitive function training to facilitate the cognitive competence of the elderly, including identifying, memory, experience sharing, planning and problem-solving. Multiple cognitive function training can not only stimulate cognitive function of the elderly but also make them not easily tired of the activities (Johnson, et al., 2007). Some existing studies have focused on single cognitive function training, such as reading or counting, which may make the elderly less interested in the training (e.g., Chaikham, 2016).

Because the horticultural program of this study usually emphasized the completion of individual horticultural work, the elderly still concentrated on their working although the members of the group frequently interacted with each other. Besides, in order to create aesthetic horticultural work, the elderly had to be familiar with and distinguish the plants, comprehend the planting steps demonstrated by the instructors, plan the aesthetics and appearance of the horticultural work, and solve all the problems in the process. Hence, in the practice of the horticultural program, cognitive function of the elderly was stimulated and trained in multiple ways, which would strengthen their cognitive competence (Gamberini, et al., 2006).

In the study, when the horticultural program was implemented, the elderly were divided into 4 groups. Each group was assisted by assistants or volunteers. Although in most of the activities, the elderly had to do personal work, they frequently cooperated with each other. When working in groups, the elderly could get assistance immediately from group members. In this way, it would facilitate the elderly's comprehension operation of the work. The last session of community garden landscaping was implemented in teamwork, and the elderly had to cooperate for better results. Also, in the integration phase of each session, the instructors always invited the elderly to appreciate the work of other group members and provide positive feedback. The group dynamics resulted in positive learning atmosphere, reinforced the seniors' social involvement, and also facilitated their cognitive function, such as identifying, memory, experience sharing, planning and problem solving.

One of the differences between this study and others (e.g., Kojima & Kunimi, 2013) is that this study implemented the horticultural program in groups. Although some of other studies have been also implemented in groups, they have rarely discussed the interaction among the members. Nevertheless, the horticultural program of this study emphasized the interaction and assistance among group members. In fact, group dynamics, which encourages the senior participants to influence each other and be engaged in activities quickly, plays a critical role in therapy activities for the elderly (Ybarra, et al., 2008).

Conclusions

Based on the reminiscence therapy, the study aimed to develop the horticultural program with life contexts for the elderly in southern Taiwan, and to explore the effect on overall cognitive function of the elderly. It has been found that after the horticultural program with life contexts was implemented, the MoCA scores of the participants were significantly improved, and after the two-week follow-up, their MoCA scores were also significantly improved, compared to the pre-test. Also, the participants obtained new planting experience and their learning motivation was enhanced. Because of integrating with life contexts, the program was

meaningful and encouraged the elderly to be engaged in the activities and recall the past. In the process, the elderly enjoyed the exchange of horticulture and life experience. Overall, the horticultural program has been confirmed to have an effect on improving the cognition function of the elderly, and this effect may sustain.

In recent years, the countries around the world have actively implemented the activities to prevent and delay cognitive function decline of the elderly. However, most of them are one-off activities without continuity and accumulation. In the future, care institutions for the elderly may modify Horticultural Program with Life Contexts according to the characteristics of the seniors or communities with systematic implementation to improve the cognitive function of the elderly.

In the future, additional research with larger sample size and a control group will help to measure the effectiveness of Horticultural Program with Life contexts, and it would be necessary to verify the long-term effects of the program and even explore specific effects of the program on certain domains of cognitive function of the elderly.

References

- Ball, K., Berch, D. B., Helmers, K. F., Jobe, J. B., Leveck, M. D., Marsiske, M., & Unverzagt, F. W. (2002). Effects of cognitive training interventions with older adults: A randomized controlled trial. *Jama*, 288(18), 2271-2281. <https://doi.org/10.1001/jama.288.18.2271>
- Bassen, S., & Saltazar, V. (1997). Flowers, flowers everywhere: Creative horticulture programming at the Hebrew Home for the aged at Riverdale. *Geriatric Nursing*, 18(2), 53-56. [https://doi.org/10.1016/S0197-4572\(97\)90055-0](https://doi.org/10.1016/S0197-4572(97)90055-0)
- Boulton-Lewis, G. M. (2010). Education and learning for the elderly: Why, how, what. *Educational Gerontology*, 36(3), 213-228. <https://doi.org/10.1080/03601270903182877>
- Caffarella, R., & Merriam, S. B. (2000). Linking the individual learner to the context of adult learning. In A. L. Wilson & E. R. Hayes (Eds.), *Handbook of adult and continuing education* (pp.55-70). Jossey-Bass.
- Chaikhom, A., Putthinoi, S., Lersilp, S., Bunpun, A., & Chakpitak, N. (2016). Cognitive training program for Thai older people with mild cognitive impairment. *Procedia Environmental Sciences*, 36, 42-45. <https://doi.org/10.1016/j.proenv.2016.09.007>
- Cheng, S. Y., Chiu, Y. C., & Xie, C. X. (2013). A mathematic training system APP for Alzheimer. *Journal of Taiwan Association for Medical Informatics*, 22(4), 15-26.
- Cotelli, M., Manenti, R., & Zanetti, O. (2012). Reminiscence therapy in dementia: A review. *Maturitas*, 72(3), 203-205. <https://doi.org/10.1016/j.maturitas.2012.04.008>
- Dirksen, J. (2016). *Design for how people learn*. New Riders.
- Friebe, J., & Schmidt-Hertha, B. (2013). Activities and barriers to education for elderly people. *Journal of Contemporary Educational Studies*, 64(1), 10-27.
- Gamberini, L., Raya, M. A., Barresi, G., Fabregat, M., Ibanez, F., & Prontu, L. (2006). Cognition, technology and games for the elderly: An introduction to ELDERGAMES Project. *PsychNology Journal*, 4(3), 285-308.
- Jarrott, S. E., Kwack, H. R., & Relf, D. (2002). An observational assessment of a dementia-specific horticultural therapy program. *HortTechnology*, 12(3), 403-410. <https://doi.org/10.21273/HORTTECH.12.3.403>
- Johnson, J. K., Lui, L. Y., & Yaffe, K. (2007). Executive function, more than global cognition, predicts functional decline and mortality in elderly women. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 62(10), 1134-1141. <https://doi.org/10.1093/gerona/62.10.1134>
- Kim, M. H., & Kim, J. M. (2012). The effect of an occupational therapeutic intervention program using horticultural therapy on cognition and daily living performance of the elderly with dementia. *The Journal of Korean Society of Community Based Occupational Therapy*, 2(1), 75-84.

- Kojima, H., & Kunimi, M. (2013). The Effect of Horticultural Activity on the Cognitive Performance of Healthy Elderly Individuals. *Journal of Therapeutic Horticulture*, 23(2), 5-18.
- Leong, K-L, Chen, Y.-C., & Chen, J.-H. (2014). Dementia: A focused review. *Journal of Intern Med Taiwan*, 25, 151-157. [https://doi.org/10.6314/JIMT.2014.25\(3\).04](https://doi.org/10.6314/JIMT.2014.25(3).04)
- Liu, Y.-I., & Chu, F.-Y. (2018). Effect of a Horticultural therapy program on the emotional well-being of older adults with dementia. *Journal of Research in Education Sciences*, 63(3), 257-289. [https://doi.org/10.6209/JORIES.201809_63\(3\).0009](https://doi.org/10.6209/JORIES.201809_63(3).0009)
- Luis, C. A., Keegan, A. P., & Mullan, M. (2009). Cross validation of the Montreal Cognitive Assessment in community dwelling older adults residing in the Southeastern US. *International Journal of Geriatric Psychiatry: A Journal of the Psychiatry of Late Life and Allied Sciences*, 24(2), 197-201. <https://doi.org/10.1002/gps.2101>
- Masuya, J., & Ota, K. (2014). Efficacy of horticultural activity in elderly people with dementia: A pilot study on the influence on vitality and cognitive function. *International Journal of Nursing & Clinical Practices*, 1, 1-4. <http://dx.doi.org/10.15344/2394-4978/2014/101>
- Parker, R. G. (1995). Reminiscence: A continuity theory framework. *The Gerontologist*, 35(4), 515-525. <https://doi.org/10.1093/geront/35.4.515>
- Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Sage Publications.
- Peng, X. D., Huang, C. Q., Chen, L. J., & Lu, Z. C. (2009). Cognitive behavioural therapy and reminiscence techniques for the treatment of depression in the elderly: a systematic review. *Journal of International Medical Research*, 37(4), 975-982. <https://doi.org/10.1177/147323000903700401>
- Phibbs, E. J., & Relf, D. (2005). Improving research on youth gardening. *HortTechnology*, 15(3), 425-428. <https://doi.org/10.21273/HORTTECH.15.3.0425>
- Relf, D. (1992). *The role of horticulture in human well-being*. Timber Press.
- Rothert, E. A. & Daubert, J. R. (1981). *Horticultural Therapy at a physical rehabilitation facility*. Chicago Horticultural Society.
- Smith, T., Gildeh, N., & Holmes, C. (2007). The Montreal Cognitive Assessment: validity and utility in a memory clinic setting. *The Canadian Journal of Psychiatry*, 52(5), 329-332. <https://doi.org/10.1177%2F070674370705200508>
- Thorgrimsen, L., Schweitzer, P., & Orrell, M. (2002). Evaluating reminiscence for people with dementia: A pilot study. *The Arts in Psychotherapy*, 29, 93-97. [https://doi.org/10.1016/S0197-4556\(01\)00135-6](https://doi.org/10.1016/S0197-4556(01)00135-6)
- Tseng, T.-H., Lu, W.-S., & Ho, C.-L. (2007). The therapeutic effects of horticultural programs on disable elderly in nursing home. *Journal of the Taiwan Society for Horticultural Science*, 53(3), 345-360.
- Wang, J. J. (2007). Group reminiscence therapy for cognitive and affective function of demented elderly in Taiwan. *International Journal of Geriatric Psychiatry: A Journal of the Psychiatry of Late Life and Allied Sciences*, 22(12), 1235-1240. <https://doi.org/10.1002/gps.1821>
- Wu, Y. L. (2014). A socio-cultural approach to understanding the learning experiences of vocational training among Vietnamese immigrant women in Taiwan. *Women's Studies International Forum*, 44, 80-88. <https://doi.org/10.1016/j.wsif.2013.10.004>
- Ybarra, O., Burnstein, E., Winkielman, P., Keller, M. C., Manis, M., Chan, E., & Rodriguez, J. (2008). Mental exercising through simple socializing: Social interaction promotes general cognitive functioning. *Personality and Social Psychology Bulletin*, 34(2), 248-259. <https://doi.org/10.1177/0146167207310454>

Appendix

Outline of Horticultural Program with Life Contexts

Session No.	Name of session	Theme	Content	Cognitive function training
1	Love of green plants	<ul style="list-style-type: none"> ● Matching plants ● Making potted culture which can purify the air 	<ul style="list-style-type: none"> ● Greeting: meeting between lecturers and the elderly ● Learning 6 plants which can purify the air ● Learning how to care the plants ● Designing potted plants 	Identifying, planning, problem-solving, experience sharing
2	Imagination of leaving the desert	Creative potted culture of succulent plants	<ul style="list-style-type: none"> ● Recalling and sharing the experience of leaving the hometown ● Learning to grow and take care of succulent plants ● Designing the floral frame 	Identifying, planning, problem solving, design, experience sharing
3	Beauty lies in plenty amount	<ul style="list-style-type: none"> ● Potted culture of nageia nagi seeds ● Potted culture of litchi seeds 	<ul style="list-style-type: none"> ● Learning characteristics and value of nageia nagi and litchi seeds ● Appreciating beauty of potting ● Making potted culture of seeds 	Sorting, counting, planning, problem-solving, experience sharing
4	Baby of the mind	<ul style="list-style-type: none"> ● Jigsaw puzzle of weeds ● Weeds baby 	<ul style="list-style-type: none"> ● Doing jigsaw puzzles of weed cards by teamwork ● Sharing memory of childhood ● Making creative potted culture of weed seeds 	Matching, planning, problem-solving, experience sharing
5	Love of Taiwan seeds	<ul style="list-style-type: none"> ● Key chain of seeds ● Five-element energy bottle 	<ul style="list-style-type: none"> ● The instructor shared the personal collection of seeds and the stories. ● Sharing travel experiences ● Learning seeds of native plants in Taiwan ● Making key chains of seeds ● Making five-element energy bottles with rice, salt, and five kinds of beans with a sticker of positive saying on the bottle 	Identifying, planning, problem-solving, experience sharing
6	Midget Crabapple	Floral design	<ul style="list-style-type: none"> ● Singing their songs of flowers in lives ● Sharing meaningful flowers in life and the stories ● Making basic floral design ● Caring for bouquets 	Design, planning, problem-solving, and experience sharing

7	Positive saying in the mind	Rubbing leaves	<ul style="list-style-type: none"> ● Sharing one positive saying and writing it down in the card ● Learning leaves of 17 kinds of plants in the community ● Getting one kind of leave and becoming the spokesman of it ● Rubbing leaves and making a card 	Design and experience sharing
8	Healthy life	<ul style="list-style-type: none"> ● Anti-mosquito repellent of herbs ● Multi-functional cream of herbs 	<ul style="list-style-type: none"> ● Learning herbs ● Making anti-mosquito repellent of herbs with essential oil of lavender, mint, citronella and eucalyptus ● Making multi-functional cream of herbs ● Massaging the peer with multi-functional cream 	Identifying and experience sharing
9	Monopoly	<ul style="list-style-type: none"> ● Monopoly map of plant landscape of the community ● Dry bouquets 	<ul style="list-style-type: none"> ● Making the map of plant landscape of the community ● Playing the monopoly with the map of plant landscape of the community ● Making dry bouquets of Chinese Valentine's Day 	Counting, planning, problem-solving, experience sharing
10	Memory of taste	<ul style="list-style-type: none"> ● Potted culture of herbs ● herb tea 	<ul style="list-style-type: none"> ● Learning herbs ● Making potted culture of herbs ● Making and drinking herb tea 	Identifying, planning, problem-solving, experience sharing
11	Ice & fire	<ul style="list-style-type: none"> ● Cooking tapioca ● Washing vegetarian gelatin 	<ul style="list-style-type: none"> ● Learning the story of vegetarian gelatin ● Learning characteristics of vegetarian gelatin and tapioca ● Washing vegetarian gelatin and brewing tea with tapioca ● Tasting the beverage of vegetarian gelatin and tea with tapioca 	Identifying, experience sharing
12	Garden decoration and sharing	<ul style="list-style-type: none"> ● Sharing old stuff ● Garden landscaping 	<ul style="list-style-type: none"> ● Sharing old stuff and its story ● Decorating the garden of the care center ● Discussing the decoration of the garden ● Decorating the garden with the plants and their old stuff ● Feedback to the horticultural program and farewell 	Design, planning, problem-solving, experience sharing

Received: *June 19, 2020*

Accepted: *October 02, 2020*

Cite as: Wu, Y-L., Chao, S-R., Tsai, W-F., & Chen, M-L. (2020). The effect of horticultural program with life contexts on the cognitive function of the elderly in Taiwan. *Problems of Education in the 21st Century*, 78(5), 856-872. <https://doi.org/10.33225/pec/20.78.856>

Ya-Ling Wu (Corresponding author)	PhD in Education, Professor, Graduate Institute of Technological and Vocational Education, National Pingtung University of Science & Technology, No.1, Shuefu Road, Neipu, Pingtung 912 Taiwan, R.O.C. E-mail: karinnpust@gmail.com Website: http://oar.npust.edu.tw/user/1676
Shan-Ru Chao	PhD in Social Work, Professor, Department of Social Work, National Pingtung University of Science & Technology, No.1, Shuefu Road, Neipu, Pingtung 912 Taiwan, R.O.C. E-mail: sw7735@yahoo.com.tw Website: https://fps.npust.edu.tw/teacher/shanchao/
Wei-Fang Tsai	MD in Landscape Architecture and Recreation Management Horticulture Instructor, Agency of Correction, Justice of Ministry, No.132,Youngfong Rd, Jhutian Township, Pingtung County 91142 Taiwan, R.O.C. E-mail: eq98469846@yahoo.com.tw
Mei-Lun Chen	PhD in Tropical Agriculture and International Cooperation, Teacher, Wanlun Elementary School, No. 28, Baozhong Rd., Wanluan Township, Pingtung County 923, Taiwan, R.O.C. E-mail: c2114433@gmail.com