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Effects of multi-faceted cognitive training program for elders with cognitive impairment living in social welfare home for older persons

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ABSTRACT

Background: Elders living in social welfare home are at risk of developing dementia due to lacking of opportunities to perform problem solving activities under non-familiar situations. Dementia declines cognitive functions leading to a limitation of performing individual activities of daily living. Therefore, the elders need a cognitive training program which may be enhancing their cognitive abilities. That program's effectiveness would be beneficial in slowing down the rise in numbers of demented elders who live with cognitive impairment at the social welfare home.

Objectives: To study the effects of a multi-faceted cognitive training program on cognitive abilities in elders with cognitive impairment living in social welfare home.

Materials and methods: Participants were the elders living at Thammapakorn Social Welfare Development Center for Older Persons, Chiang Mai Province. Twenty-four elders with cognitive impairment were selected through purposive sampling method combined a set of screening tests, including the Mini-Mental State Examination (MMSE), the Montreal Cognitive Assessment (MoCA), and the Depression Assessment 9 Questions (9Qs). Participants were divided into a control and an experimental group (n=12 each). The experimental group underwent multi-faceted cognitive training program 3 times per week, for 6 consecutive weeks. The outcome measurements were the Digit Span Test, the Thai Cognitive-Perceptual Test (Thai-CPT), and the Dynamic Loewenstein Occupational Therapy Cognitive Assessment (DLOTCA). Data was analyzed using descriptive, Mann-Whitney U Test, and Wilcoxon Signed Rank Test.

Results: After completing the multi-faceted cognitive training program, both experimental and control groups had demonstrated statistically significant differences in post-test in attention, memory, and executive functions. Within the experimental group, there was no significant difference in those cognitive areas, whereas the reduction of cognitive scores was significantly found within the control group.

Conclusions: The multi-faceted cognitive training program could prevent cognitive deterioration for elders with cognitive impairment living in social welfare home.

Introduction

Currently, dementia is more prevalent worldwide. It was found that 91-98% of people with dementia are older than 65 years old.[1] In Thailand, prevalence of dementia in elderly people is 12.4% of the total elderly population.[2] Elderly people with dementia has cognitive impairments in 3 main areas including attention, memory, and executive function.[3] The impairments cause a reduction of independent daily living affecting quality of life of the elders themselves, their caregivers and families, society and nation.[4] There is no cure for dementia and the symptoms tend to worsen over

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time.

Current research focused on reducing the risk factors which cause dementia and in early rehabilitation of cognitive skill in elders with mild cognitive impairment (MCI) to prevent or slow down dementia in high risk elders. Elderly people at high risk are those with mild cognitive impairment (MCI),[5] whose cognitive ability is regarded as less compared to same-aged individuals, but their daily activities are not yet affected.[6] These people can be identified by preliminary dementia screening. In Thailand, 95.6% of elderly people in community are not diagnosed in early stages of dementia. This shows limited access to healthcare for diagnosis and rehabilitation.[7]

Treatment guidelines for dementia are divided into 2 main types. There are pharmacological treatment, which provides good results in the first year for people with mild to moderate dementia,[8] and non-pharmacological treatment. Cognitive training is a commonly used treatment in the latter. Studies of the effectiveness of different cognitive trainings found that they could prevent and slow down the impairment of cognitive skill in elderly people with MCI.[9-12] Characteristics of cognitive training programs can include specific skill training using tabletop activities, drills, computer-based activities, strategy training, and multi-faceted cognitive training e.g. providing information on nutrition, exercise, leisure, relaxation techniques, group activities, and lifestyle modification.[13,14]

Through literature reviews of related studies in Thailand, it was found that there were some studies on developing cognitive training programs in samples who were elderly people with cognitive impairment or dementia suspects. The programs included specific skill training or multi-faceted training. The trainings were conducted in clinical settings by healthcare providers[15,16] or community public health volunteers[17] and by the samples themselves at home.[18] This shows that the studies gave priority to the home and community contexts in order to decrease elderly people's barriers of accessing healthcare services. However, there is an increasing number of elders who needed to live in social welfare homes for older persons due to the increase of the elderly population in Thailand and the change in society, culture, and economy. For example, there is an increase in the number of elderly people living alone or with income below the poverty line. The elders in need of care could not obtain it and there are limited healthcare services. From a survey in 2010, there were 2,610 elderly living in social welfare homes for older persons[19]. Elderly living in social welfare homes for older persons are at 41.6% risk of having dementia.[1] From reviewing the past studies regarding the contexts of social welfare homes for older persons, there were nominal reports about cognitive training. Elders lived in those contexts may lack the opportunity for health prevention of dementia designed by providing in-house cognitive training.

Therefore, this study aimed to develop a cognitive training program for the elders living in social welfare homes for older persons and examined its effects on cognitive abilities in 3 cognitive skills; attention, memory, and executive functions. This cognitive training program was multi-faceted created based on occupational therapy frameworks and models, relevant research, and the researcher's clinical experiences. The researcher expected that this cognitive training program might help to promote, or at least, maintain cognitive ability for elders living in the social welfare home and delay the possible occurrence of dementia.

Materials and Methods

Research Design and Participants

The study employed a quasi-experimental, assessor-blinded research design, using before and after experiment tests with a control group. Participants were elders with cognitive impairment living in Thammapakorn Social Welfare Development Center for Older Persons, Muang District, Chiang Mai Province. Calculation of sample size was done by G*power 3.1.[20] The study by Pratumtarn, Rattakorn, and Munkhetwit[18] found 1.29 effect size with 0.05 deviation score, and 0.80 test power. Calculation revealed sample size of 8 people in each group. Thus, researchers added 50% on top, which was 4 people, in case of sample drop out from research. Therefore, total sample size for this study was 24 people; 12 in each group. Inclusion criteria for the participants were: 1) either male or female aged 60-80 years old 2) able to read and communicate in Thai language, 3) scored more than 18 on the MMSE for those who graduated from primary school, more than 23 for those who graduated from higher educational levels, 4) scored between 11-25 with cognitive impairment for the Montreal Cognitive Assessment (MoCA) Thai version, 5) no dementia, 6) no severe depression with scored equal to or less than 18 for the Depression Assessment 9 Questions (9Q) and not receiving anti-depressive drugs, 7) no physical impairment which could not perform the multi-faceted cognitive training program, 8) no diagnosis of any other mental health conditions, and 9) was willing to participate with volunteer basis. The participants were excluded if they had no intention to finish the research project or participated in the experimental group less than 80% of the program.

Outcome Measure

Outcome measurement for assessing the effects of the multi-faceted cognitive training program on cognitive skills were:

1. Digit span test, subtests forward attention for assessing attention
2. Thai Cognitive-Perceptual Test: Thai-CPT, subtest memory for assessing memory
3. Dynamic Lowenstein Occupational Therapy Cognitive Assessment (DLOTCA, subtests colored block design, clock drawing, and pictorial sequence A & B for assessing executive functions

Intervention Program

The multi-faceted cognitive training program was aimed to promote attention, memory, and executive function skills which were commonly found in elders with mild cognitive impairment. The program was developed with the concept based on occupational therapy models called

'Person Environment Occupation Performance Model (PEOP)' by Christiansen and Baum[21] and the 'Dynamic Interactional (Multi-Context) Approach' by Toglia.[22] These two models were employed as a conceptual framework for determining factors, appropriate conditions or situations to stimulate the cognitive ability for elders living in the social welfare home. Cognitive performance is a complex phenomenon that is interconnected among many variables. These include person, unique environment in which one functions, and occupations.[21] Thus, the program is focused on changing of person's strategies and self-awareness, modifying external factors such as activity demands, and environment to facilitate cognitive performance.[23] In addition, activity features, duration and frequency of the training were designed based on related researches.[15-18] This multi-faceted program composed of providing knowledge about dementia and its effects, specific cognitive skill training using games and drills, group activities, role play activities, field trip activities, and teaching relaxation technique. Training time composed of 18 sessions at the frequency of 3 sessions per week for 6 consecutive weeks. Each session was approximately 60 minutes.

Statistical Analysis

General information of the participants was analyzed using descriptive statistics and the Chi-Square test. The Mann-Whitney U test was employed for comparing cognitive scores before and after the experiment between the control and experimental group. Comparison of cognitive scores before and after experiment within groups was analyzed using the Wilcoxon Signed Rank test.

Results

Results of the analysis and distribution of general information including gender, age, education level, and scores from the Mini-Mental State Examination (MMSE), the Montreal Cognitive Assessment (MoCA), and the Depression Assessment 9 Questions (9Q) of the participants are shown in Table 1.

Table 1 Participant characteristics (control group n=12, experimental group n=12).

Characteristics	Control group n (%)	Experimental group n (%)	Chi-square
Gender			0.68
Male	6 (50%)	7 (58.33%)	
Female	6 (50%)	5 (41.67%)	
Age			0.26
60-65 yr.	1 (8.34%)	2 (16.67%)	
66-70 yr.	4 (33.33%)	2 (16.67%)	
71-75 yr.	3 (25%)	4 (33.33%)	
76-80 yr.	4 (33.33%)	4 (33.33%)	
Mean±SD	72.25±5.01	72.75±5.98	
Education			0.36
Primary	6 (50%)	5 (41.67%)	
Secondary	3 (25%)	1 (8.33%)	
High school	3 (25%)	4 (33.33%)	
Bachelor degree	0	2 (16.67%)	
Screening score (mean±SD)			
MMSE	25±3.39	26±2.73	0.41
MoCA	17.75±4.37	18.17±3.59	0.48
9Q	3.25±5.01	4.17±2.89	0.47

From Table 1, distribution of gender between control group and experimental group was fairly equal. The average age of the control and the experimental group was 72.25±5.01 years and 72.75±5.98 years, respectively. Education levels of the control and the experimental group were primary education level at 50% and 41.67%, respectively. Results from cognitive screening using the MMSE revealed the average scores for the control group was 25±3.39 and 26±2.73 for the experimental group. On the MoCA assessment, the control group's average score was 17.75±4.37 and 18.17±3.59 for the experimental group. On the 9Q, the control group's average score was 3.25±5.01 and the experimental group's score was 4.17±2.89. On the Chi Square test used to test the differences of participant characteristics before experiment between control and experimental groups, correlation was found on general information on gender, age, and education level at 0.68 0.26 and 0.36. Correlation of scores from the MMSE, the MoCA and the 9Q were 0.41, 0.48, and 0.47, respectively. This showed that before experiment, characteristics of the control and

the experimental group were not statistically different.

Table 2 Mean rank and p value before and after experiment between control and experimental groups.

Cognitive skills	Pre-test		*p* value	Post-test		*p* value
	Mean rank			Mean rank		
	Control group (n=12)	Experimental group (n=12)		Control group (n=12)	Experimental group (n=12)	
Attention	13.54	11.46	0.45	9.08	15.92	0.02*
Memory						
Recall	12.08	12.92	0.77	9.29	15.71	0.02*
Recognition	12.46	12.54	0.95	11.50	13.50	0.15
Total	12.08	12.92	0.77	8.96	16.04	0.01*
Executive functions	11.54	13.46	0.50	9.42	15.58	0.03*

*NB: *statistically significant difference in means.*

Table 2 demonstrated the statistical analysis of the cognitive scores between the control and the experimental group before and after the experiment. At base line, the cognitive scores of all cognitive skills; attention, memory, and executive functions, between the control and the experimental group were not significantly different (p=0.45, 0.77, and 0.50 respectively). This indicated that the two groups did not differ in cognitive ability before the experiment. After the experiment, it was found that there were significant differences of the cognitive scores between the control and the experimental group (p=0.02, 0.01, and 0.03 respectively), which the experimental group's average scores were higher than the f control group (17.33>7.67, 16.04>8.96, and 15.58>9.42, respectively). However, in memory skill, it was found that recognition showed no significant difference.

Table 3 Mean rank, z-score, p value before and after within control group.

Cognitive skills	Negative ranks (post<pre)		Positive ranks (post>pre)		Ties (post=pre)	z	*p* value
	n=12	Mean rank	n=12	Mean rank			
Attention	10	5.50	0	0.00	2	-2.81[a]	0.001*
Memory							
Recall	12	6.50	0	0.00	0	-3.09[a]	0.001*
Recognition	1	1.50	1	1.50	10	0.00[b]	1.00
Total	11	6.00	0	0.00	1	-2.96[a]	0.001*
Executive functions	9	5.44	1	6.00	2	2.23[a]	0.03*

*NB: *statistically significant difference in means, a: based on positive ranks, b: the sum of negative ranks equals the sum of positive ranks*

Comparison of cognitive scores before and after the experiment within the control group is shown in Table 3. Significant differences of the scores was found between baseline and post experiment (p=0.001, 0.001, and 0.03). Most of the participants had negative ranks on attention (10 persons), memory (11 persons), and executive functions (9 persons) after the experiment. This indicated lower cognitive ability of the control group after the experiment. In memory skill, there was no significant difference in recognition score (p=1.00) in this group.

Table 4 Mean rank, z-score, p-value before and after within the experimental group.

Cognitive skills	Negative ranks (post<pre)		Positive ranks (post>pre)		Ties (post=pre)	z	*p* value
	n=12	Mean rank	n=12	Mean rank			
Attention	5	5.60	5	5.40	2	-0.05[a]	0.96
Memory							
Recall	4	5.50	7	6.29	1	-1.00[b]	0.32
Recognition	0	0.00	1	1.00	11	-1.00[b]	0.32
Total	4	5.00	7	6.57	1	-1.18[b]	0.24
Executive functions	5	3.90	4	6.38	3	-0.36[b]	0.72

*NB: *statistically significant difference in means, a: based on positive ranks, b: Sum of negative ranks equals sum of positive ranks.*

Comparison of cognitive score before and after the experiment within the experimental group is shown in Table 4. The scores before and after the experiment showed no statistical difference in attention, memory, and executive functions (p=0.96, 0.24, and 0.72, respectively). In addition, It was found that some participants scored in the positive ranks in attention, memory, and executive functions (5 persons, 7 persons, and 4 persons respectively) and some were able to maintain the scores (ties) after the experiment. The results indicated that the experimental group maintained or increased their cognitive ability after receiving the training program.

Discussion and Conclusion

The present study aimed to investigate the effects of multi-faceted cognitive training program for elders with cognitive impairment living in social welfare home for older persons. The results showed that both sample groups were similar (Table 1). Before the experiment, the cognitive scores of the control and the experimental group were not significantly different as shown in Table 2. This demonstrated similarity of cognitive skills between the two groups at baseline. After the experiment, the control group who did not participate in the cognitive training program and spent time on basic daily activities for 6 weeks showed lower cognitive scores while the experimental group who received the cognitive training program for 6 weeks could maintain or increase their cognitive ability in all areas (Table 2, 3, and 4). These results implied that the cognitive training program might be effective to maintain attention, memory, and executive functions in the experimental group. It confirmed the findings from previous studies regarding the deteriorating prevention for the elderly persons with cognitive impairment who had engaged in the training program.[9-12] It is acknowledged that cognitive training program is a good early intervention for elders to change or maintain their cognitive ability.[5] The participants in this study were cognitively impaired elders and could progressively develop into the late stage of dementia. In addition, the multi-faceted cognitive training program developed in this study was based on occupational therapy models and related researches regarding features the activities, duration and frequency of the program.[15-18] The program combined rehabilitation and adaptation methods doing specific activities for promoting cognitive skills with strategic integration of various activities including the use of specific techniques, knowledge provision, and strategy training, for example, the "Position Puzzles" (group activity) used the method of loci technique, the "Which one is the odd one out?" game used chunking and grouping technique and relaxation activities used deep breathing, meditation and progressive muscle relaxation technique.

The control group's scores in attention, memory, and executive functions significantly reduced after 6 weeks. Most participants of the control group (75.00-91.67%) had reduced cognitive scores due to the aging process of physiological deteriorations. In addition, personal and contextual factors might affect cognitive function in this group.[24] When considered the elders' lifestyle in the social welfare home for older persons, which focused only on their performance of basic daily activities, there was a lack of opportunities to be trained by using some complex activities under supportive environment. The study of Sasat and co-researchers[25] found that the elders living with passive routines in the social welfare home had high risk for developing a spectrum of dementia around 41.6% of Thai elderly population. However, it was found that, for memory skill, recognition score did not changed after the experiment. This conformed the theory about memory impairment in dementia that recall memory was more likely to be affected than recognition.[26-28]

At baseline and after receiving the cognitive training program for 6 consecutive weeks, there was no statistical difference of cognitive scores in the experimental group. This result could be implied that the participants in this group might be able to maintain their cognitive abilities in this period of time. The cognitive training program enables a provision of knowledge about dementia and its changeable impacts on basic daily activities in combination with cognitive challenge and leisure activities such as games and drills, memory strategies, social dynamic group activities, role play activities, field trip activities, yoga for relaxation.[9-14] Those occupations-based practice would provide friendly opportunities to perform solving problem activities during facing on any non-familiar living situations with supportive environments in order to utilize their assistive and creative cognition for a consecutive 6 week.[16-18] Diversional activities designed in this study could be applied using gradation and simplification in relation with the elders' educational levels. However, this study had some limitations that could not be generalized to the other population. The content of the training program was designed specifically to the Thammapakorn Social Welfare Development Center and might not be able to cover the other social welfare homes. The sample size was small, and long term effect was not investigated. Randomized control trial study with larger sample size and investigation for the long term effect are suggested for further studies. As preliminary study, the results from this research might be used as guideline for developing or applying the multi-faceted cognitive training program for elders who live in limited environment context like social welfare home.

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