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EVALUATION OF A COMPUTER-ASSISTED ERRORLESS LEARNING-BASED MEMORY TRAINING PROGRAMME FOR PATIENTS WITH EARLY DEMENTIA

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Ph.D

THE HONG KONG POLYTECHNIC UNIVERSITY

2014

THE HONG KONG POLYTECHNIC UNIVERSITY

DEPARTMENT OF REHABILITATION SCIENCES

Evaluation of a Computer-assisted Errorless Learning-based Memory Training Programme for Patients with Early Dementia

LEE Yuet Ying, Grace

A thesis submitted in partial fulfillment of the requirement

for the degree of Doctor of Philosophy

December 2013

DEDICATION

I would like to dedicate this work to my husband, my son and my family members for their greatest support given to me.

CERTIFICATE OF ORIGINALITY

I hereby declare that this thesis is my own work and that, to my best knowledge and belief, it reproduces no material previously published or written, nor material that has been accepted for the award of any other degree or diploma, except where due acknowledgement has been made in the text.

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ABSTRACT

Title: Evaluation of a computer-assisted errorless learning-based memory training programme for patients with early dementia

Introduction

Cognitive training can be effective in enhancing the cognitive function of older adults with cognitive impairment by possibly delaying the onset of dementia. The present study aimed to develop a theory-driven, computer-assisted errorless learning-based memory programme (CELP) for patients with early dementia; and to compare the training outcomes of a CELP group, with a therapist-led errorless learning training programme (TELP) and a control group (CG), receiving conventional treatment as usual. The programmes are based on a postulated errorless learning (EL) and enriched environment (EE) training model, and refer to cognitive reserve and neuroplasticity theories on dementia interventions. It was hypothesized that the CELP and TELP would have better treatment effectiveness compared with the CG.

Method

A randomized control trial (RCT) with a single-blind research design was adopted. Independent assessors and trainers were responsible for evaluation and training separately. Hong Kong Chinese older subjects with early Alzheimer's Disease (AD) were screened by the cut-off score of 1 using the Chinese version of Clinical Dementia Rating (CDR). The subjects were randomly allocated to a CELP, a TELP and a control group (CG) respectively. Evaluation of subjects before and after intervention and at a three-month follow-up was achieved by primary outcomes: the Chinese Dementia Rating Scale (DRS), the Chinese Mini-Mental State Examination (MMSE), and the Hong Kong List Learning Test (HKLLT). Secondary outcomes included the Chinese version of the Geriatric Depression Scale- Short Form (GDS-SF). Subjects' specific performance on prospective memory was evaluated through interviews with the subjects' carers using the Chinese Brief Assessment of Prospective Memory (BAPM-carer). A 15-session, 45-minutes individualized CELP was designed for Chinese AD subjects based on EL training principles, incorporating different memory

strategies (such as spaced retrieval, and with an enriched multi-sensory training environment) and using familiar daily life training scenario. The TELP is a training package of similar training content and format, but being delivered by therapists using a colour training manual with standardized instructions. The CELP and TELP were run twice weekly, in less than two months. Subjects in the CG attended a conventional training programme as usual.

Pilot study and expert panel review

An expert panel review was done to evaluate the structure, content and computer-human interaction effect of the CELP. A RCT pilot study with 19 subjects was done with the purpose to review the applicability of the CELP. To reinforce the learning of subjects and better encoding of information, the structure of the training programme was further enhanced from 30 minutes training to 45 minutes and added in 3 revision sessions at intervals to consolidate the learning. The errorless memory training programme was finalized as with a structure of a total of 15-session 45 minutes training programme. The result of pilot study was used to support main study sample size estimation.

Main study

A total of 115 AD subjects were screened from in-, day- and out-patients units of the psychogeriatric team at a local Kwai Chung Hospital, three dementia day care centres, two elderly day care centres and four elderly homes/ Care and Attention Homes in Hong Kong. Seventy-five subjects were successfully recruited into the CELP (n=30), TELP (n=22) and CG (n=23) and completed the study. Repeated measures ANOVA were used as statistical data analysis. There was no significant difference in the three groups for baseline outcome assessment measures, indicating homogeneity. Subjects showed statistically significant post-test score differences, as compared with pre-test evaluation, in the DRS total score ($p=0.001$) and the DRS memory subscore ($p=0.012$) among the three groups, with a better outcome improvement in the CELP and TELP than mild deterioration in the CG. There was a statistical significant difference in the CELP and TELP, when compared with the CG ($p=0.001$) while there was no

statistically significant difference in the CELP and TELP.

Also, significant positive changes in the HKLLT immediate recall subscore (p=0.005), the MMSE (p=0.01) and BAPM-carer (p=0.002) were found in the CELP and TELP in post-test assessment but there was not much improvement in the CG. This reflected an improvement in memory process in the subjects of the intervention groups but with a decline in cognitive function at the three-month follow-up while there was a general trend of very mild deterioration in the cognitive score for the CG in the post-test. This difference might be due to a natural cognitive decline of subjects with dementia. In comparison, the CELP group showed better improvement in the scores of the HKLLT immediate recall (in encoding) and the BAPM as reported by carers when compared with the TELP; while the TELP had a better improvement in the MMSE and GDS scores in the post-test evaluation. Both the CELP and TELP showed quite similar improvement in the post-test score of the DRS total.

Thus, Chinese early AD subjects were found to have better improvement in overall cognitive function after attending the EL memory programme while the computer group showed better memory scores as reflected by a more efficient encoding of information in an audio-visual stimulus-enriched environment. The CELP offered an innovative, alternative training programme for older Chinese adults, which was built up with systematic gradation, and rich audio-visual feedback. Subjects were reinforced positively in a supportive, enriched, computer environment during training. This may save therapists valuable time to run individual training programme for indicated early AD persons. For the TELP, therapists were more flexible and gave more individual prompting, guidance and extra support to subjects, based on the needs and capability of the individual subject to enhance accurate association, encoding of new information during the EL training and to overcome the subjects' literacy, attention, prospective memory and behavioral problems.

Conclusion

This study showed that EL is an effective strategy to enhance the memory function of

Chinese early AD patients in Hong Kong. Both the CELP and TELP have shown a positive treatment effect on cognition when compared with the CG. The encoding problem, working memory, executive function and prospective memory function of AD patients were improved after intervention by the CELP and TELP. However, positive treatment effect has a limited carrying over effect over three months and might have a low generalization effect to daily life function with the existing training structure in terms of volume and frequency. The CELP demonstrated better cognitive outcomes than the TELP in post-test and in the DRS total score, DRS memory subscore, HKLLT immediate recall and BAPM score. The TELP showed better cognitive outcomes in the MMSE in post-test and had better sustainability of treatment effect in the MMSE and BAPM in the three-month follow-up. Clinically, AD patients may be advised to have constant cognitive training or home programme to maintain their cognitive function. The EL training programme might be enhanced by increasing the number of overall training session to 20 sessions or more, with an increased training frequency to more than two times per week. Further support on the EL memory training from carers might be further explored. Based on the neuroplastic training theory, in future, an early cognitive assessment and intervention programme for Chinese older adults is highly recommended. A large-scale RCT multi-centre study might be done for older Chinese patients with Mild Cognitive Impairment or early AD, using the CELP (on mobile tablets) to enhance cognitive function. A cognitive health training programme might be launched for adults at the age of around 55-60, as a preventive programme to minimize the risk of developing dementia.

PUBLICATION ARISING FROM THE THESIS

Journal publication

Lee, G. Y., Yip, C. C. K., Yu, E. C. S. & Man, D. W. K. (2013). Evaluation of a computer-assisted errorless learning-based memory training program for patients with early Alzheimer's disease in Hong Kong: a pilot study. *Clinical Intervention in Aging,* 8, 623-633.

Man, D. W. K., Chung, J. C. C. & **Lee, G. Y. Y.** (2012). Evaluation of a virtual reality-based memory training programme for Hong Kong Chinese older adults with questionable dementia: a pilot study. *International Journal of Geriatric Psychiatry,* 27(5), 513-520.

Lee, G. Y. Y. & Man, D. W. K. (2008). Computer-assisted errorless-learning based memory training programme for persons with early dementia: a pilot study. *Journal of Neurorehabilitation and Neural Repair 22(5),* 533.

Yip, B., **Lee, G.** & Man D. (2008). Virtual reality-based intelligent system: new direction for community living skills training for persons with acquired brain injury. *Brain Injury, 22, 1 (suppl),* 57.

Lee, G. Y. Y., Yip, B. C. B. & Man, D. W. K. (2007). Community-based and group rehabilitation program in cognitive rehabilitation– sharing of experience and evidence of a local community program for cognitive enhancement. *Asian Journal of Gerontology & Geriatrics. 2(1),* 36.

Referred journal submission

Man, D., Yip, C., **Lee, G.**, Fleming, J. & Shum, D. (under review). Self-report prospective memory problems in people with stroke. *Journal of the International Neuropsychological Society*.

Conference presentation

Lee, G. Y. Y. (2013, December). *Cognitive rehabilitation and errorless learning-based memory training for dementia.* Paper presented at the 16th Asia Pacific Regional Conference of Alzheimer's Disease International 2013: Capacitiy Buiuding in Dementia Care, Hong Kong, China.

Lee, G. Y. Y., Yip, C. K, Yu, C. S. &. Man, D. W. K. (2013, May). *A computerized errorless learning-based memory training programme for early Alzheimer's Disease Chinese patients: a pilot study.* Poster presented at the 2013 Hong Hong Hospital Authority Convention, Hong Kong, China.

Lee, G. Y. Y. (2012, February). *Computer based training program for dementia clients: is there evidence?* Paper presented at the 2012 International Occupational Therapy Conference, 24-26 Feb, 2012, Hong Kong, China. Abstract retrieved from http://www.hkiot.org/2012otc/docs/iotc%202012%20book.pdf (Abstract book, p.48).

Lee, G. Y. Y., Man, D. W. K., Yu, C. S. & Yip, C. K. (2012, February). *Computer-assisted errorless training programme for Chinese early Alzheimer's Disease Persons in HK: A pilot study.* Paper presented at the 2012 International Occupational Therapy Conference, Hong Kong, China. Abstract retrieved from http://www.hkiot.org/2012otc/docs/iotc%202012%20book.pdf (Abstract book, p.49).

Lee, G. Y. Y., Man, D. W. K., Yu, C. S. & Yip, C. K. (2010, March). *Computer-assisted errorless learning for memory training in Chinese elderly with Alzheimer's Disease: a pilot study.* Poster presented in the *6th World Congress of Neurorehabilitation*, Vienna, Austria.

Lee, G. Y. Y. & Man, D. W. K. (2008, November). Computer-aided errorless-learning based and errorful memory training programme for persons with early Alzheimer's Dementia. 2008 International Occupational Therapy Conference, GuangZhou, China. pp.132-133.

Lee, G. Y. Y., Yip, B. C. B. & Man, D. W. K. (2007, June). *Community based screening and intervention for cognitive and QOL enhancement of senior adults.* Paper presented in the 4th Asia Pacific Occupational Therapy Congress, Hong Kong, China.

Lee, G.Y.Y. (2007, March). Cognitive assessment in practice. Paper presented in the 2007 *World Congress on Ageing and Dementia in Chinese Communities*, Hong Kong, China.

Lee, G. Y. Y., Yip, B. C. B. & Man, D. W. K. (2006, June). *Review of commonly used validated cognitive assessment tools for persons with early dementia in Hong Kong.* Poster presented in the fifth Pan-Pacific Conference on Rehabilitation, Hong Kong, China.

ACKNOWLEDGEMENTS

It is a very challenging, exciting, rewarding and encouraging work in completing this PhD study. I would like to firstly express my greatest heartfelt thanks to my chief supervisor, Prof. David W.K. Man for the guidance and unduly support given to me throughout my PhD study period. Secondly, I would like to acknowledge Dr. Edwin C.S. Yu, Psychogeriatric Consultant of Kwai Chung Hospital, my PhD co-supervisor, for the great support and encouragement offered to me during my study especially in the subject recruitment in the clinical field. Thirdly, I would like to give special thanks to Mr. Y.C. Ip, my work supervisor; Ms Mayo Lai, Mr. Ben Wong, Mr. John Lee, supporting colleagues of occupational therapy psychogeriatric service and my peer occupational therapy colleagues; Dr. Karen Wat, Mr. Ho Tat Pui, medical and nursing colleagues of psychogeriatric team of Kwai Chung Hospital of Hong Kong Hospital Authority; my Occupational Therapy students and colleagues of the Department of Rehabilitation Sciences who have given me extensive support during my study period. Fourthly, I must thank Prof. David Man's research team, including Prof. Man, Dr. Calvin Yip, Dr. Ben Yip, Ms Mayie Tsang and Mr. Ray Li for the invaluable peer support and practical help in this PhD research study; and Dr. Kit Sinclair who gave me the greatest support in finalizing the PhD thesis. Fifthly, I would like to send my greatest appreciation to the Head/ centre in-charge and staff of the following non-government organizations participating in this study, for giving me a lot of support in the subject recruitment:

- Dr. David Dai & Dr. Wu Yee Ming, Ms Maggie Lee, Ms Ada Lee, Ms Viggie Tang and colleagues of the Hong Kong Alzhiemer's Disease Association in Jean Wei Centre, Kowloon Centre and Sheung Wan Centre (with special thanks to the occupational therapists and colleagues giving their support in pre-and-post tests and follow-up outcome evaluation of subjects)
- Hong Kong Young Women's Christian Association Lam Woo Memorial Day Care Centre for the Elderly
- The Hong Kong Society for the Aged Sun Kwai Hing Garden Elderly Day Care Centre

- Hong Kong Young Women's Christian Association Wan Wah Care and Attention Home for the Elderly
- Kiangsu Chekiang and Shanghai Residents (Hong Kong) Association Kwai Tsing Hostel for the Elderly
- Rivera Elderly Centre (a private Home for the Elderly)
- Yan Chai Hospital Chinachem Care and Attention Home

Last but not the least, I thank the subjects and carers so much for the active participation and their support in this study and it is really encouraging to see the gradual improvement of subjects after the participating in the training programmes in my study.

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List of Abbreviation

Abbreviation	Full term
CG	Control Group
AD	Alzheimer's Disease
ADLQ-CV	Activities of Daily Living Questionnaire – Chinese Version
BAPM-carer	Chinese Brief Assessment of Prospective Memory, done by subject's carer
BAPM	Brief Assessment of Prospective Memory – Chinese version
CAMCI	Chinese Abbreviated Mild Cognitive Impairment Test
CDR	Clinical Dementia Rating
CELP	Computer-assisted errorless learning-based training programme
DRS	Mattis Dementia Rating Scale
EL	Errorless Learning
ER	Errorful Learning
GDS	Global Deterioration Scale
GDS-SF	Chinese Geriatric Depression Scale – Short Form
HKLIADL	Hong Kong Lawton Instrumental Activities of Daily Living
HKLLT	Hong Kong List Learning Test
MBI-CV	Modified Barthel Index- Chinese version
MMSE	Chinese Mini Mental State Examination
OT	Occupational Therapists
PM	Prospective Memory
Sig.	Significance
SR	Spaced Retrieval
TELP	Therapist-led Errorless Learning-based Memory Training Programme
VC	Vanishing Cues
WM	Working Memory
3M FU	3 month follow-up

CHAPTER 1

INTRODUCTION

1.1 Overview of the study

The population in Hong Kong is ageing. In 2011, about 13.3% of the population were elderly with an age of 65 or above, and this population was projected to rise to about 30% by 2041 (Hong Kong Census & Statistics Dept, 2014). A local study in Hong Kong, conducted by the Chinese University of Hong Kong and Department of Health of HKSAR, showed that the prevalence of dementia was 9.3% for those elderly of age 70 or above (Lam et al., 2008). According to the World Alzheimer Report 2009, about 36 million persons worldwide are estimated by Alzheimer's Disease International to suffer from dementia and this is expected to double every 20 years to 66 million by 2030 and 115 million by 2050 (Prince, Bryce & Ferri, 2011). Obviously, aging and the associated increase in dementia population is becoming a great health care problem.

Dementia is a neurodegenerative disease. It is a clinical syndrome, with different causes, and is usually irreversible. There is a progressive impairment of cognitive functions occurring in clear consciousness (in the absence of

delirium). Global impairment of intellect is the main feature, with deterioration in multiple cognitive domains, manifested as difficulty with memory, attention, thinking, and comprehension, which is severe enough to affect a person's daily living function (Gauthier, 2007; Herrmann, 2007; Hwang et al., 2012; Qiu & Fratiglioni, 2011).

With reference to World Alzheimer Report 2010 of Alzheimer's Disease International (Wimo & Prince, 2010), the total estimated cost of dementia worldwide are US$604 billion in 2010 and about 70% of the costs were found in Western Europe and North America. About two third of these persons referred to in this report live in low and middle income countries. The caring costs are around 1% of Gross Domestic Product in the world and this varies from 0.24% in low income countries to 0.35% in low middle income countries and to 1.24% in high income countries. Caring for persons with dementia would be a great financial burden to family carers and to the country.

Alzheimer's Disease is the most common type of dementia (Boustani et al., 2003). Alzheimer's patients show cognitive, memory and behaviour problems

and would have gradual deterioration activities daily living function. The burden of care to caregivers is affected by the illness severity, the level of disabilities and the amount of time spent in caring for relatives with dementia (Chan, Lam & Chiu, 2005). Caring for Alzheimer's Disease patients would be a heavy burden to the family and the carers (Lam, 2008), noting that 68% of home carers felt heavily burdened and 65% exhibited depressive symptoms (Papastavrou, Kalokerinou, Papcostas, Tsangari & Sountzi, 2007). In Hong Kong, some relatives preferred caring for persons with dementia at home rather than an institution. Actually, from a Canadian outcome study in dementia, the annual cost of care is about $14420 per patient (Herrmann et al., 2006). A study from United States also showed that home care costs were 20.8% lower than institutional care for dementia patients (Zhu et al., 2006). In the traditional Chinese culture, many elderly persons would prefer living with the relatives than living in the institution. So, it is essential to have early detection and intervention programmes for persons with dementia so as to enhance their living in the community (Lam, 2007; Prince, Bryce & Ferri, 2011).

Cognitive rehabilitation is found to be effective to improve the cognitive function

of patients with early dementia and support their coping in daily activities and thus achieving the optimal level of well being and reducing functional disability (Clare, 2001; Clare, 2003, Clare, 2010; Wilson, 1997; Wilson, 2002). The rehabilitation programmes can be commonly used remedial and compensatory approaches integrating with different memory techniques and strategies such as errorless learning, spaced retrieval, vanishing cues, and use of memory aids. Systematic review of studies in recent decades showed good evidence of cognitive intervention for persons with dementia (Hopper et al., 2013) and studies on errorless learning in an enriched environment were also found to be effective to enhance the cognitive rehabilitation process for the traumatic brain injury or AD persons (Dou, Man, Ou, Zheng & Tam, 2006; Lee, Yip, Yu & Man, 2013).

It is important to develop a systematic, effective and culturally relevant memory training programme for Hong Kong Chinese dementia patients at an early stage of the disease. Review of cognitive rehabilitation on mild dementia showed that cognitive training is effective against cognitive deterioration of persons with dementia (Clare et al., 2003; Clare et al., 2010; Mimura & Komatsu, 2007). A meta-analysis review of cognitive training for Alzheimer's patients and another

evidence based systematic review showed that cognitive training and errorless learning were effective for the restoration of learning, memory, executive functioning, activities of daily living and general cognitive problems (Hopper et al., 2013; Sitzer, Twamley & Jeste, 2006). Locally developed, computer-based cognitive training programmes (including Virtual Reality programme) have been developed by occupational therapists in Hong Kong for training of persons with dementia or questionable dementia persons. Intervention programmes, thus developed, have demonstrated positive results on memory functions (Lai, Mok, Lin, Yip & Chan, 2011; Lee & Man, 2008; Lee, Yip, Yu, & Man, 2013; Man, Chung & Lee, 2012; Sezto et al., 2006). An evidence-based review of a special training technique, named as an errorless learning (EL) training programme, showed that EL programmes could improve memory function of dementia patients (Clare & Jones, 2008).

An errorless learning-based teaching technique is used such that people are prevented to make mistakes while learning new skills or acquiring new information. Review of clinical application studies showed that errorless learning is superior to trial-and-error learning in teaching everyday tasks for

different diagnostic groups and its usage aims to ensure active participation of subjects and some might integrate into computer operation mode in the rehabilitation programme (Clare, 2002; Clare, Wilson, Carter, Roth, & Rodhes, 2002, Clare, 2003; Noonan, Pryer, Jones, Burns & Ralph, 2012). Errorless learning is a technique that can compensate for neurocognitive deficits as they relate to the acquisition of new skills and abilities during rehabilitation (Kern et al., 2003). Again, it is a better learning method compared with the trial-and-error ones for teaching individuals with acquired memory deficits (Evans et al., 2000). On the other hand, computer-assisted cognitive intervention can be very effective when it is applied together with a comprehensive programme of cognitive training in application to persons suffered from dementia (Galante, Venturini & Fiaccadori, 2007; Lynch, 2002).

Thus, a cost-effective computer-assisted, errorless learning-based memory training programme was proposed in this study and the intervention programme had been developed in such a way that this would probably delay the onset time for Alzheimer's disease and postpone the time for AD patients to move into institutions. AD patients could therefore, still lead a more happy and

meaningful life with their carers in the community in their familiar environment.

1.2 Statement of study purpose

1.2.1 Aims and objectives of research

This study aimed to develop and evaluate a computer-assisted memory training program, based on an errorless learning strategy in enhancing memory skills for patients with early dementia.

Specific objectives:

1. To develop and implement a computer-assisted memory training programme, which was based on an errorless learning strategy for patients with early dementia;

2. To compare training outcomes in a computer-assisted errorless learning-based memory training programme (CELP) group, a therapist-led errorless learning-based memory training progamme (TELP) group and a control group (CG), receving conventional treatment as usual.

1.2.2 Study significance and values

As mentioned earlier, dementia is a progressive illness. Deteriorating memory function becomes a great barrier for patients to lead an independent life. It also creates stress and burden for carers. An effective errorless computer-assisted memory training programme is proposed as an alternative training method which could be developed in a Cantonese version and later to web-based format to benefit more dementia patients in Hong Kong. Moreover, an errorless computer-assisted memory programme can be a cost-effective mode of treatment, and may be better than the traditional therapist-led memory training programme. Older adults with early dementia could benefit from this innovative memory intervention programme in a more accessible manner.

1.3 Organization of chapters

There are altogether seven chapters in this thesis. Chapter one is the introduction chapter. Chapter two is the literature review on dementia, early Alzheimer's Disease, cognitive rehabilitation theories, errorless learning and enriched environment and rehabilitation approaches on early dementia. Chapter

three mainly focuses on the theoretical framework of the computer-assisted errorless learning-based programme adopted in this study. Chapter four outlines the methodology and research design of the study. Chapter five covers an expert panel review, a pilot study, data analysis and results of main study. Chapter six contains the discussion. The last chapter, chapter seven is the conclusion. The reference list and lists of appendices can be found at the end of this report.

CHAPTER 2

LITERATURE REVIEW

This chapter will review the dementia illness, the problems and assessment of early Alzheimer's Disease (AD) patients. The review will be followed by the cognitive theories related to rehabilitation of dementia and finally the review of specific memory strategies related to errorless learning and computer-assisted training programme.

2.1 Dementia illness

Dementia describes a variety of diseases and conditions, with different causes. The main feature is decline in cognitive function, affecting the mood, personality and social behavior. The course of illness is progressive. Nevertheless, the diagnosis of dementia is made with the evidence of memory deficits and one other cognitive deficit (Sadock & Sadock, 2005). There is a high prevalence of behavioral and psychological symptoms of dementia (BPSD) from 53% to 98% (Gauthier, 2007; Herrmann, 2007). About 30-50% of patients with Alzheimer's

Disease (AD) showed depressive mood and less than 20% of them suffered from major depressive diseases (Tsuno & Homma, 2008).

2.1.1 Diagnosis on dementia

Early diagnosis of dementia is important (Brodaty & Cumming, 2010). Medical assessment, physical examination, blood test (to rule out organic causes), neurological examination, data collection on family and psychosocial history, pharmacological assessment and radiological assessment with structural imaging (computed tomography/magnetic resonance imaging) or functional imaging will be done for patients (Bourgeois & Hickey, 2009). The diagnostic criteria of dementia with reference to Diagnostic and Statistical Manual for Mental Disorder (DSM-IV-TR) (American Psychiatric Association, 2000) or the World Health Organization ICD-10 Manual of Classification of Mental and Behavioural Disorders (World Health Organization, 1993) are often adopted in the psychiatric field in Hong Kong.

2.1.2 Prevalence of dementia

The prevalence of dementia was 7.2% for those elderly of age 60 or above and it

increases to 9.3% for those elderly of age 70 or above in Hong Kong (Lam et al., 2008). The prevalence rate of dementia would double for around every 5.5 to 6.7 years of increase in age, depending on which part of the world (Lam et al., 2008; Lichtenberg, Murman & Mellow, 2003; Prince, Bryce, Albanese, Wimo, Ribeiro & Ferri, 2013). A previous local prevalence study in Hong Kong showed that about 4% of elderly aged 65 or above suffered from dementia and this rate has increased to about 6.1% for those aged 70 or above (Chiu et al., 1998). Thus, the prevalence rate for dementia in Hong Kong also showed an increasing trend. Dementia studies in China reported that among 2917 Anhui elders, the prevalence of dementia found was 7.29% for male and 9.19% for female elderly persons of aged 65 or above (Chen et al., 2012). In the United States, an Aging, Demographic, and Memory Study with a nationally representative sample showed that, the prevalence rate for dementia among individuals aged 71 and above was 13.9%, with AD of 9.7% and around 2.4 million adults in USA in 2002 (Plassman et al., 2007). In Australia, it is expected that the prevalence of dementia would increase from 245,000 in 2009 by about four times to around 1.13 million by 2050 (Brodaty and Cumming, 2000). According to the World Alzheimer Report 2012 and the World Health Organization Dementia Report released in April 2012, it was

estimated that there were 7.7 million new cases of dementia in 2010 or one new case every four seconds. Assuming that incidence would be in line with prevalence, by 2050, the incidence would increase to 24.6 million of new dementia cases annually (Batsch & Mittleman, 2012). Obviously, the world population is ageing meaning that more persons will be suffering from dementia in the future.

2.1.3 Types of dementia

There are three main types of dementia: AD (around 65% worldwide and around 60% in China); Vascular Dementia (VD) (around 29%); and dementia of other causes (about 6%) (Boustani et al., 2003; Lam et al., 2008; Chen et al., 2012). Alzheimer's Disease is the common type of dementia (Chen, et al., 2012; Laffan, Metzler-Baddeley, Walker & Jones, 2010; Qiu & Fratiglioni, 2011). Other types of dementia include Frontotemporal Dementia, Lewy Body Dementia, mixed dementia and atypical variants.

2.1.4 Predictors for dementia or Alzheimer's Disease (AD)

There are protective and risk factors related to dementia and AD. Old age is consistently associated with an increased risk of dementia while more years of education is associated with a lower risk of dementia but there is no difference in

dementia risk between male and female patients (Plassman et al., 2007). Moreover, women tend to have a higher incidence of dementia than men in very old age and this might due to longer survival after development of the disease (Jorm, 2005). There are familial and genetic factors that increase the risk of AD. Besides, regular physical exercise is found to be a protective factor against dementia (Lam et al., 2008). From the study of professor Michael Valenzuela in Australia, findings showed that cognitive training in healthy old subjects provides a strong and persistent protective effect on longitudinal neurological performance (Valenzuela & Sachdev, 2009).

2.1.5 Manifestation of Alzheimer's disease

AD is a progressive neurological disorder. The cause of AD is unknown. Pathologically, the hippocampus (key role in memory) is the first area affected by AD, with later neurodegeneration of temporal and parietal cortical tissues (semantic & higher cortical function). Neuronal loss is found as the disease progresses and with widespread formation of intraneuronal neurofabillary tangles and plagues in various brain regions. Genetic predisposition to ApoE4 (linked with working memory) was reported in A.D. (Lam, 2007; Ma, 2007; Morris & Becker, 2004). Memory impairment is prominent for AD patients especially in

episodic memory (de Werd, Boelen, Rikkert & Kessels, 2013). Alzheimer's type dementia is of insidious onset with a continuous course. It might have an eight to twelve year course of disease (Smith, 2007).

2.1.6 Alzheimer's disease - three stages

The course of AD can be divided grossly into three stages: early, middle and late stage based on the progress of the disease, but there might be some overlapping among the stages. Some people might also like to classify the three stages of dementia as mild, moderate and severe dementia. In early stage dementia, it is typically the episodic memory sub-system, containing memory for personally relevant events or episodes, being significantly impaired while the semantic memory and procedural memory are either intact or less affected (Clare et al., 2003). The short term memory is affected and the recall of recent information is difficult but the person can still communicate with others, with reduced vocabulary and with instrumental ADL ability. As the disease progresses to middle and late stage, the person will show gradual deterioration in cognitive and ADL functioning and eventually need constant support from others (Kar et al., 2006).

2.1.7 Deficits in early AD – memory problems

In Hong Kong, clinical AD is found in 3.6 % of Hong Kong Chinese elders over 70 years old. For a group of 104 AD patients observed for an average of 22 months in a recent local study (Lam, 2006), the mean age (SD) at the baseline assessment was 78.18 (5.97) years. The mean (SD) of the Chinese version of the Mini-Mental State Examination (MMSE) and Mattis Dementia Rating Scale (DRS) scores were 16.21 (3.69) and 94.88 (13.17) respectively. The annual deterioration in MMSE and DRS scores were reported to be 1.34 and 4.93 respectively (Lam, 2006).

The essential features of dementia is the development of cognitive deficits including memory impairment and at least one of the following cognitive disturbances: aphasis, apraxia, or a disturbance in executive functioning. Memory impairment is required to make the diagnosis. In fact, memory impairment is the first cognitive manifestation and the major presenting symptom of AD (American Psychiatric Association, 2000; Chiu et al., 2002; Yu et al., 1994) according to lcoal and Caucasian studies. In Hong Kong, a study showed that 74% of AD patients had disorientation in time, place and person (Chiu et al., 2002). Disorientation to time and place were very common, occurring in 60.4%

and 51.0% of people with AD respectively. Disoreintation in person occurred in about 25% of patients. The percentages of patients with disorientaton rose from 31% to 70%, 96% and 100% when patients are rated by the Clinical Dementia Rating Scale (CDR) as at 0.5, 1.0, 2.0 and 3.0 respectively and 85% of patients had impaired executive function (Chiu et al., 2002). Impairment of executive function of cognition includes planning, sequential organization, judgement and problem solving abilities and this in turn poses difficulties of AD patients to manage their community living skills independently.

In addition, semantic memory for generic knowledge is impaired relatively early in AD, deteriorating throughout the course of the disease which may be due to a loss of knowledge rather than to a retrieval deficit. There is also impairment of episodic memory & semantic memory in AD (de Werd et al., 2013; Norton, Bondi, Salmon & Goodglass, 1997*).*

There are structural abnormalities of the medial temporal lobe structures, perirhinal cortex, perforant pathway and hippocampus; decrease in hippocampal volumes are a hallmark of early AD, with impairment of declarative memory (including episodic memory) (Morris & Becker, 2004; Yuede, Dong &

Csernansky, 2007). The hippocampus is the first area affected in AD. The critical role of the hippocampus for efficient encoding and normal recall of new information is undisputed (Cipolottia & Bird, 2006). Again, early AD patients have extraordinary difficulty to form new memories. Their encoding deficit affects their acquisition and learning of new information in daily life. Moreover, AD patients lack strategies to process association with the episodic buffer that chunk items into large unit to effectively increase the working memory storage capacity (Germano & Kinsella, 2005). However, the phonological loop of early AD patients is still unimpaired and skill learning is preserved (Morris & Becker, 2004).

From a study on patients with minimal cognitive impairment, very mild or possible AD, evidence of deficits in attention (including selective and divided attention), was found in patients with mild AD (Perry, Watson & Hodges, 2000). From a local study in Hong Kong, deficits were found in delayed recall and in verbal fluency in mild dementia patients (Lam, 2007). Patients with AD also have difficulties in taking in new information and forming new memories (Clare,

Woods, Miniz, Orrell & Spector, 2003). Besides, impairment of memory span and phonological loop with deficits in central executive system of working memory in AD persons is evident (Huntley & Howard, 2010). This also poses co-ordinating problems in activities. As patients with early AD have impaired spatial attention shifting, they will have difficulty in dual task activity (Morris & Becker, 2004; Huntley & Howard, 2000).

Prospective memory (PM) is the ability to remember to carry out intended actions in the future. There are three types of PM: Time-based, Event-based and Activity-based PM (Shum et al., 1999).

PM is important for effective performance of daily activities but generally declines with age (Shum, 2008). However, there is a severe deficit in PM for people with early dementia (Huppert, Johnson & Nickson, 2000). Among the subjects in Huppert et al.'s study, with very mild dementia or at early stage dementia, only 8% succeeded on the PM task. Moreover, 85% of this group was living at home and 20% were living alone. However, remembering to perform an intended action is essential and of great importance in one's ability to live safely and their PM

problems will pose safety hazards. For 40% of probable dementia cases who showed evidence of retrospective memory (RM) problems, only 21% succeeded on the PM task. A PM task might be more sensitive than RM tasks for early dementia cases. PM performance clearly distinguished a healthy control group from a very mild AD group and is an early cognitive predictor for AD (Duchek et al., 2006). A PM clinical study also showed that mild AD subjects who received 7 week PM training, incorporated with errorless training and spaced retrieval technique showed post treatment of 90% accuracy of performing PM task successfully compared with 16-33% for control subjects (Kixmiller, 2002). It was reported by carers in the survey in a different study that failure of prospective memory would be more frustrating than retrospective memory failures in caring the Alzheimer's persons (Smith et al., 2000). A PM prevalence study in UK administered for 11596 elderly participants through event-based PM tasks, showed a strong and positive relationship between successful PM and scores on RM measures.

In summary, patients with early AD have difficulties in attending to and encoding new information and have episodic, working and prospective memory impairment

(Chung, 2007; de Werd et al., 2013). A single-blind randomized controlled trial study also reported that goal-oriented cognitive rehabilitation programmes produced significant improvement in rating of goal performance and satisfaction for early stage AD patients after eight-week individual training when compared with a control group and a group with relaxation therapy (Clare et al., 2010). A cognitive rehabilitation programme has to be designed with enriched environment, with more reinforcement and be errorless learning-based to address the encoding and memory problems of AD patients.

2.2 Assessment in dementia

Assessment of older adults with dementia is considered very important as rehabilitation plan can thus be formulated. Occupational therapists may provide assessment of the following aspects: mental, cognitive, physical, activities of daily living (ADL) functioning, social support system and home environment (Lee et al., 2012). A wide range of assessment tools are commonly used by clinicians in Hong Kong and they will be elaborated in subsequent paragraphs. Besides neuropsychological assessment, neuroimaging techniques including computed

tomography (CT) and magnetic resonance imaging (MRI) are used to classify patients having or not having a reversible cause of dementia (Gifford, Holloway & Vickrey, 2000).

2.2.1 Cognitive screening

The Mini Mental State Examination (MMSE) is useful for clinicians to screen cognitive impairment for older adults suffering from dementia (Petersen et al., 2001). The Chinese Version of MMSE (CMMSE), with a cut-off score of 19/20 is widely used with Hong Kong Chinese elderly for cognitive screening in the community (Chiu et al., 1994). For initial evaluation, the Chinese Abbreviated Mild Cognitive Assessment Test (Lam et al., 2008; with verbal fluency and delayed recall test) and the Hong Kong Montreal Cognitive Assessment (Wong et al., 2009) is used for cognitive screening and cognitive assessment respectively for persons with Mild Cognitive Impairment. Mini-Cog is recommended as one of the best cognitive screening tools for dementia that can be used by General Practitioners and other staff in some community settings for the older adults as it has the advantage of brevity, with administration time of about 5 minutes and with similar sensitivity (76% vs 79%) and specificity (89% vs 89%) in screening

subjects as "possible impaired" or "probably normal" when compared with MMSE (Boron, Scanlan, Chen & Ganguli, 2003; Brodaty, Low & Gibson, 2006). Clock-face Drawing test is also a brief, quick and valid screening assessment of dementia in Chinese older adults (Lam et al., 1998) as persons only need to fill in the number of clock-face in a pre-drawn clock circle and also place the hands on the drawn clock at a given time at test. Besides the above popularly used cognitive screen instrument, the Chinese version of Silver's test (Tsang & Man, 2006) is also employed by some clinicians of the Hong Kong Hospital Authority as a quick cognitive assessment tool with verbal and practical test, taking about 15 minutes to complete and with the cut-off score of 34 point out of 45 point, below cut-off indicating the elderly person might have cognitive impairment.

2.2.2 Dementia-specific cognitive assessments

Cognitive assessment of memory and intellectual ability is essential for diagnosis of dementia and as a baseline to measure the change resulting from intervention (Strokes & Goudie, 2002). Clinicians might select appropriate validated test instruments with local norms/cut-off to assess cognitive functioning of the elderly clients according to their stage of development of the illness.

To measure the severity of the dementia illness and the cognitive function in different domains, more detailed assessment should be done such as using Chinese Clinical Dementia Rating Scale (Choi et al., 2003), validated Mattis Chinese Dementia Rating Scale (CDRS) (Chan et al., 2001; Chan et al., 2003; Mattis 1988), validated Chinese Alzheimer's Disease Assessment Scale- cognitive subscale (ADAS-Cog) (Chu et al., 2000), Rivermead Behavioral Memory Test (Li, 2000), Chinese Hierarchic Dementia Scale (Poon, Lam & Wong, 2008), and Chinese Neurocognitive Status Examination (Chan, Fong, & Lee, 1999). Other commonly used cognitive tests in evaluating memory function in Hong Kong include Kendrick Cognitive Test for the elderly, Digit Span Test, Verbal Fluency Test, and Fuld Object Memory Evaluation (Chung & Ho, 2009). Therapists have to select appropriate assessment tools for assessing patients who might be at different stages of development of the dementia illness.

In assessing cognitive function of the elderly patients with early dementia, Mattis Chinese Dementia Rating Scale (CDRS) is recommended to be used in Hong Kong. CDRS is a modified standardized assessment with reference to Chinese culture and with a cutoff score. In CDRS, the validated study showed the optimal

cutoff score of 112 for total CDRS score to differentiate AD patients when compared with the normal elderly (Chan, 2003).

Moreover, the Hong Kong List Learning Test (Chan & Kwok, 1999) is a Chinese list-learning test that was designed to provide an individually-administrated assessment of the memory processes and organizational strategies involved in learning verbal information. Sample norms on dementia are provided for this test making it also a highly recommended Chinese test for persons with dementia.

2.2.3 ADL/ functional, staging assessment in dementia

Persons with dementia show gradual deterioration in the progress of the dementia illness. Performance of activities of daily living actually relies heavily on the cognitive and executive function of the demented persons. To assess the stages of development of the dementia illness, the Reisberg's Global Deterioration Scale (GDS) (Stage 1-3 being pre-dementia stages and stages 4-7 being dementia stages) (Reisberg, Ferris, de Leon & Crook, 1982) and the Functional Assessment Staging Test (FAST) (Stages: 1-7, evaluation of changes in functional performance and activities of daily living) (Sclan & Reisberg, 1992) are employed. From

systematic review of dementia staging instruments, Clinical Dementia Rating (CDR) is the best-evidenced scale and also broadly used internationally by clinicians as a staging measures for Alzheimer's Disease, and is available in 14 languages (Fillenbaum et al., 1996; Rikkert et al., 2011).

Moreover, the Chinese / Cantonese version of Hierarchic Dementia Scale is also used in some clinical settings in Hong Kong to evaluate the severity of dementia illness among elderly persons, with satisfactory psychometric properties, with high inter-rater reliability and test-retest reliability (alpha=0.89 and alpha=0.94 respectively) and good internal consistency (alpha=0.94) (Poon, Lam & Wong, 2008). The scale covers nine major ability areas (i.e. cognitive, language and motor functioning) in six subtests, with increasing level of difficulties in subscales of the instrument.

Besides, Chinese Disability Assessment for Dementia (Mok, 2002), Chinese Barthel Index (Leung, 2003), Lawton Instrumental ADL Scale (Lawton & Brody, 1996; Tong & Man, 2002) and Assessment of Motor and Process Skills (Fisher, 2003) are commonly applied to assess the basic ADL function and independent living skills of dementia patients in Hong Kong. Lastly, a validated Chinese

version of the Activities of Daily Living Questionnaire (Chu & Chung, 2008) is a carer-related questionnaire, with 23 items, and it is also used to evaluate the functional activity level of the dementia patients.

2.2.4 **Assessment on mood and carers**

Some dementia patients also present with mood problems, especially those with early dementia when they have insight into their failing memory and other related problems. Depressed mood and apathy are common in the early stage of illness; and these symptoms would affect their functional performance (Hall, O'Bryant, Johnson, & Barber, 2011; Lam, Tam, Chiu & Lui, 2007). Validated Cantonese Geriatric Depression Scale- Short form (with a cut-off score at 8 or above out of a total of 15 points) (Wong et al., 2002) might also be adopted to assess the mood condition for patients with early dementia.

Caregivers of older adults with dementia often face a lot of stress and 50% of the caregivers might present with depressive symptoms. It is very important to provide carer support programmes and education especially to the informal family caregivers who have relatively higher carer stress than formal caregivers (Marriott, Tarrier & Burns, 2001; Takahashi, Tanaka & Miyaoka, 2005). Actually,

informal carers have limited skills and training in handling the dementia clients. The Chinese version of Zarit Burden Interview (Chan, Lam & Chiu, 2005), Relatives' Stress Scale (Greene, Smith, Gardiner & Timbury, 1982) and Abbreviated Hong Kong Chinese version of the World Health Organization Quality of Life Measures, WHOQOL- BREF(HK) (Leung et al., 2005) are also used in Hong Kong. Moreover, a Chinese version of the Quality of Life in AD scale of 13-items, with patient and carers version, can be completed in 10 minutes to measure major aspects of quality of life of patients with dementia (Chan, Chu, Lee, Li & Yu, 2011).

Caring for dementia patients with complexity of cognitive symptoms and behaviour problems poses new challenges for multi-disciplinary staff of the rehabilitation team in working with patients and their carers together.

2.2.5 Summary of assessment on dementia

Use of different assessments on patients with dementia should be based on careful selection of validated standardized assessment tools, observation of clients' behaviours and data collection from carers. Structured and detailed neuropsychological assessment might be used to assess cognitive functioning of dementia clients at early and moderate stage of dementia but not at the late stage of

dementia. Moreover, clinical observation and carers interview is important to collect data based on the cognitive and daily life function of the dementia patients. In selecting outcome measures, validated Chinese outcome assessment scales, with good psychometric properties (reliability and validity) should be selected for assessment of early demented patients in this study.

2.3 Non-pharmacological intervention/cognitive rehabilitation

Treatment of dementia includes pharmacological and non-pharmacological interventions. Several systematic reviews and an overview of non-pharmacological intervention have been done by different professionals and occupational therapists, with recommendation of non-pharmacological treatment as evidence based practice for formal and informal carers on care of dementia (Hulme, Wright, Crocker, Oluboyede, & House, 2010; Lee et al., 2012; Olazaran et al., 2010). They include intervention of cognitive, ADL and behavioural and psychological symptoms aspects. Evidence-based effective non-drug recommended interventions include cognitive training, cognitive rehabilitation, cognitive stimulation therapy, Snoezelen/multisensory stimulation, reality orientation, reminiscence therapy, validation therapy, physical activity, ADL and

functional training, enviromental adaptation, Montessori-based programme, remotivation therapy, light therapy, music therapy, aromatherapy, animal-assisted therapy, massage/touch therapy and community occupational therapy home programme with cognitive and behavioral intervention (Arbesman & Lieberman, 2011; Clare, 2010; Hulme, Wright, Crocker, Oluboyede & House, 2010; Lam et al., 2010; Lee et al., 2012; Mok, 2004; Yamaguchi, Maki & Yamagami, 2010). Occupational therapists, different professionals and caregivers might select evidence-based intervention programme for patients with dementia depending on the needs, background, interests, cognitive and functional performance of older adults and the environment that the demented patient is living in.

Cognitive rehabilitation for patients with dementia will enhance their cognitive function and well being and it is a more individualized approach addressing the everyday manifestations of their cognitive problems (Wilson, 2002). Cognition refers to the processs involved in knowing, understanding, learning, perceiving, remembering, judging and thinking. These processes are very different when contrasted with physical, behavioural or emotional process (Wilson, 1997). Our memory system has to be effective in encoding or learning of information, storage

or maintenance of the information, and retrieval of information when required (Wright & Limond, 2004) making it possible to function in our daily environmental situations. Based on brain plasticity theories and neurorehabilitative theories, our brain is continuously plastic and an old or demented person still has the ability to learn new skills (Liberati, Raffone & Berlardinelli 2012). According to the "cognitive reserve model" or "brain reserve model" and brain plasticity theories, we can still make improvement at any age and even for AD patients, with the growth of neurons in terms of the fidelity (accuracy of brain “representation”, their power/ strength, their co-ordination of neuronal teamwork, their richness, their speed/ efficiency of brain operations) and brain gains high plasticity in response to one’s life experience or repetitive brain stimulation and might integrate the new information or learning for future neuronal network or behavioral response and enhance cognitive function (Bell, Zito, Greig, Wexler, 2008; Berlucchi, 2011; Valenzuela & Sachdev, 2006; Woldemichael, Bohacek, Gapp & Mansuy, 2014). We might use more efficient and flexible cognitive strategies in our brain process (Berlucchi, 2011; Liberati, Raffone & Berlardinelli, 2012).

A randomized controlled study for 69 early AD patients suggested that an eight

weekly personalized, individualized, goal-oriented cognitive rehabilitation programme supported by practical aids, strategies and techniques to learn new information, practice in maintaining attention and concentration and techniques for stress management, significantly improved the goal performance and satisfaction of dementia patients when comparing with the control groups (Clare et al., 2010).

Cognitive training involved guided practice on a set of standard tasks on particular cognitive domains such as memory, attention or problem solving ("executive function"); implemented individually, in the form of paper-and-pencil or computerized form, or might be simulated into activities of daily living, with a set level of difficulty levels, to be selected based on the function of patients (Clare & Wood, 2003).

A meta-analysis review of cognitive training for AD patients showed that training was effective with an overall medium effect size of 0.47 for cognitive function, activities of daily living, depression, and self-rated general function: the mean effect size was higher for restorative (0.54) than for compensatory (0.36) strategies (Sitzer, Twamley & Jeste, 2006). Evidence-based systematic review of 43 studies among 556 participants on cognitive intervention using errorless learning,

spaced retrieval, vanishing cues or verbal cueing would enhance their cognitive gains (Hopper, Bourgeois, Pimentel, Qualls, Hickey, Frymark & Schooling, 2013). Recent in-home cognitive research on individuals with mild cognitive impairment and early-stage Alzheimer's disease disease showed that intervention group with 24-hour cognitive training demonstrated significant outcome than control group in cognitive performance like face-name association, delayed recall and recognition (Tappen & Hain, 2014).

2.3.1 Cognitive rehabilitation approaches

Cognitive rehabilitation is a more individualized approach addressing the everyday manifestations of these impairments. It should be focused on real-life, functional problems and associated mood and behavioral problems and it should involve the clients, relatives and others in the planning of personal goals and implementation of a cognitive rehabilitation programme (Wilson, 2002). Emphasis of training should address improvement of function in everyday activities more than just improving cognitive tasks.

There are three main approaches in cognitive rehabilitation: basic skills

remediation/restoration, functional strategy training, and compensatory approaches such as environment modification (Wilson, 2002).

A rehabilitative approach with compensation techniques might also be employed. The principles of memory rehabilitation support the encoding, storage and retrieval of information through support of the weaker mechanism of clients' functioning (Wright & Limond, 2004). Strategies proved to be effective in memory training include spaced retrieval, errorless learning, PQRST explicit structuring procedures (Preview, Question, Read, State and Test), vanishing cues, use of compensatory strategies and memory devices (Bird & Kinsella, 1996; Clare, 2003; Cherry & D'Gerolamo, 2005; Haslam, Hodder &Yates, 2011; Lynch, 2002; Spector et al., 2003; Wright & Limond, 2004).

For the behavoral approach for functional strategy training, techniques which might be employed in teaching new skills or improving existing skills include prompting, chaining, shaping, expanded rehearsal, positive reinforcement and goal planning so that treatment is targreted to individual's functional needs (Wilson et al., 2003). Clare's study (2002) on dementia showed that dementia patients were able to learn friends' or therapist's names with 100% success after 11-week

structured training and learnt one name in one week. In the post-training test, dementia patients were able to find the right person in the social club and name him or her.

For restorative or remedial approach, remediation of specific cognitive domains was integrated into intervention (Clare, 2008). According to Wilson's recommendation, no single approach is comprehensive enough and thus a holistic approach might be adopted. The aim of cognitive rehabilitation is to reduce the disabilities and handicap associated with cognitive impairment and enhance the functioning (Wilson, 2002).

In the intervention and rehabilitation of early dementia, the main focus would thus be on everyday problems arising from problems of long-term episodic memory or executive function; and goal directed client-centered programme might be provided on individual or group basis (Clare, 2003). Moreover, a goal-planning approach has a lot of advantages when this is employed in cognitive rehabilitation (Wilson et al., 2002; Clare, 2010) and dementia patients are motivated to achieve the goal of rehabilitation step by step. Memory training includes memory strategies like attention, categorization, association and visual imagery; with exercise to practice the strategies (Olchik, Farina, Steibel, Teixeira & Yassuda,

2013). Techniques used in memory training included errorless learning, errorful learning, vanishing cues, spaced retrieval and memory aids and memory strategies might be used alone or together (Yu et al., 2009). Training strategies like errorless learning are found to work better when combined with spaced retrieval in cognitive intervention for people with dementia (Haslam, Hodder &Yates, 2011).

2.3.2 Errorless learning (EL) and enriched environment (EE)

Terrace's pigeon experiment showed that organisms might be highly motivated to positive stimulus and a great deal of response effort might be required to establish errorless discrimination (Clare & Jones, 2008). Terrace (1963 a,b) demonstrated errorless learning of discrimination using a conditioning pradigm. The techniques employed in the memory rehabilitation of the early dementia patients affect the cognitive outcome, so must be chosen carefully.

Individuals with dementia have the capability to learn when information is presented using specific strategies i.e. rehabilitation professionals should capitalize on implicit memory, use of specific memory strategies, and facilitating communication techniques in error-free learning situations (Davis, 2005).

Older people have difficulty in the encoding stages of face-name association learning, whereas retrieval is relatively unaffected. In addition, the prevention of

errors occurring during learning results in a better memory performance, and is perhaps an effective strategy for coping with age-related memory decrement (Kessels & De Haan, 2003). Besides, in a study using controlled trial, training in face-name association using errorless learning principles was found to produce significant improvement in recall and the gains, being sustained over 6 months. Moreover, participants who had insight into their memory difficulties might achieve better outcomes (Clare et al., 2002).

Errorless learning is a teaching technique, used when people are prevented from making mistakes while learning new skills or acquiring new information and this can compensate for neurocognitive deficits in the rehabilitation process (Kern, Green, Mintz & Linerman, 2003; Kern et al., 2005). Errorless learning is based on rationale to bypass error and has accurate association of information to be learnt becuase dementia patients had difficulty to self correct error; with principles of breaking down the learning into component parts, overlearning components through learning and practice; training from simple to complex and with hierarchical training of gradation (Clare & Jone, 2008; Haslam, Hodder & Yates, 2011; Kessels & De Hann, 2003; Kessels & Hensken, 2009). Errorless learning is a effective memory training method when compared with the trial-and-error,

spaced retriveal and vanishing cues in teaching individuals everyday tasks with the amnesic group and particularly beneficial to dementia patients; and errorless learning training strategies cane be used together with spaced retrieval and vanishing cues (Baddeley & Wilson, 1994; Bier et al., 2008; Clair & Jones, 2008; de Werd, Boelen, Rikkert & Kessels, 2013; Evans et al., 2000; Hopper et al., 2013; Donaghey, McMilan & O'Neill, 2010; Page, Wilson, Shiel, Carter & Norris, 2006). Errorless learning can possibly encourage more active engagement and meaningful involvement of patients and enhance the results from error prevention (Tailby & Haslam, 2003; Haslam, Gilroy, Black & Beesley, 2006; Jokel & Anderson, 2012). It is important to ensure active participation of subjects in errorless learning process and some applications might integrate computer progamme in the rehabilitation programme (Dou et al., 2006; Lee et al., 2013).

A research study on aged Alzheimer's mice showed that long-term enriched environment for four months and multisensory cognitive stimulation improve the cognitive functioning of the Alzheimer's mice than the control (Arendash et al., 2004). Other studies also suggested that an enriched environment, with multisensory stimulation might enhance the neural plasticity of brain (synaptic plasticity or the cellular plasticity) and for cognitive enhancement of memory

impaired persons or Alzheimer's mice (Dou et al., 2006; Pang & Hannan, 2013). A randomized controlled trial study on individual cognitive stimulation therapy for dementia showed that the intervention group with training of individual 30-minute training sessions over 25 weeks showed effect size of 0.35 when compared with the control (Orrell et al., 2012). Intervention study also showed that interactive communication training would provide a potent learning environment for AD patients in a memory programme (Duff, Gallegos, Cohen, & Tranel, 2013). A review on prevention of dementia also showed that there was evidence of association for cognitive stimulation and social activity in lifestyles in midlife as protective factors against dementia (Rooney, 2014).

Dementia patients with cognitive impairment often have functioning problems in household and community settings, e.g. in situations on name-face association, misplacement of dailiy objects and routing to different places. Errorless learning is a facilitative techique, with the creation of a supportive training environment to enhance the learning of new information gradually. Since the attention span of the dementia clients is known to be limited, an enriched environment, with different stimulation and memory strategies will also assist them to encode information in an accurate way, being error-free and retent information in a more

systematic way.

So, by using a combination of errorless learning method and an enriched environment delivery in a training programme, demented patients might learn more effectively in a supportive and facilitative environment in the cognitive rehabilitation process.

2.3.3 Application of computer-assisted cognitive training

omputer-assisted cognitive retraining can be very effective when it is applied together with a comprehensive programme of cognitive rehabilitation (Lynch, 2002). Virtual reality technology, for example, may also be integrated in rehabilitation (Schultheis & Rizzo, 2001). Clinicians also apply computer based programmes in different countries in the rehabilitation of the elderly and people with dementia (Man, Chung & Lee, 2012). Schreiber et al. (1999) completed an initial study on application of virtual reality computer training using simulated environment related to household task was done with 14 dementia patients with early or moderate dementia. Over a two-week period, ten 30-minutes sessions computer training programme was implemented to improve immediate and delayed retention of objects and routes. Computerized training was adapted to

individual abilities and the therapist might intervene to ensure the quality of training. The result was positive and indicated that there could be a direct tranfer of learning to real-life settings and real-life household tasks (Schreiber, Schweizer, Lutz, Kalveram, & Jancke, 1999). Thus, human computer interaction was found to be an effective training strategy in the memory rehabilitation and in improving the attention, orientation, memory, language and fluency in the intervention group for patients with dementia (Dou et al., 2006; Lee et. al, 2013; Tam et al., 2003; Zhuang et al., 2013).

A randomized clinical trial of computer-based cognitive intervention programme for dementia showed that for subjects who attended twelve individual sessions of computer exercises, the programme are effective at least to delay the continuous progression of cognitive impairment in AD when compared with a significant performance decline in control subjects (Galante, Venturini & Fiaccadori, 2007).

In the last ten years, computer training programmes have been integrating into the cognitive rehabilitation of patients in Hong Kong (Dou et al., 2006). Recent research in Hong Kong showed the success of tele-cognitive rehabilitation using

computer software as a treatment media (Tam et al., 2003). This set an interactive communication platform for trainng. Besides, with the advance of computer programming, training software might be adjusted to meet the patient's treatment needs and be made appropriate to patient's functional levels and living environment. Computer training also provides immediate visual, auditory and personalized feedback to motivate the patient and engage patients in the training according to own needs and pace. In Hong Kong, computer based programmes have been employed in the cognitive rehabiliation for the elderly for memory training such as training in attention, concentration, name-face recall in daily activities or in reminiscence scenario (Chung, Lee & Man, 2004).

Computer softwares for the elderly are available from the commerical sectors, the Assocation for Engineering and Medical Volunteer Services (EMV), and the Hong Kong Polytechnic University. Some therapists or computer technologists might tailor-make their own computer programme for the rehabilitation of the elderly or the dementia patients.

Multi-sensory computer-assisted training is beneficial to the elderly through

providing empowerment of patients through a sense of achievement, enrichment the social intereaction and communciation network The psychogeriatric patients are motivated through failure-free treatment approaches (Hellen, 1998). To enhance the motivation of demented patients, computer training might start from remembering easier to harder and from familiar things to unfamilar ones. Guidance is needed from therapists to adopt a positive learning environment. Elderly clients and patients can also be reinforced for their success participation (Lee & Man, 2008; Lee et al., 2013).

As mentioned earlier, recent studies in Hong Kong and China also showed that the combined use of an errorless learning and a computerized approach would be an effective way to improve memory for Chinese patients with traumatic brain injuries (Dou, Man, Tam & Chan, 2004; Dou et al., 2006). Recent local research reports in Hong Kong showed that computer-based cognitive training programmes are effective to improve the cognitive function of the elderly in the early stage of dementia on individual or group basis (Lai et al., 2011; Lee et al., 2013; Sezto, Wan, Wong, Wu & Ma, 2006). An evaluation study of pre-and-post intervention using Virtual Reality (VR) based memory programme for Hong Kong Chinese

adults with questionable dementia also found VR group showed greater improvement in object memory performance while therapist-led non-VR group showed better subjective memory subtest (Man, Chung & Lee, 2012). A randomized control trial single-blind study on 19 Chinese early AD persons also showed that errorless learning based training programme, either in computer-assisted mode or therapist-led mode demonstrated better training effect than errorful learning based training programme (Lee, Yip, Yu & Man, 2013).

However, some problems might also arise in employing computer based memory training programme for elderly patients with early dementia. Elderly patients in Hong Kong, in general, seldom use computers in their daily life. With impariment of memory and executive function, dementia patients might have problems to operate the personal computer on their own and might be phobic to use computer. Thus, an enhanced environment of using adpated touch screen computer would be recommended for computer-assisted rehabilitation of the early dementia patients. As this provides a facilitative and supportive learning environment, structured guidance might be given by therapists, carers or volunteers in implementing this type of memory training programme.

Demonstration on the use of the training software is essential to facilitate and support dementia patients in the training process.

Carers might have a lot of stress in caring for dementia patients. The collaboration and support of carers in computer based training programme for dementia patients might also be explored.

In 2011, the Hong Kong Alzheimer's Disease Association developed gradable computer based cognitive training software named "Six Arts" using I-pad touch screen programme. Older adults with dementia found it motivating to attend cognitive training programme with their respective level of functioning.

Due to the popularity of personal computers with touch screen input, I-pad and Tablet PC among people in Hong Kong, our patients with early dementia might have more opportunities to use the errorless learning computer-assisted memory training programme, incorporated with different memory strategies, at home or in elderly settings to enhance their optimal functioning in the community.

CHAPTER 3

CONCEPTUAL FRAMEWORK

3.1 Memory rehabilitation for dementia

Cognitive rehabilitation might assist a person to improve cognitive function at any time after injury (Sohlberg & Mateer, 1989). Planning effective memory rehabilitation programme are very important for persons with dementia. Based on neuroplasticity theories, understanding of the memory model, a conceptual model was developed based on errorless learning-based and enriched environment memory training for early AD patients.

3.1.1 Brain plasticity and memory rehabilitation of dementia

Brain plasticity refers to the capacity of the brain to learn by taking advantage of the new experience and brain plasticity can be improved at any age. The brain is able to reorganize itself to form new neural connections throughout our lives. Brain plasticity allows neurons of the brain to compensate for the disease and injury and adapt to the changes of environment. Brain reorganization takes place where undamaged axons can sprout out nerve endings and connect with other undamaged

neurons to form new neural pathway and network (Berlucchi., 2011; Fernandez-Ballesteros, Zamarron, Tarraga, Moya & Lniguez, 2003; Stuss, Winocur & Robertson, 1999). Compensation is a process of overcoming losses or deficits through which deficits or loss is moderated. (Stuss et al., 1999). People might be helped to bypass problems for their difficulties and help them to learn more effectively through memory rehabilitation. In adopting the compensatory approach, the primary emphasis is on bypassing cognitive impairment to improve the broader aspect of function and therefore might adopt errorless learning strategies (de Werd et al., 2013; Velligan et al., 2006; Wilson, 1999).

With reference to cognitive reserve hypothesis, mental training, cognitive stimulation intervention and structured cognitive training programme were found to improve the cognition and ADL function of dementia patients in different RCT and clinical studies (Jokel & Anderson, 2012; Liberati, Raffone, & Olivetti Belardinelli, 2012; Spector, Thorgrimsen, Woods, Royan, Butterworth & Orrell, 2003). A local RCT study in Hong Kong also showed that individualized functional training programme based on level of cognitive performance of mild and moderate individual dementia patients would improve the post treatment ADL functioning

(Lam et al., 2010).

In fact, older adults of all age would benefit from cognitive training. In the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) study (n=1,401) in USA (Gross & Rebok, 2011), older adults can be trained using cognitive strategies, with pre-and-post training showed durable improvement on objective memory performance and everyday life functioning. In a Seattle longitudinal study for 355 older participants, the cognitive training group on reasoning showed significantly greater gains in accuracy and number of attempted items than the comparison group (Boron et al., 2007). In a Mild Cognitive Impairment (MCI) group study, MCI older adults were found to have decreased strategy knowledge in the use of internal aids while the healthy older adults group was found to have equivalent use of external and internal memory strategies (Hutchens et al., 2011). Studies also showed that dementia patients might benefit from different types of memory rehabilitation programmes and strategies (Wilson, 2008). These will be further discussed. Use of external aids and alternative memory training strategies such as Errorless Learning (EL), Spaced Retrieval (SR), with active encoding (Joket & Anderson, 2012) and Vanishing Cues (VC) are beneficial for demented patients.

For spaced retrieval, literature review (including 34 studies, with 3 RCT) showed this technique was an effective strategies in direct memory training of dementia persons in face-and object-name associations and cue-behaviour associations, in learning new information and behavioral strategies (Creighton, van der Ploeg, & O'Connor (2013), it is recommended that spaced retrieval works better with errorless learning for demented patients. Vanishing cues memory training was also used effectively for Alzheimer's Disease patients. Prof. Linda Clare had conducted dementia studies by applying EL and vanishing cues to teach everyday skill and information. 100% subjects showed improvement with 9 months follow up. For the 3 years follow up after training, some still showed cognitive improvement. Errorless learning memory stragtegies work better with spaced retrieval and vanishing cues (Clare, Wislon, Carter, Breen & Hodges, 1999; Clare et al., 2000; Clare, Wilson, Carter & Hodges & Adam, 2001; Clare, Wilson, Carter, Roth & Hodges, 2002).

Cognitive training studies on healthy older adults, and MCI and dementia patients found that those with better cognitive function at baseline achieved better post-treatment training effects (Fernandez-Ballesteros, Zamarron, Tarraga, Moya & Lniguez, 2003; Lam et al., 2007; Mimura & Kotmatsu, 2007). Epidemiological

and clinical trials suggest that cognitive exercise might be an effective strategy to delay the onset of cognitive impairment in older adults (Valenzuela & Sachdev, 2009).

3.1.2 Memory model and process

Memory is the capacity to store experiences and perceptions for recall and recognition. The memory process includes the acquisition, storage and retrieval (Goldstein, 2008).

Sensory stimuli come in and go through sensory memory, short term memory (STM) and long term memory (LTM) stages (Figure 1). A person has a control process of rehearsal. STM holds 5-7 items for about 15-30 seconds and through elaborative rehearsal processing, information will store in LTM for deeper learning. Information is registered in STM as auditory and visual encoding.

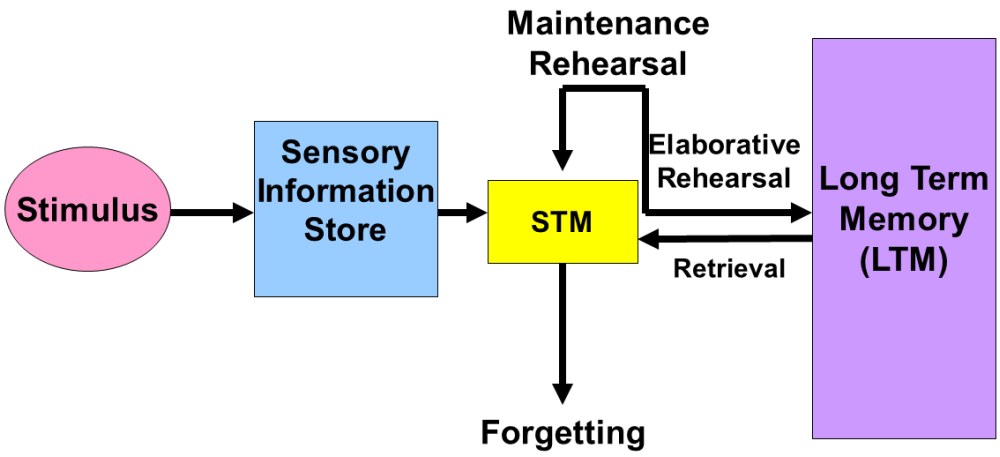


Figure 1. Process of Memory

The Working Memory Model (Baddeley & Hitch, 1974) proposed that the Working Memory consists of Phonological loop (auditory and verbal information), Visuospatial sketch pad (visual and spatial information) and the Central Executive interlinking together (Figure 2). The Central Executive is important to coordinate the visual and verbal information and operates attention (control suppression if irrelevant information) and memory strategies.

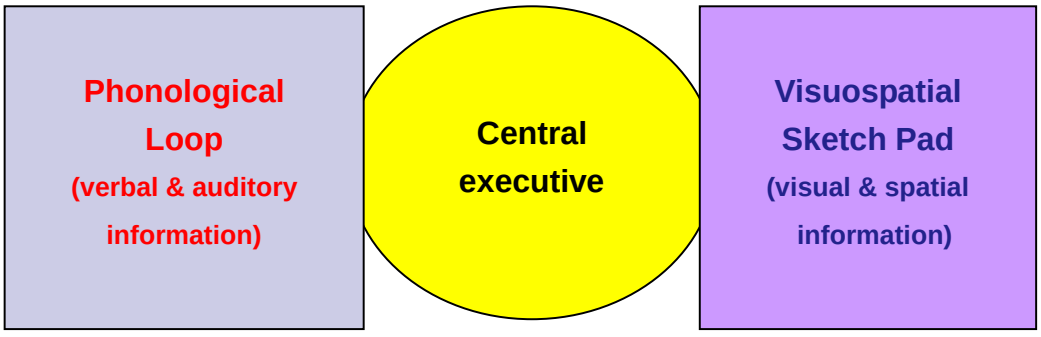


Figure 2. Baddeley's Working Memory Model (Baddeley & Hitch, 1974)

With more experimental data, a revised Working Memory Model with the addition

of the episodic buffer (Figure 3) emerged (Baddeley, 2000). Episodic buffer is a "backup store" that communicates with LTM & working memory. Episodic buffer chunks items into larger units to effectively increase working memory (WM) storage.

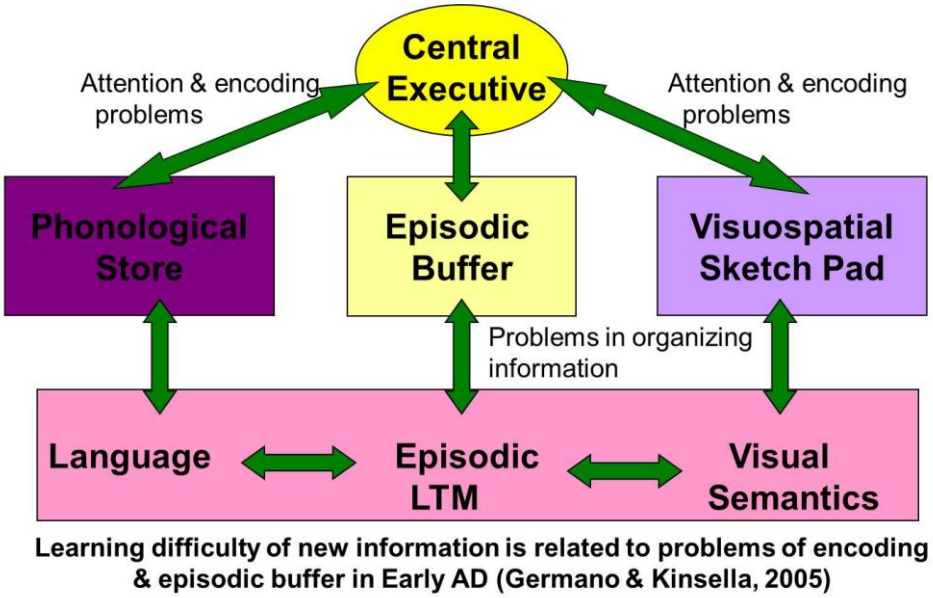


Figure 3. Revised Working Memory (WM) Model (Baddeley, 2000)

Early AD persons have great difficulty in learning new information as it is related to the problems of encoding and the episodic buffer. They also have attention and marked PM problems (Huppert, Johnson & Nickson, 2000).

3.2 Computer-human interaction

There are advantages using computer-assisted rehabilitation programmes: the

highly controlled stimuli in a standardized format; attractive, bright and colourful multi-sensory stimuli to engage and focus the attention of participants; a variety of task, structured at client's level and finally computer programme to provide immediate positive feedback to patients. Computer-assisted programme can be designed to give enough response time to participants and also record the progress of participants and summary of performance in training. Computer-assisted cognitive intervention programmes were shown to be effective in application to dementia in local and international studies (Bell, Zito, Greig, Wexler, 2008; Galante, Venturini & Fiaccadori, 2007; Lai et al., 2011; Lee et al., 2013; Lynch, 2002; Man, Chung & Lee, 2012; Tam et al., 2003; Zhuang et al., 2013).

3.3 Motivation & Errorless Learning (EL)

In a study to examine how emotional content affects the amount of visual details remembers, results showed that older adults demonstrated a unique recognition advantage for positive information (Kensinger, Garoff-Eaton & Schacter, 2007).

Demented patients are motivated to participate in activities structured in a failure-free environment. Active engagement of participants in an error-free learning context is very important and AD patients prefer learning using the EL

programme technique than errorful programme because it was less frustrating and more rewarding in the learning process (Fillingham, Sage & Ralph, 2006; Kessels & Hensken, 2009; Laffan et al., 2010).

A local study on computer-assisted errorless programme showed that EL training improved motivation to learn in the elderly persons and improvement was shown in attention, memory and problem-solving skills in pre-and-post intervention assessment (Man, 2008).

3.4 Errorless (EL) and Errorful (ER) learning

An errorless learning teaching technique is used when people are prevented from making mistakes while learning new skills or acquiring new information. In errorless and errorful learning studies, EL was shown to be effective in learning lists, verbal association, face-name association, learning to use computer, memory aids or acquire knowledge but had no benefits on learning diagrammatic route (Tailby & Haslam, 2003). EL techniques proved to be the most beneficial for patients attempting to retrieve low-level knowledge in specific details (Haslam et al., 2006). Studies showed that EL facilitates acquisition and consolidation of newly learnt items.

A review of clinical application studies showed that errorless learning was superior to trial-and-error learning in teaching everyday tasks for different diagnostic groups, that it is important to ensure active participation of subjects, and that some might integrate computer progamme in the rehabilitation programme (Clare, 2002; Clare, Wilson, Carter, Roth, & Rodhes, 2002, Clare, 2003; Clare & Jone, 2008; de Werd et al., 2013; Jokel & Anderson, 2012; Lee et al., 2013; Noonan, Pryer, Jones, Burns & Ralph, 2012).

3.5 Errorless Learning (EL) & Enriched Environment (EE) Model

Errorless learning is a teaching technique where people are prevented from making mistakes while learning new skills or acquire new information. Studies showed that EL is more effective than other types of memory training. It was important to ensure active participation of clients and some integrated EL into computer programme (Wilson, 2008).

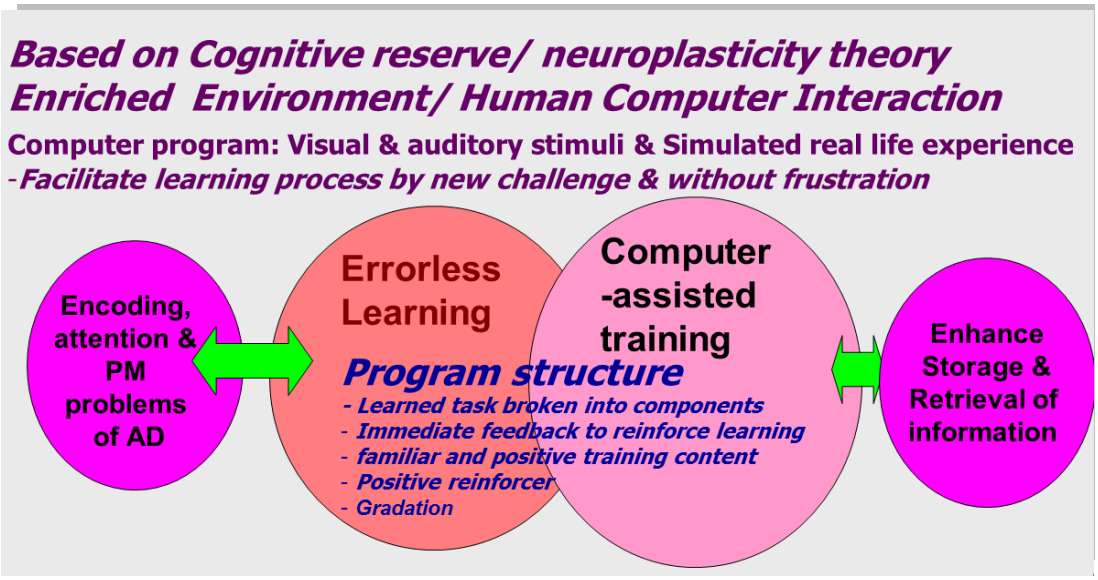


Figure 4. Computer-assisted errorless learning-based memory training for early AD (Man & Lee, 2013)

Computer-assisted, errorless memory training is based on the rationale that AD patients can bypass errors and strengthen accurate association during the learning process because patients have difficulty to self-correct the errors. An "Enriched" environment can be generated by multimedia computer-assisted errorless learning based programme and this would augment the learning process.

The errorless-learning memory programme works with the following four principles (Kern et al., 2005):

i. learned task is broken into components,

ii. over-learning of components through repetition and practice.

iii. training is from simple to complex, and

iv. there is a hierarchical training of gradation.

The following are some special features of the errorless learning-based memory programme. In the programme, early success is enhanced and positive feedback, repetition and revision are incorporated into the programme structure to reinforce learning. There is a non-threatening atmosphere, with hints to let clients adjust to the level of difficulties in the programme gradually. Repetition is used to reinforce learning. Vanishing cues and spaced retrieval strategies are incorporated into the training and more familiar daily life scenario are used in the training programme. Demonstration, guiding instructions and cues are given to patients to prompt them towards making a correct answer.

Actually, the AD patients are interacting with the environment on a daily basis. We need to provide a facilitating environment in which AD patients can learn. So, in this computer-assisted errorless learning-based memory programme, computer was used to provide an encouraging enriched environment with multi-sensory stimulation. For the personal factor, we tried to optimize the episodic memory

function of AD and support them in the learning of new information in the process. As AD patients find it very difficult to encode and learn new information, they often show apathy and lack motivation to learn. A high prevalence of PM problems is also observed in early stage AD clients (Huppert, Johnson & Nickson, 2000). It is important to have training on PM domains in an effective cognitive training programme.

A conceptual model of EL memory training for people with early AD based on cognitive reserve and neuroplasticity theory is employed (). A facilitative tailor-made computer-assisted EL memory programme is developed for training of AD patients, integrating remedial approaches on direct training of memory, with elements of EL, spaced retrieval and vanishing cues techniques, mnemonic memory strategies such as rehearsal, visual imagery, organization, association in supporting their encoding and retrieval of information. Moreover, from the compensatory approach, using computer-assisted technology and external memory strategies, the computer cognitive training programme creates an enriched supportive training environment (EE) reducing demands from environment, and builds in verbal, auditory and visual cues and memory aids to facilitate the training process.

Although AD persons had problems in PM, attention, working memory and executive function, newly learnt information on daily life training scenario is gradually built up from short term working memory to deep process of learning to long term memory. It might become easier for AD patients to retrieve the learnt information in the training programme.

Positive reinforcement of the programme with early success will be encouraging and enhance the achievement and fulfilling feeling of AD patients so that they will go through the structured training programme. The training content was designed to be more practical and familiar to participants, relating to their daily life scenario. For instances, in the Chinese culture, older adults enjoyed Chinese tea and Dim Sum. Some real life training photographs of Dim Sum were put into some attention training task in the computer programme.

3.6 Integration of conceptual framework to EL training

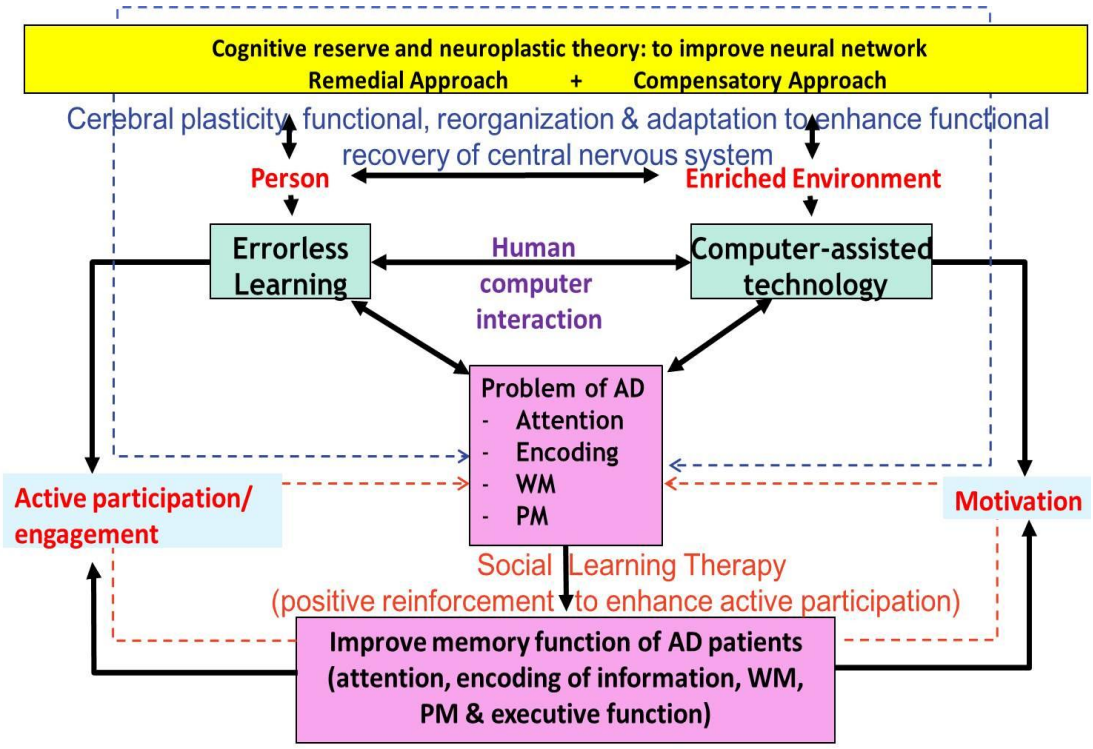


Figure 5. Conceptual Model of EL training for patients with early AD

Based on neuroplasticity theory that neural network in brain can be enriched through cognitive learning experience and by neuro-rehabilitative approaches using remedial and compensatory techniques and social learning theory based on behavioral approached with modeling and positive reinforcement, an errorless memory training programme was developed with a programme structure, integrating computer technology, rich in audio-visual stimualtion. The rationale in

developing the training programme is to bypass errors and strengthen accurate association in the learning process as patient has difficulty in self-correcting errors. The principles of the training programme are:

i. learned task broken into components;

ii. over-learning of components through repetition and practice;

iii. training from simple to complex and through a hierarchical training of gradation (de Werd et al., 2013; Kern et al., 2005).

The following features are incorporated into the EL memory programmes:

i. early success and positive feedback to reinforce learning;

ii. non-threatening approach, incorporating hints, vanishing cues and spaced retrieval strategies

iii. with training of 15 session and being implemented in a computer-assisted or therapist-led training.

iv. revision of learnt material was rehearsed at intervals

Early AD patients may require more support for encoding; thus errorless learning would help AD patients to learn new information. To facilitate new learning by

dementia subjects, a computer with a touch-screen easy-input device was structured into the training environment and demonstration questions were used in the training programme to enhance the new learning of the participants. Appropriate cognitive challenges were built into the programme.

In summary, this errorless learning based memory training programme was developed to fit the unique training needs of early AD patients.

3.7 Systematic review of CELP training for dementia

A systematic review was completed of evidenced based intervention studies with key word search for “errorless learning”, “dementia”, “errorless learning for dementia”, “computer/computerized training (include virtual reality) for dementia”, “computer errorless training for dementia”. Other literature search of data bases of MEDLINE(2000+), CINAHL(1982+), Cochrane Library(current), Clinical Evidence(current), Neurosceince abstract, Psycbite, Proquest, were also done, aiming to evaluate the effectiveness of computer-assisted errorless learning programme for dementia. RCT, clinical case control trial and then pre-and-post test clinical trial, within-subjects designs, single-subject design and sample size of

two or more intervention studies on computer-assisted and EL training for dementia persons were selected and included in this review. Articles on systematic review and overall one-subject sample size study were excluded in the analysis. A total of 18 articles were reviewed and summarized in EL intervention studies for dementia in Table 1 (12 articles) and Computer/ computer-assisted EL training for dementia in Table 2 (6 articles).

A summary of the recent meta-analysis on computer-assisted and EL training for persons with early dementia from 2000 to 2013 indicates that EL is an effective training strategy for persons with early dementia, and can be used together with SR and VC. Results of structured computer-assisted EL training also showed that post-intervention results demonstrated that computer training may improve the cognition and encoding function of early dementia training through EL and enriched audio-visual stimuli built into the computer programme.

Table 1. EL intervention studies for dementia

Studies	N	Subjects	Method	Training (EL, C, EL + C)	Training details	Outcome/ Significance/ Effect Size	Summary
1. Bier et al., 2008 (name -face associat- ion	30	15 early AD & 15 matched control	Within subject design, pre-and-post test	- All participants were exposed to 5 learning methods: SR, VC, EL, ER (with explicit/implicit memory task instruction) to learn five face-name associations, followed by free recall, cued recall and recognition.	10 session: 45-minute session, twice per week, for 5 weeks,	- Methods of SR, VC, EL, ER (with explicit/implicit memory task instruction) are effective for learning name-face associations for AD subjects and no sig. difference between them. Number of errors made during learning varies in different methods. -AD subjects showed similar outcome as control using SR in learning. AD patients with better episodic memory learn better	+ +
2. Clare et al., 2000 (on everyday memory)	6	early AD	Multiple single-case design	- Compare EL training, with VC, memory aids & expand rehearsal	- Individual tailored intervention, targeted at specific everyday memory problem	- Positive results in memory outcomes - Pre-and-post test, 3M & 6M FU. - 5 subjects showed significant improvement in target measures after EL training	+ - EL sig. gains in memory - Maintain improve- ment up to 6M

Studies	N	Subjects	Method	Training (EL, C, EL + C)	Training details	Outcome/ Significance/ Effect Size	Summary
3. Dechamps et al., 2011 (effects of different learning methods in IADL)	14	AD	Controlled trial, within subjects	- Perform 3 learning conditions: EL, trial-and-error & learning by modeling to learn 3 IADL task	6 sessions within 1 week: 30-minute/ session	-Evaluation during learning and at 1-week & 3-week FU - EL & learning by modeling showed better learning effect than trail-and-error - Learning IADL is possible for AD subjects	++
4. Dune & Clare, 2007 (Review training effect)	10	AD, VD/mixed dementia (early stage)	Within subjects, pre-and-post test	- Compare 4 training methods: VC, paired associates, target selection & forward cueing - Compare training effect by EL & ER learning	- six 1-hour training to learn one famous & one novel face-name pair	- Improved free recall, cued recall & visual recognition - Dementia subjects show evidence of learning - No sig. difference between 4 methods: VC, paired associates, target selection & forward cueing - EL & ER: no sig. difference	+

Studies	N	Subjects	Method	Training (EL, C, EL + C)	Training details	Outcome/ Significance/ Effect Size	Summary
5. Haslam, Hodder & Yates, 2011 (Evaluate training effect of EL & SR	105	60 healthy control, 30 ABI & 15 dementia	Case control	- Learn a set of 12 names by face-name associations -a 2 (intervention: treatment, i.e. EL,SR or EL+SR; baseline, i.e.trial-and-error, EL, SR, EL+SR) x 2 (task: standard, dual) x3 learning conditions: EL, SR, EL+SR)	- 2 sessions with an average of 3.2 days apart - complete 2 conditions in each session	- Effective for EL, SR, EL+SR training & showed sig. greater accuracy in name recall than trial-and-error learning. Name recall under SR was sig. better than EL. - A sig. main effect of task, $p<0.001$, effect size $r=.71$; a sig. main effect of intervention, $p<0.001$, effect size $r=.66$, with greater accuracy of name recall in treatment	++
6. Haslam et al., 2006 Study 1	11	3 probable AD & 8 matched control;	Case control	- Learning novel name-face-occupation associations	2 individual sessions, with 2 weeks in between	- Name recall efficacy, memory test, facial recognition test: better outcome for EL training (for retrieval of low-level knowledge) - EL paradigm was established but effectiveness of EL at different knowledge level is not conclusive - EL is better for learning in more specific details	+ - EL better
Study 2	2	2 probable AD;	Within subject	- Ditto (but increase chance to make errors)			
Study 3	7	2 probable D & 5 VD	Within subjects	- Learning novel name-face-occupation associations			

Studies	N	Subjects	Method	Training (EL, C, EL + C)	Training details	Outcome/ Significance/ Effect Size	Summary
7. Haslam, Moss & Hodder, 2010 (evaluate training effect of EL & VC)	82	60 healthy control & 22 AD	Case control	-Healthy control: learning under standard & dual task condition - AD: learning face- or -name associations	Using EL & EL+VC in training.	- Pre-and-post test - EL & EL+VC produced best result in AD & no difference between 2 conditions in healthy control - EL, VC, EL+VC were sig. better than trail-and-error for AD. EL + VC is better than VC	++ - EL+VC is better than VC alone
8. Hwang et al., 2012 (examine interact-ion effect)	17	10 MCI & 7 AD (at stage 4 of GDS)	RCT	- Intervention: training on memory, executive function & abstract thinking) and homework - Wait-list control.	18 sessions, weekly, 50-minute session	- Evaluation at baseline, 2-week & 3M FU - Sig. improvement in delayed recall at 2 week (p=0.04) and 3M FU (p=0.04); fluency score & Korean MMSE (p=0.07), a tendency towards improvement	+++ - Maintain positive gains in 3M FU

Studies	N	Subjects	Method	Training (EL, C, EL + C)	Training details	Outcome/ Significance/ Effect Size	Summary
9. Jokel & Anderson, 2012 (exam interact-ion effect & active encoding)	7	Semantic dementia	Within subjects	-Name of objects - 8 set of pictures - 4 treatment approaches: active vs passive; EL vs EF	96 sessions in 8-12 week (individual 2.5 hours/day, 2-3 sessions/week)	- Evaluation of naming accuracy immediately after a training session. - Reassessment at 1M & 3 M post training - EL was more successful than ER training - Maintenance of treatment gain for 1M but not 3M	+ Maintence effect for 1M
10. Kessels & Hensken, 2009 (effect of EL on mild to severe dementia)	60	20 at severe stage; 20 at mild-to-moderate stage; 20 control, without dementia	RCT	-Learn a novel procedural problem-solving task by EL (with help of cues) or trial-and-error (without cues)	Procedural task was repeated after 1-3 days	- number of steps completed without assistance immediately after EL or trial-and-error learning and after a delay of 1-3 days was recorded. - Overall performance was better in EL Learning than trial-and-error learning (p = 0.012), with effect sizes being largest in the mild-to-moderate dementia group after delayed testing (d = 1.61).	+++

Studies	N	Subjects	Method	Training (EL, C, EL + C)	Training details	Outcome/ Significance/ Effect Size	Summary
11. Ruis & Kessel, 2005 (compare EL & ER in face-name associat-ion)	10	Moderate to severe dementia (MMSE< or = 22)	Within-subject (comparative study)	- Face-name associative memory task, using EL & ER approaches	- 2 learning trials, with immediate test and10-minute delay test	- Immediate and 10-minute recall tests. - Sig. beneficial effect after 2 consecutive learning trials (p=0.01). - No sig. difference in EL & ER in 10-minute delay recall in memory performance - errorful learning resulted in short-lived better performance in dementia - Clinical applicability for EL for moderate to severe dementia is limited	+
12. Voigt-Radloff, Leonhart, Rikkert, Kessels & Hull, 2011 (compare EL & ER)	175	AD or mixed dementia (MMSE 14-24), with moderate assistance in ADL	RCT (seven-centre single-blind, active-controlled design)(1:1 randomization)	Training by either EL or ER approaches to dementia patients by trained interventionists, practicing two daily living task	15 one-hour sessions at home	-Task Performance Scale was done at six weeks post treatment - Training result will improve the user-friendly practice guideline in instructing persons with memory impairment with an efficient structured relearning techniques	+++

Table 2. Computer/ computer-assisted EL training for dementia

Studies	N	Subjects	Method	Training (EL, C, EL + C)	Training details	Outcome/ Significance/ Effect Size	Summary
1. Galante, Venturini & Fiacccadori, 2007 (computer training)	11	AD & MCI (MMSE score 19-26)	RCT	Computer exercise for intervention group; Same time and frequency programme for control group	12 individual 60-minute sessions	- Outcome evaluation on memory, attention and verbal fluency - Control group: a sig. cognitive decline as shown in MMSE at 9-month FU, compared with baseline (p=0.04) and 3M FU tests (p=0.008)	+++ -computer training delay the progress of cognitive decline
2. Lee, Yip, Yu & Man, 2013 (computer EL training)	19	Early AD (CDR=1)	Single-blind RCT	-Intervention group: computer-based EL programme (CELP); therapist-led EL learning programme (TELP: with same training content & duration as CELP) ; and control group	12 individual 30-minute sessions, held in less than 8 weeks	- Positive treatment outcome in CELP & TELP. CELP: sig. improvement on DRS (p=0.03), MMSE (p=0.04) & BAPM (p=0.03; borderline sig. in HKLLT(p=0.06); TELP: sig. improvement in MBI (p=0.04), GDS(P=0.03); with time effect in DRS (p=0.03). Sig. difference in CELP, TELP & CG in GDS (p=0.009), with better improvement in TELP. Decline in 3M FU.	+++ - positive gain but decline in 3M FU

Studies	N	Subjects	Method	Training (EL, C, EL + C)	Training details	Outcome/ Significance/ Effect Size	Summary
3. Lim, Wallace, Luszcz & Reynolds, 2013)	21	AD at early stage (Stage 2-5 at Reisberg's 7-stage dementia scale) & their carers	Clinical trial pre-and-post test	-use of tablet computer (I-pad) for cognitive training, with 7 application of software (creative art/music, simple interactive games & relaxation programme)	7 day in home trial, with training support from carers at the start to use the tablet computer	-Evaluation using interview on subjects' usage of tablet computer as part of everyday living. Result showed that approximately half of participants with dementia were able to use tablet computer independently	+
4. Man, Chung & Lee, 2012 (virtual reality training)	44	Questionable dementia CDR=0.5	Randomized trial (pre-and-post test)	Intervention: computer-assisted Virtual Reality training programme on daily living task at home/convenience shop; therapist-led training programme (of same training content and schedule)	10 individual 30-minute session, 2-3 sessions/week	-Evaluation in pre-and-post test evaluation -Sig. improvement in VR & therapist-led group - VR intervention group showed sig. improvement in encoding function (in immediate and delay recall) as shown in object memory performance in Fuld Object Memory Evaluation (p=0.001) while Therapist-led memory group showed better subjective contentment of memory performance.	++ - VR group showed better encoding function, with enriched AV stimuli

Studies	N	Subjects	Method	Training (EL, C, EL + C)	Training details	Outcome/ Significance/ Effect Size	Summary
5. Mate-Kole et.al, 2007 (use computer assisted and interactive cognitive training program)	6	Moderate to severe dementia	Within-subject pre-and-post test	A combination of cognitive training: Mind Aerobics (interactive group training seminar by 1 professional educator & 2 assistants, with training on memory, attention, cognitive flexibility) and Adaptive Computerized Cognitive Training (focus on memory, attention, problem-solving)	6-week, intensive programme (including 3 one-hour session/week for cognitive training and computerized training of 30-min individual training, 4 sessions/ week	-Sig. improvement in outcomes on cognitive function (short-term memory and cognitive failure). -carer report also showed sig. improvement on participants behavior gains and socialization - participants did not show sig. decline from pre-test to post-test levels - 4-week FU evaluation showed decline in cognitive and behavioral outcomes	++ - no training for 4-week, subjects showed decline in outcomes
6. Zhuang et al., 2013 (computer training effect)	33	19 MCI/ dementia; 14 control (age 70 or above)	RCT	Random to Intervention group: human-computer interaction-based comprehensive cognitive training; or Control group	24 weeks	-Nil sig. difference in intervention / control. - Dementia: improved attention/ orientation, memory, language & fluency; MCI: improve language & visuospatial capacity - Visuospatial ability of intervention is sig. greater in intervention group with global cortical atrophy score of 15 (p=0.05).	++ -computer training may improve cognition

CHAPTER 4

RESEARCH METHODLOGY

This chapter describes the aims, research questions and hypotheses of the present study. The latter sections give more details on the research design, sampling method, procedures, instrumentation, and data processing and analysis.

4.1 Aims of research

1 To develop and implement a computer-assisted memory training programme, based on errorless learning strategies for patients with early Alzheimer's Disease;

2 To evaluate training outcomes in a computer-assisted errorless learning-based memory training programme (CELP) group, a therapist-led errorless learning memory training programme (TELP) group and a control group (CG), using conventional group, with treatment as usual.

4.2 Research questions

1 Would the use of errorless-learning mode of memory rehabilitation programme improve the memory function of Chinese subjects with early Alzheimer's Disease?

2 Would there be any significant differences in the effectiveness of treatment outcomes between CELP and TELP groups?

3 Would there be any significant differences in the effectiveness of treatment outcomes between treatment groups and the control group?

4.3 Hypotheses of the study

A null hypothesis was that the treatment effect of treatment groups of CELP, TELP and CG were the same. An alternate hypothesis was that the treatment effect of treatment groups of CELP, TELP and CG were different.

The sub-hypotheses were:

1 After the completion of the 15-session errorless memory training programme, it was hypothesized that the CELP or TELP group would have better treatment outcome in memory performance as measured by the Chinese version of Mini Mental State Examination, Chinese Mattis Dementia Rating Scale, Hong Kong List Learning Test and Chinese version of Brief Assessment of Prospective Memory, than the control group (CG).

2 After completion of a 15-session errorless memory training programme, it was hypothesized that the CELP training group would have better treatment outcome in memory performance than TELP training group or CG.

4.4 Research Design

A single-blinded randomized control trial (RCT) research design was adopted. Subjects were randomly allocated to two independent treatment groups and a control group (CG). Raters were independent assessors, being blinded in the study (grouping of subjects). Therapists were only involved in the treatment groups. Pre-and-post test and 3-month follow-up test on treatment outcome were measured

by independent assessors who did not know which subject group they came from. Subjects were randomly allocated into one of the two treatment groups and CG. In CG, subjects attending traditional general unstructured programmes including reality orientation, reminiscence, self-care, physical exercise, leisure interests in group format. 90 subjects were planned to be recruited into the study. Statistical analysis was done to ensure homogeneity; that there was no significant difference in treatment and control groups in terms of demographic and memory functioning profiles.

4.4.1 Sampling, sample size and subject recruitment

The study was divided into two phases. Phase one was the pilot study and Phase two was the main study. As ANOVA was suggested in testing the possible difference between outcome measures of the three groups (CELP, TELP and CG), the sample size was estimated according to related literature (Cohen, 1988) using the software "Power Analysis and Sample Size for Windows, version.11 or PASS" (Hintze, 2011) accordingly. For ANOVA, using three groups, with an input of alpha=0.05, beta 0.2 (or power = 0.8) and an estimated effect size of 0.28 (from DRS in pilot study), n=30. A group size of 30 was initially put forward as a minimum size (a total of 90), anticipating medium effect size. In the end, only 75 subjects were able to complete the assessment and treatment procedures in the main study. The AD subjects were identified in multi-centers including psychogeriatric in-, day- and out-patients of Kwai Chung Hospital (a district psychiatric hospital), dementia day care centers, and elderly day care centers or Elderly homes of other

non-government organizations. The reasons for drop-outs in each group were mainly due to incompletion of the assessment resulted from deterioration of medical conditions of subjects. Thus, 30, 22 and 23 subjects were finally analysed in CELP, TEP and CG respectively.

Expert panel review was done to evaluate initially the computer-assisted errorless memory training programme for early Alzheimer's and improve the programme structure and audio-visual effect.

4.4.2 Inclusion Criteria

Patients who were:

- ✓ Aged 60 year old or above
- ✓ Both genders
- ✓ With diagnosis of Alzheimer's Disease by ICD-10 Manual of Classification of Mental and Behavioural Disorders (World Health Organization, 1993) or DSM-IV-TR) (American Psychiatric Association, 2000)
- ✓ At early stage of dementia with Chinese Clinical Dementia Rating Scale with score of 1 (Fillenbaum et al., 1996; Hughes et al., 1982)
- ✓ Mentally stable
- ✓ Able to follow instruction
- ✓ With attention span of 30 to 45 minutes

4.4.3 Exclusion Criteria

Patients who were:

- ✓ With severe visual or hearing impairment
- ✓ Computer phobic
- ✓ Having impaired physical functions that inhibited the use of a touch-screen computer
- ✓ Having depression as screened by Cantonese version Geriatric Depression Scale - short form (Wong et al., 2002)
- ✓ Having other neurological condition such as epilepsy
- ✓ Having aggressive behavior

4.4.4 Ethical consideration

In recruiting subjects, ethical issues and the human right of patients were considered. Ethical approval was sought from Ethical Committee of the Hong Kong Polytechnic University (Appendix C-1) and the Clinical Research Ethics Committee of the Kowloon West Cluster of the Hong Kong Hospital Authority Appendix C-2). Written consent was obtained from subjects and the carers before assessment and training. Before signing consent forms, researcher would provide subjects and the carers adequate information on the research study. Subjects' participation in the research was on a voluntary basis. Researchers would also ensure the confidentiality of data and the safety of subjects.

4.4.5 Allocation of subjects

Subjects were randomly allocated to computer-assisted errorless learning programme, a therapist-led training programme and a control group at centre-based.

4.4.6 Implementation CELP and TELP

Two memory training programmes were developed based on neurocognitive theories in dementia. Theories suggested that the brain's neuro network can be enriched through cognitive training (Bell et al., 2008; Berlucchi, 2011; Velligan et al., 2006). Errorless learning technique was integrated into CELP and TELP (Clare et al., 1999, 2000, 2001, 2003; Clare & Jones, 2008; Dunn & Clare 2007; Haslam, 2006). The computer-assisted errorless learning programme (CELP) or therapist-led errorless learning programme (TELP), were thus designed and developed for the present study (Lee et al., 2013). The CELP and TELP were implemented individually in a quiet room or venue with minimum distraction.

4.5 Instrumentation

4.5.1 Training programme / software

The two memory training programmes were structured, based on cognitive reserve and neuroplasticity theories in dementia that the brain's neuroplasticity reserve can be enriched through cognitive experience provided through training (Bell et al., 2008; Berlucchi, 2011; Velligan, Kern & Gold, 2006). The programmes incorporated with the techniques of errorless learning, used together with spaced retrieval, vanishing cues and environmental enrichment with multi-sensory computer-based stimulation (Clare et al., 1999, 2000, 2001, 2002; Clare, Wilson, Carter, Breen, Gossess & Hodges, 2000; Clare, Wilson, Carter, Roth & Rodhes, 2002; Clare, 2003; Clare, Woods, Miniz, Orrell & Spector, 2003; Clare & Jones,

2008; Dunn and Clare, 2007; Haslam, 2006). A computer-assisted errorless learning programme and a therapist-led errorless learning programme were thus developed accordingly. The content and structure of both programmes were similar except in the mode of delivery.

The 15 training session programme was structured with training components like basic training on sensory memory (visual and auditory), working memory, prospective memory; memory strategies on use of mnemonic and learning principles and also on name-face association; advanced memory training on application of strategies to daily life training activities including home making, habit training, money management, shopping and community living skills. Immediate positive feedback was integrated into the training programme to encourage active participation of dementia subjects. To reinforce and consolidate the learning with application of mnemonic strategies of subjects, three revision sessions were structured in the fifth, tenth and fifteenth training session (Table 3). For illustration of the daily life training scenario, please see Figure 6.

Based on errorless learning strategies, demonstration, guiding instruction and cues to give prompt to answer of questions are set and choice of answers is graded with difficulties, being easier in the early part of training programme to facilitate subjects to score the right answer. For example, in the basic training of counting fruits, the guiding instruction is “When you see one fruit, you press the number 1. For prospective memory training, there is a mission “to bring me the keys in 4 minutes”,

subjects have to remember to bring the key while performing dual task. A reminder alarm at target time was set in the early part of the training and no cues in the later part like mission of "switching off the stove in 5 minutes (vanishing cues). For illustration, see Figure 6.

The intervention was implemented by occupational therapists or occupational therapy students with prior specialist training on errorless memory programmes. The training programme was conducted on an individual basis in a quiet room, run twice per week.

The computer-assisted EL training programme was run using a touch screen computer with a touch pen input device. Therapists would provide guidance to subjects undergoing training if the subject had difficulty in using the computer input device or had literacy problems. Similarly, the therapist-led errorless training programme was also run on an individual basis. A training manual with colour print images were used. Therapists implementing the training programme would have prior training to give the same set of instructions and provide immediate and positive feedback to subjects, just like the computer-based training programme.

The control group received equal duration of conventional general unstructured training programme of the setting as usual such as reality orientation, reminiscence, self-care, leisure, recreational and physical exercise groups.

A. Programme structure with revision sessions/ 5th, 10th & 15th session to consolidate learning

B. Trainng session from basic to advance. It starts with simple attention training

C. Memory training on categorization

D. Demonstration questions are set at the front part of each session to facilitate learning

E. Prospective memory & dual task training: PM target as "switch off the stove after 5 mins" while performing task in buying vegetable.

F. Face-name recognition training, incorporated with mnemonic memory strategies and spaced retrieval technique: select photo of same person as shown before.

G. Memory training on community living skill i.e. Taking a bus at Mei Foo District

H. Immediate positive reinforcement for right answer

Figure 6. Examples of Training sessions: with daily life training scenarios

Session / Content	Training Task using EL	Training Domain
1. Fruit Sensory memory	Attention & working memory training I (comparison I & counting of fruit); Dual task (counting of fruit & cat sound); Delayed recall of daily objects I	Attention, Working memory (WM), Encoding (with rehearsal), immediate & delayed recall
2. Fruit Sensory memory	Attention & working memory training I; Dual task (counting of fruit & cat sound) Delayed recall of daily objects II	Ditto. Add on SR
3. Daily life Working memory	Attention & WM training I; Dual task; Delayed recall sentence I (basic) and calculation task	Ditto. Add on SR & VC
4. Future event Memory (PM)	Attention &WM training I; PM training & simultaneous task; Delayed recall sentence II (advance) & calculation	Ditto. Add on EF, PM training with VC, delayed recall with SR
Revision (1)	Repetition of training session 1-4.	Consolidate learning
5. Future event	Same as session 4	Same as session 4
6 &7. Name-face association Memory	Attention & WM training II (e.g. counting of persons & Dim Sum); Mnemonics strategies practice on face-name association	Ditto. Add on SR, mnemonics strategies: association, organization
8. Home making & habit training	Attention & WM training II; Mnemonics strategies on suitable placing of objects at home	Ditto. Add on mnemonics strategies: organization, habit
Revision (2)	Repetition of training session 5-8.	Consolidate learning
9. Home making & habit training	Attention, categorization & working memory training III (money recognition & counting); Mnemonics strategies practice at home	Ditto. Add on executive function training on money exchange
10 & 11. Shopping & money management strategies	Attention, categorization & working memory training III; shopping strategies (delayed recall & money exchange)	Ditto. Memory strategies of making shopping list
12. Memory Strategies - Community-living skill	Attention, categorization & working memory training III (money recognition & counting); application of community-living skill in use of transport and money exchange	Add on problem solving training in use of transport & money exchange
Revision (3)	Repetition of training session 9-12.	Ditto

Table 3. Outline of EL memory training programme

4.5.2 Screening tools

4.5.2.1 Chinese Clinical Dementia Rating Scale (CDR) (Hughes et al., 1982)

Clinical Dementia Rating Scale (CDR) is used as a screening tool to screen suitable subjects into the present study. CDR is a widely adopted assessment scale to indicate the staging of dementia severity (Hughes et al., 1982). It is conducted in

the form of a semi-structured interview with patient and the carer (Nourhashemi et al., 2008). A CDR score of 1 indicates that a person was in the stage of mild dementia. The Chinese version of CDR was used in this study.

4.5.2.2 Geriatric Depression Scale - Short Form (GDS-SF) (Yesavage et al., 1983)

A validated Cantonese version of GDS-SF was adopted (Wong et al., 2002). The assessment consists of 15 questions. A lower score indicates a better mood of the subject. A score of 8 or above (out of 15) indicates the possibility of depression.

4.5.3 Outcome measures

The outcome measures cover aspects on cognitive function, daily memory competence, ability to encode and retrieve information, prospective memory, and activities of daily life (ADL) functioning. The following specific outcome measures were selected and used in pre-test, post-test and three-month follow up: Chinese version of Mattis Dementia Rating Scale as the primary outcome measures; while cognitive assessment with Mini Mental State Examination, Hong Kong List Learning Test, Brief Chinese Assessment of Prospective Memory – Short Form, functional assessment with Modified Barthel Index and Hong Kong Lawton IADL test; and mood assessment with Geriatric Depression Scale-Short Form as secondary measures.

4.5.3.1 Mini Mental State Examination- Chinese version (Chiu, 1998)

The MMSE was widely used in Hong Kong and internationally as a cognitive

screening tool for persons with dementia and also in the elderly field. MMSE was developed by Folstein's group (Folstein, Folstein & McHugh (1975). A validated Chinese version of MMSE (CMMSE) (Chiu, 1994) is adopted, which assessed the orientation, memory, visual-spatial copying and language aspects. The scores range from 0 to 30, where higher score indicates better cognitive function. With reference to the education of older adults, different cut-off scores are used for dementia: a score of 22 or below for those with education more than 2 years, a score of 20 or below for those with 1 to 2 years of education, and a score of 18 or below for those with no education. The reported sensitivity was 97.5% and the specificity was 97.3%. The test-retest reliability is 0.78 and the inter-rater reliability was 0.99.

4.5.3.2 Mattis Dementia Rating Scale- Chinese version (Chan, Choi, Chiu & Lam, 2003)

The Chinese version of Mattis Dementia Rating Scale (CDRS) consists of five subscales: attention, initiation/ perseveration, construction, conceptualization and memory. The total score is 144, with a cut-off score of 112 and below to differentiate persons with dementia. The cut off score versus full score for the sub-scales are Attention (29/37); Initiation/ perseveration (26/37); Construction (3/6); Conceptualization (28/39) and memory (18/25). More detailed outcome measures can be evaluated in pre-and-post test upon intervention given. The sensitivity and specificity of the score is 80.0% and 91.6% respectively. The Cronbach's α for the reliability is 0.89.

4.5.3.3 Hong Kong List Learning Test (HKLLT) (Chan & Kwok, 1999)

This is a Chinese verbal learning test developed in Hong Kong that consists of two 16-word lists in which all words are two-character nouns. The words in the first list come from four categories and are organized randomly (random condition); however, the second list consists of words from another four categories that are semantically clustered (blocked condition). The levels of difficulty, frequency and of words in the two lists are matched. Typical words are used in both lists. The test consists of three immediate recall trials, two delayed recall trials (10 and 30 minutes) and one recognition task. In this study, the HKLLT- Form A, with random condition was adopted.

4.5.3.4 Brief Chinese Assessment of Prospective Memory - Short Form (BAPM) (Chau, Lee, Fleming, Roche, Shum, 2007; Man, Fleming, Hohaus & Shum, 2011)

A Chinese Assessment of Prospective Memory – the short form was used, with 16 questions covering aspects on basic self-care and Instrumental ADL. Each question was scored 1 to 5, and a lower score indicates better functioning for elderly subjects.

4.5.3.5 Modified Barthel Index, Chinese version (MBI-CV) (Leung, 2003)

The total score of MBI-CV is 100 points. A validated Chinese version of the MBI form (Leung, 2003) is used. The basic self-care assessment items cover aspects such as grooming, feeding, dressing, functional mobility, toileting, bathing, and

continence. There are five level of grading in the functional score in each self-care assessment item. The higher MBI-CV score indicates better functional capability of a person. This MBI-CV functional assessment scale is widely used in Hong Kong and internationally in the geriatric population and it was also used in the pilot study as a functional outcome measure.

4.5.3.6 Hong Kong Lawton Instrumental Activities of Daily Living Scale (HKLIADL) (Tong & Man, 2002)

Hong Kong Lawton Instrumental Activities of Daily Living Scale (Chinese version) was used in the pilot study. The scale includes aspects of community living skills such as use of telephone, use of transport, shopping, household management, laundry, taking medication, cooking and money management skills. There is a full score of 27 points for rating of 9 items of community living skills. Each item has a scoring range from 0 to 3 points. HKLIADL is widely used in the assessment of the advanced level of ADL skills required to lead an independent life living in the community for the elderly population.

4.5.3.7 Activities of Daily Living Questionnaire (Chinese version) (ADLQ-CV) (Chu & Chung, 2008)

ADLQ assesses the functional competence of persons with dementia. The Chinese validated version of ADLQ consists of 23-item. The total score has a range of 0-100. The total score and subscale score are calculated as a percentage indicated the level of ADL functional impairment. The functional impairment is

"severe" (> 66%), "moderate" (34-66%) or "none to mild" (0-33%). The reported inter-rater reliability is 0.997 and test-retest reliability is 0.998, with Cronbach's α coefficient of is 0.813.

4.6 Implementation

4.6.1 Subject recruitment

Early Alzheimer's Disease subjects meeting the inclusion and exclusion criteria were recruited into the study and were then randomly allocated to a computer-assisted errorless learning program, a therapist-led training programme and a control group.

4.6.2 Implementation of Pilot Study & Main Study

The pilot study was implemented during the period of June 2008 to January, 2010 with an Expert Panel Review done in February, 2009. The pilot study consisted of a 12-session errorless memory training programme. The main study was launched in June, 2010 to May, 2013 using a revised 15-session errorless memory training programme (Table 3). Beside the quantitative pre-and-post test and 3-month follow up outcome assessment of the subjective, qualitative feedback were also collected from subjects upon completion of memory training programme.

4.7 Data Processing and Analysis

The independent variables in this research were the three different memory training programmes: CELP, TELP and CG. The dependent variables were subjects' performance in MMSE, CDRS, HKLLT, BAPM and functional skills (as measured by MBI & HKLIADL in pilot study and ADLQ-CV in the main study). Statistical measures among groups repeated measures analysis of variance (ANOVA) were used to compare the effectiveness of treatment among the three treatment groups. Comparison was made on "within the same group" and "between different groups" on the memory outcomes.

CHAPTER 5

DATA ANALYSIS AND RESULTS

In this chapter, pilot study with expert panel review and the main study will be described. Both the descriptive and inferential data in this study were analyzed. The scores of memory-related assessment were measured in pre-and-post test and three-month follow up periods. The independent variables of this present study were the computer-based errorless memory training programme and the therapist-led errorless memory training programme. The dependent variables of this study included CDRS, CMMSE, HKLLT and BAPM.

5.1 Pilot study and expert panel review

An expert panel review meeting was done on 20 February, 2009 with the purpose to review the content, structure and audiovisual presentation of the computer-assisted errorless based learning programme (CELP). The inclusion criteria of OT clinical experts are those clinical experts in the psychogeriatric working group of the Hong Kong Hospital Autority, with a mimimum of 10 years working experience in geriatric or psychogeriatric setting. So, we finally have seven OT clinical experts in the expert panel. They have an average of 14.86 (s.d.=1.88) years of working experience in the field. Recommendation from pilot study and clinical experts was used to further improve the programme structure and enhance the audio-visual effect. The pilot study data is used for sample size estimation of the main study. For the intervention programme, after pilot study, three revision sessions are added

and the training time per session was increased to from 30 to 45 minutes. So, the final EL training programme was a 15-session, 45-minutes/session training programme.

5.2 Main phase data analysis

Both descriptive and inferential data were analyzed in this study. Statistical procedures were implemented for both across-group and within-group analysis. For across-group analysis, repeated measures of ANOVA was used to compare the treatment effect of two intervention groups, CELP and TELP group and a control group over an extended period of time (2-month training and 3-month follow up).

5.3 Demographic data of subjects

In the main phase of study, a total of 115 subjects with Alzheimer's Disease diagnosis were recruited from in-, day and out- patient psychogeriatric patients subjects from Kwai Chung Hospital; elderly subjects from private and subvented Elderly Homes and Care and Attention Homes located in Kwai Chung, Tsuen Wan and Sham Shui Po; and elderly clients from three dementia day care centre of Hong Kong Alzheimer's Disease Association (in Hong Kong and Kowloon Districts) and two elderly day care centres (in Kowloon and Kwai Chung District).

5.4 Results of main study

The recruiting period was from June, 2010 to May, 2013. After performing screening tests of Chinese Clinical Dementia Rating and Chinese Geriatric Depression Score-Short Form (Cantonese version). 80 subjects were found to meet the inclusion and exclusion criteria of the study (at early stage of dementia and not clinically depressed) and were randomized by centre base into three groups: Computer-assisted Errorless Memory Training Group (CELP), Therapist-led Errorless Training Group (TELP) and Control Group (CG).

Thirty-five subjects were screened out because they did not meet the inclusion criteria of the study or showed no motivation to join the study. For a large recruiting centre like Kwai Chung Hospital, subjects would be further randomized into CELP, TELP and CG.

Finally the following subjects are recruited: CELP (n=31), TELP (n=23) and CG (n=26). Moreover, there were 5 subjects dropped out from the study due to deterioration of physical condition or no further follow-up of subjects: one from CELP, one from TELP and three from CG. Among 80 subjects, a total of about 6.25% were dropped out and this was a very small number and might not affect too much in later data analysis on outcomes.

The total number of subjects who had completed pre-and-post test evaluation and 3 months follow-up evaluation and data analysis was 75 in this main study: CELP

(n=30), TELP (n=22) and CG (n=23) (see Consort flow diagram of randomization procedures in Figure 7).

Demographic data was shown in Table 4. By means of Chi square test and one way ANOVA, results showed that there was no group difference at baselines in demographic data and outcome measure.

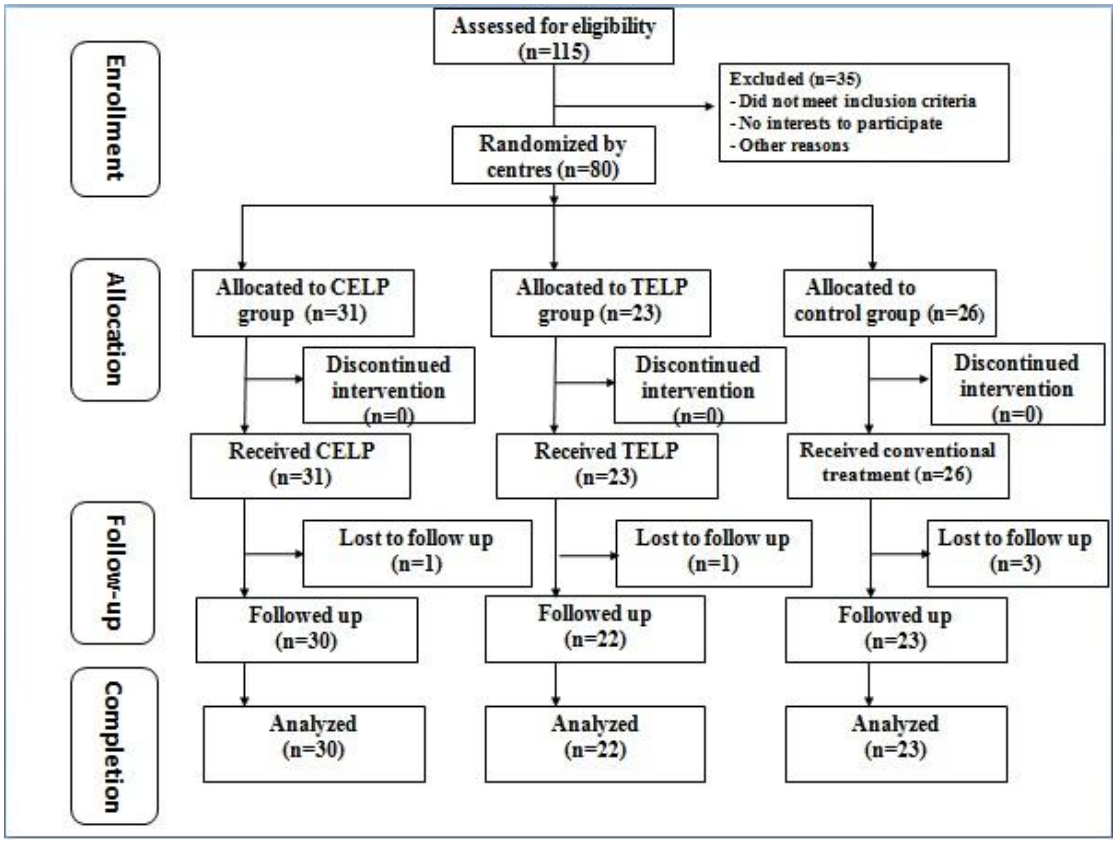


Figure 7. Consort flow diagram of randomization procedures

ANOVA for repeated measure showed that there were significant difference among three groups and the time effect (see Table 5). The interaction effect between the group ffect and time effect were also significant, which imply there may be confounding between the time and group effect. So we conducted subgroup analysis at each time point to control the time effect (see Table 6).

		Group (N=75)							
		CELP (n=30)		TELP (n=22)		CG (n=23)		χ^2	p value #
		count	%	count	%	count	%		
Gender	Male	10	33.3	10	45.5	6	26.1	1.902	0.386
	Female	20	66.7	12	54.5	17	73.9		
Education	Nil	7	23.3	9	40.9	8	34.8	6.357	0.607
	1- 2 years	6	20.0	1	4.5	5	21.7		
	3 - 6 years	9	30.0	7	31.8	6	26.1		
	Secondary	5	16.7	3	13.6	4	17.4		
	University	3	0.0	2	9.1	0	0.0		
Marital status	Married	7	23.3	8	36.4	14	60.9	8.235	0.079
	Single	1	3.3	1	4.5	1	4.3		
	Widowed or Divorced	22	73.3	13	59.1	8	34.8		
Living condition	Living alone	5	16.7	4	18.2	3	13.0	1.936	0.925
	Living with spouse	4	13.3	4	18.2	4	17.4		
	Living with family	15	50.0	11	50.0	14	60.9		
	Living in OAH	6	20.0	3	13.6	2	8.7		

p value by Chi-Square Test

	mean	s.d.	mean	s.d.	mean	s.d.	F(2,72)	p Value ##
Age	81.0	(5.2)	78.6	(6.1)	78.0	(5.0)	2.411	0.097
MMSE	18.1	(3.27)	17.1	(2.84)	16.5	(3.07)	1.787	0.175
GDS	2.17	(1.95)	2.36	(2.66)	1.30	(1.99)	1.534	0.223
DRS	101.07	(9.68)	96.77	(12.11)	97.22	(9.01)	1.423	0.248
HKLLT	7.50	(3.65)	9.18	(4.19)	7.87	(2.69)	1.488	0.233
BAPM -carer	1.89	(0.78)	1.77	(0.76)	1.61	(0.50)	0.186	0.834

p value tested by one way ANOVA Test

Table 4. Demographic characteristics of subjects and baseline outcome measures of CELP, TELP, CG

Domain	Primary outcome measures	Group effect	Time effect	Group x time effect
General cognitive ability	**CMMSE**			
	F(2,72)	4.436	19.627	3.526
	P Value	0.015*	<0.0005*	<0.01*
	Effect Size	0.110	0.214	0.089
	Power	0.160	0.986	0.278
Specific cognitive function	**CDRS total**			
	F(2,72)	3.601	10.165	5.340
	P Value	0.032*	<0.0005*	<0.0001*
	Effect Size	0.091	0.124	0.129
	Power	0.123	0.640	0.557
	CDRS, Memory Subscore			
	F(2,72)	3.949	14.139	3.576
	P Value	0.024*	<0.0005*	<0.012*
	Effect Size	0.099	0.164	0.090
	Power	0.138	0.879	0.284
	CDRS, Concept Subscore			
	F(2,72)	4.506	9.749	5.798
	P Value	<0.014*	<0.0005*	<0.0005*
	Effect Size	0.111	0.119	0.139
	Power	0.163	0.602	0.629
	HKLLT			
	F(2,72)	0.270	9.164	5.161
	P Value	0.764	<0.005*	<0.001*
	Effect Size	0.007	0.113	0.125
	Power	0.05	0.555	0.527
	HKLLT (immediate recall)			
	F(2,72)	0.663	22.372	6.343
	P Value	0.519	<0.0005*	<0.0005*
	Effect Size	0.018	0.237	0.150
	Power	0.053	0.996	0.706
	BAPM-Carer			
	F(2,72)	1.725	7.678	0.182
	P Value	0.169	<0.001*	0.834
	Effect Size	0.063	0.131	0.007
	Power	0.084	0.691	0.051
Domain	**Secondary outcome measure**			
Mood	**CGDS**			
	F(2,72)	0.083	4.869	6.313
	P Value	0.921	<0.009*	<0.001*
	Effect Size	0.002	0.063	0.149
	Power	0.473	0.42	1

Table 5. Comparison of group effect and time effect of CELP, TELP and CG on primary and secondary outcomes

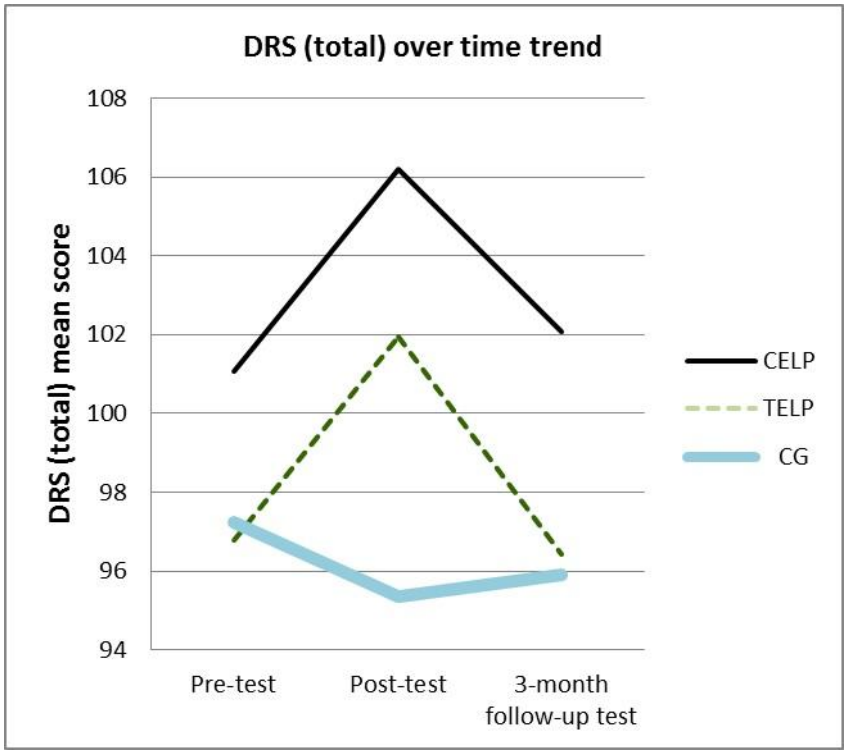
Table 6. Comparison of pre-and-post test & 3M FU for CELP, TELP, CG on primary& secondary outcomes

	CELP		TELP		CG		p value	Power
Outcomes	**Mean (S.D.)**							
CDRS (Total) Pre-test	101.07	(9.68)	96.77	(12.11)	97.22	(9.01)	0.248	1.00
CDRS (Total) Post-test	106.20	(8.70)	101.95	(12.08)	95.35	(8.98)	0.001*	1.00
CDRS (Total) 3M FU	102.07	(8.34)	96.41	(14.96)	95.91	(9.29)	0.078	1.00
Power	1.00		1.00		0.68			
CDRS (Concept) Pre-test	32.10	(3.60)	29.59	(5.13)	30.13	(4.64)	0.099	1.00
CDRS (Concept) Post-test	33.77	(3.04)	33.90	(3.10)	29.43	(4.88)	0.000*	1.00
CDRS (Concept) 3M FU	32.63	(3.08)	30.23	(5.62)	29.70	(5.39)	0.055	1.00
Power	0.57		1.00					
CDRS (Memory) Pre-test	11.90	(2.81)	12.14	(3.85)	11.22	(2.86)	0.594	0.85
CDRS (Memory) A	13.50	(3.00)	12.64	(4.07)	10.87	(3.39)	0.027*	1.00
CDRS (Memory) 3M FU	12.37	(3.01)	10.27	(3.17)	9.04	(3.71)	0.002*	1.00
Power	0.54		0.89		0.85			
MMSE Pre-test	18.07	(3.27)	17.09	(2.84)	16.48	(3.07)	0.175	0.99
MMSE Post-test	19.60	(3.02)	19.45	(2.50)	16.70	(2.90)	0.001*	1.00
MMSE 3M FU	18.13	(2.97)	18.10	(2.76)	16.04	(3.42)	0.030*	1.00
Power	0.58		0.86		0.12			
HKLLT (Total) Pre-test	7.50	(3.65)	9.18	(4.19)	7.87	(2.69)	0.233	0.99
HKLLT (Total) Post-test	10.87	(4.22)	9.40	(3.92)	8.35	(2.85)	0.056	1.00
HKLLT (Total) 3M FU	9.40	(3.85)	9.55	(4.08)	9.87	(4.78)	0.921	0.30
Power	0.99		0.07		0.76			
HKLLT (IR) Pre-test	7.67	(3.20)	7.36	(2.61)	8.30	(2.36)	0.513	0.85
HKLLT (IR) Post-test	9.53	(2.34)	10.50	(3.29)	8.30	(2.12)	0.022*	0.99
HKLLT (IR) 3M FU	8.87	(2.69)	9.55	(4.08)	8.22	(2.04)	0.339	0.99
Power	0.66		0.98		0.05			
BAPM Carer Pre-test	1.89	(0.78)	1.77	(0.76)	1.61	(0.50)	0.005*	0.13
BAPM Carer Post-test	1.57	(0.66)	1.55	(0.66)	1.62	(0.58)	0.375	0.05
BAPM Carer 3M FU	1.65	(0.65)	1.53	(0.61)	1.53	(0.58)	0.001*	0.07
Power	0.06		0.06		0.05			
CGDS Pre-test	2.17	(1.95)	2.36	(2.66)	1.30	(1.99)	0.233	0.95
CGDS Post-test	1.43	(1.63)	1.32	(1.67)	1.57	(2.46)	0.912	0.11
CGDS 3M FU	1.13	(1.70)	1.73	(2.49)	2.04	(2.85)	0.357	0.83
Power	0.25		0.24		0.14			

*$p < 0.05$

In order to compare the cognitive functioning and mood state among three groups, namely CELP, TELP and CG, at three intervals (pre-test, post-test and three-month follow-up), repeated measures ANOVA was used. The results are summarized in Table 5. There was a significant interaction effect of group over time in primary outcome of DRS total (F(2,72)=5.340,p=0.001), with a small effect size = 0.129; DRS Memory subcore (F(2,72)=3.576,p=0.012) ; MMSE (F(2,72)=3.526, p=0.01), with a small effect size = 0.089; GDS (F(2,72)=6.313, p=0.001), with a small effect size = 0.149.

5.4.1 DRS(total) score and DRS(subscore)



P<0.0001

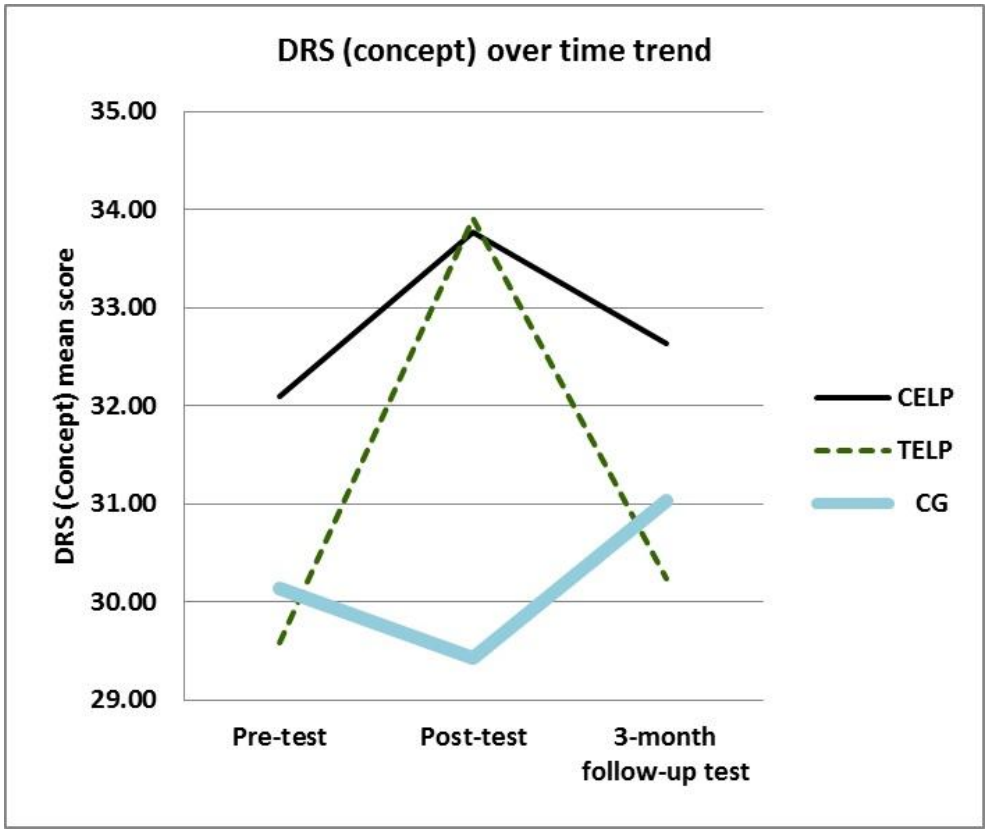
Figure 8. The DRS (total) mean score over time trend during pre-test, post-test and 3-month follow-up assessment for CELP, TELP and CG

When evaluating the "Time x Group" and "Time" factor, its associated significance level and effect size were studied. Using ANOVA, the mean score for DRS total for time and treatment effect were statistically different ($F(2,72)=5.340$, $p=0.001$, with a very small effect size of 0.129. The mean score for DRS total over time (within subject-effect) were statistically significantly different ($F(2,72)=10.165$, $p<0.005$), i.e. with significant time effect. From the mean scores of DRS total for groups (across subjects), there was significant group (treatment) effect: $F(2,72)= 3.601$, $p=0.032$, with a small effect size = 0.091.

As noted in the plot in Figure 8, there is significant interaction of group and time effect. There was a change over time and a change in treatment effect. A similar trend of improvement in DRS total score (post test) for CELP and TELP for treatment effect was observed but there was a decline observed at the 3-month follow up. However, there was not much change in CG. Using one-way ANOVA, together with Post-hoc test, there was a statistical difference across the CELP, TELP and CG ($p<0.001$). By one-way ANOVA, used with post-hoc test of Tukey HSD, only CELP was found to statistically different better than control group ($p=0.001$) during post-test. There was no significant difference found between CELP and TELP, or between TELP and control group. By comparing the pre-and-post test change of score in DRS (total) score, 5.08% and 5.35% of improvement were observed in CELP and TELP group but a mild deterioration of -1.92% was observed in CG (see Table 7).

By ANOVA, mean score for DRS (concept) subscore, time and group (treatment)

interaction effect were found to have statistically significant differences (F(3.6,72)=5.798, p=0.005), with small effect size =0.139. The mean score of DRS(concept) subcore (within subject-effect) were statistically different (F(1.806,72)=9.749,p<0.0005), with effect size=0.119 (see Figure 9). For DRS (concept) subscore, TELP demonstrated a better improvement at post-test from the pre-test, with mean score improved from 29.59 to 33.90, compared with improvement in CELP, with mean score improved from 32.10 to 33.70) while there was a mild deterioration in concept subscale in post-test in CG (See Table 7).



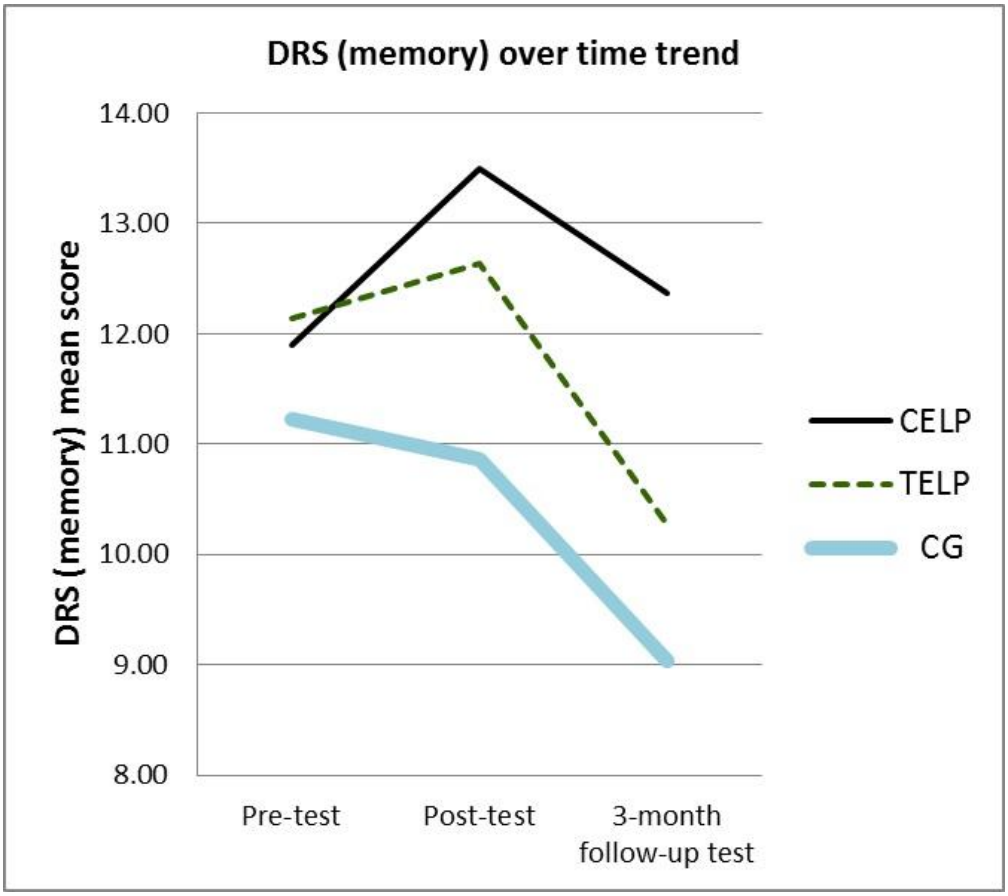
P<0.0005

Figure 9 The DRS(concept) mean score over time trend during pre-test, post-test- and 3-month follow-up assessment for CELP, TELP and CG

Using ANOVA, the mean score of DRS (memory) subscore for time and treatment interaction effect was found to have a statistically significant difference, $F(2.72)=3.576$, $p<0.012$), and with a very small effect size of 0.090.

The mean score for DRS(memory) subscore were statistically significantly different, $F(2.72)=14.139$, $p<0.0005$, with a small effect size of 0.164. The mean score for DRS (memory) subscore for group (across subjects) showed that there was a statistically significant different group (treatment) effect, ($F(2,72)=3.949$, $p=0.024$, with very small effect size of 0.099.

In comparing the DRS memory subcore, better improvement was observed in CELP than in TELP and with mild deterioration in DRS memory subscore in CG (See Figure 10 and Table 5).



P<0.04

Figure 10 The DRS(memory) mean score over time trend during pre-test, post-test & 3-month follow-up test

5.4.2 Across-group comparison of MMSE score

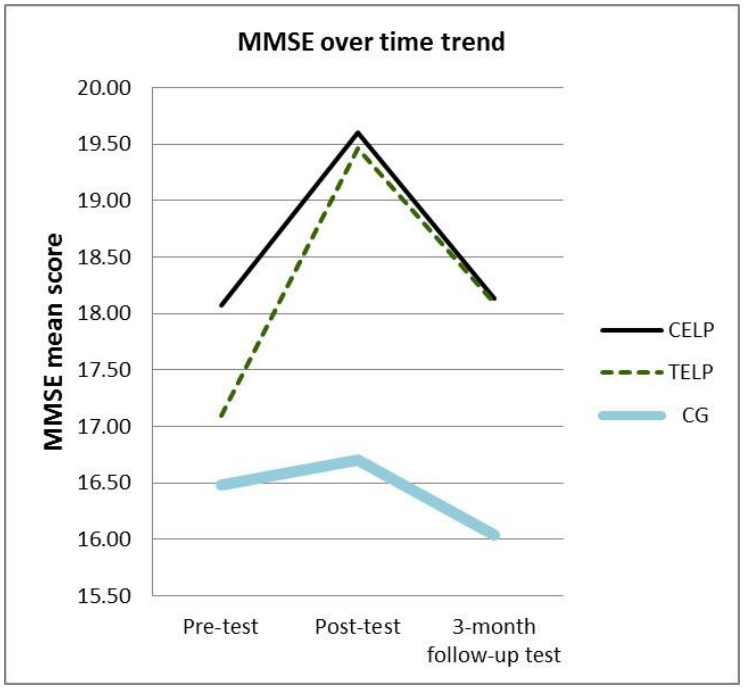
By comparing the three groups, namely CELP, TELP and CG, at time intervals of pre-test, post-test and 3 months follow-up evaluation using repeated measures analysis (ANOVA), there was a significant interaction effect of group over time in MMSE-time ($F(2,72)=3.526$, $p=0.01$), with a small effect size = 0.089. From the mean scores of MMSE for groups (across subjects), there was a significant group (treatment) effect: $F(2, 72)= 4.436$, $p=0.015$, with a small effect size = 0.110.

Outcome		CELP		TELP		CG	
Primary outcomes							
DRS	DRS(total) pre-test	101.07		96.77		97.22	
	DRS(total) pre-test	106.2		101.95		95.35	
	Mean change of Pre-and-post test (% of change)	5.13	5.08	5.18	5.35	-1.97	-1.92
	DRS(Concept) pre-test	32.10		29.59		30.13	
	DRS(Concept) post-test	33.70		33.90		29.43	
	Mean change of Pre-and-post test (% of change)	1.67	5.20	4.31	14.41	-0.7	-2.32
	DRS(Memory) pre-test	11.90		12.14		11.22	
	DRS(Memory) post-test	13.5		12.64		10.87	
	Mean change of Pre-and-post test (% of change)	1.60	13.45	0.50	4.12	-0.35	-3.12
MMSE	MMSE pre-test	18.07		17.09		16.48	
	MMSE post-test	19.6		19.45		16.70	
	Mean change of Pre-and-post test (% of change)	1.53	8.47	2.36	13.80	0.22	1.33
HKLLT	HKLLT(total) pre-test	7.50		9.18		7.87	
	HKLLT(total) post-test	10.87		9.40		8.35	
	Mean change of Pre-and-post test (% of change)	3.37	44.93	0.22	2.40	0.48	6.10
	HKLLT(immediate recall) pre-test	7.67		7.36		8.3	
	HKLLT(immediate recall) post-test	9.53		10.50		8.3	
	Mean change of Pre-and-post test (% of change)	1.86	24.25	3.14	42.66	0.00	0.00
BAPM for carer	BAPM carer pre-test	1.89		1.77		1.61	
	BAPM carer post-test	1.57		1.55		1.62	
	Mean change of Pre-and-post test (% of change)	-0.32	-16.93	-0.22	-12.43	0.01	0.62
Secondary outcome measure							
GDS*	GDS pre-test	2.17		2.36		1.30	
	GDS post-test	1.43		1.32		1.57	
	Mean change of Pre-and-post test (% of change)	-0.74	-34.10	-1.04	-44.07	0.27	20.77

* For GDS & BAPMscore, a negative change of score, indicating an improvement.
For other scores, a negative score indicated deterioration in the performance in that domain.

Table 7. Comparison of pre-and-post test mean change of score in CELP, TELP and CG on primary and secondary outcomes

From ANOVA, there was statistically significant difference for MMSE post test score (p=0.001) and MMSE 3 months follow up score (p=0.03) across three groups CELP, TELP and CG. From post-hoc test using Tukey HSD, it showed that only CELP was statistically better than CG during post test (p=0.01).



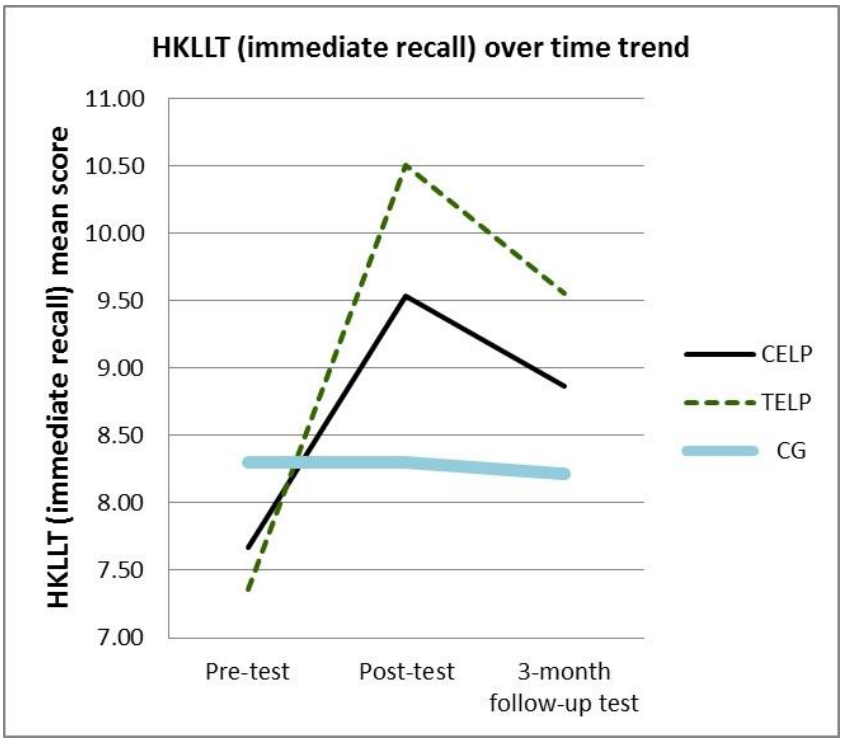
P<0.01

Figure 11. The MMSE mean score over time trend during pre-test, post-test and 3-month follow-up test for CELP, TELP and CG

From the MMSE plot (see Figure 11), there was an interaction effect of the group over time. CELP and TELP showed similar pattern of positive treatment effect of 8.47% and 13.80% of improvement in pre-and-post test score (see Table 5), but scores declined at 3-months follow-up evaluation on MMSE. However, there was not much improvement seen in control group.

5.4.3 Across-group comparison of HKLLT score

By ANOVA, mean score for HKLLT (immediate recall) subscore, time and group (treatment) interaction effect were found to have a statistically significant difference ($F(3.7,72)=6.343$, $p<0.0005$), with small effect size =0.150. The mean score of HKLLT (immediate recall) subscore for group (across subjects) were statistically different ($F(2,72)=22.372$, $p<0.0005$), with effect size=0.237) (see Figure 12). For HKLLT (immediate recall) subscore, TELP demonstrated a better improvement (mean score improved from 7.36 to 10.50) compared with the improvement in CELP (mean score improved from 7.67 to 9.53) while there was no change in subscale in CG (See Table 5).

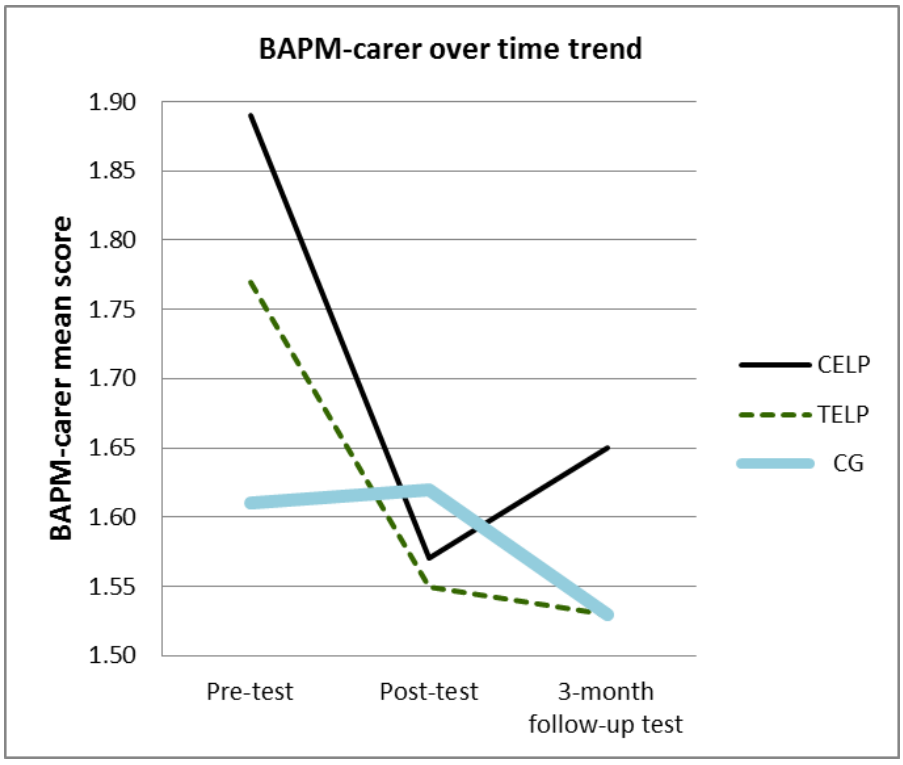


P<0.005

Figure 12 The HKLLT (immediate recall) subscore mean score over time trend during pre-assessment, post-assessment & 3M FU assessment for CELP, TELP and CG

5.4.4 Across-group comparison of BAPM-Carer score

By ANOVA, the mean score of BAPM of carers taken at pre-test, post-test and 3 month follow-up, were found to have a statistically significant difference, ($F(1.497,72)=7.678$, $p<0.002$, with a small effect size of 0.131. However, the time and group interaction effect was not statistically significant. Moreover, it showed a positive trend of treatment effect in CELP and TELP, with some improvement in CELP and TELP, with a pre-and-post test change of score by 16.9% and 12.43% respectively while there was a little deterioration of 0.62% in post-test of CG (see Table 7 and Figure 13).

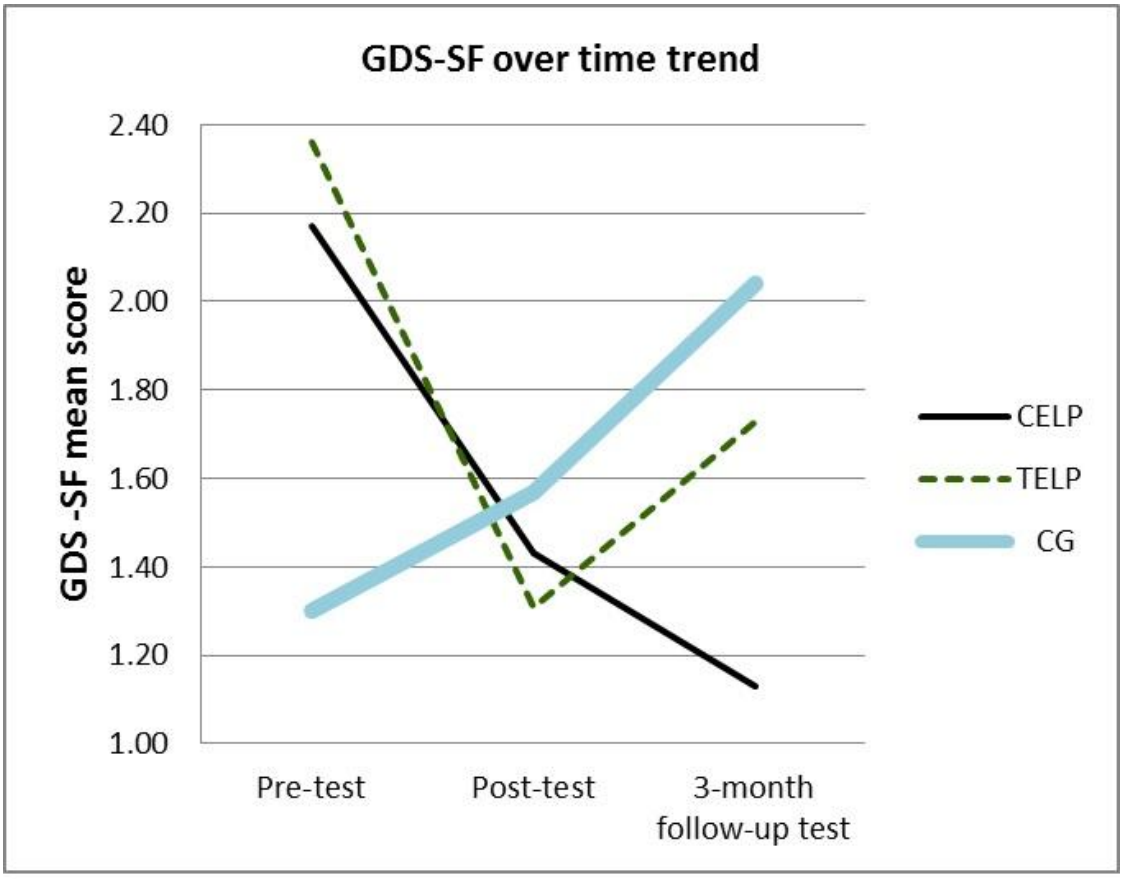


A negative score indicate improvement shown
P<0.001 for time effect

Figure 13 The BAPM-carer mean score over time trend during pre-assessment, post-assessment, and 3-month follow-up assessment for CELP, TELP and CG

5.4.5 Across group comparison in GDS-SF score

By comparing the three groups at time intervals of pre-test, post-test and 3 months follow-up evaluation by using one way ANOVA, there was a significant interaction effect of group treatment over time in GDS-SF-time ($F(2,72)=6.313$, $p=0.001$). The mean score of GDS-SF (within subjects) was found to have a statistically significant difference, ($F(2,72)=4.869$, $p<0.009$,with small effect size of 0.063 (See Figure 14).



A negative score indicate improvement shown
P<0.009 for time effect

Figure 14 The GDS-SF mean score over time trend during pre-assessment, post-assessment, and 3-month follow-up assessment for CELP, TELP and CG

CHAPTER 6

DISCUSSION

6.1 Effectiveness of CELP & TELP for early AD

The aim of this study was to develop and evaluate a computer-assisted memory training programme based on errorless learning memory strategies. It was hypothesized that CELP and TELP were able to enhance the memory skills for persons with early dementia. From the statistical results comparing outcomes on cognitive function, we found that errorless memory training programme, CELP and TELP were both effective to improve cognitive function of early stage AD Chinese older patients as referenced by DRS, MMSE, and HKLLT with statistically significant treatment and time effect of $p<0.001$, $p<0.01$, and $p<0.001$ respectively, when compared with the control group.

Meta-analysis reviews of cognitive training for early dementia and AD patients showed effectiveness for restoration of learning, memory, executive function, activities of daily living and general cognitive problems, with an overall medium size effect of 0.47 (Mimura & Komatsu, 2007; Sitzer, Twamley & Jeste, 2006). In our study, only mild effect size could be found. They were found to be 0.129, 0.125, and 0.089 for time and treatment effect in DRS, HKLLT and MMSE respectively at post-treatment evaluation. A statistically significant difference was found in treatment effect in MMSE Score and DRS score with $p<0.015$ and $p <0.032$ respectively in pre- and post-test evaluation.

In comparing the control group, CELP and TELP group showed good positive improvement in DRS score in the mean score change in pre- and post-test (increase

in mean score of 5.13 point for CELP; increase in 5.18 point for TELP while -1.97 point for CG) while early AD subjects showed some deterioration in cognitive function as the disease might be in progression (see Table 5). For DRS (memory) subscore, group and time interaction effect was found to have a statistically significant difference in comparing CELP, TELP and CG of $p<0.012$ (time effect: $p<0.005$; treatment effect: $p<0.024$).

Similar findings were also reported in computer-based cognitive intervention in RCT study for AD and MCI persons (Galante, Venturini & Fiaccado, 2007; Miller et al., 2013; Kanaan et al., 2014) that significantly improve the memory, orientation and verbal fluency of participants at post-test evaluation and delayed the progress of cognitive decline in the intervention group. For MMSE score, both CELP and TELP showed very good improvement (increase of 1.53 point for CELP; 2.36 point), when compared with mild positive change in CG (0.48 point). There was a statistical difference among treatment groups and control groups for time ($p<0.0005$) and treatment effect ($p<0.015$). There was remarkable improvement in outcome after the EL intervention programme and the TELP seemed to have slightly better effect than CELP. It might be because therapist might provide the participants in errorless training with more guidance, prompts and flexibility to cater for the individual cognitive level of functioning and needs of AD patients.

For HKLLT immediate recall subscore, both CELP and TELP group showed

significant positive improvement in post-test score while there was no change in post-test score in CG. Similar study results were also found in virtual reality-based training for persons with questionable dementia (Man, Chung & Lee, 2012) in that virtual reality training group showed significant improvement in encoding function in immediate and delay recall after training.

For BAPM-carer, test results of caregivers were found to provide more reliable outcome measures than subjects' subjective BAPM measures as some subjects with early AD might not have very good insight into the severity of their prospective memory problem. For repeated measure ANOVA, it was found that there was a statistically significant difference in time effect in CELP, TELP and CG group, for BAPM-carer, with $p=0.002$. There was a significant improvement in BAPM-carer score for CELP and TELP while there is a deterioration of BAPM score for CG.

In short, both CELP and TELP were both effective in improving the general cognitive function and memory performance of early AD subjects in comparing with CG. CELP group had better improvement in training of memory and prospective memory as reflected in the DRS memory subscore, HKLLT and BAPM-carer scores, with improvement respectively in pre- and post-test change in score comparison while TELP group showed better improvement in general cognitive function test such as MMSE and HKLLT immediate recall of improvement respectively (see Table 5). The results was much in line with

international and local cognitive training programmes in that improvement was found in cognitive training or computer-based cognitively training programme (Clare & Jone, 2008; Galamte, Venturimi & Fiaccadori, 2007; Hwang et al., 2012; Lai et al., 2011; Lee et al., 2013; Miller et al., 2013).

In my study, I had introduced control subjects who are early AD patients attending general unstructured programmes including sessions of reality orientation, reminiscence, self-care, physical exercise and leisure interests in group format. Thus, the control group also had very mild improvement in MMSE (mean change in score of 0.22; 1.33%) and HKLLT score (0.48, 6.10%) when comparing pre- and post-test change of score assessment after 2 months.

In consideration of the secondary outcome on mood state, it was measured by GDS-SF after participants attended individual based errorless learning training programme,. CELP and TELP groups were found to have improvement of 1.43 point and 1.04 point while there was found to be some deterioration in the CG of 0.27 point of out of a total of 15 point score. There was time effect within the group, with p=0.009 and there was time and intervention effect of p=0.001 with mild effect size of 0.149 while the group effect not yet reached a statistically significant difference. Both CELP and TELP subjects were motivated to join the individual computer-assisted or therapist-led errorless learning-based programme. For the CELP group, the mastery of the computer gave them a good sense of achievement. For both CELP and TELP group, subjects were happy and all

proud of the immediate positive feedback from the computer or therapists. They were much encouraged by the culturally relevant praise and the reinforcement scores obtained after attending a training session. Some subjects were eager to share to their carers about their very good achievement in individual EL training programme after the training. Subjects attending the errorless learning programme also gave feedback that they would recommend this training to others who might also have cognitive impairment.

6.2 Mechanism of Enriched Environment (EE) and Errorless Learning (EL) programme

As mentioned earlier, errorless training-based memory training programme was developed based on neuroplastic theories and errorless learning principles in an enriched environment for the rehabilitation of early stage AD subjects: avoiding errors, facilitating accurate association, with training materials built from familiar daily life scenario of cultural relevancy. The programme was structured with gradation, repetition and immediate positive multi-sensory feedback for right attempts (Clare & Jones, 2008; Clare et al., 2000; Clare et al., 2002; de Werd et al., 2013; Dou et al., 2006; Germano et al., 2006; Lee et al., 2013; Wilson, 2002). Restorative strategies like errorless learning, spaced retrieval and vanishing cues were integrated with compensatory mnemonic strategies, like visual imagery, categorization, chunking and cueing, in the training sessions to reinforce encoding and retrieval of information in the memory process (Clare, Wilson, Carter, Roth & Rodhes, 2002; Clare et al., 2010; Gross & Rebok, 2011; Haslam,

Hodder, & Yates, 2011; Kessels & De Haan, 2003; Kessels & Hensken, 2009; Kixmiller, 2002; Simon, Yokomizo & Bottino, 2012). Cues and prompting instruction were integrated into training sessions and subjects worked by graduating from easier sessions in the beginning to more challenging sessions at later sessions.

In implementing the EL training programme, subjects actively participated in the training programme which focused on attention, working memory, executive function and prospective memory. Programmes were equipped with carefully selected training photographs of daily life tasks. The programme began with photos of typical home tasks and could be upgraded to photos of community living task (with good figure-ground, clear and large images; clear and slow voice to give instruction and feedback). The training content had varying familiarity and interests to older adults (like attention task in counting of fruits and Dim Sum; working memory task on money exchange; prospective memory task on remembering to switching off stove while "shopping for vegetables" in a role-play scenario; name-face training task to reinforce mnemonic strategies like association). Programmes were built up with repetition of training elements and new information was gradually introduced to reinforce encoding of new messages and the learning of memory strategies. The revision sessons at 5^{th}, 10^{th} and 15^{th} session were included in the 15-session training programme to consolidate the learning. Subjects were observed to master the training programme with success right from the first session. In CELP, a supportive user-friendly enriched

environment was created and stimulating audio-visual computer feedback of enjoyable praise and visual images which appeared immediately when the participant got right answer after completing each question. A summary of the training score achieved was displayed at the end of each training session, like a score of 100. TELP was a similar programme to CELP except that the programme was led by an occupational therapist or a student occupational therapist with prior training to conduct the programme, and using colourful manual and guiding questions. It had the same training content and scenario as CELP. Therapists gave standardized instruction and positive feedback immediately (instead of the computer) to support the subjects in the training process as case difficulties arose.

Like other international or local studies, the present study showed positive improvement of cognitive function post-training in Chinese early AD older persons in DRS, MMSE and HKLLT immediate recall scores. The EL training programme was effective to overcome the impairment of encoding function of AD persons and facilitate the active learning process of memory strategies. Through repetition, learning of new information in working memory for AD persons (with elaborated rehearsal), information and messages were reinforced into long term memory and retrieval of information was facilitated by learnt memory strategies. Thus, the study results gave initial evidence of subjects' improvement in global cognitive function and memory function after participating in a specially designed EL programme. This also echoes the neuroplasticity and

cognitive reserve theory (that the cognitively impaired would still be able to develop alternative neuro-pathway through structured errorless learning-based memory programme, with spaced retrieval and vanishing cues (restorative approach and internal strategies), integrated with enriched environment and mnemonic memory strategies (compensatory approach and external strategies) (Clare & Jones, 2008; Dou, 2006; Galante et al., 2007; Hwang et al., 2012; Lai et al.,2011; Lee et al., 2013; Morris & Becker, 2004; Pang & Hannan, 2013; Sachdev & Valenzuela, 2006 & 2011). Subjects enjoyed the EL training and expressed thanks to trainers. However, some subjects were observed to have great difficulty in participating in prospective memory and the dual task in the training programme and needed a lot of guidance and support from trainers to get the correct answer. In comparing the training effect of CELP and TELP, computer-assisted programme with rich audio-visual element tended to create an enriched environment, integrated with EL training elements. CELP seemed to reinforce more on general memory function and prospective memory; and TELP seemed to show better global cognitive improvement as therapist might give more individualized hints to cater for various level of function of the subjects.

6.3 Carry-over effect

In the present study, the improvement in outcomes score was found mainly in post intervention in the treatment groups CELP and TELP. This improvement might not be able to be carried over and sustained in the 3-month follow up outcome evaluation. There was a general decline in cognitive function, compared

with post-test. But it still showed some positive results compared with the pre-intervention baseline scores (see Figures 8, 9, 10, 11, and 12). Some RCT studies for early AD patients (Galante, Venturini & Fiaccadori, 2007; Hwang et al., 2012) also showed a similar trend of improvement in global cognitive function after cognitive training in post-test but only exhibited a tendency of improvement at 3-month follow up evaluation (with some deterioration in outcomes in comparison with post-test) compared with baseline evaluation. Our results also echoed some other studies showing that there was deterioration in cognitive scores of participants at one month post-training (Jokel & Anderson, 2012; Mate-Kole, Fellows, Said, Mcdougal, Catayong, Dang & Gianesini, 2007). So, it is recommended that early AD persons should actively engage in structured cognitive training programme to maintain their cognitive function and slow down the rate of deterioration in cognitive health and progression of AD disease. Home programmes, in form of tablet computer or paper-and-pencil cognitive task, with the support of carers are recommended to supplement individual training sessions so as to maintain the improved cognitive function (Hwang et al., 2012). Some booster training sessions might be considered in the long run even after completion of the EL training programme to maintain the training effect.

6.4 Brain reserve

From cognitive reserve studies and meta-analysis with over 25000 subjects, Sachdev & Valenzuela (2006) reported that persons with high cognitive reserve would have 46% reduced risk in developing dementia compared with those with low cognitive reserve. Factors that might affect a person's cognitive function

include education, occupation achievement, participation in physical and cognitive exercise. Cognitive lifestyle including cognitive exercise, leisure/social activity participation might affect the cognitive reserve and cognitive performance and reduce risk of dementia (Rooney, 2014). So, in future cognitive training studies, there might be needs to further evaluate the protective factors for better cognitive performance of subjects in a Chinese cultural context. In our study, participants with better social participation and active engagement in day training programme were found to have better maintenance of cognitive training gains. Besides, in this study, most of subjects lived in the community; carer support to demented persons would pose variable results in the study. Some carers were observed to be active and eager to understand the cognitive training programme of participants in the study. Carer support given to participants to reinforce the 15-session cognitive training session, would further improve the overall training outcomes.

In our study, subjects were in the early stage of AD who had not used a computer before. Moreover, they also showed great interests to learn and be engaged in this structured computer-assisted EL training programme. They gained significant positive training outcomes and mastered the use of touch screen computers after training. Nowadays, there is popularity of the use of Tablet PC, I-pad and smart phone. A recent study also showed that AD persons would benefit from the use of I-pad in cognitive training with initial support from carers (Lim, Wallace, Luscz & Reynolds, 2012). So, there is a great

need to develop more mobile cognitive training programmes for the healthy or mildly cognitive impaired older adults to build up their cognitive reserve, enhance cognitive function and prevent or delay onset of dementia disease.

6.5 Clinical implication

6.5.1 Cost-effectiveness of CELP

Both CELP and TELP were found to be effective to improve the global cognitive function of early AD patients. The computer-assisted EL training programme was found to be more cost-effective in provide a training programme as the programme is in a standardized format, with high quality in-built structured, gradable and enriched audio-visual environment. It might be implemented by supporting staff of professionals or carers and this would save occupational therapists' manpower to provide more individualized training programmes.

The CELP training programme could also be arranged in a group situation with the support of volunteers or carers. This saving of occupational therapists manpower especially important in recent years as there is a severe shortage of occupational therapists in Hong Kong. The CELP might also be implemented in different hospitals and elderly settings for cognitive training of Cantonese speaking Chinese early AD persons in Hong Kong, Mainland China, Tai Wan or other overseas countries.

6.5.2 Development of 'brain health' programme and research

The errorless learning-based memory training programme might further be enriched with upgrading and downgrading functions to suit the different levels of cognitive functioning of mild cognitive impaired (MCI) or healthy older adults. Artificial intelligence might be integrated into the CELP so that participants might actively select basic, intermediate and advanced level of training programme to reach an appropriate level of cognitive challenges and improve the level of training programme flexibly. With reference to research on cognitive intervention on MCI, there is an urgent need to have further large scale randomized multi-center studies for health older adults and MCI persons. Cognitive interventions can serve as a primary 'brain health' protective intervention programme to delay the development of MCI in older persons. They could also delay the conversion process from MCI to early dementia through CELP in internationally or in developed countries (Gates, Sachdev, Singh & Valenzuela, 2011; Simon, Yokomizo & Bottino, 2012). An example of this is taking place in Australia with a large scale "Mind your mind" which has further progressed "Mind you brain" dementia prevention programme with brain training applications (Apps) in Tablet PC to provide cognitive exercise and health tips (on healthy lifestyle and diets) to minimize the risk of the development of dementia for persons of age 40 or over. In Hong Kong, the retirement age for adults is around 55-60. So, cognitive health training programme should be launched for this group in order to minimize the risk of developing dementia.

6.5.3 Mobile cognitive training programme development

This study may be the first RCT study with computer-assisted EL memory training programme for Chinese early AD patients in Hong Kong. The existing programme was implemented using a notebook computer, equipped with a touch screen monitor so that it was more user-friendly for older adults. With the technological advance and popularity of using mobile I-pads, Android pad, Tablet PC and smart phone, the training programme might also be further developed into mobile tablet training format so that it will benefit more cognitively impaired or healthy older adults. This would make it more accessible for hands-on practice of EL cognitive training and in game-format.

6.5.4 International development of Chinese 'brain health' programme

The global population is aging. As there is a pressing need to enhance the cognitive function in older adults and delay the process of developing dementia, this programme might be developed into a Chinese 'brain health' training programme with Cantonese / Mandarin version. It can also be modified into web-based programmes so that more Chinese older persons in China or from overseas might benefit. As this EL training is designed with Chinese cultural and social considerations in the programme structure and content, more collaboration with Chinese clinical experts in joint-research in the 'brain health' training area might be explored.

6.5.5 OT Clinical guidelines and computerized cognitive training in dementia

Meta-analysis of the literature review in the CINAHL database (1982+) and Medline (2000+) via ProQuest (through search of keys word "errorless learning for dementia", "computer training for dementia", "computer-assisted training for dementia" and "computer errorless training for dementia"), showed that 18 intervention programmes with errorless learning or computer training for persons with dementia were reviewed, and there was very strong evidence that AD persons would benefit from EL instruction technique and learning method in memory training. Critical review and intervention studies by occupational therapists suggested a need to consider errorless learning in the daily clinical care of dementia persons (Croe & Gabriel, 2013; Whallon, 2010). In this local study, computer-assisted errorless learning-based memory training programme was found to be a cost-effective cognitive training method in the Chinese culture (Lee et al., 2013). It is recommended to occupational therapists clinical experts in Hong Kong Hospital Authority or health care settings to update CELP and TELP into the clinical guideline in the treatment of persons with dementia so as to improve the care plan and the training effect of AD persons to ultimately enhance their quality of life. Further OT training on this CELP evidence based training might be planned.

6.5.6 Development of Neurocognitive Patient Service

In Hong Kong, there is still a limitation in provision of service for early cognitive assessment and intervention programmes for the older adults with cognitive

impairment. Development of an early cognitive impairment clinic service in General Out-patient Clinic, with a new cognitive enhancement laboratory and computer-based training programme might be explored. More collaboration among clinical OTs, multi-disciplinary staff and the local university experts might be enhanced to develop a new cognitive training model in Hong Kong for older adults or persons with neurocognitive impairment.

6.6 Limitations

There were several limitations in this study:

6.6.1 Dosage of CELP

The dosage of the existing individualized EL training programme might not be high enough for big effect size (15 session of around 45-minute training session, being held twice per week). There is still limited research on the optimal level of training volume and intensity, i.e. duration, fluency and total number of cognitive training session in the training programme. Some cognitive training programmes might be as intensive as daily training and some might be weekly programmes. Further study might be planned in the future in relation to the optimum level of training "dosage" for CELP (Galante, Venturini & Fiaccadori, 2007).

Feasiblity and efficacy study of intensive cognitive training for 21 early AD patients showed that training effect of 10 days over 2 weeks of 4 to 5 hours individualized cognitive training (computer-assisted and paper-and-pencil task) each day, showed post-test improvement in outcome scores of MMSE, letter fluency and trail-making tests and maintained the effect at 2- and 4-month follow up (Kanaan et al., 2014).

Besides, a recent intervention study showed that computer brain exercise programme improved cognitive performance of retired older adults in a computer training protocol of 5 days a week, with 20-25 minutes each day, participants playing 40 sessions over 6 months got significant improvement in immediate memory, delayed memory and language while no significant effect for wait-list control group (Miller et al., 2013).

More intensive training schedule and booster training sessions / home programme might be considered in future development of computer-assisted cognitive training programme to enhance effect size and carrying over effect.

6.6.2 RCT and research design

In the clinical settings, it would be unethical if treatment is not given to patients. So, our control subjects also attended conventional group programmes, organized by professional and supporting staff. These might produce some training effects for the control group. In future, studies might be conducted in out-patient settings, with RCT, with AD subjects randomized to intervention group or wait-listing control group (providing general discussion group with same dosage of training as CELP and TELP). Alternatively, if the study was to be implemented in hospital settings, individual subjects in the control group might also attend 15 individual training sessions such as discussion, but without cognitive training domains. Larger scale RCT and multi-centre studies should be planned in cognitive training for older adults.

6.6.3 Research-trainer dual role

There is a limitation in this study that the researcher is also the trainer in the in the therapist intervention programme due to limited manpower resource in the clinical study. This might impose bias in the effectiveness of the research. In the future research, research fund might be requested so that researcher is an independent co-ordinator of the clinical study while therapists just would involve in the intervention part of the study.

CHAPTER 7

CONCLUSION

This study showed that EL can be an effective strategy to enhance the memory function of Chinese early AD patients in Hong Kong. Both CELP and TELP had shown selective positive treatment effect on cognition when compared with CG. The encoding problem, working memory, executive function and prospective memory function of AD patients could be improved after intervention by CELP and TELP. However, the positive treatment effect has limited carrying-over effect over 3 months and might have low generalization effect to daily life function with the existing training structure in terms training dosage and frequency. CELP demonstrated better cognitive outcomes than TELP in post-test in DRS total score, DRS memory subscore, HKLLT and BAPM score. But TELP showed better cognitive outcomes in MMSE and DRS concept subscore in post-test and with better sustainability of treatment effect in MMSE and BAPM in three months follow up. Clinically, AD persons may be advised to have continual cognitive training or a home programme to maintain their cognitive function. EL training programmes might be enhanced by increasing the number of overall training session to 20 sessions or more, with an increased training frequency to more than two times a week. More support on EL memory training from carers might be further explored. Based on neuroplastic training theory, early cognitive assessment and intervention programme for Chinese older adults is highly recommended in future. Large scale RCT multi-centre study might be done for

Chinese older persons with Mild Cognitive Impairment or early AD, using CELP (in mobile tablets) to enhance cognitive function. Cognitive health training progammes might be launched for adults aged around 55-60, as a preventive programme to minimize risk of developing dementia.

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List of Appendices

Appendix A: Informed Consent form in English

Research Project Informed Consent Form

Project title : Evaluation of a computer-assisted errorless memory training programme for persons with dementia

Investigator(s) : Professor David Man, PhD

Co-investigator(s) : Ms Lee Yuet Ying, Grace
(Senior Occupational Therapist, Kwai Chung Hospital)

Purpose of the study :
The objectives of the study were develop an errorless computer-assisted memory training programme and evaluate the effectiveness of the training programme.

Who are to be recruited ?
1. Patients suffered from early dementia
2. Patients without depression
3. Male or female
4. Aged 60 or above
5. Able to follow instructions

What to do as a participant ?
Participants will be assessed by the MMSE, DRS, HKLLT, BAPM, memory competence questionnaire and, the demographic information including age, sex, physical illness and score of MBI and IADL will be collected for analysis.

Consent
I, _____, have been explained the details of this study. I voluntarily consent to participate in this study. I understand that I can withdraw from this study at any time without giving reasons, and my withdrawal will not lead to any punishment or prejudice against me. I am aware of little potential risk in joining this study. I also understand that my personal information will not be disclosed to people who are not related to this study and my name or photograph will not appear on any publications resulted from this study.

I can contact the chief investigator, Professor David Man at telephone 27666711 for any questions about this study. If I have complaints related to the investigator(s), I can contact Mrs Michelle Leung, secretary of Departmental Research Committee, at 2766-5397. I know I will be given a signed copy of this consent form.

Signature (subject): _____ Date : _____
Signature (witness): _____ Date : _____
Signature (Co-investigator): _____ Date : _____
Signature (Relative/carer): _____ Date : _____

Appendix B: Informed Consent form in Chinese

參予研究同意書

研究題目 ： 評估早期痴呆症長者健腦記憶訓練計劃

總研究員 ： 文偉光教授

副研究員 ： 李月英（葵涌醫院職業高級治療師）

研究目的 ： 本研究旨在建立一套有系統的長者健腦記憶訓練治療程序，並研究無錯誤學習記憶訓練的治療效果。

研究對象 ：

1. 患有早期痴呆症之病人
2. 沒患有抑鬱症病人
3. 不論男性及女性
4. 年齡在 60 歲以上
5. 能夠明白指示

參加者須知事項 ：

參與者需接受智能認知評核、記憶評核及自我照顧功能評核。此外參與者的年齡、性別及身體患病項目資料亦會一拼搜集，並連同認知功能一同作資料分析。

同意聲明

本人, _____, 已透過研究員解釋是項研究的目的，並自願參與。本人明白有權於任何時侯退出參與研究而不會被懲罰或控訴，而本人亦明白是項研究並不存有危害性，而有關本人的姓名，相片或病歷資料均會絕對保密，並不會刊登。

本人如對是項研究有任何問題，可致電 2766 6711 聯絡總研究員文偉光教授。若本人對此研究員有任何投訴，可以聯絡梁女士(部門科研委員會秘書)，電話 2766 5397。本人亦明白，參與此研究課題需要本人簽署一份同意書。

簽署（參加者）： _____ 日期 ： _____

簽署（見証人）： _____ 日期 ： _____

簽署(副研究員）： _____ 日期 ： _____

簽署(家人/照顧者）： _____ 日期 ： _____

Appendix C-1 : Ethical approval of this study from the HK Polytechnic University

The Hong Kong
POLYTECHNIC UNIVERSITY
香港理工大學

MEMO

To : MAN Wai Kwong, Department of Rehabilitation Sciences
From : NG Yin Fat, Chairman, Departmental Research Committee, Department of Rehabilitation Sciences

Ethical Review of Research Project Involving Human Subjects

I write to inform you that approval has been given to your application for human subjects ethics review of the following research project for a period from 25/07/2008 to 31/12/2010:

Project Title : Evaluation of a computer-assisted errorless memory training programme for persons with early dementia

Department : Department of Rehabilitation Sciences

Principal Investigator : MAN Wai Kwong

Please note that you will be held responsible for the ethical approval granted for the project and the ethical conduct of the research personnel involved in the project. In the case the Co-PI has also obtained ethical approval for the project, the Co-PI will also assume the responsibility in respect of the ethical approval (in relation to the areas of expertise of respective Co-PI in accordance with the stipulations given by the approving authority).

You are responsible for informing the Departmental Research Committee Department of Rehabilitation Sciences in advance of any changes in the research proposal or procedures which may affect the validity of this ethical approval.

You will receive separate notification should you be required to obtain fresh approval.

NG Yin Fat
Chairman
Departmental Research Committee
Department of Rehabilitation Sciences

Appendix C-2 Ethical approval of this study from Kwai Chung Hospital

醫院管理局
HOSPITAL AUTHORITY

群策群力為病人・優質醫護滿杏林
Quality Patient-Centred Care Through Teamwork

22 December 2006

Mr LEE Yuet-ying, Grace
Senior Occupational Therapist
Occupational Therapy Department
Kwai Chung Hospital

Dear Mr LEE

KWC-CREC Reference: KW/EX/06-107

Evaluation of a computer-aided errorless-learning based memory training programme for persons with early dementia

The Kowloon West Cluster Clinical Research Ethics Committee (KWC-CREC) is authorized by the Cluster Chief Executive to review and monitor clinical research. It serves to ensure that research complies with the Declaration of Helsinki, local regulations and HA policy. It has the authority to approve, require modifications in (to secure approval), or disapprove research. This Committee has power to terminate / suspend a research at any time if there is evidence to indicate that the above principles and requirements have been violated.

KWC-CREC has approved your research application on 1 December 2006 by expedited review process, and reached the following decision on the documents submitted as shown below. You are required to adhere to the attached conditions.

Study site(s)	Kwai Chung Hospital
Document(s) approved	I. Clinical Research Ethics Approval Application Form II. Research Degree Proposal III. Consent Form (Chinese version) IV. Chinese Version of Mattis's Dementia Rating Scale V. Everyday Memory Questionnaire (Chinese version) VI. Hong Kong Lawton IADL Scale (Chinese version)
Document(s) reviewed	I. CV of Principal Investigator
Conditions	1. Do not deviate from, or make changes to the study protocol without prior written REC approval, except when it is necessary to eliminate immediate hazards to research subjects or when the change involves only logistical or administrative issues. 2. Apply a clinical trial certificate from Department of Health if indicated. 3. Report the followings to KWC-CREC* : (i) study protocol or consent document changes, (ii) serious adverse event, (iii) study progress (iv) new information that may be relevant to a subject's willingness to continue participation in the study. 4. Report first study progress to KWC-CREC at **12-monthly intervals** until study closure. [*Forms are available from KWC-CREC intranet webpage]

Please quote the CREC Reference **(KW/EX/06-107)** in all your future correspondence with the KWC-CREC, including submission of progress reports and requesting for amendments to the research protocol.

If you have any inquiry, please feel free to contact Mr Lewis LI, Secretary of the KWC-CREC, at 2990 3749. Thank you for your attentions.

Yours sincerely,

(Dr TSAO Yen-chow)
Chairperson
Clinical Research Ethics Committee
Kowloon West Cluster

c.c. DM(O&T), KCH

Secretariat of Clinical Research Ethics Committee, Kowloon West Cluster
Room 133, Block J, Princess Margaret Hospital, Lai Chi Kok, Kowloon, Hong Kong Tel (852) 2990 3749 Fax (852) 2990 1059

Ms LEE Yuet-ying, Grace,
Senior Occupational Therapist
Occupational Therapy Department,
Kwai Chung Hospital

21 March, 2012

Dear Ms LEE,

KWC-REC Ref.: KW/EX/06-107(16-31)(1)

Title: Evaluation of a computer-aided errorless-learning based memory training programme for persons with early dementia

Thank you for submitting the protocol amendment application to the Research Ethics Committee of the Kowloon West Cluster (KWC-REC). I am pleased to inform you that the following amendment item and documents have been reviewed and approved by the KWC-REC through an expedited process on 20 March 2012.

No.	Document/Amendment Type
1	Protocol Amendment Application Form dated 7 February 2012 – Extend the research end date to 30 June 2013

Please note that all conditions pertaining to the previous approval of your research study as stated in my letter of 22 December 2006 are still in force.

If you have any inquiry, please feel free to contact Ms Catherine CHENG, Secretary of the KWC-REC, at 2990 3749. Thank you for your attention.

Yours sincerely,

(Dr YU Wai-cho)
Chairperson
Research Ethics Committee
Kowloon West Cluster

Appendix D: Subject data base form

香港理工大學
葵涌醫院職業治療部
健腦訓練評估表 -- 痴呆症病患者

編號：_____

日期：_____

1. 個人資料

姓　　名：_____　性別 / 年齡：_____

出生日期：_____　教育程度：_____年

入日間醫院 / 中心日期：_____　入日間醫院 / 中心為期：_____月

2. 個人病歷

老人痴呆症：　a) ☐ 亞氏痴呆症　b) ☐ 血管性痴呆症　c) ☐ 混合痴呆症

☐ 長期病患：_____

☐ 心臟病　☐ 高血壓　☐ 糖尿病　☐ 骨質疏鬆症

☐ 中風　(左 / 右腦 _____年)　☐ 慢性阻塞性肺病

☐ 其他　請註明：_____

3. 家人支援

☐ 獨居

☐ 現在是與以下家人同住：

☐ 丈夫　☐ 太太　☐ 兒子　☐ 媳婦

☐ 女兒　☐ 女婿　☐ 孫兒　☐ 孫女

☐ 外籍傭工　☐ 其他：_____

4. 以往有否接受過電腦訓練或記憶訓練？　否 ☐　有 ☐ (請註明：_____)

5. 現在進食的藥物：_____

Appendix E-1: Clinical Dementia Rating Scale (Chinese version)

File no: _____ *Date:* _____ *Starting time of interview:* _____

臨床痴呆評定量表(CDR)

這是一個半結構式晤談。請發問所有問題。如有需要，發問附加問題去評定患者的CDR。請筆錄發問附加問題所獲取的有關資料。

有關「記憶力」的問題（由照顧者回答）

1. 他/她有記憶或思維的問題嗎？ ☐有 ☐沒有
1a. 如果有，這些問題是不是經常出現的？(和"時有時無"相反) ☐是 ☐不是
2. 他/她能回憶最近發生的事情嗎？ ☐經常 ☐有時 ☐很少
3. 假如讓他/她到商店去買3樣，4樣或5樣東西，
   他/她能不用寫字條就能記住買什麼嗎？ ☐經常 ☐有時 ☐很少
4. 這一年來他/她的記憶有減退嗎？ ☐有 ☐沒有
5. 他/她的記憶問題足以干擾他/她日常的活動嗎？
   有沒有因爲他/她的記憶和思維問題，使得他/她四五年前能做的事情，
   他/她現在做得不好或者不能做了？ ☐是 ☐否
6. 他/她會否完全忘記一些重大事件呢？例如幾周內發生的家庭聚會，
   旅行，新聞和社會上的重要事件。 ☐經常 ☐有時 ☐很少
7. 他/她會忘記這些事情的細節嗎？
   例如什麼時候發生和誰在哪兒。 ☐經常 ☐有時 ☐很少
8. 他/她會完全忘記很久以前發生的重要事情嗎？
   例如生日，結婚紀念日等。 ☐經常 ☐有時 ☐很少
9. 過一會兒我要和他/她交談，我想問他/她最近做過的一些他/她應該記得的事情，使我能知道他/她能否記住。所以我需要你告訴我一些事情。上周(或者周末)他/她有沒有做過什麼事情有點和平常不大一樣的？（記錄地點、時間、參加者、進行了多久，何時完結和患者或其他參加者怎樣到達場地等資料作爲稍後的測試之用。）

   一星期內：_____

   _____

   一個月內：_____

   _____

10. 他/她的生日是什麼時候？_____

11. 他/她在哪兒出生的？_____

12. 他/她上的最後一所學校叫什麼名字？那所學校在哪裡？他/她上到什麼年級？

    名稱_____

    地點_____

    年級_____

13. 他/她的主要職業是什麼（如果患者從來沒有工作，他/她配偶主要的工作是什麼）？_____

14. 他/她最後的主要工作是什麼（如果患者從來沒有工作，他/她配偶最後的工作是什麼）？_____

15. 他/她（或配偶）什麼時候退休的？爲什麼退休？_____

有關「定向」的問題（由照顧者回答）

他/她是否經常能夠知道確切的：

1. 日期？

   □經常 □有時 □很少 □不知道

2. 月份？

   □經常 □有時 □很少 □不知道

3. 年份？

   □經常 □有時 □很少 □不知道

4. 星期幾？

   □經常 □有時 □很少 □不知道

5. 當事情的發生有前後關係的時候，他/她在意識此時間關係上有困難嗎？

   □經常 □有時 □很少 □不知道

6. 他/她是否能夠在熟悉的街道找到路？

   □經常 □有時 □很少 □不知道

7. 他/她是否能在自己家居住地區以外的地方知道怎麼從一個地方到另一個地方？

   □經常 □有時 □很少 □不知道

8. 他/她是否能在室內找到路？例如在家裡或熟悉的地方。

   □經常 □有時 □很少 □不知道

有關「判斷和解決問題能力」的問題（由照顧者回答）

☐ 和以前一樣好

☐ 好，但是不如以前

☐ 只是一般

☐ 差

☐ 根本沒有能力

2. 告訴我關於他/她處理少量金錢的能力。和四五年前相比，他/她在找錢或留小費的能力：

☐ 沒有喪失

☐ 有些喪失

☐ 嚴重喪失

3. 他/她處理複雜的財務和交易活動(例如算存折賬，付錢等)的能力與他/她四五年前比較是：

☐ 沒有喪失

☐ 有些喪失

☐ 嚴重喪失

4. 假如家中出事，例如水管漏水或著了小火，他/她會處理得：

☐ 和以前一樣好

☐ 因爲思維問題而惡化了

☐ 因爲其他問題而惡化了，這些問題是：_____

5. 他/她能理解場合或他人的解釋嗎？

☐經常 ☐有時 ☐很少 ☐不知道

6. 他/她在公眾場合或與人交往中還能表現得*恰當嗎？

☐經常 ☐有時 ☐很少 ☐不知道

---

*此項目是評估行爲，而不是外表。

有關「社區活動」的問題（由照顧者回答）

工作方面

1. 患者是否仍然工作？ ☐是 ☐否 ☐不適用

   (如不適用，跳到問題 4; 如是，跳到問題 3; 如不是，跳到問題 2)

2. 他/她決定退休是不是因爲他/她的記憶或思維問題？ ☐是 ☐不是 ☐不知道

   （跳到問題 4）

3. 患者是否由於記憶或思考問題而在工作上出現重大的困難？

   ☐很少或從不 ☐有時 ☐經常 ☐不知道

社交方面

4. 他/她開過車或獨自乘坐過公共交通工具嗎？ ☐是 ☐否

   他/她現在是否仍有開車或獨自乘坐公共交通工具？ ☐是 ☐否

   假若不是，是否由於記憶或思考問題？ ☐是 ☐否

5. 如果他/她仍有開車或獨自乘坐公共交通工具，你認爲由於思維障礙，

   他/她開車或獨自乘坐公共交通工具的時候有什麼問題或危險嗎？ ☐有 ☐沒有

6. *他/她能獨立地去購物嗎？

   ☐很少或從不 （每次購物也需要別人陪伴）

   ☐有時 （購買有限數量的物品；購買重複的物品或忘記購買需要的物品）

   ☐經常

   ☐不知道

7. 他/她能獨立地進行家庭以外的活動嗎？

   ☐很少或從不 （一般來說不能在沒有協助的情況下進行活動）

   ☐有時 （有限的和/或常規的；例如在教會或小組聚會時表面地參與；去美容中心)

   ☐經常 （在活動中有意義地參與，例如投票選舉）

   ☐不知道

8. 他/她有沒有被帶去參加家庭以外的任何社會活動？ ☐有 ☐沒有

   如沒有，爲什麼？_____

9. 一個偶然看到他/她的行爲的人會認爲他/她有什麼問題嗎？ ☐會 ☐否

10. 在護老院裡，他/她能夠好好地參與社會活動（思維）嗎？ ☐能 ☐不能

重點：

有沒有足夠的資料去評估患者在社會活動方面的衰退程度呢？**如沒有，請進一步探究。**

社區事務：例如去教會，探望朋友或家庭成員，政治活動，專業組織，其他專業團體，社會俱樂部，服務組織，教育活動。

_____

***如有需要請筆錄去澄清患者在這方面的功能程度。**

有關「家務和嗜好」的問題（由照顧者回答）

1a. 他/她做家務的能力有什麼改變嗎？_____

_____

1b. 有些甚麼事情是他/她現在還能夠做得好的？_____

_____

2a. 他/她參與嗜好的能力有什麼改變嗎？_____

_____

2b. 有些甚麼事情是他/她現在還能夠做得好的？_____

_____

3. 在護老院裡，有些甚麼事情是他/她不能夠再做得好的(家務和嗜好)？_____

_____

日常活動 (Blessed)：

		沒有喪失	有些喪失	嚴重喪失
4.	做家務的能力	0	0.5	1

請描述：_____

_____

5. 他/她做家務的表現：(選一個。不需要直接問照顧者。)

☐ 缺乏有意義的功能 (只有在很多的督導下才能做簡單的工作，例如鋪床。)

☐ 只能在有限的活動上發揮功用 (在一些督導下，洗碗碟或擺設餐桌能做到可接受的清潔程度。)

☐ 能夠獨立地應付某些工作 (操作機器，例如吸塵機，準備簡單的飯菜。)

☐ 能夠進行日常的活動，但不及一般水平

☐ 在日常的活動表現正常

重點：

有沒有足夠的資料去評估患者在家庭和愛好方面的衰退程度呢？如沒有，請進一步探究。

家務：例如煮食，洗衣服，清潔，購買食品雜貨，倒垃圾，打理庭院，簡單的自我護理，和簡單的家居維修。

嗜好：縫紉，繪畫，手工藝，閱讀，款待來客，攝影，園藝，欣賞劇表現或交響音樂會，木工藝，參與運動。

有關「個人自理」的問題（由照顧者回答）

*請你估計他/她在以下各方面智力技能是怎樣的：

		不需要幫助	有時會扣錯鈕等等	錯誤的程序 時常忘記所需步驟	沒有能力穿衣
1.	穿衣 (Blessed)	0	1	2	3
		不需要有人幫助	需要提示	有時需要幫助	時常或近乎時常需要幫助
2.	洗澡和修飾	0	1	2	3
		乾淨的； 使用適當的餐具	弄跌食物； 只懂用匙	簡單的固體	完全需要別人餵食
3.	飲食習慣	0	1	2	3
		一般完全受控	有時會尿床	時常尿床	雙重失禁
4.	括約肌的控制 (Blessed)	0	1	2	3

---

*如果患者個人護理的水平比以前差，即使不需要提示，也可以考慮給 1 分。

有關「記憶力」的問題 (由患者回答)

1. 你在記憶和思維方面有沒有什麼問題？ □有 □沒有

2. 剛才，你的(配偶等)告訴了我一些近來發生在你身上的事情。你可否告訴我一些它們的內容？(有需要便給提示，例如地點，時間，在場人士，進行了多久，何時完結和患者或其他參加者怎樣到達場地。)

   一星期內

   1.0 –大部份正確 _____

   0.5 –

   _____

   0.0 –大部份不正確 _____

   一個月內

   1.0 –大部份正確 _____

   0.5 –

   _____

   0.0 –大部份不正確 _____

3. 我會給你一個姓名和地址去記住幾分鐘，請跟我重覆一次：(重覆直至它們被記住或最多三次。)

項目	1	2	3	4	5
	陳	大文，	42 號	新填地街，	旺角
	陳	大文，	42 號	新填地街，	旺角
	陳	大文，	42 號	新填地街，	旺角

   (在正確重覆項目下畫線。)

4. 你何時出生的？_____

5. 你在哪裡出生的？_____

6. 哪一間是你最後就讀的學校？

   名稱_____

   地點_____

   年級_____

7. 你的主要職業/工作是甚麼（如果患者從來沒有工作，他/她配偶的主要工作是什麼）？_____

8. 你最後一份主要工作是甚麼（如果患者從來沒有工作，他/她配偶的最後一份工作是什麼）？_____

9. 你（或配偶）何時退休的？爲什麼退休？_____

10. 請重覆我叫你記住的姓名和地址：(在被正確重覆的項目下畫線。)

項目	1	2	3	4	5
	陳	大文，	42 號	新填地街，	旺角

有關「定向」的問題（由患者回答）

記錄患者每題的正式答案。

1. 今天是幾號？ ☐正確 ☐不正確

_____

2. 今天是星期幾？ ☐正確 ☐不正確

_____

3. 現在是幾月份？ ☐正確 ☐不正確

_____

4. 現在是哪一年？ ☐正確 ☐不正確

_____

5. 這裡是什麼地方？ ☐正確 ☐不正確

_____

6. 我們現在在什麼城市或地區？ ☐正確 ☐不正確

_____

7. 現在大概是幾點？ ☐正確 ☐不正確

_____

8. 就在你進到這兒之前，我和什麼人在這兒談話？那個人是誰？ ☐正確 ☐不正確

_____

有關「判斷和解決問題能力」的問題（由患者回答）

指示：如果患者的最初反應不值得零分，評估員需要進一步探究以便評估出患者理解問題的最佳程度。圈出最近似的答案。

相似：

我要問你兩種東西相似的程度，它們會有什麼共同點。這兒是一個例子：假如我問鋼筆和鉛筆有什麼相似之處，你會說它們都是書寫用具。

1. 那麼白蘿蔔和椰菜花有什麼相似之處呢？ _____

(0=蔬菜)
(1=食物，生物，可以煮的等等)
(2=答案不切題；不同；買它們)

2. 那麼寫字檯和書架呢? 它們有什麼相似之處呢? _____

(0=傢俱，辦公室傢俱，兩樣都用來放書)

(1=木做，有腳的)

(2=答案不切題，不同)

不同：

現在讓我來問你兩種東西會有什麼不同。這兒是一個例子：假如我要問糖和醋有什麼不同，你會說，一個是甜的，另一個是酸的。

3. 那麼謊言和錯誤有什麼不同呢? _____

(0=一個是有意，一個是無意)

(1=一壞一好 – 或只解釋其中一樣事物)

(2=其他答案，相似)

4. 河流和排水道有什麼不同呢? _____

(0=天然-人工)

(1=其他答案)

計算：

5. 一元裡有多少個一角？ ☐正確 ☐不正確

6. 六點五元裡有多少個五角？ ☐正確 ☐不正確

7. 用 20 減 3，再用每一個得數接減 3，一直減下去。 ☐正確 ☐不正確

判斷：

8. 如果你一個人到了一個陌生的城市，你會怎樣去找一個你想見的，住在那兒的朋友?

(0=查電話簿，去法院查姓名住址簿，致電共同認識的朋友)

(1=致電警署，致電電話接線生(很多時不會給地址))

(2=沒有清楚的回答)

9. 患者對自己能力的缺陷和生活處境的評估，及他/她對自己爲何在這裡進行評估的理解。

(可能在之前的問題已有覆蓋，但在這裡評分)：

☐洞悉力良好 ☐只能洞悉部分自己能力的缺憾 ☐對自己能力的缺憾洞悉力很少

Finishing time of interview: _____

Actual duration of interview: _____ *minutes*

Appendix E-2: Geriatric Depression Scale- Short Form (Cantonese Version)

老人抑鬱短量表（廣東話口語化版本）

以下的問題是人們對一些事物的感受，答案是没有對與不對。請想一想，在過去一星期內，你是否會有以下的感受。如有的話，請圈「是」，若無的話，請圈「否」。

1	問	1>	喺上個禮拜裡面,你滿唔滿意自己嘅生活呢	是/**否**
	問	2>	咁你係滿多啲,抑或唔滿意多啲呢	
2	問	1>	喺上個禮拜裡面,你有無放棄咗好多以前嘅活動或者啫好呢?	**是**/否
	問	2>	喺上個禮拜裡面,好多以前你鍾意做嘅嘢,係咪已經冇做啦?	
	問	3>	咁喺上個禮拜裡面,你喺朝早或日頭有冇啲嘢做吓?	
			例如:晨運、落街行吓,同人傾吓偈,或者響屋企做吓家務呢	
3	問	1>	喺過去呢個禮拜裡面,你係咪覺得生活空虛呢?	**是**/否
	問	2>	喺上個禮拜裡面,你係咪覺得做人都幾百無聊賴呢?	
4	問	1>	喺上個禮拜裡面,你係咪成日覺得好煩悶呀?	**是**/否
5	問	1>	你上個禮拜嘅心情係咪成日都咁好呢?	是/**否**
	問	2>	咁你喺上個禮拜,係開心嘅時候多啲,定係唔開心嘅時候多啲呢?	
6	問	1>	喺上個禮拜裡面,你有無担心有啲唔好嘅嘢會發生喺自己你身上呢?	**是**/否
7	問	1>	喺上個禮拜裡面,你係咪成日都覺得開心呢?	是/**否**
	問	2>	咁你喺,上個禮拜裡面,係開心多啲,抑或唔開心多啲呢?	
8	問	1>	喺上個禮拜,你有冇覺得無論做乜嘢,都係冇用呢?	**是**/否
	問	2>	喺上個禮拜,你有冇覺得無論做乜嘢,都係無補於事呢?	

9.	問	1>	喺上個禮拜裡面,你係咪寧願留低響老人院 / 屋企,都唔想落街做啲有新意嘅事呢?	**是**/否
	問	2>	喺上個禮拜裡面,你係咪寧願留低響老人院 / 屋企,都唔想落街做啲特別嘅事情呢?	
	問	3>	咁你上個禮拜其實想唔想落街行下,做啲你平時少做嘅嘢?	
10	問	1>	喺上個禮拜裡面,你有冇覺得你的記性比其他老人家差呢?	**是**/否
	問	2>	咁比起兩三個禮拜前,你上個禮拜嘅記性有冇差到呢?	
11	問	1>	喺上個禮拜裡面,你有無覺得做人係一件好事呢?	是/**否**
	問	2>	喺上個禮拜裡面,你覺得做人係有意思嘅 , 係唔係呢?	
12	問	1>	喺上個禮拜裡面,你係咪覺得自己好無用呢?	**是**/否
	問	2>	喺上個禮拜裡面,你有冇覺得自己完全冇用呢?	
13	問	1>	喺上個禮拜,你係咪覺得精力充沛呀?	是/**否**
	問	2>	喺上個禮拜,你係咪好精力呀 ? 或	
	問	3>	喺上個禮拜,你係咪好夠精神呀?	
14	問	1>	喺上個禮拜裡面,你有無覺得你嘅處境係無晒希望呢?	**是**/否
15	問	1>	喺上個禮拜裡面,你係咪覺得大部人嘅情況都好過你?	**是**/否

總分:

_____

評估員: _____ 評估日期:_____

Appendix F-1 Mini-Mental State Examination (Chinese version)

Mini Mental State Examination (簡短智能測驗)

最高 分數
分數

5 ( ) 依家係乜野日子(年份)(季節)(月份)(幾號)(星期幾)?

5 ( ) 我地依家係邊喥?
(九龍/新界/香港) (九龍/新界/香港既邊度)(醫院)(邊層樓)(病房)
或 (九龍/新界/香港) (九龍/新界/香港既邊度)(邊一科診所)
(診所名字)(邊層樓)
或(九龍/新界/香港) (九龍/新界/香港既邊度)(邊條街)(邊一座)
(邊層樓)
或(九龍/新界/香港) (九龍/新界/香港既邊度)(邊個屋村)
(中心名字)(邊層樓)

3 ( ) 依家我會講三樣野既名，講完之後，請你重覆一次。
請記住佢地,因為幾分鐘後,我會叫你再講番俾我聽。
[蘋果]，[鎖匙]，[火車]。依家請你講番哩三樣野俾我聽。
(以第一次講的計分,一個一分;然後重複物件,直至全部 三樣都記住。)

5 ( ) 請你用一百減七，然後再減七，一路減落去，
直至我叫你停為止。(減五次後便停) [93, 86, 79, 72, 65]
或 依家我讀幾個數目俾你聽,請你倒轉頭講番出黎。
【42731】

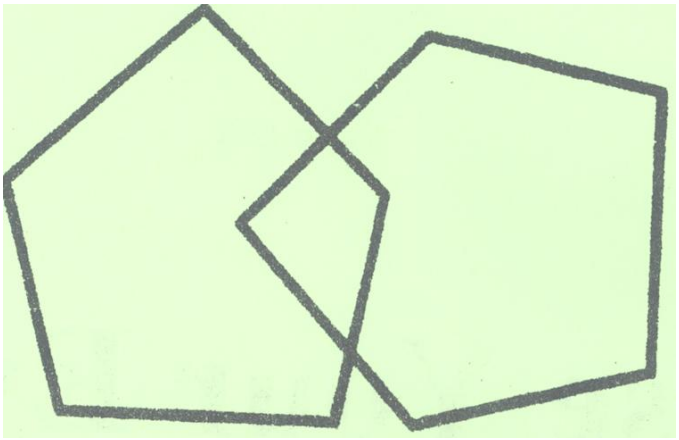
3 ( ) 我頭先叫你記住既三樣野係乜野呀？

9 ( ) 哩樣係乜野？[鉛筆][手錶]。(2)
請你跟我講句說話【姨丈買魚腸】(1)
依家檯上面有一張紙，用你既右手拿起張紙，
用兩隻手一齊將紙摺成一半，然後放番張紙係檯上面。(3)
請讀出哩張紙上面既字，然後照住去做。(1)

[拍手]

請你講任何一句完整的句子俾我聽，例如：【我係一個人】、【今日天氣好好】。(1)

哩處有幅圖，請你照住黎畫啦。(1)



總分: /30

評估員: _____ 評估日期:_____

Appendix F-2: Mattis Dementia Rating Scale (Chinese version)

痴呆症衡量表

中文版

計分表

翻譯者: 陳瑞燕
潘惠玲
蔡明坤
張美珍

姓名　　年齡　　性別

職業　　教育程度

診斷

測驗員　　測驗日期

量度	基本分數	分界 + 或 -	樣本 百分位數	樣本 T 值
▲ 專注力				
● 主動 / 持續性				
★ 構圖				
◆ 概念化				
■ 記憶				
總分				

特許編譯本權予陳瑞燕博士, 香港中文大學, 沙田, 香港
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專注力

A. 數字廣度 (Digit Span)

請跟我唸一些數目字, 例如, 我話 6、7, 你就跟我話 6、7。留心聽我講, 等我講完後, 你至開始講。

A1. 順背

2, 5 _____

3, 1, 6 _____

4, 7, 9, 2 _____

(0, 2, 3, 4) _____

而家我會再講一些數目字, 當我講完之後, 你要將佢地掉轉頭講番出嚟。例如, 我話 1-2, 你就話 2-1... 明白嗎?... 準備開始...

A2. 倒背

1, 4 _____

5, 3, 9 _____

8, 5, 9, 3 _____

(0, 2, 3, 4) _____

分數 A_____▲
(0-8)

B. 連續兩個指令 (Two Successive Commands)

我會叫你做一些動作, 請跟著我講的去做。

B1. "請張開你的口和閉上你的眼睛" (1 分)_____

B2. "請伸出你的舌頭和舉起你的手" (1 分)_____

分數 B_____▲
(0-2)

假如分數 B = 2, 前往 E
C-D 則給予滿分

C. 單一指令 (Single Command)

我會叫你做一些動作, 請跟著我說的去做。

C1. "張開你的口" (1 分)_____

C2. "伸出你的舌頭" (1 分)_____

C3. "閉上你的眼睛" (1 分)_____

C4. "舉起你的右手" (1 分)_____

分數 C_____▲
(0-4)

D. 模仿 (Imitation)

睇住我...請跟著我做的照做。

D1. 張開口 (1 分)_____

D2. 搖頭 (1 分)_____

D3. 閉上眼睛 (1 分)_____

D4. 舉起手 (1 分)_____

分數 D_____▲
(0-4)

主動和持續性

E. 複雜口語的主動/持續性(Complex Verbal Initiation/Perseveration)

請你講俾我聽在超級市場裡所有可以買到的東西, 儘量講, 講得越多越好, 直至我叫你停為止...開始... (時限 60 秒, 每個正確答案可得 1 分)

1 _____	11 _____
2 _____	12 _____
3 _____	13 _____
4 _____	14 _____
5 _____	15 _____
6 _____	16 _____
7 _____	17 _____
8 _____	18 _____
9 _____	19 _____
10 _____	20 _____

分數 E_____
(0-20)

假如分數 E > 13, 前往 I
F-H 則給予滿分

F. 簡單口語的主動/持續性 (Simple Verbal Initiation/Perserveration)

請你講俾我聽所有有關衣服的名稱。你可以用我和你身上的衣服作為參考。 (時限 60 秒, 每個正確答案可得 1 分)

1 _____	5 _____
2 _____	6 _____
3 _____	7 _____
4 _____	8 _____

分數 F_____
(0-8)

G. 輔音持續 (Consonant Perseveration)

請跟我講 "bee"... 跟我講 "key"... 跟我講 "gee"...
依家請講 4 次 "bee – key – gee"

"bee – key – gee"-- 4 次 (1 分)_____

分數 G_____
(0-1)

H. 元音持續 (Vowel Perseveration)

請跟我講 "bee"... 跟我講 "bah"... 跟我講 "boh"...

依家請講 4 次 "bee – bah – boh"

"bee – bah – boh" -- 4 次 (1 分)_____ 分數 H_____●
(0-1)

I. 雙重交替動作 (Double Alternating Movements)

依家我想你用手做一些動作。睇住我做, 然後照樣跟住我做。一隻手心向上, 一隻手心向下, 然後調轉... 你繼續做, 直至我叫你停為止。

一隻手心向上, 一隻手心向下 -- 5 次 (1 分)_____ 分數 I_____●
(0-1)

假如分數 I = 1, 前往 L
J-K 則給予滿分

J. 雙重交替動作 (Double Alternating Movements)

依家這樣做...一隻手握拳頭, 一隻手放開手指, 然後調轉... 你繼續做, 直至我叫你停止。

一隻手握拳頭, 一隻手放開手指 -- 5 次 (1 分)_____ 分數 J_____●
(0-1)

K. 交替敲拍動作 (Alternate Tapping)

依家這樣做... 敲左, 然後敲右, 再敲左, 然後再敲右...你繼續做, 直至我叫你停為止。

敲左, 然後敲右 -- 10 次 (1 分)_____ 分數 K_____●
(0-1)

L. 繪圖設計 1 (Graphomotor Design 1)

展示測試工具小冊子內的咭 1, 並給予受試者一張白紙。 **喺哩度 (手指白紙), 照哩個圖案畫出來** (以手由左至右指著 "壁壘"圖案)。

畫出 "壁壘" (1 分) _____ 分數L_____●
(0-1)

假如分數 L = 1, 前往 P
M-O 則給予滿分

M. 繪圖設計 2 (Graphomotor Design 2)

展示測試工具小冊子內的咭 2。**喺哩度** (手指白紙), **照哩個圖案畫出來** (手指"圓形")。

畫出 "圓形" (1 分) _____ 分數 M_____●
(0-1)

N. 繪圖設計 3 (Graphomotor Design 3)

展示測試工具小冊子內的咭 3。**喺哩度** (手指白紙), **照哩個圖案畫出來** (手指"X")。

畫出 "X" (1 分) _____ 分數 N_____●
(0-1)

O. 繪圖設計 4 (Graphomotor Design 4)

展示測試工具小冊子內的咭 4。**喺哩度** (手指白紙), **照哩個圖案畫出來** (手指"交替的 XOXO" 圖案)。

畫出 "交替的 XOXO" (1 分) _____ 分數 O_____● (0-1)

構圖

P. 構圖設計 1 (Construction Design 1)

展示測試工具小冊子內的咭 5, 然後將圖案反轉。**喺哩度** (手指白紙), **照哩個圖案畫出來** (手指"直線")。

畫出 "直線" (1 分) _____ 分數 P_____★ (0-1)

Q. 構圖設計 2 (Construction Design 2)

展示測試工具小冊子內的咭 6。**喺哩度** (手指白紙), **照哩個圖案畫出來** (手指"包含菱形的正方形")。

畫出 "包含菱形的正方形" (1 分) _____ 分數 Q_____★ (0-1)

假如分數 Q = 1, 前往 V R-U 則給予滿分

R. 構圖設計 3 (Construction Design 3)

展示測試工具小冊子內的咭 7。**喺哩度** (手指白紙), **照哩個圖案畫出來** (手指"正方形及菱形")。

畫出 "正方形及菱形" (1 分) _____ 分數 R_____★ (0-1)

S. 構圖設計 4 (Construction Design 4)

展示測試工具小冊子內的咭 8。**喺哩度** (手指白紙), **照哩個圖案畫出來** (手指"菱形")。

畫出 "菱形" (1 分) _____ 分數 S_____★ (0-1)

T. 構圖設計 5 (Construction Design 5)

展示測試工具小冊子內的咭 9。**喺哩度** (手指白紙), **照哩個圖案畫出來** (手指"正方形")。

畫出 "正方形" (1 分) _____ 分數 T_____★ (0-1)

U. 構圖設計 6 (Construction Design 6)

請寫出自己的姓名 (手指白紙)。

寫出自己的姓名 (1 分) _____ 分數 U_____★ (0-1)

概念化

V. 相同及不同 (Identities and Oddities)

依次展示咭 10 至 17。看看這 3 個圖案, 講俾我聽邊兩個是相同的...邊兩個是比較相似的？ 然後重新展示咭 10 至 17。**看看這 3 個圖案, 邊一個是不同的...邊一個跟其他是不同類的？**

V1. 咭 10 相同 (1 分) _____ 不同 (1 分) _____
V2. 咭 11 相同 (1 分) _____ 不同 (1 分) _____
V3. 咭 12 相同 (1 分) _____ 不同 (1 分) _____
V4. 咭 13 相同 (1 分) _____ 不同 (1 分) _____
V5. 咭 14 相同 (1 分) _____ 不同 (1 分) _____
V6. 咭 15 相同 (1 分) _____ 不同 (1 分) _____
V7. 咭 16 相同 (1 分) _____ 不同 (1 分) _____
V8. 咭 17 相同 (1 分) _____ 不同 (1 分) _____ 分數 V_____◆
(0-16)

W. 近似點 (Similarities)

_____ 和 _____ 係邊方面是相似的 ?... 他們有什麼相同的地方？ 記錄答案。

W1. 蘋果和香蕉 _____(0-2 分)_____
W2. 褸和恤衫 _____(0-2 分)_____
W3. 船和車 _____(0-2 分)_____
W4. 檯和椅 _____(0-2 分)_____ 分數 W_____◆
(0-8)

假如分數 W > 5, 前往 AA
X-Z 則給予滿分

X. 歸納思考 (Priming Inductive Reasoning)

請講出 3 種 可以食的東西 / 穿係身上的東西 / 交通工具。_____, _____和 _____ 係邊方面是相似的 ?...他們有什麼相同的地方？ 記錄答案。

X1. 可以食的東西_____ _____ _____
回應_____(1 分)_____
X2. 穿係身上的東西_____ _____ _____
回應_____(1 分)_____
X3. 交通工具_____ _____ _____
回應_____(1 分)_____ 分數 X_____◆
(0-3)

Y. 不同點 (Differences)

我依家講 3 種東西, 請你講俾我聽邊一個跟其他係不同的。

Y1. 狗、貓、貌 (1 分)_____
Y2. 門、男孩、男人 (1 分)_____

Y3. 魚、車、船　　(1 分)_____　　分數 Y_____◆
(0-3)

Z. 近似點 – 選擇題 (Similarities – Multiple Choice)

_____ 和 _____ … 他們都是 _____, 還是 _____, 還是 _____ ?

Z1. 蘋果 - 香蕉
- 皆是水果　(2 分)_____
- 皆是蔬菜　(1 分)_____
- 皆是動物　(0 分)_____

Z2. 褸 - 恤衫
- 皆是衣服　(2 分)_____
- 皆是羊毛　(1 分)_____
- 皆是水果　(0 分)_____

Z3. 船 - 車
- 皆是交通工具　(2 分)_____
- 皆是可以行走的　(1 分)_____
- 皆是衣服　(0 分)_____

Z4. 檯 - 椅
- 皆是傢俬　(2 分)_____
- 皆是木頭　(1 分)_____
- 皆是交通工具　(0 分)_____

分數 Z_____◆
(0-8)

AA. 文字回憶 – 閱讀句子 (Verbal Recall – Sentence Reading)

展示測試工具小冊子內的咭 18。**請大聲讀出哩句句子。請記住佢, 因為我遲些會叫你再講番出來。**　(不評分)

AB. 文字回憶 – 隨意創作句子 (Verbal Recall - Sentence Initiation)

請隨便講出一句完整的句子。 請記住佢, 因為我遲些都會叫你再講番出來。記錄句子。

_____ (1 分)　　分數 AB_____◆
(0-1)

記憶

AC. 定向 (Orientation)

AC1. 今日係星期幾？　(1 分)_____
AC2. 係幾多號？　(1 分)_____
AC3. 係幾多月？　(1 分)_____
AC4. 今年係西曆幾多年？　(1 分)_____
AC5. 香港現任的特區首長係邊一個？(1 分)_____
AC6. 你依家喺邊度？　(1 分)_____

AC7. 這裡是甚麼城市？ (1 分)_____

AC8. 你今年幾多歲？ (1 分)_____

AC9. 你係邊度出世？ (1 分)_____ 分數 AC_____■
(0-9)

AD. 分心數數目 1 (Counting Distraction 1)

展示測試工具小冊子內的咭 19。 (把咭轉直) **數下有幾多個數目字 "7", 指俾我睇。**

分數 AD_____▲
(0-6)

AE. 分心數數目 2 (Counting Distraction 2)

展示測試工具小冊子內的咭 20。**數下有幾多個數目字 "7", 指俾我睇。**

分數 AE_____▲
(0-5)

AF. 文字回憶 – 閱讀 (Verbal Recall – Reading)

頭先我叫你大聲讀左一句句子, 你記得嗎？請講番俾我聽。
記錄句子。

_____

完整句子 (4 分) _____ 灰色 (1 分) _____
小孩 (1 分) _____ 小狗 (1 分) _____ 分數AF_____■
(0-4)

AG. 文字回憶 – 隨意創作 (Verbal Recall – Initiation)

頭先我叫你作左一句完整的句子, 你記得嗎？請講番俾我聽。
記錄句子。

_____

完整句子 (3 分) _____
與原句相同的任何一個字 (1 分) _____
與原句相同的另一個字 (1 分) _____ 分數AG_____■
(0-3)

AH. 文字辨認 – 展示 (Verbal Recognition – Presentation)

展示測試工具小冊子內的咭 21。**請大聲讀出以下的詞語 4 次, 儘量記住每個詞語。**

AH1. 1st 正確讀出 (1 分) _____
AH2. 2nd 正確讀出 (1 分) _____
AH3. 3rd 正確讀出 (1 分) _____
AH4. 4th 正確讀出 (1 分) _____ 分數 AH_____▲
(0-4)

AI. 文字辨認 (Verbal Recognition)

我依家會俾你睇一些詞語, 每次兩個, 請你講俾我聽邊一個詞語係你頭先讀過的。逐一展示測試工具小冊子內的咭 22 至 26。

AI1. *黃昏* - 頭腦 (1 分) ___ AI4. *機器* - 夜晚 (1 分) ___

AI2. 尺寸 - *植物* (1 分) ___ AI5. *火花* - 牛奶 (1 分) ___

AI3. 土地 - *開關* (1 分) ___

分數 AI_____■
(0-5)

AJ. 視覺配對 (Visual Matching)

展示測試工具小冊子內的咭 27 及 28。 **我哩張咭** (手指咭 28) **上面的圖案, 同哩張咭**(手指咭 27)**上面的係完全一樣。當我指住我哩張咭上面的圖案時, 我想你指俾我睇, 係你張咭上面同佢一樣的圖案。邊一個圖案同哩個一樣** (從受試者的角度觀看,手指咭 27 上的左上角圖案)**?** 以任何次序, 配對其餘三個圖案。重覆三次。

AJ1. 1st 呈現圖案 (1 分) _____

AJ2. 2nd 呈現圖案 (1 分) _____

AJ3. 3rd 呈現圖案 (1 分) _____

AJ4. 4th 呈現圖案 (1 分) _____

分數 AJ_____▲
(0-4)

AK. 視覺記憶 (Visual Memory)

我依家會俾你睇一些圖案, 每次兩個, 請你講俾我聽, 邊一個圖案係你頭先見過的。逐一展示測試工具小冊子內的咭 29 至 32。

AK1. 左 (1 分) _____ AK3. 右 (1 分) _____

AK2. 右 (1 分) _____ AK4. 左 (1 分) _____

分數 AK_____■
(0-4)

Appendix F-3: Hong Kong List Learning Test (HKLLT) 2nd Edition

Hong Kong List Learning Test (HKLLT)
香港文字記憶學習測試
Agnes S. Chan, Ph.D., & Isaac C. Kwok, B.S.Sc
陳瑞燕博士及郭澤恩先生

Record Form 記錄表

Form 1 (Random Condition) 表一（隨意詞句）

(Trial 1)(第一回)
「我會讀一些詞語給你聽，請你儘量記住它們。當我讀完之後，請你告訴我你記得的詞語，次序不要緊，你記得多少便多少。你有沒有問題呢？沒有便開始。」

(Trial 2 & 3)(第二及第三回)
「我會將那些詞語再讀多一次給你聽，請你儘量記住它們。我讀完之後，請你告訴我所有你記得的詞語，連同你剛說給我聽的那些都請再說一次，次序不要緊，預備好便開始。」

	Trial 1 第一回	Trial 2 第二回	Trial 3 第三回
祖母 Δ			
書檯 ○			
印度 ♦			
鏡子 ○			
瑞士 ♦			
嬸母 Δ			
茄子 ▼			
姪女 Δ			
寮國 ♦			
黃瓜 ▼			
智利 ♦			
表弟 Δ			
電燈 ○			
芥菜 ▼			
衣櫃 ○			
洋葱 ▼			

你用什麼方法幫助你

_____

_____

(Trial 4, 10-minute delay recall) (第四回，十分鐘後口述)
「我剛才讀過一些詞語給你記，讀過三次，請你現在告訴我那些詞語是什麼，次序不要緊，預備好便開始。」

	Trial 4 第四回
祖母 Δ	
書檯 ○	
印度 ♦	
鏡子 ○	
瑞士 ♦	
嬸母 Δ	
茄子 ▼	
姪女 Δ	
寮國 ♦	
黃瓜 ▼	
智利 ♦	
表弟 Δ	
電燈 ○	
芥菜 ▼	
衣櫃 ○	
洋葱 ▼	

(Trial 5, 30-minute delay recall) (第五回，三十分鐘後口述)
「我剛才讀過一些詞語給你記，讀過三次，請你現在告訴我那些詞語是什麼，次序不要緊，預備好便開始。」
(Recognition)(別認)
「現在我讀一些詞語給你聽，當中有部份你剛才已聽過，有部份則是未聽過的。如果你曾聽過，你就說舊的。如果是新詞語，你就說新的。」

	Trial 5 第五回	Recognition 別認					
祖母 Δ		電燈	O		油菜	NSR	
書檯 ○		茄子	O		印度	O	
印度 ♦		地氈	NR		表哥	NSR	
鏡子 ○		衣架	NSR		游水	N	
瑞士 ♦		姪女	O		鏡子	O	
嬸母 Δ		狐狸	N		跑步	N	
茄子 ▼		姑丈	NR		嬸母	O	
姪女 Δ		書檯	O		瑞士	O	
寮國 ♦		寮國	O		火車	N	
黃瓜 ▼		秋天	N		豌豆	NR	
智利 ♦		荷蘭	NR		衣櫃	O	
表弟 Δ		祖母	O		芥菜	O	
電燈 ○		印尼	NSR		暴風	N	
芥菜 ▼		表弟	O		洋葱	O	
衣櫃 ○		輪船	N		黃瓜	O	
洋葱 ▼		智利	O		獅子	N	

評估員: _____ 評估日期:_____

Appendix F-4: Modified Barthel Index(Chinese version) (Leung, 2003)

中文版 Barthel Index 評級標準

基本評級標準

Barthel Index 是一個日常生活自我照顧能力的尺度。此尺度共有十項的活動，包括進食、個人衛生、穿衣、洗澡、如厠、大小便控制、床椅轉移、步行和上落樓梯。每個活動的評級可分為五級，不同的級別代表了不同程度的獨立能力。最低的是一級，而最高是五級。級數越高，代表獨立能力越高。以下是基本的評級標準：

1. 完全依賴別人去完成整項活動。
2. 某程度上能參與，但在整個活動的過程中都需要別人提供協助才能完成。
   註：【整個活動的過程】可介定為有超過一半的活動過程。
3. 能參與大部份的活動，但在某些過程中仍需要別人提供協助才能完成整項活動。
   註：【某些過程】可介定為一半或以下的工作。
4. 除了在準備或收拾時需要協助，病人可以獨立完成整項活動；或進行活動時需要別人從旁監督或提示，以策安全。
   註：【準備或收拾】是指一些可在測試前後去處理的非緊急活動過程。
5. 可以獨立完成整項活動而毋需別人在旁監督、提示或協助。

個別活動的評級標準：

(1) 進食

進食的定義是用合適的食具將食物由容器送到口中。整個過程包括咀嚼及吞嚥。

評級標準：

1. 完全依賴別人協助進食。
2. 某程度上能運用食具，通常是匙羹或筷子。但在進食的整個過程中都需要別人提供協助。
3. 能運用食具，通常用匙羹或筷子。但進食的某些過程仍需要別人提供協助。
4. 除了在準備或收拾時需要協助，病人可以自行進食；或過程中需有人從旁監督或提示，以策安全。
5. 可自行進食，而毋需別人在場監督、提示或協助。

先決條件：

- 病人有合適的座椅或靠背支撐，
- 食物須放置於病人能伸手可及的盛盤或桌子上

進食方式：

- 口部進食或使用喉管進食

準備或收拾活動：

例子：

- 戴上及除下進食輔助器具

考慮因素：

- 哽咽並不視作進食的一部份，但如哽咽令安全受到影響，則表現應被降級
- 不需考慮病人在進食時身體是否能保持平衡，但如安全受到影響，則表現應被降級
- 喉管進食的過程並不需考慮插入及取出喉管

(2) 個人衛生

個人衛生包括洗臉、洗手、梳頭、保持口腔清潔(包括假牙齒)、剃鬚(適用於男性)及化妝(適用於有需要的女性)。

評級標準：

1. 完全依賴別人處理個人衛生。
2. 某程度上能參與，但在整個活動的過程中都需要別人提供協助才能完成。
3. 能參與大部份的活動，但在某些過程中仍需要別人提供協助才能完成整項活動。
4. 除了在準備或收拾時需要協助，病人可以自行處理個人衛生；或過程中需有人從旁監督或提示，以策安全。
5. 自行處理個人衛生，而毋需別人在場監督、提示或協助。男性病人可自行剃鬚，而女性病人則可自行化妝及理髮。

先決條件 ：

- 病人在設備齊全的環境下進行測試
- 所有用具須放置在病人能伸手可及的範圍內
- 鬚刨須已通電，並已插入刀片

使用方法：

- 床邊，瓷盆側或洗手間內

準備或收拾活動：

例子：

- 事前將一盆水放在床邊或更換清水
- 事先用輪椅或便椅將病人堆到瓷盆傍邊
- 準備或清理梳洗的地方
- 戴上或除下輔助器具

考慮因素：

- 往返洗手間的步行表現並不作考慮之列
- 化妝只適用於平日需要化妝的女士

(3) 穿衣

穿衣包括穿上、脫下及扣緊衣物；有需要時也包括腰封、義肢及矯形架。

評級標準：

1. 完全依賴別人協助穿衣。
2. 某程度上能參與，但在整個活動的過程中都需要別人提供協助才能完成。
3. 能參與大部份的活動，但在某些過程中仍需要別人提供協助才能完成整項活動。
4. 除了在準備或收拾時需要協助，病人可以自行穿衣；或過程中需有人從旁監督或提示，以策安全。
5. 自行穿衣而無需別人監督、提示或協助。

先決條件：

- 所有衣物必須放在伸手可及的範圍內

衣物的種類：

- 衫、袂、鞋、襪及需要時包括腰封、義肢及矯形架
- 可接受改良過的衣服，如鞋帶換上魔術貼
- 不包括帽、胸圍、皮帶、領呔及手套

準備或收拾活動：

例子：

- 於穿衣後將扭扣扣上
- 穿鞋後把鞋帶束緊

考慮因素：

- 到衣櫃或櫃桶拿取衣物將不作評級考慮之列

(4) 洗澡

洗澡包括清潔、沖洗及抹乾由頸至腳的部位。

評級標準：

i. 完全依賴別人協助洗澡。
i. 某程度上能參與，但在整個活動的過程中都需要別人提供協助才能完成。
i. 能參與大部份的活動，但在某些過程中仍需要別人提供協助才能完成整項活動。
v. 除了在準備或收拾時需要協助，病人可以自行洗澡；或過程中需有人從旁監督或提示，以策安全。
v. 病人可用任何適當的方法自行洗澡，而毋需別人在場監督、提示或協助。

先決條件：

- 病人在洗澡的地方內進行測試
- 所有用具都須放於洗澡地方的範圍內

洗澡方法 ：

- 盤浴(浴缸)、淋浴(花灑)、海綿浴、抹身、用桶或盆洗身、用沖涼椅或浴床

準備或收拾活動：

例子：

- 在洗澡前後準備或更換清水
- 開啟或關閉熱水爐

考慮因素：

- 包括在浴室內的體位轉移或步行表現，但毋需考慮往返浴室的步行表現
- 不包括洗頭、攜帶衣物和應用物品進出浴室及洗澡前後穿脫衣物

(5) 如廁

如廁包括在廁盆上坐下及站起，脫下及穿回褲子，防止弄髒衣物及附近環境，使用廁紙和用後沖廁。

評級標準：

1. 完全依賴別人協助如廁。
2. 某程度上能參與，但在整個活動的過程中都需要別人提供協助才能完成。
3. 能參與大部份的活動，但在某些過程中仍需要別人提供協助才能完成整項活動。
4. 除了在準備或收拾時需要協助，病人可以自行如廁；或過程中需有人從旁監督或提示，以策安全。
5. 病人可用任何適當的方法自行如廁，而毋需別人在場監督、提示或協助。如有需要，病人亦可在晚間使用便盆、便椅或尿壺。然而，此類方法需包括將排泄物倒出並把器皿清洗乾淨。

先決條件：

- 病人在設備齊全的廁所內進行測試
- 廁紙須伸手可及

如廁設備：

- 尿壺、便盆、便椅、尿管、尿片、痰罐、坐廁或蹈廁

準備或收拾活動：

例子：

- 於如廁前後準備、清理或清洗如廁設備

考慮因素：

- 包括在廁所內的體位轉移或步行表現，但毋需考慮往還廁所的步行表現
- 可接受使用輔助器具，例如助行器及扶手
- 不需考慮病人是否能表達如廁需要
- 若如廁後把衣服和附近環境弄髒,其表現應被降級，但把身體弄髒將不作評級考慮之列
- 若需要跨過門檻進出廁所，其表現應需被考慮及評級
- 上述適當的方法是指一些被社會認同的方法。例如病人用嗽口盅誤作如廁的設備，其表現應被降級。

(6) 肛門控制 (大便控制)

肛門(大便)控制是指能完全地控制肛門或有意識地防止大便失禁。

評級標準：

1. 完全大便失禁。
2. 在擺放適當旳姿勢和誘發大腸活動的技巧方面需要協助，並經常出現大便失禁。
3. 病人能作出適當旳姿勢，但未能運用誘發大腸活動的技巧；或在清潔身體及替換紙尿片方面需要協
4. 並間中出現大便失禁。
5. 甚少出現大便失禁，病人在使用栓藥或灌腸器時需要監督；或需要定時有人從旁提示，以防失禁。
6. 沒有大便失禁，在需要時病人亦可自行使用栓藥或灌腸器。

其他方法：

- 肛門造口或使用紙尿片

考慮因素：

-【經常大便失禁】可介定為有超過一半的時間出現失禁

-【間中大便失禁】可介定為有一半或以下的時間出現失禁

-【甚少大便失禁】可介定為每月有不多於一次的大便失禁

- 評級包括保持身體清潔及有需要時能使用拴藥或灌腸器
- 若排便後把身體弄髒，其表現應被降級，但把衣服和附近環境弄髒將不作評級考慮之列
- 若病人長期便秘而需要別人定時協助放便，其情況應視作大便失禁。
- 病人如能自行處理造口或使用紙尿片，應視作完全沒有大便失禁。若造口或尿片發出異味而病人未能及時替換，

其表現應被降級。

(7) 膀胱控制 (小便控制)

膀胱(小便)控制是指能完全地控制膀胱或有意識地防止小便失禁。

評級標準：

1. 完全小便失禁。
2. 病人經常小便失禁。
3. 病人通常在日間能保持乾爽但晚上小便失禁，並在使用內用或外用輔助器具時需要協助。
4. 病人通常能整天保持乾爽但間中出現失禁；或在使用內用或外用輔助器具時需要監督；或需要定時從旁提示，以防失禁。
5. 沒有小便失禁，在需要時病人亦可自行使用內用或外用輔助工具。

其他方法：

- 內置尿管、尿套或使用紙尿片

考慮因素：

-【經常小便失禁】可介定為有超過一半的時間出現失禁

-【間中小便失禁】可介定為有一半或以下的時間出現失禁

-【甚少小便失禁】可介定為每星期有不多於一次的小便失禁

- 包括保持身體清潔及有需要時能插入及除去尿導管或尿套

- 若便溺後把身體弄髒或發出臭味，其表現應被降級，但把衣服和附近環境弄髒將不作評級考慮之列

(8) 床椅轉移

病人將輪椅移至床邊，把煞掣鎖緊及拉起腳踏，然後將身體轉移到床上並躺下。再坐回床邊(在有需要時可移動輪椅的位置)，並將身體轉移坐回輪椅上。

評級標準：

1. 完全依賴或需要兩人從旁協助或要使用舉重器來幫助轉移。
2. 某程度上能參與，但在整個活動的過程中都需要別人提供協助才能完成。
3. 能參與大部份的活動，但在某些過程中仍需要別人提供協助才能完成整項活動。
4. 除了在準備或收拾時需要協助，病人可以自行轉移；或過程中需有人從旁監督或提示，以策安全。
5. 自行轉移來回床椅之間，並無需別人從旁監督、提示或協助。

其他轉移方法：

- 由便椅轉移到床上
- 由坐椅轉移到床上

準備或收拾活動：

例子：

- 如測試前將椅子的位置移好至某個角度

考慮因素：

- 包括移動椅子到適當的位置
- 可利用輔助器具，例如床欄和馬騮拉架而不被降級

(9) 步行

步行從病人站立開始，在平地步行五十米。病人在有需要時可戴上及除下腳架或義肢，並能適當地使用助行器。

評級標準：

1. 完全不能步行。
2. 某程度上能參與，但在整個活動的過程中都需要別人提供協助才能完成。
3. 能參與大部份的活動，但在某些過程中仍需要別人提供協助才能完成整項活動。
4. 可自行步行一段距離，但不能完成五十米；或過程中需有人從旁監督或提示，以策安全。
5. 自行步行五十米，並無需其他人從旁監督、提示或協助。

考慮因素：

- 需要時可用助行器而不被降級
- 評級包括要擺放助行器在適當的位置

(9A) 輪椅操控 (代替步行)

輪椅操控包括在平地上推動輪椅、處理彎角，及操控輪椅至桌邊、床邊或洗手間等。病人需操控輪椅並移動最少五十米。

評級標準：

1. 完全不能操控輪椅。
2. 可在平地上自行推動輪椅並移動短距離，但在整個活動的過程中都需要別人提供協助才能完成。
3. 能參與大部份的輪椅活動，但在某些過程中仍需要別人提供協助才能完成整項活動。
4. 可推動輪椅、轉彎，及圍繞桌邊、床邊或洗手間等，但在準備及收拾時仍需協助；或過程中需有人從旁監督或提示，以策安全。
5. 可完全自行操控輪椅並移動最少五十米，並無需其他人從旁監督、提示或協助。

先決條件：

- 此項目只適用於在第 9 項中被評為【完全不能步行】的病人，而此類人仕必須曾接受輪椅操控訓練。

準備或收拾活動：

例子：

- 需要額外精力準備及配合環境，例如在狹窄的轉角位移走障礙物

(10) 上落樓梯

上落樓梯是指可安全地在兩段分別有八級的樓梯來回上下行走.。

評級標準：

1. 完全依賴別人協助上落樓梯。
2. 某程度上能參與，但在整個活動的過程中都需要別人提供協助才能完成。
3. 能參與大部份的活動，但在某些過程中仍需要別人提供協助才能完成整項活動。
4. 病人基本上不需要別人協助，但在準備及收拾時仍需協助；或過程中需有人從旁監督或提示，以策安全。
5. 病人可在沒有監督、提示或協助下，安全地在兩段樓梯上落。有需要時，可使用扶手或 / 及助行器。

先決條件：

- 病人可步行

準備或收拾活動：

例子：

- 自行將助行器擺放在適當的位置

考慮因素：

-- 可接受使用扶手和助行器而毋須被降級

一 完 一

Remarks: The Chinese Barthel Index was prepared by Sharron O C Leung & Chetwyn C H Chan in 2001. The research version was based on the Barthel Index modified by Shah, Vanclay & Cooper in 1989.

Modified Barthel Index

(中文版) 紀錄表

日常生活自我照顧能力評估

診斷：_____

日期	/ /		/ /	
日常生活自我照顧活動	病人分數	備註	病人分數	備註
個人衛生	/ 5		/ 5	
進食	/ 10		/ 10	
穿衣	/ 10		/ 10	
如廁	/ 10		/ 10	
洗澡	/ 5		/ 5	
床椅轉移	/ 15		/ 15	
*步行 / 輪椅操控	/ 15		/ 15	
上落樓梯	/ 10		/ 10	
膀胱控制 (小便控制)	/ 10		/ 10	
肛門控制 (大便控制)	/ 10		/ 10	
總分	**/ 100**		**/ 100**	
***依賴別人的程度**	**完全依賴別人 嚴重 中度 輕度 完全獨立**		**完全依賴別人 嚴重 中度 輕度 完全獨立**	
評估員				

* 「輪椅操控」只適用於在「步行」項目中被評為「完全不能步行」的病人，而此類人士必須曾接受
輪椅操控訓練。

* 將不適用者刪去

每一項活動的個別評級標準

評級標準 日常生活自我照顧活動	1 完全依賴別人	2 某程度上能參與但都需要協助	3 能參與大部份的活動但仍需要協助	4 從旁監督或提示以策安全	5 獨立完成整項活動
個人衛生	0	1	3	4	5
進食	0	2	5	8	10
穿衣	0	2	5	8	10
如廁	0	2	5	8	10
洗澡	0	1	3	4	5
床椅轉移	0	3	8	12	15
步行	0	3	8	12	15
輪椅操控	0	1	3	4	5
上落樓梯	0	2	5	8	10
膀胱控制 (小便控制)	0	2	5	8	10
肛門控制 (大便控制)	0	2	5	8	10
總分					100

Ref: Leung, S., & Chan, C. (2001); Shah, S., Vanclay, F., & Cooper, B. (1989)

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OT / TEAM 6 / 8 (Revised on 20 February 2004) Prepared by LEE C. K. John

Appendix F-5: The Lawton Instrumental Activities of Daily Living Scale

The Lawton Instrumental Activities of Daily Living Scale

(Chinese version)(Tong & Man, 2002)

洛頓家居活動功能評估

	項目	
1.	“你能唔能夠自己用電話?” 包括找電話號碼、 打及接聽電話	
	不需要任何幫忙	3
	可以自己做, 但做的時候有困難	2
	需要一些幫忙	1
	完全不能自己做	0
2.	“你能唔能夠自己搭車?” 包括自己上到正確的車, 俾車錢/ 買車票、上/ 落車 (假設你必須要搭交通工具去一個遠的地方, 例如探朋友/ 睇醫生)	
	不需要任何幫忙	3
	可以自己做, 但做的時候有困難	2
	需要一些幫忙	1
	完全不能自己做	0
3.	“你能唔能夠自己買野呢?” 包括自己揀貨品, 俾錢及攞返屋企 (假設你必須要到附近商店買食物及日用品)	
	不需要任何幫忙	3
	可以自己做, 但做的時候有困難	2
	需要一些幫忙	1
	完全不能自己做	0
4.	“你能唔能夠自己煮食呢?” 包括自己諗食咩、準備材料、煮熟食物及放入碗碟內. (假設你必須要自己準備兩餐)	
	不需要任何幫忙	3
	可以自己做, 但做的時候有困難	2
	需要一些幫忙	1
	完全不能自己做	0

5.	“你能唔能夠自己做家務呢?” (假設你必須要自己做家務) 包括簡單家務 (如抹檯、執床、洗碗)及較重的家務 (如抹窗/ 地)	
	不需要任何幫忙	3
	可以自己做, 但做的時候有困難	2
	需要一些幫忙	1
	完全不能自己做	0
6.	“你能唔能夠應付簡單嘅家居維修呢?” 例如換燈泡、維修檯及上緊螺絲等 第假設你必須自己做)	
	不需要任何幫忙	3
	可以自己做, 但做的時候有困難	2
	需要一些幫忙	1
	完全不能自己做	0
7.	“你能唔能夠自己洗衫呢?” 包括清洗及晒自己的衫、被及床單等 (假設你必須要洗自己的衫、被、床單等)	
	不需要任何幫忙	3
	可以自己做, 但做的時候有困難	2
	需要一些幫忙	1
	完全不能自己做	0
8.	“你能唔能夠自己服用藥物呢?” (假設你必須查藥油或食藥等)	
	不需要任何幫忙	3
	可以自己做, 但做的時候有困難	2
	需要一些幫忙	1
	完全不能自己做	0
9.	“你能唔能夠處理自己嘅財務呢?” 包括日常錢銀找續、交租/ 水電費及到銀行提款 (假設你必須要買野、自己交租/ 水電費及將錢放在銀行)	
	不需要任何幫忙	3
	可以自己做, 但做的時候有困難	2
	需要一些幫忙	1
	完全不能自己做	0
	總分	/27

Appendix F-6: Brief Assessment of Prospective Memory -short form (Chinese version)

前瞻性記憶評估－短版
Brief Assessment of Prospective Memory (Short Form)
甲部份：忘記頻率
(Shum and Man, 2008)

姓名 ：_____ 日期 ：_____
性別 ：_____ 年齡 ：_____

指示：

是次問卷調查是關於記憶的流逝，大多數人都有這種情況。在過去的一個月內，你忘記事情的情況頻密嗎？請盡量嘗試回答以下所有問題，及減少選擇「不適用」作為答案。

答案代號：

1 = 完全沒有
2 = 甚少 (一個月一次)
3 = 一般 (一個月兩至三次)
4 = 經常 (每星期都會發生)
5 = 常常 (每日都會發生)
NA = 不適用 (如果這事情復與你無關)

		答案
1.	在士多 / 雜貨店 / 超級市場，忘記要購買的東西 I	_____
2.	忘記約了醫生或治療師覆診 I	_____
3.	在熨衫後，忘記關熨斗 I	_____
4.	忘記在收集垃圾時段前，把垃圾放於收集處 I	_____
5.	外出時，忘記鎖好大門 B	_____
6.	忘記替盆栽 \ 花園 \ 花卉澆水 I	_____
7.	忘記代人轉達訊息 I	_____
8.	忘記依時服藥 I	_____
9.	忘記收衫 I	_____
10.	忘記洗澡 B	_____
11.	忘記吃飯 B	_____
12.	穿衣時，忘記穿上衣物的一部份 (例如：忘記穿襪子)B	_____
13	外出時，忘記帶銀包 B	_____
14.	忘記整理儀容 (例如：梳頭、刮鬍子) B	_____
15.	忘記關水喉 B	_____
16.	忘記刷牙或清潔假牙 B	_____

BADL score = total score for BADL items ÷ total number of BADL items endorsed = _____
IADL score = total score for IADL items ÷ total number of IADL items endorsed = _____
TOTAL score = total score for all items ÷ total number of items endorsed = _____

Appendix F-7: Activities of Daily Living Questionnaire (Chinese version)

日常生活問卷

請比較患者在出現老人痴呆症病徵之前和之後各方面的能力，並根據患者目前的情況在以下各項圈出一個分數

1. 自我照顧

A. 進食
- 0 = 無問題
- 1 = 能獨立完成，但動作緩慢或食物有時濺出
- 2 = 需要協助剪細食物或倒出飲品，食物經常濺出
- 3 = 須餵食大部分食物
- 9 = 不知道

B. 穿衣服
- 0 = 無問題
- 1 = 能獨立完成，但動作緩慢或笨拙
- 2 = 穿衣次序出錯，忘記穿著部分衣物或選擇合適的衣服時有困難
- 3 = 穿衣服時需要協助
- 9 = 不知道

C. 洗澡
- 0 = 無問題
- 1 = 自行洗澡，但需要提示
- 2 = 在協助之下自行洗澡
- 3 = 依賴別人洗澡
- 9 = 不知道

D. 大、小便
- 0 = 能獨立上廁所
- 1 = 當別人提醒時才上廁所，間中出現失禁
- 2 = 大、小便需要協助
- 3 = 大便或小便失禁
- 9 = 不知道

E. 服藥
- 0 = 記得服藥，無需協助
- 1 = 如藥物放在特別地方，會記得服藥
- 2 = 需要口頭或書面提示
- 3 = 必須由他人給予藥物
- 9 = 無需定時服藥 或 不知道

F. 注重儀容
- 0 = 與以往一樣
- 1 = 外出時注重儀容，在家不會
- 2 = 容許別人替其梳洗，或在要求下才容許別人替其梳洗
- 3 = 抗拒照顧者替其梳洗
- 9 = 不知道

2. 家務

A. 備餐/煮食
   0 = 準備和烹煮全無問題
   1 = 有時會煮食，但次數較以前少，或款式較少
   2 = 只會取一些即食或已煮熟的食物來吃
   3 = 不會做任何備餐工作
   9 = 從不備餐或煮食 或 不知道
B. 擺放餐具
   0 = 無問題
   1 = 能獨立完成，但動作緩慢或笨拙
   2 = 忘記擺放部分餐具或放錯位置
   3 = 再無進行這項家務
   9 = 從無進行這項家務 或 不知道
C. 家居清潔
   0 = 如常清潔家居
   1 = 最少做以往的一半清潔工作
   2 = 偶然會吸塵或做些簡單清潔工作
   3 = 再無清潔家居
   9 = 從無清潔家居 或 不知道
D. 清洗衣物
   0 = 如常清洗衣物 (時間和做法如以往一樣)
   1 = 清洗衣物次數比以前少
   2 = 只有在別人提醒時才清洗衣物，忘記加入洗衣粉或某些步驟
   3 = 再無清洗衣物
   9 = 從不清洗衣物 或 不知道

3. 外出及康樂活動

A. 外出
   0 = 與平時一樣
   1 = 如有車接送便會外出
   2 = 坐輪椅外出
   3 = 只留在家中或院舍
   9 = 不知道
B. 康樂活動
   0 = 與平時一樣
   1 = 較以前少參與康樂活動
   2 = 已失去進行康樂活動(如打麻將)所需的某些技巧，在別人鼓勵之下才肯參與
   3 = 再無參與康樂活動
   9 = 從不參與康樂活動 或 不知道

4. 購物及消費

A. 購買食物
   0 = 無問題
   1 = 忘記買某些食物或買了不需要的東西
   2 = 購買時需要別人陪同
   3 = 再無購買食物
   9 = 從不需負責購買食物 或 不知道
B. 處理現金
   0 = 無問題
   1 = 有時支付了錯誤數目，數錢有困難
   2 = 遺失現金或放錯位置
   3 = 再無處理現金
   9 = 從不需負責處理現金 或 不知道
C. 理財
   0 = 繳付賬單、處理銀行財務沒有問題
   1 = 逾期繳付賬單，填寫支票有困難
   2 = 忘記繳付賬單，結算支票賬戶有困難，需要別人協助
   3 = 再沒有理財
   9 = 從不需負責理財 或 不知道

5. 到別的地方

A. 公共交通工具
   0 = 如常使用公共交通工具
   1 = 使用公共交通工具次數減少
   2 = 曾經在使用公共交通工具時迷路
   3 = 再無使用公共交通工具
   9 = 從不定期使用公共交通工具 或 不知道
B. 前往附近地區
   0 = 與平時一樣
   1 = 外出次數減少
   2 = 曾在極近的地方迷路
   3 = 再無獨自外出
   9 = 以往到鄰近地區一向受到限制 或 不知道
C. 前往陌生地方
   0 = 與平時一樣
   1 = 在陌生環境裡偶然會迷失方向
   2 = 嚴重迷失方向，但如有人陪同便無問題
   3 = 再無能力前往別處
   9 = 從未到過熟悉環境以外的地方 或 不知道

6. 溝通

A. 使用電話
   0 = 與平時一樣
   1 = 只會撥數個熟悉的電話號碼
   2 = 只會接聽電話 (不會打出)
   3 = 沒有使用電話
   9 = 從來沒有電話 或 不知道
B. 談話
   0 = 與平時一樣
   1 = 比以前少說話，想出字詞或名字時有困難
   2 = 說話時偶然會出錯
   3 = 所說的話幾乎無法理解
   9 = 不知道
C. 理解能力
   0 = 如以往一樣明白別人所說的話
   1 = 要求別人重複所說的話
   2 = 在理解對話內容或特別字詞方面有時會有困難
   3 = 大多未能明白別人所說的話
   9 = 不知道
D. 閱讀
   0 = 與平時一樣
   1 = 較以前少閱讀
   2 = 理解或記憶所閱讀過的內容有困難
   3 = 已放棄閱讀
   9 = 不識字 或 不知道
E. 書寫
   0 = 與平時一樣
   1 = 較以前少書寫，偶然會寫錯字
   2 = 除簽名外不會書寫
   3 = 已放棄書寫
   9 = 不識字 或 不知道

Appendix G: Evaulation Questionnaire for Expert Panel Review on CELP

Evaluation Questionnaire for Expert Panel Review on Computer-assisted Errorless Learning-based Memory Training Programme for Persons with early Alzheimer's patients

* Introduction of the rationale and operation of computer-assisted errorless learning training programme for persons with early Alzheimer's patients will be presented in the initial part of expert panel review meeting before filling in the evaluation questionnaire.

(Please select and circle the most appropriate answer.)

Personal Data

Name of OT: _____ (Optional)

Rank/Post: _____

Year of Working Experience:_____ Years OT unit: _____

Fields of Practice: Psychogeriatrics / Geriatrics / Educational Organization

Overall comment on rationale, format and operation of the computer-assisted errorless memory training programme

1. The program structure presented in a logical sequence: from basic training and advance to application to daily life activities.

1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree

Other comments:

_____

_____

2. The training content in the computer-assisted errorless memory training programme is appropriate to apply to persons with early Alzheimer's Disease.

1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree

Other comments:

_____

_____

3. Touch screen computer is appropriate to be used in the computer-assisted errorless memory training programme for persons with early Alzheimer's Disease

1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree

Other comments:

_____

_____

4. The process and the speed of flow is designed well in the computer-assisted errorless memory training programme for persons with early Alzheimer's Disease

1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree

Other comments:

_____

_____

5. The presentation format (background, contrast & font size) is designed well in the computer-assisted errorless memory training programme for persons with early Alzheimer's Disease

1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree

Other comments:

_____

_____

6. The computer training programme is designed well to achieve the objectives of the computer-assisted errorless memory training programme for persons with early Alzheimer's Disease

1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree

Other comments:

_____

_____

7. The computer-assisted errorless memory training programme is well-design to achieve the errorless learning strategies for persons with early Alzheimer's Disease

1. Strongly Disagree	2. Disagree	3. Agree	4. Strongly Agree

Other comments:

_____

_____

8. Any other comments to improve the computer-assisted errorless memory training programme for persons with early Alzheimer's Disease

Other cmments:

_____

Information given will be keep confidential.

Thank you very much for your participation in the expert panel review session!