Innovative Mobile Cognitive Training Programme for Older Adults with Mild Cognitive Impairment and Early Dementia

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Outline of presentation

1. Study on errorless learning-based memory programme for dementia
   - Objectives of the study
   - Brief literature review
   - Theoretical framework
   - Research questions
   - Methodology
   - Results
   - Discussion and conclusion

2. Development of an innovative memory training programme for mild cognitive impairment
Evaluation of computer-assisted errorless learning-based memory training programme for patients with early dementia

Dr. Grace Lee, SOT, Kwai Chung Hospital

Prof David Man, Dept. of Rehabilitation Sciences, The Hong Kong Polytechnic University
Objectives

- To develop and implement a computer-assisted memory training programme based on an errorless learning strategies for patients with early dementia.
- To compare training outcomes in a computer-assisted errorless learning-based memory training programme (CELP) group, a therapist-led errorless learning-based memory training programme (TELP) group and a control group (CG) (conventional treatment as usual).
# Background

<table>
<thead>
<tr>
<th>Dementia</th>
<th>Neurodegenerative disease, decline in cognitive function, affect mood, personality &amp; social behaviour; <em>progressive</em> illness (Sadock &amp; Sadock, 2005)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High prevalence of <em>behavioral and psychological symptoms of dementia</em> (BPSD) (Gauthier, 2007; Herrmann, 2007)</td>
</tr>
<tr>
<td>Ageing population</td>
<td>Elderly population aged &gt; 65 in HK: 2011: 13.3% ; 2041: 30.0% (HK Census &amp; Statistics Dept, 2014)</td>
</tr>
<tr>
<td>Prevalence</td>
<td>Age &gt; 60, 7.2 % ; Age &gt; 70, 9.3 %  (dementia) (Lam et al, 2008)</td>
</tr>
</tbody>
</table>
| Types     | Alzheimer’s Disease : 65%  
Vascular Disease : 30%  
Dementia of other causes: 5% (Boustani et al., 2003; Chen et al, 2012; Lam et al, 2008) |
Literature Review
Alzheimer’s Disease (AD)

- **Progressive** neurological disorder
  - **Staging**: Disease progress from **early**, middle to late stage

- Amyloid plagues & neurofibrillary tangles

- **Hippocampus** (key role in memory) affected by AD
  - Neuronal loss as disease progresses & with widespread formation of intraneuronal neurofibrillary tangles

- Genetic predisposition to ApoE4, linked with working memory  (Morris & Becker, 2004)
Memory Problems for early AD

- Memory impairment
  - Encoding deficit affect learning new information and forming new memories (Clare, Woods, Miniz, Orrell & Spector, 2003; Germano & Kinsella, 2005)
  - Working memory deficits in central executive system of working memory in co-ordinating processes of activities. Difficulty found in dual task activity (Morris & Becker, 2004; Huntley & Howard, 2000)
  - Delayed recall & in verbal fluency deficit in mild dementia (Lam, 2006; Morris & Becker, 2004)
  - Deficit in Prospective Memory (or future memory)
    - performance clearly distinguished healthy control group from very mild AD group and was an early cognitive predictor for AD (Duchek et al., 2006)
- Thus, AD patients experience difficulties to select & encode message effectively and this might affect the later retrieval and necessary execution of action
Errorless Learning (EL)

- A teaching technique through which people are prevented to make mistakes while learning new skills or acquire new information
- Active participation
- Might be used together with spaced retrieval and vanishing cues
- Effective strategies for training persons with memory problems especially AD patients

(Clare & Jones, 2008; Haslam, Hodder & Yates, 2011; Kessels & De Haan, 2003; Kessels & Hensken, 2009)
Meta-analysis on Cognitive training on dementia

- Cognitive training was effective for restoration of learning, memory, executive functioning, ADL & general cognitive problems of AD patients (Sitzer, Twamley & Jeste, 2006); EL training improved memory function of patients with early dementia (Clare & Jones, 2008)

- EL Intervention groups showed significant cognitive gains when compared with conventional group or errorful training (Clare & Jones, 2008; Dunn & Clare, 2007; Haslam et al., 2006; Haslam, Moss & Hodder, 2010; Kessels & Hensken, 2009)
Computer training for dementia

- RCT study showed that computer training would delay the cognitive decline of subjects of MCI and dementia (Galante, Venturini & Fiaccadori, 2007); improve cognition after training (5 day/week; 20-25 minutes/day for 6 months (Miller, et al., 2013)

- Feasibility and efficacy of intensive cognitive training for 21 early AD patients in U.S. showed that training of 10 days over 2 weeks of 4 to 5 hours individualized cognitive training (computerized or paper-and-pencil task) each day, showed post-test improved outcomes on MMSE, letter fluency & Trail-making tests, maintained effect at 2- & 4-month FU (Kanaan, McDowd, Colgrove, Burns, Gajewski & Pohl, 2014)
Neuro-cognitive approach & Computer-Assisted Memory Programme

Brain’s plasticity

- Possible improvement at any age
- brain reorganization to form new neural pathway and network (Berlucchi, 2011; Velligan et al., 2006)

Computer-assisted memory EL training

- A few local computer-assisted / virtual reality training studies showed positive training results on memory function of dementia older adults, using errorless learning approach and building in enriched multi-sensory stimuli (Lee, Yip, Yu & Man, 2013; Man, Chung & Lee, 2012)
Conceptual Framework
Computer-assisted Errorless based Memory Training Programme for early AD

Program structure:
- Learned task broken into components
- Immediate feedback to reinforce learning
- Familiar and positive training content
- Positive reinforcer
- Gradation

Enhance Storage & Retrieval of information

Encoding, attention & PM problems of AD
Cerebral plasticity, functional, reorganization & adaptation to enhance functional recovery of central nervous system

Person

Errorless Learning

Human computer interaction

Computer-assisted technology

Enriched Environment

Cognitive reserve and neuroplastic theory: to improve neural network

Remedial Approach + Compensatory Approach

Problem of AD
- Attention
- Encoding
- WM
- PM

Social Learning Theory
(positive reinforcement to enhance active participation)

Active participation/engagement

Motivation

Improve memory function of AD patients
(attention, encoding of information, WM, PM & executive function)
Instrumentation: Errorless Memory Training - Programme structure
(Kern R.S. et al, 2005)

Rationales:
- Bypass errors & strengthen accurate association as patients have difficulty to self-correct errors

Four principles:
- Learned task broken into components
- Over-learning of components through repetition & practice
- Training from simple to complex
- Hierarchical training of gradation

Key features:
- Early success, positive feedback to reinforce learning
- Non-threatening with hints, incorporating Spaced Retrieval & Vanishing Cues strategies
Research questions
Research questions

1. Would the use of EL memory rehabilitation programme improve the memory function of Chinese subjects with early AD?

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

3. Would there be any significant differences in the effectiveness of treatment outcomes between treatment groups and the control group (conventional treatment as usual)?
Hypotheses of the study

- Null hypothesis: training outcome of treatment groups among computer-assisted EL memory training programme (CELP), Therapist-led EL memory training Programme (TELP) and the conventional group (CG) would be the same.

- Alternative hypothesis is that treatment effect among different treatment groups, CELP, TELP & CG are not the same.
Methodology
Research design

- A single-blind (i.e. independent rater) randomized control trial (RCT) research design
  - Therapists/researchers were only involved in the treatment group and were blind to the rating aspects
  - Pre, post- and 3 month follow up assessment

- Random allocation of subjects to CELP, TELP and CG

- 2-phase study: Pilot and main study

- Sampling calculation by PASS version 11
  (Power Analysis and Sample Size for Windows)
Subject recruitment

- Subjects are recruited from psychogeriatric in, day and out patients unit of Kwai Chung Hospital (referred to OT service), dementia day care centres, elderly day care centres, subvented elderly homes/ care and attention home and private old age homes by convenience sampling.

- Randomly allocated to CELP, TELP or CG.
# Inclusion/ exclusion criteria

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Aged 60 or above</td>
<td>- With severe visual or hearing impairment</td>
</tr>
<tr>
<td>- Both genders</td>
<td>- Computer phobic</td>
</tr>
<tr>
<td>- Diagnosis: Alzheimer’s Disease (ICD-10 or DSM-IV criteria)</td>
<td>- Having impaired physical function that inhibited to use a touch-screen computer or with epilepsy</td>
</tr>
<tr>
<td>- Early stage of dementia as screened by Chinese Clinical Dementia Rating Scale with score of 1 (Hughes et al., 1982)</td>
<td>- Having depression as screened by Cantonese version GDS-SF (Wong et al., 2002) at score of 8 or above</td>
</tr>
</tbody>
</table>
CONSORT flow diagram of the randomization procedures

Assessed for eligibility (n=115)
- Excluded (n=35)
  - Did not meet inclusion criteria
  - No interests to participate
  - Other reasons

Randomized by centres (n=80)

Allocated to CELP group (n=31)
  - Discontinued intervention (n=0)
  - Received CELP (n=31)
    - Followed up (n=30)
      - Analyzed (n=30)

Allocated to TELP group (n=23)
  - Discontinued intervention (n=0)
  - Received TELP (n=23)
    - Followed up (n=22)
      - Analyzed (n=22)

Allocated to conventional group (n=26)
  - Discontinued intervention (n=0)
  - Received conventional treatment (n=26)
    - Followed up (n=23)
      - Analyzed (n=23)

Discontinued intervention (n=0)

Received CELP (n=31)

Received TELP (n=23)

Received conventional treatment (n=26)

Followed up (n=30)

Followed up (n=22)

Followed up (n=23)

Lost to follow up (n=1)

Lost to follow up (n=1)

Lost to follow up (n=3)
**Instrumentation: CELP, TELP, CG**

<table>
<thead>
<tr>
<th>Group</th>
<th>Training Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>CELP</td>
<td>15, 45-minutes individual computer-assisted errorless learning-based training, delivered at least for around twice per week, with guidance from trainers (with prior training)</td>
</tr>
<tr>
<td>TELP</td>
<td>Similar training structure and content and dosage except training by therapists</td>
</tr>
<tr>
<td>CG</td>
<td>Similar training dosage but using conventional general unstructured training programme (e.g. Reality Orientation, reminiscence, self-care, physical exercise, leisure and recreational groups)</td>
</tr>
</tbody>
</table>
# EL Memory Programme

## 15 Training sessions

<table>
<thead>
<tr>
<th>Incorporating Training rationale and EL principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1 &amp; 2: Sensory Memory (auditory) training</td>
</tr>
<tr>
<td>Session 3: Working Memory training</td>
</tr>
<tr>
<td>Session 4: Prospective Memory training</td>
</tr>
<tr>
<td>Revision 1: Application to Daily Life (I)</td>
</tr>
<tr>
<td>Session 5: Prospective Memory training</td>
</tr>
<tr>
<td>Session 6 &amp; 7: Memory strategies – name face association</td>
</tr>
<tr>
<td>Session 8: Memory strategies - home making &amp; habit training</td>
</tr>
<tr>
<td>Revision 2: Application to Daily Life (II)</td>
</tr>
<tr>
<td>Session 9: Memory strategies - home making &amp; habit training</td>
</tr>
<tr>
<td>Session 10 &amp; 11: Memory strategies- shopping and money management</td>
</tr>
<tr>
<td>Session 12: Memory strategies: community living skill</td>
</tr>
<tr>
<td>Revision 3: Application to Daily Life (III)</td>
</tr>
</tbody>
</table>
Training components:
- From basic to advance level, revision to consolidate training, upgrade complexity
Basic training on attention

counting of fruits

counting of dim sum
Errorless: appropriate cognitive challenge to subject's ability e.g. categorization
Positive reinforcement for right answer scored
Memory training strategies:

- **Prospective memory training**

Name face association

- 記住人名 / 面孔方法
  - 記住個人面部的特質，並將名字用自己的方法聯想起來
  - 例如：李姑娘（木、子等於李或聯想起李姑娘喜歡雪『梨』的『梨』諧音）
  - 短頭髮，有戴眼鏡等
Upgrade training to community living

task:

door access, cross road, take bus
Outcome Measures

Pre-and-post & 3 month follow up assessment:

Primary outcome
- Chinese Mattis Dementia Rating Scale (CDRS) (Mattis, 1998; Chan et al., 2003)

Secondary Outcomes
- Chinese Mini Mental State Examination (CMMSE) (Chiu et al., 1994)
- HK List Learning Test (HKLLT) (Chan et al., 2003)
- Brief Chinese Assessment of Prospective Memory - short form, by interview of carers (BAPM-carer) (Man, Fleming and Shum, 2011)
- Cantonese Geriatric Depression Scale - short form (CGDS) (Wong et al., 2002)
TELP & CELP
Results
Pilot study / Expert panel review

- **Review** structure, content & computer-interaction effect of **CELP** and make recommendation for improvement

- Use result for main study **sample size estimation**
## Results of Pilot study (June, 08 – Jan, 10)

<table>
<thead>
<tr>
<th>Sample size</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>CELP (n=6), TELP (n=6), CG (n=7)</td>
</tr>
<tr>
<td>Pre-and-post test</td>
<td>Significant positive change on scores: CELP: MMSE (p=0.03), DRS (p=0.001), BAPM (p=0.03) and MBI (0.04); a marginal sig. change in HKLLT (p=0.06). TELP: sig. change in DRS (p=0.03). For CG: limited improvement</td>
</tr>
<tr>
<td></td>
<td>By Friedman’s test for time effect</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>GDS-SF: sig. difference among three groups (p=0.009). Subjects felt happier after treatment. MBI: sig. improvement (p=0.04) for TELP &amp; CG</td>
</tr>
<tr>
<td></td>
<td>By Kruskal-Wallis test for between group treatment effect</td>
</tr>
</tbody>
</table>
Pre-and-post test change of Outcome Score on CELP, TELP & ACG (pilot study)

*Friedmen’s test for time effect.  DRS estimated effect size: 0.276
Kruskal-Wallis test for treatment effect
Evaluation of a computer-assisted errorless learning-based memory training program for patients with early Alzheimer’s disease in Hong Kong: a pilot study

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Edwin CS Yu³
David WK Man⁴

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Background: Improving the situation in older adults with cognitive decline and evidence of cognitive rehabilitation is considered crucial in long-term care of the elderly. The objective of this study was to implement a computerized errorless learning-based memory training program (CELP) for persons with early Alzheimer’s disease, and to compare the training outcomes of a CELP group with those of a therapist-led errorless learning program (TELP) group and a waiting-list control group.

Methods: A randomized controlled trial with a single-blind research design was used in the study. Chinese patients with early Alzheimer’s disease screened by the Clinical Dementia Rating (score of 1) were recruited. The subjects were randomly assigned to CELP (n = 6), TELP (n = 6), and waiting-list control (n = 7) groups. Evaluation of subjects before and after testing, and at three-month follow-up was achieved using primary outcomes on the Chinese Mini-Mental State Examination, Chinese Dementia Rating Scale, Hong Kong List Learning Test, and the Brief Assessment of Prospective Memory-Short Form. Secondary outcomes were the Modified Barthel Index, Hong Kong Functional Assessment Activities of Daily Living Scale, and Depression...
Data Analysis

- Chi square test, one-way analysis of variance (ANOVA) to evaluate demographic for homogeneity of baseline measures ($p > 0.05$ (this implied the baseline measures of the 2 treatment groups and control group were comparable))

- Repeated-measures ANOVA to analyze differences in the dependent variables among the three groups

- One way ANOVA followed by post hoc test to compare any statistical significant difference between post test score and 3-month FU test score
### Data of Main study (June, 10 – May, 13)

<table>
<thead>
<tr>
<th>Sample size</th>
<th>75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjects</td>
<td>Early AD patients (CDR = 1)</td>
</tr>
<tr>
<td>Sex</td>
<td>Male : 26 (34.7%)  Female:49 (66.3%)</td>
</tr>
<tr>
<td>Groups</td>
<td>CELP   (n=30)  TELP (n=22)  CG (n=23)</td>
</tr>
</tbody>
</table>
Demographic data in Main Study

<table>
<thead>
<tr>
<th>Group (N=75)</th>
<th>CELP (n=30)</th>
<th>TELP (n=22)</th>
<th>CG (n=23)</th>
<th>( \chi^2 )</th>
<th>( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>count</td>
<td>%</td>
<td>count</td>
<td>%</td>
<td>count</td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>33.3</td>
<td>10</td>
<td>45.5</td>
<td>6</td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>66.7</td>
<td>12</td>
<td>54.5</td>
<td>17</td>
</tr>
<tr>
<td>Education</td>
<td>count</td>
<td>%</td>
<td>count</td>
<td>%</td>
<td>count</td>
</tr>
<tr>
<td>Nil</td>
<td>7</td>
<td>23.3</td>
<td>9</td>
<td>40.9</td>
<td>8</td>
</tr>
<tr>
<td>1-2 years</td>
<td>6</td>
<td>20.0</td>
<td>1</td>
<td>4.5</td>
<td>5</td>
</tr>
<tr>
<td>3-6 years</td>
<td>9</td>
<td>30.0</td>
<td>7</td>
<td>31.8</td>
<td>6</td>
</tr>
<tr>
<td>Secondary</td>
<td>5</td>
<td>16.7</td>
<td>3</td>
<td>13.6</td>
<td>4</td>
</tr>
<tr>
<td>University</td>
<td>3</td>
<td>0.0</td>
<td>2</td>
<td>9.1</td>
<td>0</td>
</tr>
<tr>
<td>Marital status</td>
<td>count</td>
<td>%</td>
<td>count</td>
<td>%</td>
<td>count</td>
</tr>
<tr>
<td>Married</td>
<td>7</td>
<td>23.3</td>
<td>8</td>
<td>36.4</td>
<td>14</td>
</tr>
<tr>
<td>Single</td>
<td>1</td>
<td>3.3</td>
<td>1</td>
<td>4.5</td>
<td>1</td>
</tr>
<tr>
<td>Widowed or</td>
<td>22</td>
<td>73.3</td>
<td>13</td>
<td>59.1</td>
<td>68</td>
</tr>
<tr>
<td>Divorced</td>
<td>2</td>
<td>6.7</td>
<td>4</td>
<td>18.2</td>
<td>3</td>
</tr>
<tr>
<td>Living condition</td>
<td>count</td>
<td>%</td>
<td>count</td>
<td>%</td>
<td>count</td>
</tr>
<tr>
<td>Living alone</td>
<td>5</td>
<td>16.7</td>
<td>4</td>
<td>18.2</td>
<td>3</td>
</tr>
<tr>
<td>Living with spouse</td>
<td>4</td>
<td>13.3</td>
<td>4</td>
<td>18.2</td>
<td>4</td>
</tr>
<tr>
<td>Living with family</td>
<td>15</td>
<td>50.0</td>
<td>11</td>
<td>50.0</td>
<td>14</td>
</tr>
<tr>
<td>Living in OAH</td>
<td>6</td>
<td>20.0</td>
<td>3</td>
<td>13.6</td>
<td>2</td>
</tr>
</tbody>
</table>

\( p \) value by Chi-Square Test
Baseline comparison in Main study

<table>
<thead>
<tr>
<th></th>
<th>CELP</th>
<th>TELP</th>
<th>CG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>s.d</td>
<td>mean</td>
</tr>
<tr>
<td>Age</td>
<td>81</td>
<td>(5.2)</td>
<td>78.6</td>
</tr>
<tr>
<td>MMSE</td>
<td>18.1</td>
<td>(3.27)</td>
<td>17.1</td>
</tr>
<tr>
<td>GDS</td>
<td>2.17</td>
<td>(1.95)</td>
<td>2.36</td>
</tr>
<tr>
<td>DRS</td>
<td>101.07</td>
<td>(9.68)</td>
<td>96.77</td>
</tr>
<tr>
<td>HKLLT</td>
<td>7.50</td>
<td>(3.65)</td>
<td>9.18</td>
</tr>
<tr>
<td>BAPM-carer</td>
<td>1.89</td>
<td>(0.78)</td>
<td>1.77</td>
</tr>
</tbody>
</table>

p value tested by one way ANOVA Test

p > 0.05 (this implied the baseline measures of the 2 treatment groups and conventional group were comparable)
Comparison of group effect & time effect in CELP, TELP & CG in primary outcome (Main study)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Group effect</th>
<th>Time effect</th>
<th>Group x time effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDRS total</td>
<td>3.601</td>
<td>10.165</td>
<td>5.340</td>
</tr>
<tr>
<td>F(2,72)</td>
<td>3.949</td>
<td>14.139</td>
<td>3.576</td>
</tr>
<tr>
<td>P Value</td>
<td>0.032*</td>
<td>&lt;0.0005*</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Effect Size</td>
<td>0.091</td>
<td>0.124</td>
<td>0.129</td>
</tr>
<tr>
<td>Power</td>
<td>0.123</td>
<td>0.640</td>
<td>0.557</td>
</tr>
<tr>
<td>CDRS, Memory Subscore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(2,72)</td>
<td>4.506</td>
<td>9.749</td>
<td>5.798</td>
</tr>
<tr>
<td>P Value</td>
<td>&lt;0.014*</td>
<td>&lt;0.0005*</td>
<td>&lt;0.0005*</td>
</tr>
<tr>
<td>Effect Size</td>
<td>0.111</td>
<td>0.119</td>
<td>0.139</td>
</tr>
<tr>
<td>Power</td>
<td>0.163</td>
<td>0.602</td>
<td>0.629</td>
</tr>
</tbody>
</table>

* indicate P<0.05
Comparison of group effect & time effect in CELP, TELP & CG in secondary outcome (Main study)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Group effect</th>
<th>Time effect</th>
<th>Group x time effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMMSE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(2,72)</td>
<td>4.436</td>
<td>19.627</td>
<td>3.526</td>
</tr>
<tr>
<td>P Value</td>
<td>0.015*</td>
<td>&lt;0.0005*</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>Effect Size</td>
<td>0.110</td>
<td>0.214</td>
<td>0.089</td>
</tr>
<tr>
<td>Power</td>
<td>0.16</td>
<td>0.986</td>
<td>0.278</td>
</tr>
<tr>
<td>HKLLT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(2,72)</td>
<td>0.270</td>
<td>9.164</td>
<td>5.161</td>
</tr>
<tr>
<td>P Value</td>
<td>0.764</td>
<td>&lt;0.005*</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Effect Size</td>
<td>0.007</td>
<td>0.113</td>
<td>0.125</td>
</tr>
<tr>
<td>Power</td>
<td>0.05</td>
<td>0.555</td>
<td>0.527</td>
</tr>
<tr>
<td>HKLLT (immediate recall)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(2,72)</td>
<td>0.663</td>
<td>22.372</td>
<td>6.343</td>
</tr>
<tr>
<td>P Value</td>
<td>0.519</td>
<td>&lt;0.0005*</td>
<td>&lt;0.0005*</td>
</tr>
<tr>
<td>Effect Size</td>
<td>0.018</td>
<td>0.237</td>
<td>0.150</td>
</tr>
<tr>
<td>Power</td>
<td>0.053</td>
<td>0.996</td>
<td>0.706</td>
</tr>
<tr>
<td>BAPM-Carer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F(2,72)</td>
<td>1.725</td>
<td>7.678</td>
<td>0.182</td>
</tr>
<tr>
<td>P Value</td>
<td>0.169</td>
<td>&lt;0.001*</td>
<td>0.834</td>
</tr>
<tr>
<td>Effect Size</td>
<td>0.063</td>
<td>0.131</td>
<td>0.007</td>
</tr>
<tr>
<td>Power</td>
<td>0.084</td>
<td>0.691</td>
<td>0.051</td>
</tr>
</tbody>
</table>

* indicate P<0.05
## Pre-and-post test, 3M FU on DRS (Main study)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>CELP Group</th>
<th>TELP Group</th>
<th>C Group</th>
<th>p value</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean (S.D.)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CDRS (Total) Pre-test</td>
<td>101.07 (9.68)</td>
<td>96.77 (12.11)</td>
<td>97.22 (9.01)</td>
<td>0.248</td>
<td>1.00</td>
</tr>
<tr>
<td>CDRS (Total) Post-test</td>
<td>106.20 (8.70)</td>
<td>101.95 (12.08)</td>
<td>95.35 (8.98)</td>
<td>0.001*</td>
<td>1.00</td>
</tr>
<tr>
<td>CDRS (Total) 3M FU</td>
<td>102.07 (8.34)</td>
<td>96.41 (14.96)</td>
<td>95.91 (9.29)</td>
<td>0.078</td>
<td>1.00</td>
</tr>
<tr>
<td>CDRS (Concept) Pre-test</td>
<td>32.10 (3.60)</td>
<td>29.59 (5.13)</td>
<td>30.13 (4.64)</td>
<td>0.099</td>
<td>1.00</td>
</tr>
<tr>
<td>CDRS (Concept) Post-test</td>
<td>33.77 (3.04)</td>
<td>33.90 (3.10)</td>
<td>29.43 (4.88)</td>
<td>0.000*</td>
<td>1.00</td>
</tr>
<tr>
<td>CDRS (Concept) 3M FU</td>
<td>32.63 (3.08)</td>
<td>30.23 (5.62)</td>
<td>29.70 (5.39)</td>
<td>0.055</td>
<td>1.00</td>
</tr>
<tr>
<td>CDRS (Memory) Pre-test</td>
<td>11.90 (2.81)</td>
<td>12.14 (3.85)</td>
<td>11.22 (2.86)</td>
<td>0.594</td>
<td>0.85</td>
</tr>
<tr>
<td>CDRS (Memory) Post-test</td>
<td>13.50 (3.00)</td>
<td>12.64 (4.07)</td>
<td>10.87 (3.39)</td>
<td>0.027*</td>
<td>1.00</td>
</tr>
<tr>
<td>CDRS (Memory) 3M FU</td>
<td>12.37 (3.01)</td>
<td>10.27 (3.17)</td>
<td>9.04 (3.71)</td>
<td>0.002*</td>
<td>1.00</td>
</tr>
</tbody>
</table>

* *p<0.005 using ANOVA

Significant increase in DRS(total, concept & memory) in post-test score & in memory subscore in 3 M FU
Result: DRS (total)

P < 0.0001
Result: DRS (memory)

P < 0.0005
# Pre-and-post test, 3M FU on MMSE & HKLLT (Main study)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>CELP Group</th>
<th>TELP Group</th>
<th>C Group</th>
<th>p value</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSE Pre-test</td>
<td>18.07 (3.27)</td>
<td>17.09 (2.84)</td>
<td>16.48 (3.07)</td>
<td>0.175</td>
<td>0.99</td>
</tr>
<tr>
<td>MMSE Post-test</td>
<td>19.60 (3.02)</td>
<td>19.45 (2.50)</td>
<td>16.70 (2.90)</td>
<td>0.001*</td>
<td>1.00</td>
</tr>
<tr>
<td>MMSE 3M FU</td>
<td>18.13 (2.97)</td>
<td>18.10 (2.76)</td>
<td>16.04 (3.42)</td>
<td>0.030*</td>
<td>1.00</td>
</tr>
<tr>
<td>HKLLT (Total) Pre-test</td>
<td>7.50 (3.65)</td>
<td>9.18 (4.19)</td>
<td>7.87 (2.69)</td>
<td>0.233</td>
<td>0.99</td>
</tr>
<tr>
<td>HKLLT (Total) Post-test</td>
<td>10.87 (4.22)</td>
<td>9.40 (3.92)</td>
<td>8.35 (2.85)</td>
<td>0.056</td>
<td>1.00</td>
</tr>
<tr>
<td>HKLLT (Total) 3M FU</td>
<td>9.40 (3.85)</td>
<td>9.55 (4.08)</td>
<td>9.87 (4.78)</td>
<td>0.921</td>
<td>1.00</td>
</tr>
<tr>
<td>HKLLT (IR) Pre-test</td>
<td>7.67 (3.20)</td>
<td>7.36 (2.61)</td>
<td>8.30 (2.36)</td>
<td>0.513</td>
<td>0.85</td>
</tr>
<tr>
<td>HKLLT (IR) Post-test</td>
<td>9.53 (2.34)</td>
<td>10.50 (3.29)</td>
<td>8.30 (2.12)</td>
<td>0.022*</td>
<td>0.99</td>
</tr>
<tr>
<td>HKLLT (IR) 3M FU</td>
<td>8.87 (2.69)</td>
<td>9.55 (4.08)</td>
<td>8.22 (2.04)</td>
<td>0.339</td>
<td>0.99</td>
</tr>
</tbody>
</table>

* p<0.005 using ANOVA  
IR- immediate recall

Significant increase in MMSE post-test & 3M FU score & HKLLT (IR) for post-test
Result: CMMSE

P < 0.01
Result: HKLLT (immediate recall)

HKLLT (immediate recall) over time trend

- CELP
- TELP
- CG

P < 0.0005
Discussion & conclusion
Evaluation of study outcomes

- CELP & TELP were effective in improving the general cognition and memory performance of early AD
- CELP showed better outcomes in CDRS memory subscore, HKLLT & BAPM in post-test. TELP showed better improvement in CMMSE
- Integration of EE & EL in computer-assisted training may reinforce more on general memory function & PM and echo brain neuro-plasticity theory that brain reserve can be enriched by cognitive experience
Evaluation of study outcomes II

- Training program might be developed for healthy old adults.

- Further cognitive challenging MCI/brain health/dementia prevention programme might be developed, with Brain apps in mobile tablet PC or smart phones & put cognitive training into game format. The relationship of engaging in active cognitive lifestyle and dementia prevention might be explored.
Discussion - Clinical Implication II

- **CELP** is a cost-effective programme & will save more **professional** time to for therapists to train memory function of early AD patients.

- **TELP** also showed significant improvement as it is a **personalized and patient-centred** EL based training and OT is more flexible and give immediate guidance, feedback and support patients in intervention programme (e.g. in literacy problems).
Discussion – Clinical Implication II

- Recommendation to OT in HK to update clinical guideline with application of CELP / TELP in treatment of mild dementia patients

- OT might collaborate with multi-disciplinary staff and University experts to further develop a new cognitive training model for older adults / persons with cognitive impairment in HK
Clinical Implication III

- With collaboration with multi-disciplinary staff, OT might further develop early cognitive impairment clinic service, with a new cognitive enhancement laboratory and different computer-assisted training programme for patients with neurocognitive impairment.
Limitations of study

- “Dosage” of this errorless training programme might not be intensive enough for larger effect size.
  - Recent MCI study - cognitive training of 24 hours showed significant improvement in outcomes (Kanaan et al., 2014)

- Limitation in carrying-over effect
  - Further booster training / home programme might be reinforced to maintain the training outcome

- Dual role of research-trainer might induce bias in training effectiveness
Future studies

* Further CELP might be enhanced with artificial intelligence and cognitive challenges might be upgraded and down graded automatically to tailor-made flexibility to cognitive function of older adults

* More RCT in computer-assisted training might be explored

* Future study to maintain treatment outcome after intervention might be explored
Conclusion

- Errorless learning memory training strategy can be an effective training strategy to enhance memory function of Chinese early AD patients in HK. Both CELP and TELP are better than CG.
- CELP showed better training outcome in memory outcomes as reflected in CDRS, HKLLT and BAPM. Further home programme might be added to maintain the training outcome.
- OT might collaborate with rehabilitation team members/ experts to further develop brain health programme and plan further RCT cognitive training studies.
Acknowledgement

- Research team
- Prof. David Man
- Dr. C.S. Yu
- DM(OT) & staff of OT Dept. / Psychogeriatric Team of Kwai Chung Hospital; OT students
- Dr. Calvin Yip and other research team members of HKPU
Development of innovative memory training programme for mild cognitive impairment

Prof David Man,
Dept. of Rehabilitation Sciences,
The Hong Kong Polytechnic University

Dr. Grace Lee, SOT, Kwai Chung Hospital
and Other OT in HA & NGO

Department of Rehabilitation Sciences
The Hong Kong Polytechnic University

Occupational Therapy Dept.
Kwai Chung Hospital
Cognitive games: i-pad/ tablet PC
Cognitive Plasticity in Healthy, Mild Cognitive Impairment (MCI) Subjects & Alzheimer's Disease (AD) patients: Research in Spain

Based on Cognitive Plasticity theories, cognitive training would improve the memory function of Healthy, MCI & AD persons

Fernandez-Ballesteros et al., Cognitive Plasticity in Healthy Mild Cognitive Impairment (MCI) subjects and Alzheimer’s Disease patients: A research project in Spain

*European Psychologist, Vol.8, No.3, Sept.2003, pp 148-159*
Training Results:

- 200 elderly persons, healthy / MCI / AD all have improved performance in visual memory, verbal learning and executive function.

- Healthy subjects showed the best performance and MCI subjects benefit more from learning than AD patients
Cognitive and memory training in adults at risk of dementia: a systematic review

- **Background:** MCI individuals at risk to develop dementia
- **Methods:** Systematic review of eligible trials, followed by effect size analysis. **Cognitive training included cognitive exercises and memory strategies**
- **Results:** 305 MCI subjects received cognitive training. Only 5 RCT. **Moderate effect on memory outcomes**. Cognitive exercise (relative effect sizes ranged from .10 to 1.21, might lead to better benefits than memory strategies (.88 to -1.18). e.g. like change in MMSE
- **Conclusion:** cognitive exercise can produce moderate to large beneficial effects on memory outcomes. **Suggestion:** further high quality RCT with better design on cognitive training
Cognitive and memory training in adults at risk of dementia: a systematic review

- **Cognitive training**: provides structured practice of complex mental activity to enhance cognitive function

- **Cognitive training format & delivery**: Computerized exercise were the most common form of training e.g. NeuroPsychological Training & Cogpack, provided multi-modal & multi-domain training while POSIT trained only one cognitive domain i.e. auditory process. Cognitive exercise included pen & paper tasks of repeated 30 mins: cancellation, ordering & mathematical tasks. Memory strategies included visual imagery, association and categorization.

- **High volume cognitive exercise training better**

- **Meta-Analysis of cognitive training in healthy adults suggested that 2-3 month training periods may have persistent protective benefits.** Total volume of sessions are important. Training needed to reach a "critical threshold" in order to produce sufficient adaptive neurobiological changes. Due to variability of study, it is not yet possible to determine the minimum required frequency.

Evaluation of a virtual reality-based memory training programme for Hong Kong Chinese older adults with Mild Cognitive Impairment (MCI)

- Pre-and-post test design
- Primary outcome: Multifactorial Memory Questionnaire, Fuld Object Memory Evaluation, HK Lawton IADL
- VR-based (20 subjects) and a therapist-led memory training (24 subjects) group, with questionable dementia. 10 individual, 30-mins training program, being run around 2-3 times per week
- Both group showed positive results
- VR group showing greater improvement in objective memory performance and the non-VR group showing better subjective memory subtest

David W. K. Man, Jenny C. C. Chung and Grace Y. Y. Lee
Int J Geriatr Psychiatry (2012); 27:513-530
Living Room Task
現在的任務：
請先找出茶几上的便條，然後留意並記紙條上的食物。

[如果你要看茶几上的便條，請按 確定 ]
現在的任務：
請先找出茶几上的便條，然後留意並記住紙條上的食物。

便條

朱古力 牛奶

麪包 點心

花生醬 蛋

你現在有 00m 03s 068ms 去記下便條上的東西
By Prof. David Man, Grace Lee and research team
New Brain Health Program for older adults
Development in progress. Ready in May, 2014

Prof. David Man,
Dept. of Rehab. Sciences,
HKPU (Co-ordinator)
Dr. Grace Lee,
SOT, KCH
Other research team members


Reference III


Mind your Mind
...to reduce your risk of dementia

Alzheimer’s Australia’s National public health program

Brain exercises from the age of 40 reduce your risk of Alzheimer’s

E-mail: leeyyg@ha.org.hk