

Known-Group Validity and Inter-Rater Reliability of the Dynamic Loewenstein Occupational Therapy Cognitive Assessment (DLOTCA) - Thai Version

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ABSTRACT

Objectives: To investigate the known-group validity and inter-rater reliability of the Dynamic Loewenstein Occupational Therapy Cognitive Assessment (DLOTCA) - Thai version.

Study design: Descriptive cross-sectional design.

Setting: Four hospitals and four community rehabilitation centers in Chiang Mai province, Thailand.

Subjects: Thirty-seven patients with cognitive impairment and 37 healthy subjects were recruited by using the purposive sampling method.

Methods: The DLOTCA - Thai version was administered to the subjects. People with cognitive impairment were evaluated by two occupational therapists. The known-group validity was determined by using a comparative design between the groups with the Mann-Whitney U test and within the groups with the Wilcoxon signed-rank test. The reliability between the two raters was analyzed by using the intra-class correlation coefficient (ICC).

Results: The DLOTCA - Thai version successfully differentiated the pre-mediation scores between the two groups. People with cognitive impairment showed lower cognitive abilities and needed higher levels of mediation. Significant differences were found between the pre- and post-mediation scores within each group, which indicated high known-group validity of the DLOTCA - Thai version. The ICC between the two raters ranged from 0.914 to 1.000 that showed the high inter-rater reliability of the instrument.

Conclusions: From the results of the high degree of the known-group validity and inter-rater reliability, the DLOTCA - Thai version is an effective tool for identifying cognitive abilities in neurological dysfunction with cognitive impairment in clinical settings. This assessment tool also suggests potential change and provides an indication of the level of mediation that would benefit cognitive intervention.

Keywords: Dynamic Loewenstein Occupational Therapy Cognitive Assessment, cognitive impairment, psychometric property, neurological dysfunction, occupational therapy

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Introduction

Cognitive impairment is frequently found in people with brain damage; such as, stroke and traumatic brain injury (TBI).¹⁻³ This impairment leads to complications in the setting of the treatment goals, planning of intervention programs, and estimation of the rehabilitation outcomes.⁴⁻⁶ Therefore, the early detection of cognitive impairment in patients with neurological dysfunction would benefit the therapists in setting suitable goals and appropriate intervention for their clients. In addition to physical assessment, cognitive evaluation is very important and requires an accurate and reliable assessment tool.⁷

The conventional cognitive assessment tools are static and provide information only about the clients' cognitive abilities and impairments, while dynamic cognitive assessment tools have been developed to address the learning potential and cues, which have helped therapists to improve the skills and intervention planning for their clients.⁸⁻¹³

The Dynamic Loewenstein Occupational Therapy Cognitive Assessment (DLOTCA) is one of the standardized cognitive functional assessment tools, which is popularly used in occupational therapy practice. The DLOTCA was developed from the Loewenstein Occupational Therapy Cognitive Assessment (LOTCA), a static assessment tool to become a dynamic one, in order to gather information about the quantity of a client's cognitive abilities and impairments. It is also used to identify the learning potential and recognize thinking strategies through the use of mediation. These strategies can help estimate the ability to learn or understand the type of information that a person requires for the optimal performance of a task and develop effective intervention planning.⁸⁻¹³ The DLOTCA has been developed to assess individuals aged 18-69 years with neurological dysfunction, and has been studied for reliability and validity in various populations. The findings supported the construct validity, thus demonstrating the high efficiency to differentiate the responses between people with cognitive impairment and healthy people. In addition, the

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results showed excellent inter-rater reliability and moderate to excellent internal consistency.^{10,14} The DLOTCA is a battery test that consists of 28 items in seven cognitive domains comprising Orientation, Awareness, Visual Perception, Spatial Perception, Praxis, Visuomotor Construction, and Thinking Operation. The DLOTCA can assess cognitive functions and cover more aspects than other dynamic assessment tools, e.g., Contextual Memory Test (CMT) and Toggia Category Assessment (TCA), where they can only evaluate the memory and categorization functions.^{10,14-17}

The DLOTCA was initially developed in Israel and has since been translated into many languages in other countries like Denmark and Portugal in order to use this tool in different cultures and contexts, as well as to decrease any errors in the assessment process.^{18,19} To the authors' knowledge, there is no standard test of the cognitive function in the Thai language. The authors, therefore, were interested in exploring the psychometric property of the DLOTCA - Thai version in terms of known-group validity and inter-rater reliability.

Methods

Subjects

The sample size in the present study was calculated by the G*power 3.1 program that configured the effect size = 0.8, error probability = 0.05, and power of the test = 0.95.²⁰ The effective numbers of the subjects were 74. The subjects were recruited by the purposive sampling method from eight settings in Chiang Mai province, Thailand: 1) Maharaj Nakorn Chiang Mai Hospital, 2) Chiang Mai Neurological Hospital, 3) McCormick Hospital, 4) Sarapeeborvonpattana Hospital, 5) Nong Pa Khrang Rehabilitation Center, 6) Nong Khwai Rehabilitation Center, 7) San Klang Rehabilitation Center, and 8) San Pong Rehabilitation Center. The 74 subjects were divided into two groups consisting of 37 healthy adults and 37 patients with cognitive impairment. Inclusion criteria for the subjects with cognitive impairment were: 1) been diagnosed with stroke or TBI, 2) aged 18 - 69 years, and 3) had cognitive impairment when assessed by the Mental State Examination T10 (MSET10). The inclusion criteria for the healthy adult group were to have a normal cognitive function when assessed by the MSET10. Both the healthy adults and cognitive impairment subjects could understand the Thai language and could follow three instructions. The exclusion criteria were: 1) had hearing loss or uncorrected visual problems by asking from their caregivers, 2) been diagnosed with psychosis or depression as seen from the patients' medical records or by asking from their caregivers, and 3) had drowsiness by observing their behavior during the screening phase.

Materials

1. The DLOTCA - Thai version:

Before the translation and adaptation process began, the authors sent an e-mail to Dr. Noomi Katz, the original DLOTCA's author, to request permission for the process of

translation. After receiving permission, the authors started the process of the translation and adaptation of the instrument proposed by the World Health Organization (WHO). This process consisted of forward translation, the expert panel, back-translation, expert panel discussion, and pretesting.²¹ In the first process, the English version of the DLOTCA was translated to the initial Thai version by the translator, an occupational therapist who was knowledgeable in the English and Thai languages, and familiar with the DLOTCA battery. Next, the authors and the forward translator discussed solving the inconsistent expressions of the translation and concluded it to be a forward Thai version. In the back-translation step, the forward Thai version was translated into English by the back-translator, a psychologist who was knowledgeable in the Thai and English languages, but unfamiliar with the DLOTCA. For the expert panel discussion that included the authors and translators, the discrepancies between the back-translation version and the original version were solved for conceptual and semantic equivalence. In this step, some words and some sentences were changed for appropriateness with the Thai culture for clarity. This completed the DLOTCA pretesting Thai version. In the pretesting phase, 10 healthy adults and 10 patients with cognitive impairment were recruited. They were aged 18-69 years, able to understand the Thai language, and could also follow the three instructions. The first author administered the DLOTCA pretesting version to these respondents and asked them which words or instructions were unclear. In this process, only two sentences in the Visuomotor Construction and Thinking Operations domains needed to be altered. After these five steps, the final DLOTCA - Thai version was produced.²²

The DLOTCA - Thai version was a battery of tests consisting of a test booklet and test kits. It was administered for 45-90 minutes depending on the amount of mediation needed. In case subjects were unable to complete the assessment in one session, it was possible to administer this test in more than one session within a reasonable time.

The DLOTCA - Thai version contained 28 subtests in seven cognitive domains. The first one, Orientation (O), consisted of two subtests composed of four questions for Orientation to Place (OP) and four questions for Orientation to Time (OT). Each question had a score of 0-2. The second one, Awareness (A), comprised three questions to examine the reason for hospitalization, recognition of cognitive impairment before testing, and after testing. Each question had a score of 1-3. The Awareness domain was administered only to the cognitive impairment group and also calculated for inter-rater reliability. The third one, Visual Perception (VP), contained three tasks for recognizing familiar objects (Object Identification), overlapping objects (Figure-ground) and objects at a different angle (Object Constancy). Each task had a score of 1-4. The fourth one, Spatial Perception (SP), comprised three subtests composed of awareness of their own body (Direction on the Client's Body), recognizing the position of objects around them (Spatial Relations), and recognizing

the position of objects in a picture (Spatial Relationships in a Picture). Each question had a score of 0-1. The fifth one, Praxis (P), had three subtests consisting of imitating movements (Motor Imitation), demonstrating how to use familiar objects (Utilization of Objects), and gesturing to use an object (Symbolic Actions). Each instruction had a score of 0-2. The sixth domain, Visuomotor Construction (VC), was composed of seven subtests comprising copying geometric shapes (Copying Geometric Forms), rebuilding the design from the model (Reproduction of a Two-dimensional Model), reconstructing the pattern on the board with pegs (Pegboard Construction), rebuilding the design with color blocks (Colored Block Design), rebuilding the design with the plain blocks (Plain Block Design), rebuilding the puzzle design (Reproduction of a Puzzle), and filling the numbers on a clock face by pointing the hands to 11:10 (Drawing a Clock). Each subtest had a score of 1-5. The last one, Thinking Operations (TO), consisted of eight subtests of sorting 14 cards of objects into groups (Categorization), sorting 18 plastic pieces into groups (ROC Unstructured), arranging five pictures in the correct sequence (Pictorial Sequence A), arranging six pictures in the correct sequence (Pictorial Sequence B), drawing the correct geometric shapes in sequence (Geometrical Sequence A), drawing the correct number and position of arrows in a sequence (Geometrical Sequence B), four questions of calculation (Verbal Mathematical Questions), and arranging 18 plastic pieces into groups as shown in the example (ROC Structured). Each subtest had a score of 1-5, except the Verbal Mathematical Questions that had a score of 0-1.

Each subtest, except for Orientation and Awareness, had a set of structured mediations from general to specific cognitive strategies. There were detailed options for each level of mediation where the evaluator could select the best option for the client to improve their performance. The Visual Perception, Spatial Perception, and Motor Imitations subtests of the Praxis domains had a structure of four mediation options, while the rest had a structure of five mediation options. The ranges from one to five were: 1) General intervention; 2) general feedback; 3) specific feedback; 4) partial intervention; and 5) stimuli reduction.

The scoring consisted of three components for each subtest, except Orientation and Awareness. The first one was a basic pre-mediation score. This was a static score in which higher scores indicated better performance. The second one was a dynamic mediation score. This was given in the case of a participant needing some cognitive strategies to understand or to do the task correctly or completely. This score then indicated the level of information required. The last one, a post-mediation score, was given to test the participant's ability to repeat the original task after mediation. Higher scores indicated better performance. If a participant needed no mediation, the post-mediation score equaled the pre-mediation score.¹⁰

2. *The Mental State Examination T10 (MSET10):*

This instrument was recommended as a cognitive screening test. The sensitivity of the MSET10 was 100%, and its specificity ranged from 98.40% to 99.40%. It had ten subtests. The first subtest, Orientation to Time, contained five questions about time awareness. The second subtest, Orientation to Place, contained five questions about place awareness. The third area was Registration consisting of a question for repeating three words. For the fourth area, Attention and Calculation, an examiner chose only one of two questions depending on the person's ability to make a calculation or spell a word. The fifth area was Recall that the examiner asked the client to repeat the names of three things being heard beforehand. The sixth area, Naming, was about the recognition of two familiar objects. The seventh area was to test the ability to exactly repeat a sentence. The eighth area was to examine following three commands. The ninth area was to test following a reading command. The last one was writing, where the examinee was asked to write a sentence. The highest scores were 29. The cut-off scores for the interpretation of the MSET10 results were divided into three categories depending on the educational level of the examinee. Firstly, a score less than 15 indicated having an impaired cognitive function for no education or illiterate people. Secondly, a score less than 18 was considered as an impaired cognitive function for people who graduated from primary school. Lastly, a score less than or equal to 22 was considered as cognitive impairment for those who finished at a higher level than primary school.²³

Study protocol

The multisite studies were ethically approved by three institution research boards comprising the Board of the Faculty of Associated Medical Sciences, Chiang Mai University, the Board of Maharaj Nakorn Chiang Mai Hospital, and the Board Chiang Mai Neurological Hospital. Before screening the subject, the first author gave the research project information to each subject and then requested them to sign the consent form. Next, the first author firstly recruited the patients with cognitive impairment, and then the healthy people according to the inclusion and exclusion criteria.

For studying the known-group method, the patients with cognitive impairment and the healthy people were individually assessed by the first author with the DLOTCA - Thai version. When the first author assessed the cognitive abilities of the patients with cognitive impairment, the research assistant, an occupational therapist with at least three years of experience working with neurological patients and who had received DLOTCA scoring training with the manual, gave a score to each subject separately from the first author to study the inter-rater reliability.^{24,25}

Statistical analysis

The frequency and percentage of the demographic data were presented and tested for the homogeneity between

those of the cognitive impairment group and those of the healthy group by using the chi-square test. The mean, standard deviation, median, and interquartile range were calculated to express the cognitive performance and levels of mediation for each group in studying the known-group validity. This was because the cognitive scores were not distributed in a normal curve, the Mann-Whitney U test; thus, was used to analyze the difference of the domain scores between groups. Furthermore, the Wilcoxon-signed rank test was calculated to test the change from the pre- to post-mediation scores within the group in all domains, except on Orientation and Awareness. The ICC was used to analyze the inter-rater reliability.

Results

In the study of the known-group validity, 37 clients with cognitive impairment and 37 healthy adults were purposively recruited. Most of them were aged 60-69 years, had completed elementary education, and worked in commerce and service occupations. Moreover, the age, education level, and occupation type in both groups showed no differences (Table 1). In addition, only 37 clients with cognitive impairment were included for testing the inter-rater reliability.

Known-group validity

The mean, standard deviation, median, and interquartile range of the pre-mediation cognitive scores of each group

are presented in Table 2. The comparison of the scores between the two groups by the Mann-Whitney U test revealed that there was a significant difference in the pre-mediation scores in all domains between the groups. In addition, the results revealed that healthy participants achieved maximum scores on Orientation, Spatial Perception, and Praxis. They also got a near maximum score on Visual Perception, Visuomotor Construction, and Thinking Operation. However, clients with cognitive impairment received maximum scores only on Spatial Perception. These scores indicated that clients with cognitive impairment had lower cognitive performance than healthy participants.

The mean, standard deviation, median, and interquartile range of the mediation scores in all domains are presented in Table 3. The mediation scores between the groups of clients with cognitive impairment and healthy adults who needed mediation displayed significant differences in all domains. The healthy adults needed low levels of mediation (general intervention and general feedback) in all domains except in Visual Perception and Verbal Mathematical Questions. For these two domains, the healthy adults needed higher levels of mediation (partial intervention). The clients with cognitive impairment needed the highest levels (partial intervention and reduced amount) of mediation in all domains.

Moreover, the mean, standard deviation, median, interquartile range and comparison of the pre- with the post-mediation cognitive scores within the groups of participants

Table 1. The demographic data of the age, education level, and occupation type of the people with cognitive impairment and healthy adults in the construct validity measurement (n = 74; 37 in each).

Demographics	No. of persons (%)		p-value
	Cognitive impairment group	Healthy adults	
Age (years)	Less than 60	18 (48.60)	0.817
	60-69	19 (51.40)	
Education	Elementary level	24 (64.90)	1.000
	Secondary level or upper	13 (35.10)	
Occupation	Agriculture	4 (10.80)	1.000
	Commerce and services	32 (86.50)	
	Student	1 (2.70)	

*p < 0.05 by chi-square test

Table 2. Comparison of the pre-mediation cognitive scores between the cognitive impairment and healthy group (n = 74; 37 in each).

Cognitive domains ^a	Pre-mediation cognitive scores ^b								Z-score	p-value
	Cognitive impairment group				Healthy adults					
	M	SD	Me	IQR	M	SD	Me	IQR		
O (0-2)	1.28	0.47	1.25	1.69-1.06	2.00	0.00	2.00	2.00-2.00	-7.58	< 0.001*
VP (1-4)	2.72	0.67	3.00	3.17-2.33	3.61	0.15	3.67	3.67-3.67	-6.97	< 0.001*
SP (0-1)	0.62	0.21	1.00	1.00-0.86	0.94	0.05	1.00	1.00-1.00	-7.07	< 0.001*
P (0-2)	1.23	0.42	1.33	1.50-1.00	1.96	0.07	2.00	2.00-1.92	-7.21	< 0.001*
VC (1-5)	2.29	1.13	2.00	3.36-1.21	4.37	0.39	4.43	4.64-4.14	-6.72	< 0.001*
TO (1-5)	1.83	0.91	1.43	2.57-1.14	4.12	0.40	4.14	4.50-3.86	-7.19	< 0.001*
VQ (0-1)	0.05	0.15	0.00	0.00-0.00	0.51	0.35	0.50	0.86-0.25	-6.23	< 0.001*

^aO, orientation; VP, visual perception; SP, spatial perception; P, praxis; VC, visuomotor construction; TO, thinking operations; VQ, verbal mathematical questions; ^bM, mean; SD, standard deviation; Me, median; IQR, interquartile range; *p < 0.05 by the Mann-Whitney U test (1-tailed).

revealed significant differences in the cognitive scores between the post- and pre-mediation in all domains (Tables 4 and 5). These scores indicated that cognitive abilities could be improved through the mediation process.

Inter-rater reliability

In an inter-rater reliability study, the intra-class correlation coefficient (ICC) was calculated for a subsample of 37 clients with cognitive impairment. As shown in Table 6, the correlations of the pre- and post-mediation scores and level of medication given by the two raters were between .914 to 1.000. These scores addressed the consistency of the implementation of the rating system.

Discussion

The known-group validity analysis of the DLOTCA - Thai version revealed that the pre-mediation scores between the groups had statistically significant differences on all domains at the level of 0.05. This supported the construct validity by discriminating between the groups of healthy adults and those of the cognitive impairment clients. This also strengthened the fact that this assessment tool was designed for identifying both the basic and higher cognitive abilities and limitations of a client suffering from neurological dysfunction in clinical practice.^{10,14} In addition, clients with cognitive impairment received lower scores than healthy adults in all domains. These scores confirmed that the cognitive impairment clients had lower cognitive abilities than healthy people. The results

Table 3. Comparison of the mediation scores between clients of the cognitive impairment group and healthy group who needed mediation

Domains ^a	Mediation Scores ^b										Z-score	p-value
	Cognitive impairment group					Healthy adults						
	N	M	SD	Me	IQR	N	M	SD	Me	IQR		
VP	37	3.48	0.58	4.00	4.00-3.00	36	3.88	0.37	4.00	4.00-4.00	-3.38	0.001*
SP	36	3.24	0.95	3.76	4.00-2.50	22	1.86	0.71	2.00	2.00-1.00	-4.62	< 0.001*
P	36	3.34	0.92	3.41	4.11-2.61	12	1.99	0.76	2.00	2.83-1.13	-3.79	< 0.001*
VC	37	4.18	0.96	4.57	5.00-3.69	35	2.07	0.64	2.00	2.60-1.60	-6.42	< 0.001*
TO	37	4.43	0.57	4.57	5.00-4.07	37	2.53	0.55	2.50	3.00-2.00	-7.28	< 0.001*
VQ	37	4.64	0.53	5.00	5.00-4.25	28	3.43	1.15	4.00	4.33-2.63	-4.93	< 0.001*

^aVP, visual perception; SP, spatial perception; P, praxis; VC, visuomotor construction; TO, thinking operations; VQ, verbal mathematical questions; ^bM, mean; SD, standard deviation; Me, median; IQR, interquartile range; *p < 0.05 by the Mann-Whitney U test (2 tailed).

Table 4. Comparison of the post-mediation cognitive scores with the pre-mediation cognitive scores in the cognitive impairment group (n = 37).

Domains ^a	Cognitive scores ^b								Z-score	p-value
	Pre-mediation				Post-mediation					
	M	SD	Me	IQR	M	SD	Me	IQR		
VP	3.14	0.71	3.33	3.67-3.00	3.68	0.05	3.67	3.67-3.67	-4.46	< 0.001*
SP	0.78	0.18	0.75	0.92-0.67	0.99	0.03	1.00	1.00-1.00	-4.70	< 0.001*
P	1.70	0.39	1.83	2.00-1.63	2.00	0.00	2.00	2.00-2.00	-5.23	< 0.001*
VC	3.06	1.38	3.43	4.29-1.71	5.00	0.00	5.00	5.00-5.00	-4.79	< 0.001*
TO	2.68	1.16	3.00	3.64-1.43	4.99	0.47	5.00	5.00-5.00	-4.79	< 0.001*
VQ	0.05	0.15	0.00	0.00-0.00	0.57	0.46	0.75	1.00-1.00	-4.47	< 0.001*

^aVP, visual perception; SP, spatial perception; P, praxis; VC, visuomotor construction; TO, thinking operations; VQ, verbal mathematical questions; ^bM, mean; SD, standard deviation; Me, median; IQR, interquartile range; *p < 0.05 by the the Wilcoxon signed-rank test (2 tailed).

Table 5. Comparison of the pre-mediation cognitive scores between the cognitive impairment and healthy group (n = 74; 37 in each).

Cognitive domains ^a	Cognitive scores ^b								Z-score	p-value
	Pre-mediation				Post-mediation					
	M	SD	Me	IQR	M	SD	Me	IQR		
VP (1-4)	3.61	0.15	3.67	3.67-3.67	3.68	0.05	3.67	3.67-3.67	-2.65	0.008*
SP (0-1)	0.94	0.05	0.92	1.00-0.92	1.00	0.03	1.00	1.00-1.00	-4.41	< .001*
P (0-2)	1.95	0.07	2.00	2.00-1.92	2.00	0.00	2.00	2.00-2.00	-3.17	0.002*
VC (1-5)	4.37	0.39	4.43	4.64-4.14	5.00	0.00	5.00	5.00-5.00	-5.17	< .001*
TO (1-5)	4.12	0.40	4.14	4.50-3.86	4.99	0.05	5.00	5.00-5.00	-5.32	< .001*
VQ (0-1)	0.51	0.35	0.50	0.86-0.25	0.97	0.16	1.00	1.00-1.00	-4.61	< .001*

^aVP, visual perception; SP, spatial perception; P, praxis; VC, visuomotor construction; TO, thinking operations; VQ, verbal mathematical questions; ^bM, mean; SD, standard deviation; Me, median; IQR, interquartile range; *p < 0.05 by the Wilcoxon signed-rank test (1 tailed).

Table 6. The inter-rater reliability of the DLOTCA - Thai version (n = 37) with intra-class correlation coefficient.

Cognitive domains	Examiner A		Examiner B		Intra-class correlation coefficient	Reliability level
	M	SD	M	SD		
Orientation	1.283	0.470	1.307	0.486	0.993	Excellent
Awareness	2.297	0.435	2.198	0.523	0.914	Excellent
Visual perception						
Pre-mediation	2.720	0.673	2.720	0.664	0.997	Excellent
Mediation	3.477	0.576	3.477	0.576	1.000	Excellent
Post-mediation	3.144	0.705	3.153	0.705	0.995	Excellent
Spatial perception						
Pre-mediation	0.621	0.214	0.621	0.214	1.000	Excellent
Mediation	3.242	0.952	3.305	0.872	0.956	Excellent
Post-mediation	0.779	0.175	0.772	0.171	0.992	Excellent
Praxis						
Pre-mediation	1.229	0.415	1.234	0.415	0.997	Excellent
Mediation	3.337	0.924	3.351	0.906	0.998	Excellent
Post-mediation	1.700	0.392	1.709	0.393	0.998	Excellent
Visuomotor construction						
Pre-mediation	2.293	1.126	2.293	1.127	0.998	Excellent
Mediation	4.180	0.957	4.180	0.957	1.000	Excellent
Post-mediation	3.061	1.381	3.054	1.380	1.000	Excellent
Thinking operations						
Pre-mediation	1.183	0.911	1.183	0.912	1.000	Excellent
Mediation	4.429	0.565	4.429	0.565	1.000	Excellent
Post-mediation	2.687	1.160	2.683	1.165	1.000	Excellent

M, mean; SD, standard deviation.

in this present study were different from the study of the original version of the DLOTCA. In the study of the DLOTCA - English version, the comparison of healthy people and stroke patients found a significant difference in pre-mediation in the Orientation, Visual Perception, Spatial Perception, and Praxis domains between the groups. There was no difference in the scores on the Visuomotor Construction and Thinking Operation domains between the groups. This might be a result of the influence of education on cognitive function. In that study, healthy participants had less years of education than the stroke patients.¹⁰ Contrary to this present study, healthy people and clients with cognitive impairment were a similar age, education level, and occupation.

In addition, the results revealed that clients with cognitive impairment needed a higher level of mediation than the healthy group. This was consistent with the literature review where Radomski and Morrison²⁶ stated that people with brain damage would have a change of input data and cognitive processes resulting in cognitive impairment. The results also demonstrated the significant differences of the pre- and post-mediation cognitive scores in a group of clients with cognitive impairment who had a high level of mediation; mostly partial intervention and reduced stimuli. These scores suggested that through the structure of the mediation process the potential for change in cognitive abilities would benefit in the intervention. This was consistent with the literature review of

Haywood and Tzurriel¹² that the teaching or mediation process could measure strategies for thinking, perception, learning, problem-solving, and also improve cognitive function. It also supported the hierarchy of the cognitive abilities that were the foundation for the LOTCA development^{10,27} and the notion of higher cognitive demands; therefore, more mediation would be required to improve the skills. The DLOTCA - Thai version thus has been in line with those of previous studies and theories and supported the premise of a new method of evaluation that has led directly to intervention planning for the clients.^{8-14,28}

The results also showed that the healthy participants received maximum scores on the basic cognitive skills, except on the Visual Perception domain. This might be because of the difference in culture. The DLOTCA was developed in Western culture and some objects used in Visual Perception would be unfamiliar in the Thai culture resulting in not recognizing the objects. For higher cognitive skills; such as, Visuomotor Construction, Thinking Operations, and Verbal Mathematical Questions, even healthy adults did not reach the maximum scores. They then needed mediation to perform the subtests. These results indicated that healthy people had some difficulties too, probably due to their education and experience, as well as terms of complexity and unfamiliarity with the task.^{10,14,29}

In the study of inter-rater reliability, the results revealed that the scoring of the pre- and post-mediation, as well as the level of mediation process on all cognitive domains were at an excellent level. This indicated that the DLOTCA - Thai version used clear words and language, as well as guiding to consistently implement the rating system. This was because of the standardized translation and adaptation of the instruments process that followed the WHO guidelines²¹ where there was a translation, back-translation, and verification of semantic and conceptual equality between the original assessment tool and translated version by a panel of experts. There were corrections followed by the advice of experts and the use of concise and clear words.^{21,30} Another impact may have been the result of the training before the implementation of the tool. This was consistent with the literature review that training is a necessary process to help practitioners gain knowledge, understanding, and skills to perform accurately and effectively. Moreover, this would help to increase the potential of the practitioners as well.³¹ The results confirmed the advantage of this tool for practitioners and researchers in occupational therapy. The good psychometric properties in terms of construct validity and inter-rater reliability of the DLOTCA - Thai version were suitable for assessment in Thai clients. However, there were no cut-off points for each domain. Further research is recommended for sensitivity and specificity studies.

Conclusions

The DLOTCA - Thai version has passed the study of the psychometric properties of known-group validity and inter-rater reliability that could be used as a cognitive assessment tool in the Thai context. Therapists could use the data that were derived from the DLOTCA - Thai version for planning and cognitive rehabilitation that would be appropriate with competence and impairments, learning potential, and the conceptual strategies of an individual. Lastly, the therapists could use mediation in cognitive intervention.

Disclosure

The authors have no conflict of interest to declare.

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