

Innovative Communication Mechanism for the Psychological Well-being of Caregivers and Elderly with Dementia in the context of Thailand

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The present research aims to develop an innovative communication mechanism to promote the relationship between caregivers and people with dementia. A mobile application system was developed based on the Reminiscence therapy framework in conjunction with an effective interpersonal communication method using enabling technology, which is the Speech to Text and Natural Language Processing (NLP). Thirty pairs of caregivers and their counterparts with dementia were the experimental subjects with another thirty pairs as the control. The results indicated a better relationship and psychological well-being after the use of this mobile application. The experimental group also has a higher rating score on both counts than the control group.

Key words: *Dementia, Caregivers, Reminiscence therapy, Speech to text, Natural language processing, Application.*

Introduction

Even though medical advancements can extend people's lives, some people might face mental and physical deterioration, especially brain disorders. Dementia is a brain disorder found mostly in elderly patients (Assantachai, 2013). Dementia usually causes the elderly to lose their memory, knowledge, ideas, decision-making abilities, emotions, and control over

behaviour (Muangpaisarn, 2010). Additionally, dementia is a chronic disease; therefore, a caregiver is necessary to provide ongoing care (Chansirikarn, 2009) and help patients with basic routines, particularly those who have behavioural and emotional problems.

Dementia caregivers should have a management technique to take care of patients (Chansirikarn, 2009). However, confrontation problems while taking care of dementia patients can cause stress to caregivers (Dickens et al., 2009), not only from dealing with their personal life and other responsibilities, but caring for them may increase the workload of caregivers. Caring for patients takes a great deal of time and presents significant challenges. How to be effective and efficient in the care for these patients requires specific knowledge about the disease and how to do appropriate caring so that possible conflicts and anger towards the patient can be minimised. The relevant caring experience would reduce the problems of abandonment and hurting the patient physically and verbally (Sasat, 2008).

A study of the caregivers stated that patients' stress is related to psychological well-being in various ways (Ryff, 2014). The study found a positive relationship between patients and caregivers directly associated with social factors, such as relationship attitudes towards family members. Interestingly, having a good relationship with the family affects the psychological well-being of a patient directly. Nevertheless, the study did not mention the process of how to build a good relationship within the family. Also, there was no theory explaining how to make a good relationship between patients and caregivers. Furthermore, the study of communication between caregivers and dementia patients (Thongyindee, et al., 2009) states that as the patients cannot speak properly, the caregivers might need to use various methods to communicate with patients (Sukyist, 2001) by adapting the interpersonal communication process (Hargie, 2016).

The most effective communication between patients and caregivers creates a good relationship and maintains consistency. To take care of them, the caregiver is playing an important role (Guzmán-García et al., 2013). Thus, caregivers should have a positive outlook on patients, must be able to find various ways to handle their behaviour problems, and should have nursing skills related to the typical symptoms. On the other hand, patients should exercise their brains by doing activities, such as participating in various social events. The patients can exercise their minds by doing meditation, mindfulness training, imaginative thinking, drawing pictures, and having cognitive stimulation. Also, caregivers should use written messages and pictures as communication tools. The patients and caregivers need to talk and do the activities that the patients prefer together. This method will create good emotions for both caregivers and patients. Therefore, caregivers must communicate with patients frequently to improve their relationship.

The literature review found that there was a lack of connection and development in terms of the introduction of communication elements to increase the relationship between caregivers and patients. This research aims to study how to improve the interpersonal relationship between them. Thus, this research has proposed the implementation of Reminiscence Therapy (Lazar et al., 2014) for dementia patients. The typical way is to use Reminiscence Therapy for gathering participants to join activities. However, this method is complicated because of its inconvenience. Therefore, the other form of interaction improvement between caregivers and patients is to develop an application that can be used in the household.

In this study, the researcher has developed the product model innovation, based on Reminiscence Therapy, which will improve the relationship between caregivers and patients and better the mental well-being of both parties. The application model combines Reminiscence Therapy with a Speech Recognition system (Besacier et al., 2013) that will transform audio into text (Speech to Text). Technological advancement was adapted in the application, including the Natural Language Processing (NLP) (Machiraju & Modi, 2017), which is the study of linguistic structure. Additionally, this application system will use the artificial intelligence of knowledge representation with the system that helps analyse words to develop this practical, innovative, and successful application.

Literature Review

Reminiscence Therapy

Hamilton (1985) proposes the concept of Reminiscence Therapy that aims to restore good experiences of which the elderly are proud, happy, and valuable for them to survive. Reminiscence Therapy is a process of experience thinking that makes the patients feel pleased and be able to reminisce. The reminiscence process created by Hamilton (Buchanan, 2016) consists of four phrases as follows:

1. Memory is the past event, thoughts, and the feelings towards each event that remain in memory forever.
2. Experience is the stage of event meaning; Also, the attitude towards each event that delivers impression to the person. Thus, experience allows people to keep memory all the time.
3. Social interaction is an experience-sharing period. Also, the emotion that people have will help enhance social interaction and improve self-expression.
4. The Cclosure is the a period of relationship termination, and this is an important phrase. When the time for termination has arrived, it is a chance for the elderly to summarize what happened during the relationship improvement process.

Reminiscence types were classified by Wong and Watt (Meléndez, 2015), and they can be used for data analysis as follows:

1. *Integrative Reminiscence* mainly focuses on the integration between the present and the past. It indicates feelings, self-confidence, and self-conflict.
2. *Instrumental Reminiscence* is a reminder that draws past experience that affects recent problem solving by using media.
3. *Transmissive Reminiscence* is the story of experiences aiming at exchanging information and pleasantness.
4. *Escapist Reminiscence* is the mechanic with self-defence towards past experience and current experience.
5. *Obsessive Reminiscence* is a reminder of prior experience. The negative feelings with this type of experience tend to make people expect more positive feelings towards present life.
6. *Narrative Reminiscence* is the use of nature instead of interpretation or evaluation. Narrative Reminiscence is an autobiographical style or text without adding. This type of experience draws the elderly think about past events (Buchanan, 2016).

In operating the reminiscence program for the elderly, it is essential to start by building a good relationship between caregivers and the elderly with dementia. To create a good relationship requires various skills such as feeling reflection skills, listening skills, interpretation skills, observation skills, encouragement skills, and questioning skills (Buchanan, 2016).

Cited by Capuzzi and Gross (Haight & Burnside, 2005), the reminiscence topic selection has been done by following these guidelines: 1. The process begins with experience related to age, culture, education, gender, and ethics. Furthermore, previous research has selected the topics related to life span, which are children, young people, late-teens, middle age group, or elderly. 2. The topic should have an emphasise on people in the same age group. 3. Other topic selections include hobbies, festivals, special days, home, food, favourite things, and pursuit by vision, hearing, smell, taste, and sensory stimulation (Bejan et. al, 2018).

Moreover, the reminiscence in patients can reduce cognitive decline because the first stage of dementia will have only short-term memory deficiency, but long-term memory remains. Besides, stimulating memory allows the elderly to think about past-experience, which is easier than remembering new things. The previous research found that the cognitive ability of the elderly can get better by using this method. Also, the reminiscence will increase psychological well-being as well as enhancing the cognitive ability. However, there are not many studies on reminiscence therapy in Thailand.

Natural Language Processing

The use of reminiscence can strengthen the relationship between caregivers and patients as it relies on the principles of Natural Language Processing (NLP), which uses voice communications to reduce the restrictions on the use of smartphones of the elderly and especially those with dementia. Furthermore, the NLP system is the interpretation from typical language that humans use to communicate through what is called "structured data." The process can be understood in two ways (Kaysorn, 2010), which is the study and understanding of the linguistic structure and other structures based on knowledge of artificial intelligence by replacing the knowledge representation with the corpus.

For Thai text, Young et. al. (2018) states that it is necessary to break the sentences because the Thai language has the form of writing words and no spaces between words as English. Moreover, the word-cutting program for Thai text that is open for free download has been developed by an operating unit called Human Language Science, Technology Centre, Electronics, and The National Computer (NECTEC) is the LexTo (Thai Lexeme Tokenizer) and TLexs (Thai Lexeme Analyser) programs. When the text is extracted, the words are analysed and replaced in a structure. Also, the natural language processing by linguistic structure consists of the smallest subunit called "morpheme," which may or may not have meaning. When many morphemes form, the words will be meaningful because many words are composed of phrases, and many phrases will create "Sentence:S" that does not consider the meaning of a word, but relies on its function as follows (Sintupuan, 2003):

$S = NP + VP$

$NP = N \mid N + (ADJ) + (ADV) + (PP) \mid PRON$

$VP = V \mid V + (ADV) \mid AUX + V \mid VP + NP$

$PP = PREP + NP \mid PREP + VP \mid PREP + NP + VP$

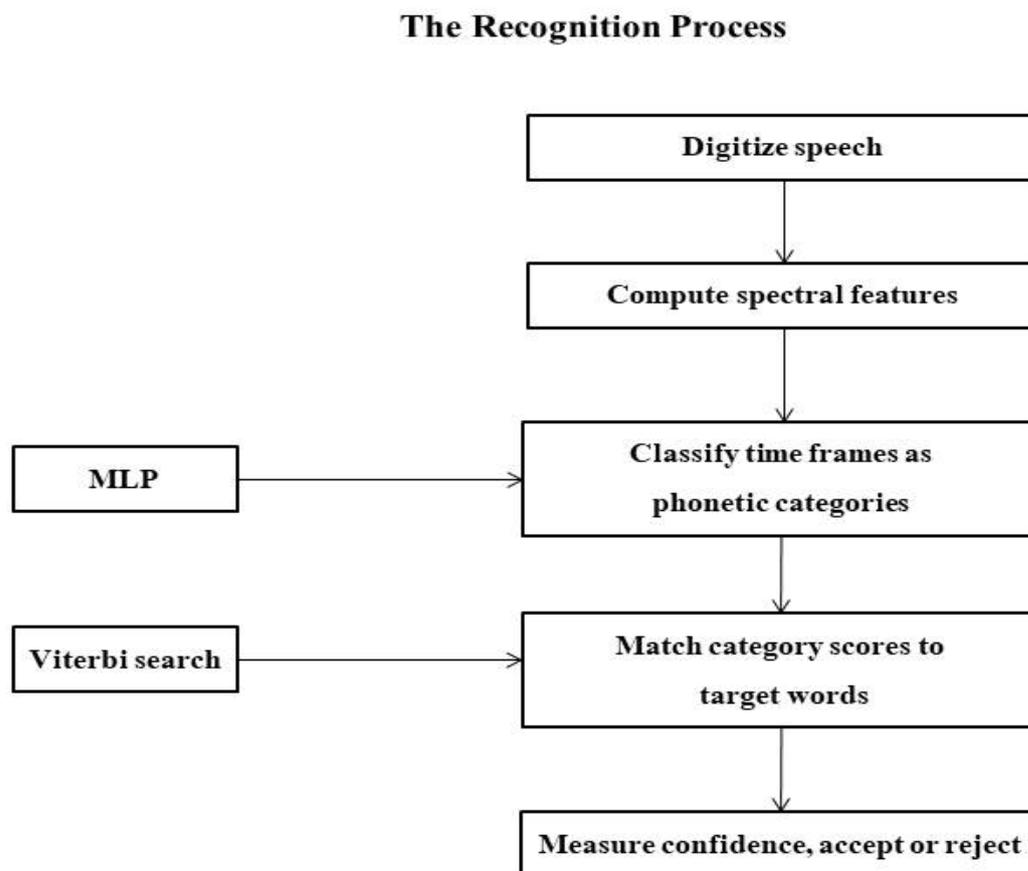
(S= Sentence, NP= Noun Phase, VP= Verb Phase, N= Noun, ADJ= Adjective, ADV= Adverb, PP= PREP NP, PRON= Pronoun, AUX= Auxiliary Verb, PREP= Preposition)

Natural language processing uses knowledge substitution with word corpus because the Thai language is immutable, and it is not possible to analyse all sentences. This results in the need to compile words from documents and sentences from relevant sources, which are considered by domain experts and stored in the corpus. After putting information via the NLP, the system will convert to text and voice, then analyse the pronunciation to develop communication skills and improve the interaction between caregivers and patients.

Speech Recognition

Thai speech recognition systems have been studied and researched for more than 40 years. Currently, speech recognition technology is very useful and can be adapted to use in lifestyle in various ways (Sitikongtham & Paireekreng, 2017).

Picture 1. Speech Recognition Process



Source: (Speech Recognition) (Hansakunbuntheung et al., 2005)

However, the current Thai speech recognition system is still not 100% accurate, which is caused by the variation in various aspects depending on the different speakers (Montri and Chalermphan, 2010). Furthermore, speaking in groups of things that the system has learned will have a different effect when compared with new subjects that the system has not yet determined; also, it will give different results (Hansakunbuntheung et. Al., 2005). This system will be able to translate the user's voice into text to be able to store various information easily and be ready to bring information. These factors have been analysed and the results obtained from the use of innovative communication processes to enhance the interaction between caregivers and Dementia patients.

Research method

Although the primary research method of the present study is experimental research, the research processes extend to application development and survey research as well. The application and the questionnaire are the instruments used in the experiment. This section comprises three sub-sections: data and sample, the experimental research process, and the research instruments.

Data and Sample

Dementia is a brain disorder symptom, and it typically happens with older patients, and symptoms will increase as age increases. Assansathai (2013) projected that, in Thailand, the prevalence of those suffering from dementia was around 229,000 in 2010, 450,000 in 2020, and 1,200,000 in 2050. Chansirikhan (2009) found 40-70% of those also become Alzheimer patients.

Although previous studies reported a large number of Alzheimer's and Dementia patients in Thailand, no official listing is available publicly; thus, the researcher employed the convenient sampling technique to gain access to the experimental research samples. One inclusion criterion was those with early dementia who can communicate and help themselves. The researcher contacted the caregivers via the Alzheimer's Caregiver Association to gain access to the available samples in this study. The sampling frame also included patients from two government hospitals and one nursing home.

The experimental research samples in this study were 60 pairs of caregivers and dementia patients. Forty pairs of the subjects were from the Bangkok metropolitan area and 20 from Chonburi province. The samples were divided into two groups with 30 pairs per group. The preferences of research participants were taken into consideration when dividing the pairs into experimental or control groups. The experimental group used the application, while the control group did not.

Experimental Research Process

A pilot test was carried out with three pairs of caregivers and patients. One physician and one nurse also provided comments on the experimental procedures. The pros and cons of testing procedures helped to sharpen the steps of the actual experiment. The experimental group also needed to attend an orientation on how to use the application.

During the one week of the data collection, the caregivers would take care of the patients as usual and were requested to use the application on a tablet at least once a day for 10-15

minutes each time. The app recorded all usages so that the researcher could monitor the activity at all times by using an administration account.

Besides, using the application for one week, the research process included both before and after surveys from all experimental pairs on the relationships and psychological well-being (Ryff and Keyes, 1995). There were two sets of paper-based questionnaires, one for the caregiver and another for the dementia patient. For each dementia patient response, his/her caregiver would ask the question and mark the answer on the questionnaire. The same set of inquiries with the same procedure was used to assess the psychological well-being of both caregivers and dementia patients in the control group only one time.

Research Instruments

Application System Development

The two phases of application development were as follows:

Phase 1 was to gather background information for the product model innovation that would improve the relationships between caregivers and patients. This phase consisted primarily of a literature review on theoretical foundations to be incorporated into innovative product models. Three topics to be reviewed were as follows:

- 1) The study of dementia and related concepts
- 2) The study of interpersonal communication concepts with dementia patients
- 3) The study of memory recall process (Reminiscence Therapy)

Phase 2 used the information gathered in Phase 1 to design the application (the innovative product model). In this phase, the basic model was juxtaposed with relevant technology, namely Natural Language Processing (NLP) and Thai Speech Recognition System technology. A mobile application system was then developed and validated by six experts to ensure that the use of this application could enhance the relationships between caregivers and those with dementia.

The Application System Features (Example Screenshots in Appendix A)

Users of the application will have control and flexibility in changing the content relevant to their own life experiences. The questions are in the form of images, symbols, and music. The application system allows the caregiver to insert pictures and ask questions related to the personal information of patients. For example, putting pictures of children and asking who is in this picture and they enter the correct answer. While using the application, caregivers

should stimulate patients to remember and think about the content of the question in place. The application is also friendly for elderly users by using NLP and Thai speech recognition. For example, caregivers can insert questions by typing or speaking then the system processes data into sentences: While dementia patients are using the application, they can read questions and answers or press a button for listening.

The questions pertaining to individual users will be kept separately and will be randomly combined with other questions in the application. For convenience, only three choices of answers are available. The application will check the correctness of answers and the answering time. Caregivers are instructed to help set up the application and encourage patients to press the answer on the mobile device by themselves. For every ten questions, the application will summarise the usage results. The application also provides statistical data of individual and cumulative usages by each user.

The Survey instrument (Caregiver and Dementia questionnaires in Appendix B)

The questionnaire was designed to assess the relationships and psychological well-being of both caregivers and patients. For the experimental group, the same test was administered twice, before using the application and after. The same test was given to the control group but only one time. All ratings use a 5-point Likert scale (Likert, 1932). The questionnaire consists of three parts:

Part 1 is the general information such as demographic data, e.g., gender, age, educational background, the relationship between caregivers and Dementia patients, care-taking duration per day, and the number of years of caring for the patient.

Part 2 contains 20 questions about the relationship between caregivers and patients. The questions will determine the perception of the relationship between caregivers and patients by assessing communication, attention, and behaviour between them. Both caregivers and patients will be assessed.

Part 3 includes 15 questions about psychological well-being. The questions will assess the well-being of caregivers and patients by evaluating satisfaction in life and attitude towards patients' related conditions.

Ethics Statement

All participants were informed about the objective of the study and their verbal consent. The study was approved by the research ethics review committee for research involving human research participants, the health sciences group, and Chulalongkorn University.



Results

This research has surveyed a sample of 60 pairs in the Bangkok and Chonburi areas by using the SPSS program for statistical analyses.

Profile of Caregivers and Dementia Patients

The demographic data is divided into 60 caregivers and 60 Dementia patients. As shown in Table 1, the caregivers included 31 women and 29 males; most of them were between 28- 37 years old (19 persons) and married (26 persons). Twenty-one caregivers were on duty for one year and twenty-one for 4- 6years. The duration of care per day was between 7- 10hours. The profile of the patients included 36 women and 24 men; 24 people were single; 28 were 66-75 years old; 32 persons received dementia medication and 26 occupational therapy.

Table 1: Demographic data of people with dementia and caregivers

<i>Respondents</i>	<i>Frequency</i>		<i>Respondents</i>	<i>Frequency</i>	
	Dementia	Caregiver		Dementia	Caregiver
Gender			Treatment of dementia by occupational therapy		
Male	24	29	No	34	
Female	36	31	Yes	26	
Status			Treatment of dementia by medication		
Single	24	18	No	28	
Married	14	26	Yes	32	
Widow	10	8			
Divorce	12	8	Caregiver Assistant Availability		
			Not Available		33
			Available		27
Age (Years old)			Relationship with people with dementia		
< 45	0		Couple		8
45-55	4		Relatives		10
56-65	20		Children		10
66-75	28		Parents		8
76 up	8		Friends		7
			Caregivers		8
Age (Years old)			Attendants		9
18-27		8	Duration of care (Years)		
28-37		19	< 1year		21
38-47		15	1-3 years		18
48-57		10	4-6 years		21
58 up		8	6 years up		0
Period of dementia (Years)			Period of care per day (Hours)		
< 1year	12		< 3hrs.		13
1-3 years	14		3-6 hrs.		15
4-6 years	20		7-10 hrs.		18
6 years up	0		10 hrs. up		14

Overall Relationships and Psychological Well-Being

The Experimental Group after Using the Application and Control Group

T-test statistics, comparing the means between the experiment and control groups, were carried out to test whether the relationships between caregivers and dementia patients had changed after the use of the application. The same goes for comparing the well-being of both groups.

$$H_0: \mu_{\text{control group}} = \mu_{\text{After test group}}$$

$$H_1: \mu_{\text{control group}} < \mu_{\text{After test group}}$$

Table 2: Overall relationships and psychological well-being of patient experimental group after using the application and those in the control group

	After (N=30)		Control Group (N=30)		t	df	P-Value	Sig. (1- tailed)
	Mean	S.D.	Mean	S.D.				
Relationship	154.93	19.527	143.67	17.864	2.33	58	0.458	0.0115
Psychological well-being	123.80	10.125	116.30	11.117	2.73	58	0.498	0.004

The results in Table 2 show that after using the application, the “experimental” pairs had better relationships and psychological well-being than the “control” pairs, (relationship means = 154.93, 143.67, $t=2.33$, $p=0.0115$; psychological well-being means = 123.80, 116.30, $t=2.73$, $p=.004$). Both statistics demonstrate a 0.05 level of significance.

The Experimental Group before Using the Application and after Using the Application (Experimental Group)

T-test statistics, comparing the means between the experiment after using the application and before, were carried out to test whether the relationships between caregivers and the person with dementia had changed after the use of the application. The same goes comparing the well-being of both groups.

$$H_0: \mu_{\text{before test group}} = \mu_{\text{After test group}}$$

$$H_1: \mu_{\text{before test group}} < \mu_{\text{After test group}}$$

Table 3: Overall relationships and Psychological well-being of the experimental group after using the application and before using the application

	After (N=30)		Before (N=30)		t	df	P- Value	Sig. (1-tailed)
	Mean	S.D.	Mean	S.D.				
Relationship	154.93	19.527	143.10	18.792	2.392	58	0.096	0.01
Psychological well-being	123.80	10.125	115.67	11.117	3.083	58	0.07	0.0015

Results in Table 3 show that after using the application, the experimental pairs had better relationships and psychological well-being than before using the application (relationship means = 154.93, 143.10, $t=2.392$, $p=0.01$; Psychological well-being means = 123.80, 115.67, $t=3.083$, $p=.0015$). Both statistics demonstrate a 0.05 level of significance.

Discussion

For people with dementia, learning something new is very difficult, but they can practice recalling their old memories, they can be shared with others and also remain accessible (Brooker and Duce, 2000). Reminiscence therapy can encourage elderly people with dementia to have social interaction with group members (Tadaka and Kanagawa, 2007). The result shows that it is an effective therapy for people with dementia and the a necessary process to improve life satisfaction (O'Shea et al., 2014). According to psychological well-being dimensions, Meléndez et al. (2013) state that reminiscence therapy is effective in improving some of these dimensions. This therapy achieves a sense of coherence and meaning in life, which appears to have a positive and direct link to well-being (O'Rourke et al., 2011). Moreover, according to reminiscence group therapy, interactions occur between group members through activities that provide stimulus and social support to both caregivers and patients (Brooker and Duce, 2000).

In terms of the therapy, it indicated that the process improves their relationship with others, especially caregivers. Quinn C. et al. (2009) stated that from 15 studies included in the review examined a wide variety of aspects of relationship quality were noted. The findings indicated that caregiving can make an impact on the quality of the relationship between the caregiver and the care recipient. Also, the results confirm that relationship quality can have an effect on the wellbeing of caregivers and on the care that caregivers provide. There was, however, little evidence regarding the impact of relationship quality on the care recipient's well-being.

From this study, after people with dementia using mobile reminiscence applications together with caregivers, the result shows that relationship and psychological well-being between



caregivers and dementia people are better than before using the application and control group. By using the mobile application, patients are encouraged by multimedia and can input their own data, which is more effective than traditional reminiscence therapy. Moreover, the user is more comfortable to use it anywhere and anytime. While they are using the application, they also have conversations together about daily life and experiences that make their relationship better.

Conclusion and Recommendation

This research examined the relationship between caregivers and people with dementia and the psychological well-being of those parties by using an application (app) developed from the concept of Reminiscence Therapy with Speech to Text technology and National Language Processing as a catalyst for interaction. This research aimed to study the relationships and psychological well-being of both caregivers and elderly with dementia in two groups. First, the experimental group, which was surveyed twice – once before using the application and once after. Second, the control group that did not use the application. After that, all results were compared to find the level of relationship and psychological well-being of the two groups of researchers. The result found that caregivers and dementia patients had a better relationship and healthier psychological well-being after using the application for one week. Also, when compared with the control group that did not use the app, the results found that after the experimental group used the app, there was a better relationship and psychological well-being than the control group. Therefore, if continuously and consistently using the application, it should result in better relationships between caregivers and people with dementia, as well as improve psychological well-being.

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