Designing Early Detection Screening System for Dementia in Indonesia

Agatha Maisie Tjandra[1,2], Zi Yi Li[1], and Chien-Hsu Chen[1]

[1]Industrial Design Department, National Cheng Kung University, Tainan, Taiwan
[2]Visual Communication Design, Universitas Multimedia Nusantara, Indonesia

ABSTRACT

The lack of awareness and misunderstanding between dementia and forgetfulness as normal parts of aging often leads to late diagnoses of dementia. This situation can be compounded by the fact that there is currently no cure for dementia and it is difficult to prevent or slow its progression. To address this, an early warning system for detecting dementia symptoms is essential. This study aims to design a new approach to dementia screening by using a chatbot with customized questions for each user. If any potential symptoms are detected, the chatbot will provide recommendations for medical evaluation. This research focuses on individuals over 60 years of age who reside in urban areas in Indonesia and will be conducted through the WhatsApp platform, a widely used communication tool in the country. The chatbot will gather information on personal habits based on elements of dementia measurement through questions asked. Initial data was obtained through qualitative interviews, used to customize questions specific to each participant's preferences. By using the customization questions, the Chatbot Prevention Dementia will offer a personalized approach to detecting cognitive status and help family members understand the situation of the elderly individual.

Keywords: Dementia, Early detection, Chatbot, Prevention

INTRODUCTION

As one of the global diseases, the number of People Living with Dementia (PWD) in the world is predicted to increase from 47 million people in 2015 to 115 million in 2050. Indonesia is one of the top ten list countries with a high number of people with dementia among other Asian countries. Moreover, Indonesia as one of the most populated elderly in Southeast Asia, predicted to increase to 2 million in 2030 and 4 million people in 2050 (Azwar, 2021). The increased number of dementias linearly with the expenses for taking care and health care maintenance which can accumulate economic impact in a county, especially in low-income and middle-income countries (LMICs) where most two-thirds of PWD live globally (Holm et al., 2022). The expenses are primarily spent on caring for the patient and caregivers (Ong et al., 2021). PWD will cause serious healthcare problem and bring impact on socioeconomic if not anticipated.

Which has known dementia cannot be cured; thus, prevention is one of the important ways to cope with it. In some cases, misunderstanding the

dementia symptoms dementia and forgetfulness as normal parts of aging can delay the diagnosis of dementia itself and usually come to a neurologist after finding several signs of dementia. Moreover, caregivers or family members might contribute to missed or delayed diagnosis of elder dementia (Bradford et al., 2009). High activities of family members who live in an urban city can be problems in dealing with the care of dementia issues.

There were some dementia scales available to measure and diagnose dementia disease for various purposes. However, it cannot be said that one scale is better than the other. This is because the symptoms of dementia are very customized from one patient to another. One measurement of dementia is The Eight-item Informant Interview to Differentiate Aging and Dementia (AD8®). This was developed by Knight Alzheimer Disease Research Center, Washington University School of Medicine in St. Louis. AD 8 as a brief instrument to help discriminate between signs of normal aging and mild dementia. It contains eight items that test for memory, orientation, judgment, and function and being used as part of a brief dementia detection instrument (in conjunction with a patient assessment) to evaluate patients in community settings. Basically, AD8 can be used for normal to mild-stage demented individuals. Moreover, the availability of informants can help patients diagnosed with the advanced level of dementia by AD 8 (Galvin et al., 2005).

Tracking record cognitive changing by understanding daily activities can give prevention of dementia, and at the same time, it makes family members aware of the elder who might have dementia (Wallace et al., 2018, Harding et al., 2020, Favela et al., 2020). Besides, for the long-term record using clinical measurements will provide monotone questions in clinical terms that might not be related to elder personality and what they face daily, although some research did other approaches such as gamification (Wallace et al., 2018) or computer avatar (Tanaka et al., 2017) to diagnose dementia.

Based on it, this research tries to offer a solution by answering the question of how to design dementia screening test based on AD 8 that is able to record the elder's cognitive based on their daily habit. Furthermore, the design is able to make the family member aware of the elder's cognitive condition, thus prevent the late diagnose of dementia.

The aim of this paper is to explain the process of designing The Diary AD8. In this research, it is important to customized AD 8 questions for each user to ensure that the measurement of dementia scales adopts an empathetic approach towards the situations of older adults.

In the future, the prototype will test by involve some stakeholders such as elder, family members, and healthcare workers. So that if there any cognitive changes are identified, the chatbot will send suggestions to family members to discuss the possibilities of the older adult's cognitive conditions with the doctor. Thus, The Diary AD 8 serves as screening system for detecting dementia by using a chatbot via the WhatsApp chat platform.

RELATED WORKS

The conventional way to use the dementia scale of AD8 is by using pen and paper and filling out the form by the observer, who can be the family member

or partner who understands the patient's daily basics. Using AD8 for self-assessment has a less high level of accuracy when compared to the assessment by observers (Chio et al., 2018). However, the results written by the observer have a high level of subjectivity. The AD 8 was one of the dementia scale system that have simple categorization and can be asses to record elder situation. There are 8 elements consist of the AD 8 there are; (1) The difficulties in ability to makes any decisions, (2) Leaving the activities that previously quite interesting at that things (hobbies), (3) Frequently repeating the same questions or same statement, (4) Having difficulties to using the tools or things that previously the elderly using in daily life, (5) Forget the month or year, (6) Facing any difficulties to arrange the financial, (7) Facing any difficulties to remind the appointment with others, (8) Have memory problem and lack of consistency of thinking in daily life (Galvin et al., 2005).
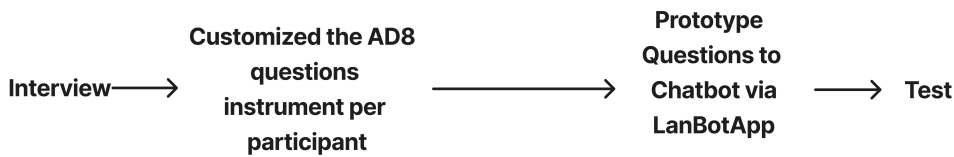
However, these days, there are some approaches to reach patients closely, such as changing the language, which has been done in INA-AD 8 (Indonesian language) (Utomo, 2019), AD8 Chinese version (Yang et al., 2011), and AD 8 Turkish version (Usarel et al., 2019).

In Indonesia, awareness for early detection of dementia has recently begun to be developed with several smartphone applications, such as the E-Memory Screening (EMS) app launched by PT Eisai Indonesia, a subsidiary of Japan-based pharmaceutical company Eisai Co., Ltd., in collaboration with PERDOSSI. It is currently available on the Google Play Store. In this application, there are three features in the form of articles, a senile screening test using AD 8, and a directory showing the nearest doctors and hospitals relevant to dementia specialists (Wira, 2020). One of the development chatbot using multiplatform to detect dementia with various platform is Chattybot. This chatbot as the tools is suitable to act as independent communication media for the next generation elderly and potentially extended with broader thematic purposes (Wianto et al., 2021).

METHOD

According the eight elements of AD 8, the objective of interview is to understand the elderly's background, activities, hobbies and situation in their daily living, and how the younger family member thinking about the elderly's health condition. This research was adopting contextual mapping method that commonly use in participatory design by involve user through design process (Visser et al., 2005).

The present study was initiated by conducting qualitative interviews with elderly individuals and their family members to gather information regarding their health conditions and lifestyles. Results indicated that the participants meet the criteria for the study. Subsequently, a customized set of eight AD 8 questions was developed based on the experiences and daily lives of the participants. These questions were drafted using the Landbot messaging platform, which is integrated with WhatsApp. The feasibility of the prototype was tested by administering the questions to two respondents, and their responses were recorded, as depicted in Figure 1.

Interview ⟶ **Customized the AD8 questions instrument per participant** ⟶ **Prototype Questions to Chatbot via LanBotApp** ⟶ **Test**

Figure 1: Method designing the AD 8.

Interview

Interviews were conducted twice separately with family members and participants. The purpose of this interview is to find out the habits, lifestyles, and hobbies of the elderly.

Family members as participants were selected based on their residence in Jakarta, Bogor, Depok, Tangerang, and Bekasi (Jabodetabek), living at home with parents over 60 years old or visiting their parents at least once a week. The interview was conducted by telephone.

The total number of interviewees as family members were four people, aged 25–38 years. During the interview, eight questions were asked about AD 8 and asked to reflect on their parents. Most of them are not sure whether their parents have dementia or the natural forgetfulness as part of normal aging.

The following interview on elders. In this interview, they were asked about daily activities, possible physical limitations, hobbies, favourite foods, places frequently visited, and diseases they have (especially those with the potential for dementia). As seen in Table 1.

Customized the AD8 Questions Instrument per Participant

Based on the participant data, AD 8 questions were prepared per point, as shown in Table 2. Question no 3 Repeated the same things over and over (questions, stories, or statements) and was asked directly to family members when validating the data.

The customization questions in The Diary AD8 are not limited to the content but also the types of questions. The AD 8 questions consist of three types: multiple choice (including image question), and open-ended (Figure 2). Modifying the question type will provide extended answers to give a deep understanding of the user's way of thinking.

Prototype Questions to Chatbot

All questions that have been written are then arranged sequentially using Landbot. Landbot is an application for creating automated chatbots, then publish it via Whatsapp, as seen in Figure 3.

The Landbot also provide the chat view on their platform, so researcher can be monitor through the live chat, Figure 4.

Test

The prototype of chatbot The Diary AD 8 was tested at a random session on 2 participants (participant 2 and participant 5). The test has done in

Table 1. Participant's data.

	P1 (Male)	P2 (Female)	P3 (Female)	P4 (Female)	P5 (Male)
Age	66	63	69	63	69
Living Place	Bekasi-Indonesia	Bogor- Indonesia	Bekasi-Indonesia	Tangerang - Indonesia	Tangerang - Indonesia
Devices used daily	Smartphone, Laptop, Smart TV	Smartphone	Smartphone, Smart TV	Smartphone, Laptop, Smart TV	Smartphone, Laptop, Smart TV
Smartphone applications that are often used to communicate	Whatsapp	Whatsapp	Whatsapp	Whatsapp	Whatsapp
Duration Using Smartphone per day (in hour)	4–6 hours	4–6 hours	1–3 hours	1–3 hours	>9 hours
Application frequently access	Youtube	Youtube	Youtube	Youtube	Youtube
Previously job before pension	Sales	Housewife & enterpreneur	Housewifes	Finance staff	Sales
activity level and type of activity in retirement	High activity	Medium activity	Medium activity	Medium activity	Low activity
	open shop, playing badminton treasurer in neighborhood community	Take care home, cooking Gardening and sell plants Playing with grandchildren	Take care home, cooking Religious community, Crafting community	Take care home, cooking Religious community, Crafting community Playing with grandchildren	Gardening, Watching youtube, Playing with grandchildren
Duration doing physical activitiy perday (in hour)	>3	>3	1–2 hours	1–2 hours	1–2 hours
Hobby	Doing tennis table, watch movies, listening radio	Traveling, Cooking, Gardening	Knitting, Gardening, cooking	Reading, Cooking, Sewing	Doing sport (pétanque-before heart attack), Watching videos,
Pre-Condition might leads to dementia	None	Highblood pressure, Diabetic	None	Diabetic	High Blood pressure, Cholesterol, Had heart surgery in 2019
Frequency of medical examinations to the doctor (in a year)	1	3	1	>3	>3

Table 2. Customized topics based on user data.

AD8®Dementia Screening Interview	Customized topics
Problems with judgment (e.g., problems making decisions, bad financial decisions, problems with thinking)	• Asking about their decision or suggestion and decision about what they are possibly facing on them. Examples, what time suitable to doing the things that they usually like
Less interest in hobbies/activities	• Duration of their activity, asking why they like doing that, what is interesting about the hobby when they do it. • Hobby/ pass hobbies and why they change (mostly answer because of their health condition
Repeats the same things over and over (questions, stories, or statements)	Ask to family member
Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control)	• Ask the step by step to operate washing machine, maintanance the devices and type of devices at their home that they usually use everyday • Asking daily devices that they use every day, Asking about the tools and how that tools should be used (using pictures)
Forgets correct month or year	• Asking about their kid's birthday • Common knowledge such as independence day, • Their spouse's birthday, wedding anniversary
Trouble handling complicated financial affairs (e.g., balancing checkbook, income taxes, paying bills)	• Asking about simple counting. • Money kurs fom one currency to others • Electicity counting in payment
Trouble remembering appointments	• Ask about their schedule with doctors, drinking medicine, or praying habits
Daily problems with thinking and/or memory	• Ask about common logic, such as way turning of locking and open the door.

10–15 minutes based on the task for 7 questions. Table 3 shows the results. Table 3 figured some elements including the AD 8 screening parameters, customized questions, answers, and indication of whether it found any weird or error answers.

DISCUSSION AND CONCLUSION

The Diary AD 8 offers a new approach that may enable elderly to assess their own dementia symptoms with the help of family members by understanding and confirming their answers. However, the parameters of AD 8 instrument
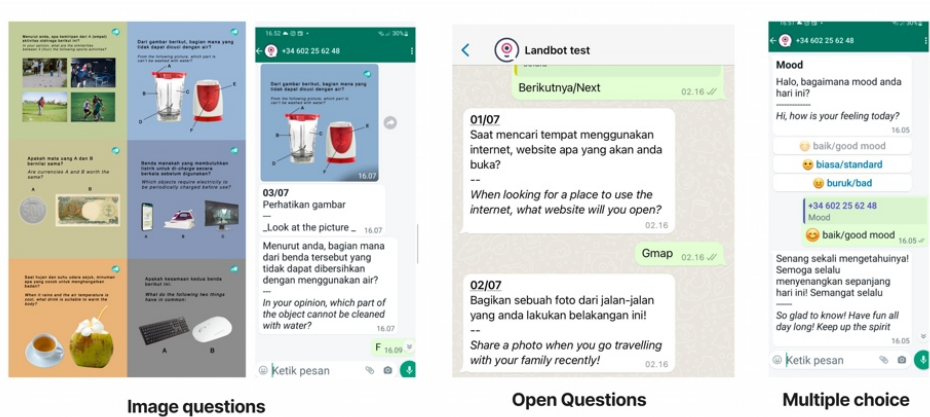
Figure 2: Questions type for the diary AD 8 (multiple choice (including image questions), and open question).
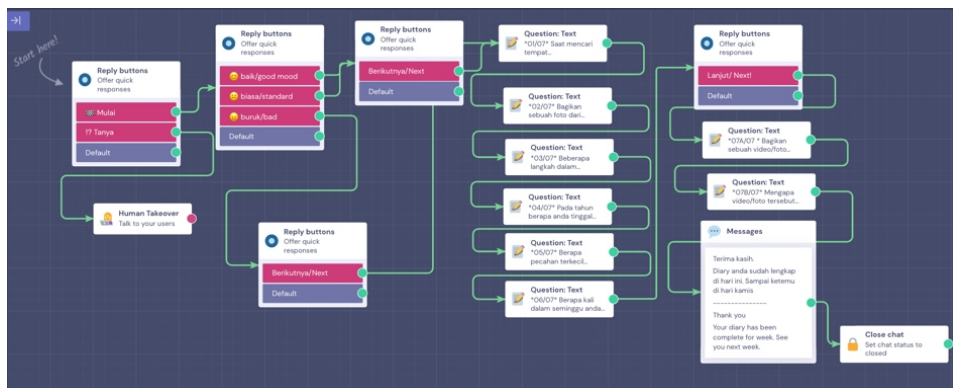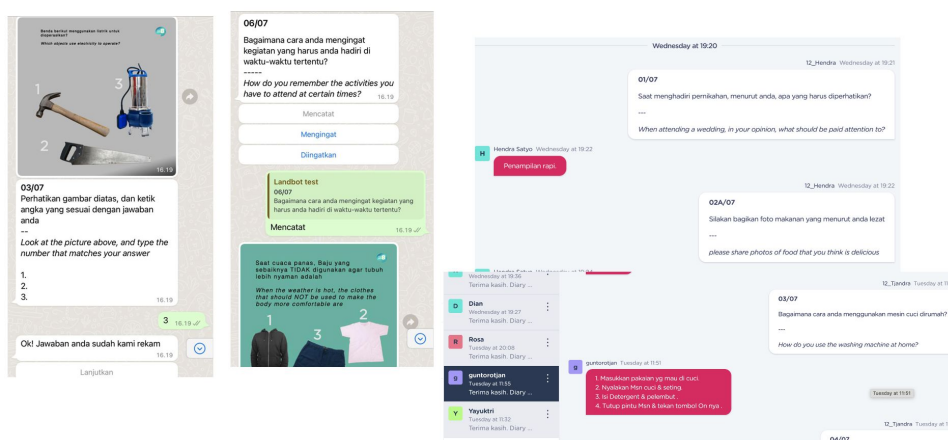

Figure 3: Chatbot in whatsApp and landBot questions.

Figure 4: Chatbot Questions in whatsapp and landbot chat interface.

Table 3. Customized questions and test result The diary AD 8 participants (P2 & P5).

NO	The The Eight-item Informant Interview to Differentiate Aging and Dementia (AD8*)	PARTICIPANT 2 SESI 6 QUESTIONS	ANSWER	Indication	PARTICIPANT 5 SESI 8 QUESTIONS	ANSWER	Indication
1	Apakah keluarga anda mengalami kesulitan dalam membuat keputusan? Misalnya tidak mampu memberi saran dengan benar, tidak mamppu mengurus keuangan, membeli hadiah yang tidak layak untuk orang lain, bermasalah dengan pemikiran? / *Problems with judgment (e.g., problems making decisions, bad financial decisions, problems with thinking)*	When you looking for a place using the internet, what website will you open?	Google Map	OK	Here is the personal information: 1. Weight 2. ATM PIN 3. National ID Number (NIK) 4. Passport Number Which number of the above information has a high level of privacy?	No.2	OK
2	Apakah keluarga anda sudah tidak menekuni hobi/ kegiatan yang sebelumnya disenangi? Misalnya merajut, menjahit, berkebun, memasak kue, membaca buku, bermain catur, memainkan alat musik, atau bernyanyi?/ *Less interest in hobbies/activities*	Share a photo of the recent trip you took!		OK	What activities do you usually do when you have free time?	Watching TV, playing games, and chatting.	OK
3	Apakah keluarga anda mengalami kesulitan belajar menggunakan perkakas & peralatan?, seperti TV, radio, komputer, microwave, remote control, kompor, setrika, blender? / *Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control)*	"Steps to change the gas for a stove: 1. Remove the regulator from the old gas cylinder. 2. Turn off the stove. 3. Attach the regulator to the new gas cylinder. 4. Check the gas pressure through the regulator meter. 5. Turn on the stove. 6. Remove the seal from the new gas cylinder."	I apologize, I have been using natural gas for a long time so I forgot about using LPG.	OK	In your opinion, what electronic device in your home do you use the least? Why do you use that device rarely?	Electric stove, electric fan. Because there is a gas stove and AC.	OK
4	Apakah keluarga anda lupa nama bulan atau tahun? / *Forgets correct month or year*	In what year did you move into the house you are currently living in?	About 4 or 5 years ago	OK	What is the date 2 days from now?	Tgl 2 september	OK
5	Apakah keluarga anda mengalami kesulitan mengatur keuangan? Misalnya membayar rekening air/listrik, periksa buku cek, pajak pendapatan, mengambil uang pensiun di bank? / *Trouble handling complicated financial affairs (e.g., balancing checkbook, income taxes, paying bills)*	What is the smallest denomination of paper currency in Indonesia currently?	1rupiah koin	OK	How many zeros are in the largest denomination of Indonesian paper currency?	5	OK
6	Apakah keluarga anda mengalami kesulitan mengingat janji terhadap orang lain?/ *Trouble remembering appointments*	How often do you visit your children/grandchildren in a week?	once in two days	OK	When was the last time you had a meeting with family/friends/colleagues?	two weeks ago	OK
7	Apakah keluarga anda sehari-harinya mengalami Apakah keluarga anda sehari-harinya mengalami gangguan memori dan pemikiran yang konsisten?. Misalnya lupa meletakkan kaca mata, kunci kendaraan, meletakkan barang tidak sesuai pada tempatnya/ *Daily problems with thinking and/or memory*	Share a video/photo that you find interesting! Why do you find the video/photo interesting?	"Because the photo is very joyful for us to gather with all the big family which has not been able to happen again for 4 years and my husband was not there because he had already left for another matter... An extraordinary moment. "Thanks God"	OK	Please send picture of your favourite food	Laksa...	OK

has provided an overview of dementia assessment indicators, including examples. On the other hand, by gaining a deeper understanding of the user, AD 8 questions can be designed to align more closely with the user's daily life without altering the overall meaning of the AD 8 instrument.

Customization of questions in The Diary AD 8 gives users a personal approach based on what they are facing and their experiences. These more detailed questions offer a different approach from the conventional AD 8 instruments and have been found to increase user openness and willingness to share their experiences. The enthusiasm of participant can be seen in their answers to the questions. They usually use long chats as can be seen in Table 3 at participant 2. Participant 2 explained in more than 50 words and add emoji to express emotion's when explain the interesting memory. While participant 5 asked the family member whether they missed the session or whether they will have again in the future.

The type of questions play role in shaping the user's answers. For measurements related to dementia, commonly use open questions. These are preferable as they allow for a more comprehensive understanding of the user's responses.

REFERENCES

Azwar, M. K. S., Siti 2021. Modifiable Risk Factors For Dementia In Indonesia's Urban Population. *Acta Med Indones - Indones J Intern Med,* Vol 53, 31–41.

Bradford, A., Kunik, M. E., Schulz, P., Williams, S. P. & Singh, H. 2009. Missed And Delayed Diagnosis Of Dementia In Primary Care: Prevalence And Contributing Factors. *Alzheimer Dis Assoc Disord,* 23, 306–14.

Chio, O. I., Yip, P. K., Liu, Y. C., Chen, L. H., Wang, P. C., Tsai, T. H. & Tang, S. H. 2018. Detection Of Cognitive Impairment Using Self-Rated Ad8 And Informant-Reported Ad8. *J Formos Med Assoc,* 117, 42–47.

Favela, J., Cruz-Sandoval, D., Morales-Tellez, A. & Lopez-Nava, I. H. 2020. Monitoring Behavioral Symptoms Of Dementia Using Activity Trackers. *J Biomed Inform,* 109, 103520.

Galvin, J. E., Roe, C. M., Powlishta, K. K., Coats, M. A., Muich, S. J., Grant, E., Miller, J. P., Storandt, M. & Morris, J. C. 2005. The Ad8: A Brief Informant Interview To Detect Dementia. *Neurology,* 65, 559–64.

Harding, B. N., Floyd, J. S., Scherrer, J. F., Salas, J., Morley, J. E., Farr, S. A. & Dublin, S. 2020. Methods To Identify Dementia In The Electronic Health Record: Comparing Cognitive Test Scores With Dementia Algorithms. *Healthcare-The Journal Of Delivery Science And Innovation,* 8, 7.

Holm, E., Jacobsen, K. K., De Lony, T. B., Lembeck, M., Pedersen, H., Andersson, C., Johannsen, P., Jørgensen, T. S. H. & Torp-Pedersen, C. 2022. Frequency Of Missed Or Delayed Diagnosis In Dementia Is Associated With Neighborhood Socioeconomic Status. *Alzheimer's &Amp; Dementia: Translational Research &Amp; Clinical Interventions,* 8.

Ong, P. A., Annisafitrie, F. R., Purnamasari, N., Calista, C., Sagita, N., Sofiatin, Y. & Dikot, Y. 2021. Dementia Prevalence, Comorbidities, And Lifestyle Among Jatinangor Elders. *Front Neurol,* 12, 643480.

Tanaka, H., Adachi, H., Ukita, N., Ikeda, M., Kazui, H., Kudo, T. & Nakamura, S. 2017. Detecting Dementia Through Interactive Computer Avatars. *Ieee J Transl Eng Health Med,* 5, 2200111.

Usarel, C., Dokuzlar, O., Aydin, A. E., Soysal, P. & Isik, A. T. 2019. The Ad8 (Dementia Screening Interview) Is A Valid And Reliable Screening Scale Not Only For Dementia But Also For Mild Cognitive Impairment In The Turkish Geriatric Outpatients. *Int Psychogeriatr,* 31, 223–229.

Utomo, A. B., Et Al 2019. Uji Reliabilitas Dan Validitas Aplikasi Smartphone Ina-Ad8 Untuk Tes Skrining Gangguan Fungsi Kognitif. *Berkala Neurosains,* 18, 46–51.

Visser, F. S., Stappers, P. J., Van Der Lugt, R. & Sanders, E. B. N. 2005. Contextmapping: Experiences From Practice. *Codesign,* 1, 119–149.

Wallace, B., Knoefel, F., Goubran, R., Masson, P., Baker, A., Allard, B., Guana, V. & Stroulia, E. 2018. Detecting Cognitive Ability Changes In Patients With Moderate Dementia Using A Modified "Whack-A-Mole" Game. *Ieee Transactions On Instrumentation And Measurement,* 67, 1521–1534.

Wianto, E., Chen, C.-H., Chen, C.-C. & Lin, C.-L. 2021. Chatty Bot: An Alternative To Implement A Memory Training Option For The Upcoming Older Adults In Indonesia. *Advances In Human Factors And Ergonomics In Healthcare And Medical Devices.*

Wira, N. N. 2020. Mobile App Allows Early Detection Of Alzheimer's Disease.

Yang, Y. H., Galvin, J. E., Morris, J. C., Lai, C. L., Chou, M. C. & Liu, C. K. 2011. Application Of Ad8 Questionnaire To Screen Very Mild Dementia In Taiwanese. *Am J Alzheimers Dis Other Demen,* 26, 134–8.