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Educational Program Using Robots for Preventing Cognitive Decline of Elderly Persons

Yumiko NAKAMURA[a,1], Yukie MAJIMA[a], Nobuhiro SAKATA[b], Seiko MASUDA[a], Kotoka MURASHIMA[a]
[a] *Research Institute for Advanced Nursing Technology, Osaka Prefecture University, Japan*
[b] *Dokkyo Medical University*

Abstract. An expected surge of dementia patients in Japan indicates a pressing need to establish countermeasures. As described herein, by developing an educational program for elderly people using robots, we performed a demonstration experiment. Results revealed that involvement of elderly people with robots enhances their enjoyment, indicating a future direction of cognitive decline prevention education for elderly people.

Keywords. Cognitive function, educational program, robot

1. Introduction

To develop an educational program including collaborative work with robots and musical instruments at our university, we conducted a demonstration experiment for elderly participants in a class designed to keep the brain lively. The results can elucidate elderly persons' motivation for and satisfaction with the class and their self-esteem. Additionally, we can evaluate the educational program using robots.

2. Methods

Educational Program Development: We designed an educational program based on a motivation model: The ARCS model (Keller, 2008)[1] (Table 1). Devices used: We used Pepper (SoftBank Robotics) as a communication robot and Alexa (Amazon.com Inc.) and RoBoHon (Sharp Corp.) as supplementary robots. Swing Bar Guitar, a Bunne instrument originating from Sweden, was used as the musical instrument. Implementation: We implemented the program in classes held on Oct. 31 and Nov. 1, 2018. After the class, we evaluated the program based on responses to an anonymous self-administered questionnaire administered to participants.

[1] Corresponding Author, Yumiko Nakamura, Osaka Prefecture University, 1-1 Gakuentyo Nakaku Sakaishi, Osaka, Japan; E-mail: naka-yu@nursing,osakafu-u-ac.jp.

3. Results

The program included 79 participants aged 65 or older: 21 men and 58 women.

Table 1. Educational program based on teho ARCS model.

Time	ARCS	Content
5 min	Attention (A)	1) Introduction and explanation of the Bunne instrument (a) Introduction of the Bunne instrument (b) Explanation of how to play
5 min	Relevance (R)	2) Introduction of songs to be played 1. Pepper directs Alexa to play Mushi no Koe (The Sounds of Insects). 2. Alexa plays Mushi no Koe on the smart speaker. 3. Pepper directs RoBoHon to sing Tsuki (Moon). 4. RoBoHon sings Tsuki.
15 min +15 min	Confidence (C), Satisfaction (S)	3) Ensemble (Song 1, Mushi no Koe; Song 2, Moon) • Make groups of three: One is in charge of the lever. Another is the pick. The other is the conductor (who reads out colors). • Play the song in an ensemble following Pepper's conducting. • Others sing the song.

Table 2. Participant evaluation of the program.

	Content	Very much	Much	Not much	None	NA
Impression	It was fun.	54 (68.4)	19 (24.1)	4 (5.1)	0 (0)	2 (2.5)
	It made me feel bright.	61 (77.2)	16 (20.3)	0 (0.0)	0 (0)	2 (2.5)
	It made me smile more.	53 (67.1)	23 (28.6)	0 (0.0)	0 (0)	3 (3.8)
Participation	I was able to move my hands and body.	44 (55.7)	28 (34.4)	5 (6.3)	0 (0)	2 (2.5)
	I was able to talk to others.	42 (53.7)	32 (40.5)	2 (2.5)	0 (0)	3 (3.8)
	I want to participate again.	57 (72.2)	18 (22.8)	2 (2.5)	0 (0)	2 (2.5)
	I will tell someone what I did today.	55 (69.6)	22 (27.8)	1 (1.7)	0 (0)	1 (1.3)
Difficulty	The guitar was easy to play.	34 (43.0)	33 (41.8)	9 (11.4)	0 (0)	3 (3.8)
	The music performed was easy to play.	33 (41.8)	35 (43.3)	7 (8.7)	0 (0)	4 (5.1)

Table 3. Functional evaluation of the robots.

	Good	Normal	Bad	NA
Speaking speed	62 (78.5)	7 (8.9)	2 (2.1)	8 (10.1)
Response speed	58 (73.4)	2 (2.1)	13 (16.5)	6 (7.6)
Method and content of explanation	25 (31.6)	47 (59.5)	1 (1.3)	6 (7.6)
Pitch and ease of hearing of the voice	39 (49.4)	35 (44.3)	0 (0.0)	5 (6.3)
Gestures of body and hands	35 (44.3)	34 (43.0)	3 (3.8)	7 (8.9)
Contents of talks	32 (40.5)	38 (48.1)	4 (5.1)	5 (6.3)

4. Conclusions

Activities that use music to maintain the cognitive functions of older people are inferred as effective. These study participants increased their enjoyment by playing a new musical instrument, reading musical scores, and singing songs together with robots and coordinators.

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