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EXAMINING THE BENEFITS OF SOMATOSENSORY GAME MACHINE ON SENIORS WITH DEMENTIA-TAKING THE EXAMPLE OF ONE YUNLIN COUNTY'S DAYCARE CENTER WITH SENIORS

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Abstract

This research adopted a quasi-experimental design in which purposive sampling was used. The research site was the National Cheng Kung University Hospital Dou-Liou Branch dementia daycare center, from which 30 patients with dementia who were ≥ 65 years old were recruited. During the research, participants were randomly assigned to either the experimental or control groups. During the research, eight participants withdrew due to personal reasons; 22 participants completed the research. The research spanned 12 weeks, from 21 September to 31 December 2017.

The experimental group included four male dementia patients (76.25 ± 6.61 years), of which three had mild dementia and one had moderate dementia; and seven female dementia patients (80.14 ± 6.38 years), of which four had mild dementia and three had moderate dementia. In the control group, there were five seniors male dementia patients (80.8 ± 1.6 years), of which three had mild dementia and two had moderate dementia; and six female dementia patients (82.83 ± 8.93 years), of which three had mild dementia and three had moderate dementia.

The present research employed an interactive drum-beating somatosensory game, "Taiko no Tatsujin". Results showed that differences in the experimental group across the 12-week program reached statistical significance (p =.046). The Jamar dynamometer was used to measure the grip strength of both hands of the participants; the experimental group showed significant improvement across the 12 weeks (p≦.001***). The Minnesota manual dexterity test was used to measure bilateral hand coordination of the participants. Though there were significant differences in the performance between the experimental and control groups (p≦.001***), both groups improved the time taken to complete the test across the 12 weeks.*

Keywords: *hand-grip strength, hand coordination, somatosensory games, dementia.*

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Introduction

The demographic structure of Taiwan is aging; from passing the benchmark for an aging society in 1993, the proportion of senior people (≥ 65 years of age) reached 14.7% in 2014. The phenomenon and effects of an aging population will become even more evident as the baby-boomer population ages, increasing the population of senior people to 4 million people (17.14%) by 2021. Extrapolating this trend further, senior people will comprise one-fifth of Taiwan's population by 2025: a proportion similar to that of countries such as the UK, France, and the USA (Council for Economic Planning and Development, Executive Yuan, 2010). Unlike Taiwan, however, Western countries benefit from close to a century of experience in coping with aging populations. On the other hand, the senior population in Taiwan is estimated to increase from 7% to 14.0% in a 24-year period (1993-2017). According to the February 2017 statistics by the Ministry of the Interior, R.O.C. (Taiwan), the proportion of senior people aged 65 years and above was 13.33%. This shows that the senior population in Taiwan has a rapidly growing trend.

According to the February 2017 statistics by the Ministry of the Interior, R.O.C. (Taiwan), the proportion of senior people aged 65 years and above was 13.33% and Taiwan has already become an aging society. As age increases, living functions, memory, cognition, and other cognitive abilities may decrease. However, many studies found that games can greatly aid in the training of cognitive functions. As age increases, memory, spatial abilities, and other cognitive abilities may decrease. Many studies have found that games can greatly aid in the training of cognitive functions (Anguera et al., 2013; Jesse van Muijden et al., 2012)

Therefore, this research intended to use the intervention and stimulation from a somatosensory game machine to increase the attention, manipulation ability, bilateral hand-grip strength, bilateral hand coordination, memory, and cognitive functions in the seniors. In this research, a drum-beating somatosensory game in which senior people can interact with the machine was used. Moreover, training the participants to beat the drum was used to enhance the interactions and emotional exchanges between senior people and improve their self-satisfaction and enjoyment.

The hypotheses for the implementation of this strategy were as follows:

Hypothesis 1: The MMSE results have significant effects on the experimental and control groups.

Hypothesis 2: The somatosensory game machine has significant effects on bilateral hand coordination in senior population.

Hypothesis 3: The somatosensory game machine has significant effects on bilateral hand-grip strength in senior population.

Literature Review

Cognitive Abilities

The research performed by Anguera et al., (2013) found that a 3-D game, NeuroRacer, can affect brain function: Video game training increases the midline frontal θ power, which is associated with control of cognitive functions; the stronger the waves, the better the cognitive function. Playing for 1 h thrice a week induced significant improvements by 4 weeks. These improvements persisted for 6 months.

Jesse van Muijden, Guido P. H. Band, and Bernhard Hommel (2012) conducted cognitive training for five types of online games. The training group underwent training for 30 minutes every day over the course of 7 weeks. The research found that the fluid intelligence and response inhibition showed improvements relative to the control group. The investigation also found that game-based training affects cognition in senior people.

In addition to other several other researchers, Basak et al., (2008) posited that games can improve the response of inhibition (Torkel et al., 2005; Jaeggi et al., 2008; Karbach & Kray, 2009; Lövdén et al., 2010). Cognitive training studies also showed that playing action games can increase various cognitive and perception abilities, including attention to visual space (Green & Bavelier, 2003; Chisholm & Kingstone, 2015). Walter Boot et al., (2013) found that training using both action games and non-action games resulted in improvements in senior people; of the two types of games, non-action games were found to be more suitable for senior people (Tori et al., 2014).

Bilateral Hand Coordination

Bilateral hand coordination, also known as inter-limb coordination, entails three types of motor coordination: between both hands, the upper limbs, and the upper and lower limbs. The time taken for both hands to initiate and stop an action are almost identical; however, the end of synchronized hand movements is more evident than their initiation. This phenomenon is referred to as goal invariance (Perrig et al., 1999). Spatial and temporal factors, exercise physiology, and dynamic mode theory can all affect bilateral hand coordination (Xing & Zhang, 2011). Bilateral hand coordination in normal people under any circumstances will conform to the principle of goal invariance.

Hand-Grip Strength

Recent studies have gradually defined hand-grip strength as an important physical-fitness indicator and proved that increased hand-grip strength has multiple benefits to the individual, including better hand endurance, forearm muscularity, physical flexibility, stronger palm strength, and a louder and clearer voice (Bohannon, 1997; Atkinson et al., 2012; Bohannon, 2013; Poitras, 2015).

"Hand-grip strength" is an important comprehensive test indicator of vitality. As hand-grip strength tests are simple, easy to perform, and feature high reliability, Bohannon recommended that hand-grip strength can be used as a predictive standard when screening or observing the health status of middle-aged to senior participants (Bohannon, 1997; Bohannon & Schaubert, 2005; Massy-Westropp et al., 2012).

Many physiatrists all recommended that hand-grip strength training should be increased in cancer patients or stroke patients who are undergoing rehabilitation (Bohannon & Schaubert, 2005; Bohannon, 2010; Massy-Westropp et al., 2012; Wehren et al., 2012).

Hand Dexterity Test

Dexterity (hand function) is defined as a hand skill that usually requires learning, training, and experience accumulation for rapid limb coordination during movement. The Minnesota manual dexterity test was introduced in 1991 by the Lafayette Instrument Company. This test requires speed, precision, hand-eye coordination, and bilateral hand-dexterity control during individual movements to quickly and skillfully move one or two hands to grab, turn, place, and perform other movements (Backman et al., 1992; Desrosiers et al., 1997; Beebe & Lang, 2009; Mehmet, 2014).

Research Methodology

Physical Activity Readiness Questionnaire (PAR-Q)

PAR-Q is a simple and pre-evaluation assessment instrument for the moderate intensity physical activity programs. PAR-Q is also used to assess each participant's medical risk (Thomas et al., 1992). PAR-Q involves seven questions regarding heart trouble, chest pain, high blood pressure, dizzy spells, joint problems, and other problems that may prevent participants from participating in physical activities. Participants, who answered "yes" to any of the questions on the PAR–Q, or those in need of rehabilitation, should be referred to the exercise physiologists and rehabilitation specialists for further evaluation. A research has reported that PAR-Q might be a useful instrument to identify older adults for whom low to moderate physical activity participation is safe (Thomas et al., 1992; Cardinal et al., 1997).

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Research Participants

This research was a purposive sampling, and during the research, participants were randomly assigned to either the experimental or control groups. The present research enrolled 30 patients with dementia for participation in the 12-week experimental research, spanning from 21 September to 31 December 2017. The research site was the National Cheng Kung University Hospital Dou-Liou Branch dementia daycare center.

During the research, 8 participants withdrew due to personal; both groups thus included 11 patients. The experimental group was composed of four senior male dementia patients (76.25 ± 6.61 years of age), of which three had mild dementia and one had moderate dementia; and seven female dementia patients (80.14 ± 6.38 years of age), of which four had mild dementia and three had moderate dementia. The control group included five senior male dementia patients (80.8 ± 1.6 years of age), of which three had mild dementia and two had moderate dementia; and six female dementia patients (82.83 ± 8.93 years), of which three had mild dementia and three had moderate dementia.

Somatosensory Game Machines

Taiko drums are divided into four areas (the left and right drumheads and the left and right sides). The player should follow the game instructions to strike these four regions to achieve the goals of the game. The player must coordinate with the music and strike the body of the traditional Japanese musical instrument, the Taiko drums, to play the correct beat.

In this research, the Taiko drums used for Weeks 1-6 were small drums (Figure 1 and 2), and those used for Weeks 7-12 were large drums (Figure 3).The accessories and controllers used in the somatosensory game device assist these populations in carrying out physical activity and team competitions. In addition to increasing physical fitness, this game also increases the conversations and interactions among elderly people in the same unit.

Figure 1. Small Taiko no Tatsujin somatosensory game machine used in weeks 1-6.

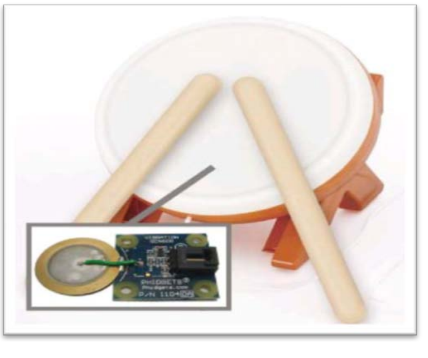

Figure 2. Small Taiko no Tatsujin somatosensory game machine used in weeks 1-6.

Figure 3. Large Taiko no Tatsujin somatosensory game machine used in weeks 7-12.

Collection of Research Data

Besides the distribution status of demographic and statistical variables of the participating participants, the data collected in this research also included the Mini-Mental State Examination (MMSE) test scores, Jamar dynamometer scores, and Minnesota manual dexterity test scores. The data were manually inspected, classified, organized, and analyzed.

Research Design

Tables 1 and 2 outline the research design. The experiment was divided into two phases: the first six weeks were dedicated to training with a small drum, weeks 7-12 consisted of large- drum training. The tempo of the music played included fast and slow types (BPM, beats per minute): Larghetto (60-66 bpm), Lento (40-60 bpm), Larghissimo (≤ 40 bpm).

Table 1. Experiment design.

Factor	Rhythm	Type
Weeks 1-6 (small drum)	Fast, 60-66bpm Slow, ≤ 40bpm	---
Weeks 7-12 (large drum)	Fast, 60-66bpm Slow, ≤ 40bpm	Single player Double players

Table 2. Experiment design.

Group	Pre-testing	Weeks 1-6	Mid-testing	Weeks 7-12	Post-testing
Experimental group	X1	Intervention experiment	X2	Intervention experiment	X3
Control group	X4	---	X5	---	X6

Main Test Items and Tools

(1) Individual general data characteristics questionnaire

This research used a self-generated individual general data characteristics questionnaire to observe the daily lifestyle habits of senior participants. The question items included: gender, age, education level, health status, sleep habits, and exercise habits.

(2) Mini-Mental State Examination (MMSE)

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The scale scores were used to measure whether there are any significant differences in the scores between the senior people from the experimental and control groups during the 12 weeks of testing. The Mini–Mental State Examination (MMSE) or Folstein test is a 30-point questionnaire that is used extensively in clinical and research settings to measure cognitive impairment. It is commonly used in medicine and allied health to screen for dementia. (Marshal F. Folstein et al., 1983). Administration of the test took between 5 and 10 minutes to examine the functions including registration (repeating named prompts), attention and calculation, recall, language, ability to follow simple commands and orientation.

(3) Bilateral hand-grip strength tests

A Jamar dynamometer (model serial no. 10020806) (Figure 4) was held by the participants. The participants sat upright against the back of a chair with both feet on the ground, extended his or her elbow forward, and finally turned his or her wrist 90 degrees. The wrist was lightly extended before the participants engaged in a gripping action in order to measure the user's grip strength: the participants exerted force to squeeze the dynamometer for a few seconds before releasing it.

Figure 4. A Jamar dynamometer (model serial no. 10020806).

(4) Bilateral-hand-coordination scale (Minnesota manual dexterity test)

The Minnesota manual dexterity test (model no. 32023) (Figure 5) and stopwatch (model no. ZSD-013) were used to measure bilateral hand coordination. The participants adopted a standing position and placed a blank test board on the table in front of him or herself. The building blocks for the test were arranged neatly in sequence in front of the blank test board. The participants used his or her dominant hand to move the blocks to the grooves on the blank test board. The sequence of placement began at the side of the dominant hand and with the block nearest to the blank test board is placed at the farthest groove. and this is followed in sequence downwards until all the blocks have been placed, wherein the test is completed.

Figure 5. The Minnesota manual dexterity test (model no. 32023).

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Research Results

For descriptive statistics, mean and standard deviation, quantity, and percentages were used to describe the gender and age distribution of the participants, as well as the distribution of physiological indicators and health status (Table 3).

Table 3. Self-generated individual data characteristics.

		Experimental group		Control group	
	Item	*N*	%	*N*	%
Sex	Male	4	36.4	5	45.5
	Female	7	63.6	6	54.5
Age	65-69 years	1	9.1	1	9.1
	70-74 years	2	18.2	0	0.0
	75-79 years	4	36.4	3	27.3
	>80 years	4	36.4	7	63.6
Education level	Literate but did not undergo formal education	2	18.2	1	9.1
	Elementary school	6	54.5	5	45.5
	Secondary (junior high)	3	27.3	1	9.1
	School (vocational school)	0	0.0	4	36.4
Health status	Diabetes	0	0.0	1	9.1
	Hypertension	4	36.4	3	27.3
	Heart disease	1	9.1	1	9.1
	comorbidities	5	45.5	2	18.2
	Others	1	9.1	4	36.4
Sleep habits	8 hours of sleep every day	10	90.9	10	90.9
	Less than 8 hours	1	9.1	1	9.1
Exercise habits	Regular weekly exercise	0	0.0	2	18.2
	No regular weekly exercise	11	100.0	9	81.8

Bilateral Hand Coordination Tests

In this research, the SPSS 22.0 statistics software was used for analysis. The mean time taken for the experimental group to complete the Minnesota manual dexterity test pre-, mid-, and post-intervention were all shorter than the mean time taken by the control group. These results indicated that regular and fixed somatosensory activities resulted in significant improvements in bilateral coordination (Table 4)

When repeated measures ANOVA (Analysis of Variance) was used to analyze the results of the Minnesota manual dexterity test in the two groups at Week 12 of the research, we found the participants in the experimental group showed significant improvement in their performance on the Minnesota manual dexterity test ($F(2,20) = 23.797$ ($p \leqq .001^{***}$), partial correlation, eta squared = 0.704). The participants in the control group also showed significant improvement in their

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performance (F(2,20) = 29.123 (p≦.001***), partial correlation = 0.744) (Table 5). These results indicated that repeated operation of and practice on the Minnesota manual dexterity test will be yield improved performance, regardless of external training.

Table 4. **Descriptive statistics (time taken to complete the test in seconds) of the performance of the experimental and control groups on the Minnesota manual dexterity test).**

	Hand dexterity test pre-testing		Hand dexterity test mid-testing		Hand dexterity test post-testing	
Group	**Experimental group**	**Control group**	**Experimental group**	**Control group**	**Experimental group**	**Control group**
Mean	141.4182	142.7109	128.6282	137.4427	121.2291	134.9000
Standard deviation	41.8397	34.7920	36.9353	34.1421	32.8168	34.9014

Table 5. **ANOVA analysis of the performance of the experimental and control groups on the Minnesota manual dexterity test.**

Group	Source of variation	Type III sum of squares, *SS*	Degrees of freedom, *df*	Mean square, *MS*	*F*-test test	*p*	Partial correlation Eta squared
Experimental group	Hand dexterity	2295.077	2	1147.538	23.797	p<.0001	0.704
	Error	964.454	20	48.223			
Control group	Hand dexterity	349.175	2	174.587	29.123	p<.0001	0.744
	Error	119.896	20	5.995			

Bilateral Hand-Grip Strength Tests

The means for the grip strength of the experimental group at pre-, mid-, and post-testing were all better than the grip strength of the control group. Performing regular and fixed somatosensory activities may account for the significant improvements in bilateral hand-grip strength.

When repeated measures ANOVA was used to analyze the results of the bilateral hand-grip strength tests in the two groups at Week 12 of the research, we found that the participants in the experimental group showed significant improvement in their performance on the bilateral hand-grip strength test: left hand, F(2,20) = 37.691 (p≦.001***), partial correlation, eta squared=0.790; right hand, F(2,20) = 56.208 (p≦.001***), partial correlation, eta squared = 0.849 . In the control group did feature show any significant changes in their performance on the bilateral hand-grip strength tests: left hand, F (2,20) = 0.212, p = 0.551 correlation, eta squared = 0.058; right hand, F (2,20) = 1.303, p =.061 correlation, eta squared = 0.244 (Table 6).The research data showed that 12 weeks of training with the Taiko no Tatsujin game machine improves bilateral hand-grip strength.

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Table 6. ANOVA analysis of the performance of the experimental group and control group on bilateral hand-grip strength tests-left and right hands.

Group		Source of variation	Type III sum of squares, *SS*	Degrees of freedom, *df*	Mean square, *MS*	*F*-test test	*p*	Partial correlation Eta squared
Experimental group	Left hand	hand-grip strength	137.515	2	68.758	37.691	p<.0001	0.790
		Error	36.485	20	1.824			
	Right hand	hand-grip strength	180.545	2	90.273	56.208	p<.0001	0.849
		Error	32.121	20	1.606			
Control group	Left hand	hand-grip strength	0.424	2	0.212	0.614	0.551	0.058
		Error	6.909	20	0.345			
	Right hand	hand-grip strength	2.606	2	1.303	3.233	0.061	0.244
		Error	8.061	20	0.403			

Taiko No Tatsujin Somatosensory Game Machine Tests

When repeated measures ANOVA was used to analyze the results at Week 12 of the research, we found that participants in the experimental group significantly improved their performance on the small Taiko no Tatsujin somatosensory game machine ($F(5,50) = 272.374$ ($p \leqq .001^{***}$), partial correlation, eta squared = 0.755). Though there were no significant differences when hitting the large drum alone across weeks 7-12 ($F(5,50) = 39.631$, $p = .446$, partial correlation, eta squared = 0.888), improvement was observed over the same period when the game was played in pairs ($F(5,50) = 161.464$, $p = .027^{*}$, partial correlation, eta squared = 0.217) (Table 7).

Table 7. ANOVA analysis of the performance of the experimental and control groups in Taiko no Tatsujin game machine.

Group	Source of variation	Type III sum of squares, *SS*	Degrees of freedom *df*	Mean square, *MS*	*F*-test test	*p*	Partial correlation, Eta squared
Beating small drum at Weeks 1-6 Single player	Hand-grip strength	1361.868	5	272.374	30.785	p<.0001	.755
	Error	442.383	50	8.848			
Beating large drum at Weeks 7-12 Single player	Hand-grip strength	198.153	5	39.631	.969	.446	.088
	Error	2044.895	50	40.898			
Beating large drum at Weeks 7-12 Double layers	Hand-grip strength	807.318	5	161.464	2.778	.027*	.217
	Error	2906.308	50	58.126			

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MMSE Tests

When repeated measures ANOVA was used to analyze the MMSE results of the two groups at Week 12 of the research, we found that all participants in the experimental group showed significant improvement in their MMSE performance ($F(2, 20) = 3.619$, $p = .046$, partial correlation, eta squared = 0.266).The 11 seniors participants in the control group did not show significant changes in their MMSE performance ($F(2, 20) = 2.155$, $p = .142$, partial correlation = 0.177) (Table 8). These results indicated that the regular and fixed somatosensory activities can improve MMSE scores. (Figure 6)

Table 8. ANOVA analysis of the MMSE performance of the experimental and control groups.

Group	Source of variation	Type III sum of squares, *SS*	Degrees of freedom *df*	Mean square, *MS*	*F*-test test	*p*	Partial correlation, Eta squared
Experimental group	MMSE	4.606	2	2.303	3.619	0.046*	0.266
	Error	12.727	20	.636			
Control group	MMSE	2.364	2	1.182	2.155	.142	.177
	Error	10.970	20	.548			

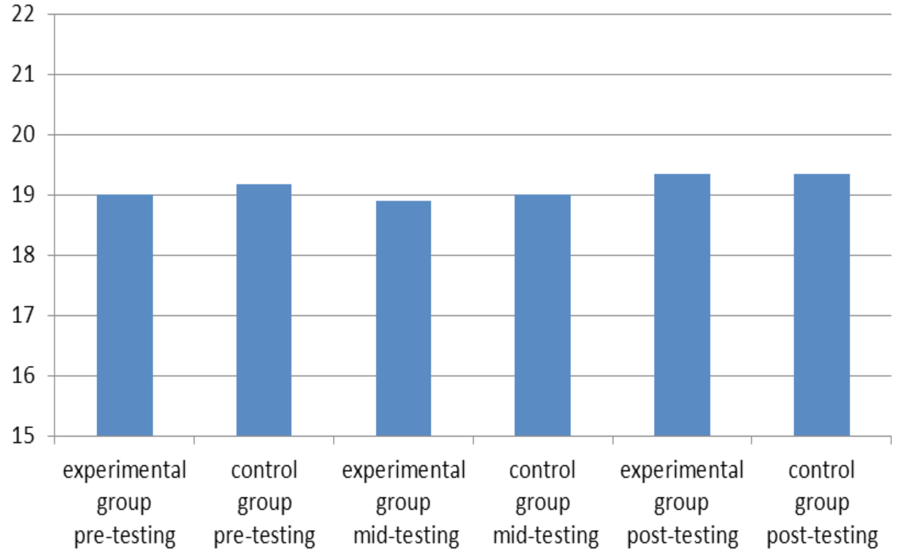

Figure 6. MMSE mean scores for drum playing on the somatosensory game machine during weeks 1-12.

Discussion

Research team recruited senior participants with dementia who were ≥ 65 years of age. Future studies should enroll dementia patients < 65 years of age to focus on preventive training and thereby help achieve national policies and goals for healthy aging. As a short-term intervention, this research did not consider long-term outcomes. Future interventions can lengthen the experiment duration to determine whether the progress of the participants is continuous. In addition, a greater variety of somatosensory game machines can be used for training or rehabilitation courses. This would facilitate multi-faceted measurements and evaluation, thereby helping to prevent or delay the onset of dementia.

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Conclusions

In this research, research team performed a preliminary examination of the effectiveness of somatosensory game machines in improving the activities of daily living, memory, and cognition of senior dementia patients by performing 12 weeks of interventional experiments. These interventions were conducted for 15 minutes, once a week. The data were analyzed by using the SPSS 22.0 software and an $\alpha = 0.05$ for analysis of the training time and number of completions. The following findings were obtained:

1. The MMSE results were significantly different between the experimental and control groups.
2. The experimental and control groups did not show any significant differences in the time taken to complete the Minnesota manual dexterity test.
3. The experimental and control groups showed significant differences in their respective right and left hand grip strengths as assessed by the bilateral hand-grip strength test.

The MMSE results indicate that 12 weeks of somatosensory game training resulted in significant changes in the cognitive abilities of the seniors. In addition, an analysis of the completion time results for the Minnesota manual dexterity test showed that 12 weeks of regular training resulted in significant improvements in the completion time for the Minnesota manual dexterity test by senior participants.

With regards to bilateral hand-grip strength, during the 12 weeks of Taiko no Tatsujin game, it was found that bilateral hand-grip strength in the experimental and control groups showed significant differences (Gabel et al., 2009; Pérez-Mármol et al., 2017; Padala et al., 2017; Stanmore et al., 2017).

In Weeks 7-12 of the experiment, we observed that the scores achieved by the senior participants when playing the Taiko no Tatsujin in pairs were higher than when hitting the drums alone. Moreover, we found that senior participants in the experimental group demonstrated better interpersonal relationships, face-to-face conversations, and less emotional fluctuations relative to the control group after the completion of the experiment. Indeed, during the 12 weeks of activity, we found through qualitative interviews that senior participants in the experimental group had warmer and more frequent interactions with residents, nursing staff, and relative caregivers before the intervention; there were no significant improvements in the control group during the experiment (Schwab & Memmert, 2012; Narme, 2016; Li & Li, 2017; Zheng et al., 2017).

Prior research has found that senior or older adults have difficulties in the recognition of anger, sadness, fear, surprise, happiness, etc. However, oxytocin can improve the ability to read various emotions from faces, such as joy, anger, sadness, and happiness (Shahrestani et al., 2013). Along with our observations of the aforementioned changes in the experimental participants' behavior, such research informs our speculation that both the increase in activity itself and playing the Taiko no Tatsujin game in pairs helped to increase the secretion of oxytocin (Ruffman et al., 2008; Lee et al., 2009); the participants' ability to read emotions, an essential skill to successful relationships, was thus improved.

Acknowledgments

This research was reviewed by the research ethics committee of National Cheng Kung University Hospital (approval number: A-ER-106-171) and was approved on 27 September 2017. We thank the National Cheng Kung University Hospital Dou-Liou Branch cross-disciplinary research project for their sponsorship, which provided excellent support during the entire research and enabled the successful completion of this research.

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Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Competing Interest Statement

All authors are required to declare that they have no significant competing financial, professional, or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

References

Anguera, J. A., Boccanfuso, J., Rintoul, J. L., Al-Hashimi, O., Faraji, F., Janowich, J., Kong, E., Larraburo, Y., Rolle, C., Johnston, E., & Gazzaley, A. (2013). Video game training enhances cognitive control in older adults. *Nature, 501*(7465), 97-101. doi: 10.1038/nature12486.

Backman, C., Cork, S., Gibson, D., & Parsons, J. (1992). Assessment of hand function: The relationship between pegboard dexterity and applied dexterity. *Canadian Journal of Occupational Therapy, 59*, 208–213. doi.org/10.1177/000841749205900406.

Beebe, J. A., & Lang, C. E. (2009). Relationships and responsiveness of six upper extremity function tests during the first six months of recovery after stroke. *Journal of Neurologic Physical Therapy, 33*(2), 96-103. doi: 10.1097/NPT.0b013e3181a33638.

Bohannon, R. W. (1997). Reference values for extremity muscle strength obtained by hand-held dynamometry from adult aged 20 to 79 years. *Archives of Physical Medicine and Rehabilitation, 78*, 26-32. doi:10.1016/S0003-9993(97)90005-8.

Bohannon, R. W. (2008). Hand-grip dynamometry predicts future outcomes in aging adults. *Journal of Geriatric Physical Therapy, 31*, 3-10. doi:10.1519/00139143-200831010-00002.

Bohannon, R. W., & Williams Andrews, A. (2011). Normal walking speed: A descriptive meta-analysis. *Physiotherapy, 97*(3), 182-9. doi: 10.1016/j.physio.2010.12.004.

Boot, W. R., Champion, M., Blakely, D. P., Wright, T., Souders, D. J., & Charness, N. (2013). Video games as a means to reduce age-related cognitive decline: Attitudes, compliance, and effectiveness. *Frontiers in Psychology*, *4*, 31. doi:10.3389/fpsyg.2013.00031.

Cardinal, B. J., & Cardinal, M. K. (1997). Changes in exercise behavior and exercise identity associated with a 14-week aerobic exercise class. *Journal of Sport Behavior, 20*(4), 377-386. Retrieved from https://psycnet.apa.org/record/1997-41336-001.

Chisholm, J. D., & Kingstone, A. (2015). Action video games and improved attentional control: Disentangling selection- and response-based processes. *Psychonomic Bulletin & Review, 22*:1430–1436.doi 10.3758/s13423-015-0818-3.

Folstein, M. F., Robins, L. N., & Helzer, J. E. (1983). The mini-mental state examination. *Archives of General Psychiatry, 40*(7), 812. doi:10.1001/archpsyc.1983.01790060110016.

Gabel, C. P,, Melloh, M., Michener, L. A., & Burkett, B. (2009). Clinimetric evaluation of measurement tools used in hand therapy to assess activity and participation. *Journal of Hand Therapy, 23*(1), 83-84. doi: 10.1016/j.jht.2009.09.003.

Jaeggi, S. M., Buschkuehl, M., Jonides, J., & Perrig, W. J. (2008). Improving fluid intelligence with training on working memory. *Proceedings of the National Academy of Sciences of the United States of America, 105*(19), 6829-33. doi: 10.1073/pnas.0801268105.

Karbach, J., & Kray, J. (2009). How useful is executive control training? Age differences in near and far transfer of task-switching training. *Developmental Science, 12*(6), 978-90. doi: 10.1111/j.1467-7687.2009.00846.x.

Lee, H. J., Macbeth, A. H., Pagani, J. H., & Young, W. S. (2009). Oxytocin: The great facilitator of life. *Progress in Neurobiology, 88*(2), 127-151. doi.org/10.1016/j.pneurobio.2009.04.001. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/19482229.

Li, D. M., & Li, X. X. (2017). The effect of folk recreation program in improving symptoms: A study of Chinese elder dementia patients. *International Journal of Geriatric Psychiatry, 32*(8), 901-908. doi: 10.1002/gps.4543.

Lövdén, M., Bäckman, L., Lindenberger, U., Schaefer, S., & Schmiedek, F. (2010). A theoretical framework for the study of adult cognitive plasticity. *American Psychological Association, 136*(4), 659-76. doi: 10.1037/a0020080.

Narme, P. (2016). Benefits of game-based leisure activities in normal aging and dementia. *Geriatrie et psychologie neuropsychiatrie du vieillissement, 1*; 14(4), 420-428. doi: 10.1684 / pnv.2016.0632.

Padala, K. P., Padala, P. R., Lensing, S. Y., Dennis, R. A., Bopp, M. M., Roberson, P. K., & Sullivan, D. H. (2017). Home-based exercise program improves balance and fear of falling in community-dwelling older adults with mild alzheimer's disease: A pilot study. *Journal of Alzheimers Disease, 59*(2), 565-574. doi: 10.3233/JAD-170120.

Pérez-Mármol, J. M., García-Ríos, M. C., Ortega-Valdivieso, M. A., Cano-Deltell, E. E., Peralta-Ramírez, M. I., Ickmans, K., & Aguilar-Ferrándiz, M. E. (2017). Effectiveness of a fine motor skills rehabilitation program on upper limb disability, manual dexterity, pinch strength, range of fingers motion, performance in activities of daily living, functional independency, and general self-efficacy in hand osteoarthritis: A randomized clinical trial. *Journal of Hand Therapy, 30*(3), 262-273. doi:https://doi.org/10.1016/j.jht.2016.12.001.

Poitras, C. (2015). *Grip strength is good indicator of overall health*. Available at: http://today.uconn.edu/2011/06/.

Ruffman, T., Henry, J. D., Livingstone, V., & Phillips, L. H. (2008). A meta-analytic review of emotion recognition and aging: Implications for neuropsychological models of aging. *Neuroscience & Biobehavioral Reviews, 32*(4), 863-81. doi: 10.1016/j.neubiorev.2008.01.001.

Schwab, S., & Memmert, D. (2012). The impact of a sports vision training program in youth field hockey players. *Journal of Sports Science and Medicine, 11*(4), 624-31.

Shahrestani, S., Kemp, A. H., & Guastella, A. J. (2013). The impact of a single administration of intranasal oxytocin on the recognition of basic emotions in humans: A meta-analysis. *Neuropsychopharmacology, 38*, 1929–1936. doi: 10.1038/npp.2013.86.

Shawn Green, C., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature, 423*(6939), 534-537.

Stanmore, E., Stubbs, B., Vancampfort, D., de Bruin, E. D., & Firth, J. (2017). The effect of active video games on cognitive functioning in clinical and non-clinical populations: A meta-analysis of randomized controlled trials. *Neuroscience & Biobehavioral Reviews, 78*, 34-43. doi: 10.1016/j.neubiorev.2017.04.011.

Thomas, S., Reading, J., & Shephard, R. J. (1992). Revision of the Physical Activity Readiness Questionnaire (PAR-Q). *Canadian Journal of Sport Sciences, 17*(4), 338-45.

Toril, P., Reales, J. M., & Ballesteros, S. (2014). Video game training enhances cognition of older adults: A meta-analytic study. *Psychology and Aging, 29*(3), Sep 2014, 706-716. doi: 10.1037/a0037507.

Tuncay Duruöz, M. (Ed.). (2014). *Hand function: A practical guide to assessment*. New York, NY: Springer.

van Muijden, J., Band, G. P., & Hommel, B. (2012). Online games training aging brains: Limited transfer to cognitive control functions. *Frontiers in Human Neuroscience, 6*, 221, doi: 10.3389/fnhum.2012.00221.

Wang, Y. C., Bohannon, R. W., Kapellusch, J., Garg, A., & Gershon, R. C. (2015). Dexterity as measured with the 9-Hole Peg Test (9-HPT) across the age span. *Journal of Hand Therapy, 28*(1), 53–59; quiz 60.

Xing, Y-C., & Zhang, Z-J. (2011). Bimanual coordination and influences of cognitive factors. *Chinese Journal of Applied Psychology*, *3*, 259-264.

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