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Original Article

Prevalence and Factors Associated with Cognitive Decline in Japanese Older Adults Requiring Long - Term Care Measured by Mini-Cog

RYO SATO, RPT, MS [1)], YOHEI SAWAYA, RPT, PhD [2)], MASAHIRO ISHIZAKA, RPT, PhD [2)]

1) Division of Physical Therapy, Doctoral Program in Health Sciences, Graduate School of Health and Welfare Sciences, International University of Health and Welfare
(2600-1 Kitakanemaru, Otawara, Tochigi 324-8501, Japan)

2) Department of Physical Therapy, School of Health Sciences, International University of Health and Welfare

Abstract:[Purpose] To determine the proportion of individuals with cognitive impairment, among older adults requiring long-term care, as measured by Mini-Cog, and the factors associated with cognitive impairment. [Subjects and Methods] The study included 127 adults aged 65 years or older who required long-term care (73 males and 54 females). Cognitive function was measured using the Mini-Cog, and all participants were classified into two groups: cognitively impaired and non-cognitively impaired. Factors related to cognitive function were examined. [Results] Cognitive decline was observed in 23.6 % of the participants. Low grip strength and Barthel index scores were significantly associated with cognitive decline. [Conclusion] Cognitive function, as measured by Mini-Cog, was independently associated with grip strength and activities of daily living. The results suggest that Mini-Cog is a practical screening tool for cognitive function in older adults requiring long-term care.

Keywords: Mini-Cog, cognitive function, long term care

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I. INTRODUCTION

As Japan's population ages, the number of older adults requiring long-term care because of cognitive decline is increasing, and dementia has become one of Japan's most pressing public health issues [1, 2)]. Cognitive decline has been associated with decreased activities of daily living (ADL) and muscle strength [3, 4)]. ADL and muscle strength are important outcomes in the rehabilitation of older adults. Therefore, early evaluation of older adults who show cognitive decline is important to allow intervention for modifiable factors to prevent further deterioration of their condition. The "Mini-Cog" is a quick simple screening test for dementia used to evaluate cognitive function [5)]. The Mini-Cog contains two questions about dementia, and a score of 2 or less out of 5 points is considered "cognitive function doubtful" (defined as cognitively impaired in this study). The Mini-Cog has been reported to have the same validity as the Mini–Mental State Examination (MMSE), which is the cognitive function test that is most frequently used to evaluate and identify cognitively impaired persons [6)]. However, the characteristics of older adults requiring long-term care extracted by the Mini-Cog have not been reported. Therefore, this study examined the proportion of cognitively impaired individuals measured using the Mini-Cog, and the association between cognitive impairment and the outcomes of ADL and muscle strength assessment.

*Corresponding author: RYO SATO (19s1095@g.iuhw.ac.jp)

II. PARTICIPANTS AND METHODS

The participants of this study were older adults who visited a day care rehabilitation facility located in Tochigi, Japan, between August 2021 and September 2022. This rehabilitation facility is available to those covered by the Japanese long-term care insurance and those certified as requiring support or care under Japan's long-term care insurance [2]. Exclusion criteria were (1) adults younger than 65 years, (2) adults who had difficulty understanding test instructions, and (3) adults who had difficulty standing and walking. This study was approved by the Ethics Review Committee of the International University of Health and Welfare (Approval No.21-Io-22, 17-Io-189-7). All participants or their families were fully informed of the purpose and measurements of the study, and provided consent to participate.

The Mini-Cog was used to assess cognitive function [7]. Mini-cog, a neuropsychological test, consists of two questions related to dementia: word playback and clock drawing. Immediate replay of the three words was not included in the scoring; however, delayed replay and clock drawing were included. Each delayed replay of the three words was scored one point each for a total of three points. In addition, the clock drawing (the numbers on the clock and the hand indicating 11:10) was scored as two points, and the total score was five points. A score of less than 3 out of 5 raised suspicion for dementia [6]. In this study, the patients were classified into two groups: the non-cognitively impaired group, which scored three or more points out of five, and the cognitively impaired group, which scored less than three points out of five. The usual walking speed was measured twice between 3 m and 8 m (5 m) by walking straight ahead on an 11 m walking path, and the average value was used as the representative value. Grip strength was measured using a grip strength meter (Takei Kiki Kogyo, model TKK5401 Grip-D, Niigata, Japan). The maximum value of two measurements taken in the sitting position, one on each side, was used as the representative value. Skeletal muscle mass index (SMI) was measured by the bioelectrical impedance analysis method using a body composition analyzer (InBody520, InBody, Seoul, South Korea). Depressive symptoms were assessed with the Geriatric depression scale 15 (GDS-15) [8]. The Mini Nutritional Assessment-Short Form (MNA-SF) was used to assess nutritional status [9]. Activities of daily living were assessed using the Barthel index [10]. Age, gender, and pre-existing medical conditions were obtained from the facility's medical records.

Comparisons of the basic attributes between the cognitively non-impaired and impaired groups were analyzed using the χ^2 test, unpaired t-test, and Mann-Whitney U test. In the binomial logistic regression analysis, the presence or absence of cognitive decline was used as the dependent variable, and the variables selected using the stepwise method were used as independent variables. Adjustment variables were gender and age. All statistical analyses were performed using SPSS version 25 (IBM, Armonk, NY, USA). Statistical significance was set at $p < 0.05$.

III. RESULTS

Table 1 compares the basic attributes of cognitively non-impaired and impaired groups. Thirty of 127 patients (23.6%) had cognitive decline. The cognitively impaired group had significantly lower Barthel index, MNA-SF, SMI, grip strength, and walking speed than the non-impaired group.

Factors independently related to cognitive function are presented in Table 2. Binomial logistic regression analysis showed that grip strength (OR= 0.85, 95%CI= 0.77-0.95, p= 0.005) and Barthel index (OR= 0.92, 95%CI= 0.88-0.97, p= 0.001) were independently and significantly associated with cognitive decline.

Table 1. Comparison of baseline characteristics between cognitively impaired and non-impaired groups

	Cognitively non-impaired(n=97)	Cognitively impaired (n=30)	p-value
Female (%)	40.2	50.0	0.343
Age (years)	79.2 ± 6.9	81.1 ± 7.6	0.203
BMI (kg/m^2)	22.2 ± 4.1	22.2 ± 3.2	0.990
Barthel index (score)	92.3 ± 9.0	81.8 ± 13.4	< 0.001
GDS-15(score)	5.8 ± 4.0	6.1 ± 3.7	0.648
MNA-SF (score)	10.3 ± 2.8	8.9 ± 3.0	0.019
Calf circumference (cm)	33.6 ± 3.1	32.5 ± 4.2	0.131
SMI (kg/m^2)	6.4 ± 1.0	6.0 ± 0.9	0.026
Grip strength (kg)	23.4 ± 8.1	17.4 ± 5.7	< 0.001
Gait speed (m/s)	0.8 ± 0.3	0.6 ± 0.3	< 0.001
Cardiovascular disease (%)	21.6	23.3	0.846
Respiratory disease (%)	11.3	13.3	0.493
Cerebrovascular disease (%)	48.5	60.0	0.269
Orthopedic diseases (%)	55.7	53.3	0.822
Malignant tumor (%)	22.7	6.7	0.050
Intractable neurological disease (%)	14.4	6.7	0.215
Osteoporosis (%)	7.2	10.0	0.434
Diabetes mellitus (%)	19.6	33.3	0.117
Hypertension (%)	39.2	50.0	0.293

The data are expressed as mean ± SDs. The unpaired t-test, Mann–Whitney U test, and $\chi 2$-test were used to study differences between participants in the cognitively impaired and non-impaired groups. MNA®-SF, Mini Nutritional Assessment-Short Form; BMI, body mass index; GDS-15, Geriatric Depression Scale, 15; SMI, skeletal muscle mass index.

Table 2. Factors associated with cognitive function based on binomial logistic regression

	OR	95%CI	p-value	VIF
Grip strength	0.85	(0.77 - 0.95)	0.005	1.770
Barthel index	0.92	(0.88 - 0.97)	0.001	1.088
		PCC 80.3%		

Model $\chi 2$ test; $p < 0.001$, Hosmer-Lemeshow test; $p = 0.158$.
Dependent variables: cognitively non-impaired = 0, cognitively impaired = 1.
Controlling for age and gender.
PCC: percentage of correct classifications.

IV. DISCUSSION

The purpose of this study was to determine the prevalence and factors associated with cognitive decline in older adults requiring long-term care as measured by Mini-Cog. The results showed that 23.6% of the older adults requiring long-term care had cognitive decline. Moreover, low grip strength and ADL were associated with cognitive decline. To the best of our knowledge, this is the first study in Japan to clarify the relationship between cognitive function and grip strength and ADL in older adults requiring long-term care.

A previous study of Japanese urban residents aged ≥ 65 years reported a 10.8% rate of cognitive decline, as assessed by the MMSE [11]. Thus, the percentage of cognitively impaired individuals was 12.8% higher in this study than in previous studies. This may be because this study targeted older adults who were certified by the Japanese insurance system to require support or care, and therefore tended to have a higher percentage of cognitively impaired individuals than the older adult population living in the community.

The relationship between cognitive function and grip strength has been reported in several studies. Cognitive function and grip strength have been shown to decrease with increasing age [12]. Moreover, grip strength is a component of sarcopenia and has been reported to be associated with cognitive decline [13]. Several studies have also reported that low grip strength is associated with cognitive decline and the risk of developing dementia [3, 14]. The results of this study support previous research and suggest that grip strength and cognitive function are closely related and that a decline in grip strength may be accompanied by a decline in cognitive function in older adults requiring long-term care. Elevated IL-6, which is also a factor associated with sarcopenia, has been reported to be associated with a risk of cognitive decline [15]. These factors may be associated with both cognitive function and grip strength, and further evidence is needed to confirm the relationship between them.

Regarding the relationship between cognitive function and ADLs, it has been reported that cognitive decline is associated with diminished motor function and affects activities of daily living [4, 16]. Wang et al. have shown that cognitive decline precedes ADL deterioration [17]. The results of this study support previous research and suggest that older adults with low cognitive function have lower ADLs than those without. Thus, the early screening of cognitive function in older adults is an important strategy for preventing further ADL impairment and maintaining independence.

This study had several limitations. First, because this was a cross-sectional study, causal relationships could not be determined. Follow-up of participants would be necessary to clarify the causal relationship between these factors in a future longitudinal study. Second, this study defined cognitive decline by measuring the Mini-Cog; it should be noted that the Mini-Cog is a screening tool for cognitive function and is not a definitive diagnosis of dementia. Third, the results of this study were based on a small sample from one institution. Therefore, a study with a larger sample size is needed to make generalizations.

In conclusion, cognitive decline as measured by the Mini-Cog was independently associated with grip strength and ADL, suggesting that the Mini-Cog is a practical screening tool for cognitive function in older adults requiring long-term care.

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FUNDING AND CONFLICT OF INTEREST

The authors have declared that no competing interests exist.

REFERENCES

1) Takahashi S, Yonekura Y, Takanashi N, et al. Risk factors of long-term care insurance certification in Japan: A scoping review. Int J Environ Res Public Health. 2022, 19: 2162.
2) Yamada M, Arai H. Long-term care system in Japan. Ann Geriatr Med Res. 2020, 24: 174–180.
3) Cui M, Zhang S, Liu Y, et al. Grip strength and the risk of cognitive decline and dementia: A systematic review and meta-analysis of longitudinal cohort studies. Front Aging Neurosci. 2021, 13: 625551.
4) Lee G. Impaired cognitive function is associated with motor function and activities of daily living in mild to moderate alzheimer's dementia. Curr Alzheimer Res. 2020, 17: 680–686.
5) Fage BA, Chan CC, Gill SS, et al. Mini-Cog for the detection of dementia within a community setting. Cochrane Database Syst Rev. 2021, 7: CD010860.
6) Tsoi KK, Chan JY, Hirai HW, et al. Cognitive tests to detect dementia: A systematic review and meta-analysis. JAMA Intern Med. 2015,175: 1450–1458.
7) Borson S, Scanlan J, Brush M et al. The mini-cog: a cognitive 'vital signs' measure for dementia screening in multi-lingual elderly. Int J Geriatr Psychiatry. 2000, 15: 1021–1027.
8) Almeida OP, Almeida SA. Short versions of the geriatric depression scale: a study of their validity for the diagnosis of a major depressive episode according to ICD-10 and DSM-IV. Int J Geriatr Psychiatry. 1999, 14: 858–865.
9) Rubenstein LZ, Harker JO, Salvà A, et al. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). J Gerontol A Biol Sci Med Sci. 2001, 56: 366–372.
10) Bouwstra H, Smit EB, Wattel EM, et al. Measurement properties of the Barthel Index in geriatric rehabilitation. J Am Med Dir Assoc. 2019, 20: 420–425.e1.
11) Sakuma N, Ura C, Miyamae F, et al. Distribution of Mini-Mental State Examination scores among urban community-dwelling older adults in Japan. Int J Geriatr Psychiatry. 2017, 32: 718–725.
12) Zammit AR, Robitaille A, Piccinin AM, et al. Associations between aging-related changes in grip strength and cognitive function in older adults: a systematic review. J Gerontol A Biol Sci Med Sci. 2019, 74: 519–527.
13) Cabett Cipolli G, Sanches Yassuda M, Aprahamian I. Sarcopenia is associated with cognitive impairment in older adults: A systematic review and meta-analysis. J Nutr Health Aging. 2019, 23: 525–531.
14) Jeong S, Kim J. Prospective association of handgrip strength with risk of new-onset cognitive dysfunction in Korean adults: A 6-year national cohort study. Tohoku J Exp Med. 2018, 244: 83–91.
15) Weaver JD, Huang MH, Albert M, et al. Interleukin-6 and risk of cognitive decline: MacArthur studies of successful aging. Neurology. 2002, 59: 371–378.
16) Kang TW, Lee NG, Park HJ. Relationship between aging-related pulmonary function, cognition, motor function, and activities of daily living in older adults with dementia. NeuroRehabilitation. 2022, 5: 425–432.
17) Wang J, Zhu WH, Li YF, et al. Temporal precedence of cognitive function and functional abilities: A latent difference score model of the Chinese community-dwelling elders. Int J Geriatr Psychiatry. 2019, 34:1892–1899.

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Report

Consideration of the Effect of Tablet Use in Physical Therapy Classes (Third Report)

TAKASHI YOSHIZAWA, RPT, PhD [1, 4], TAKASHI NAKADA, OTR, MS [2], SYUICHI YOSHIDA, RPT, MS [3]

1) Department of Physical Therapy, Fukuoka Wajiro Professional Training College (2-1-13 Wajirogaoka,Higashiku, Fukuoka-city, Fukuoka 811-0213, Japan)

2) Department of Occupational Therapy, Yachiyo Rehabilitation College

3) Department of Physical Therapy, Yachiyo Rehabilitation College

4) School of Physical Therapy, Faculty of Rehabilitation, Reiwa Health Sciences University

Abstract:[Purpose] The purpose of this study is to consider the effect of the introduction of tablets into the classroom of the college of physical therapy And whether the educational goals were achieved. [Subjects and Methods] Eighty first year students of the college of physical therapy were targeted. Use of tablets was introduced into the classes, and the students were requested to answer an original questionnaire regarding nine items based on Bloom's Taxonomy on the last day of the class. [Results] From the results of the questionnaire, a significant difference between the affective domain and the cognitive and psychomotor domains, and between the psychomotor domain and cognitive domain were observed. Moreover, the educational goals of the class were achieved. [Conclusion] In order to promote an educational effect in the affective domain of the students, introduction of tablets into the classroom for research study, video taking, sharing and group work, etc. was found to be significant.

Keywords: tablet, Bloom's Taxonomy, affective domain

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I. INTRODUCTION

In recent years, education using Information and Communication Technology (ICT education) and e-learning have been widely introduced into the field of higher education [1]. From the viewpoint of a knowledge based society, the usability of ICT education has a large potential from now and many countries have established policies to promote its use [1]. The Ministry of Education, Culture, Sports, Science and Technology [2] (MEXT) has recognized ICT as an effective tool to enhance the discovery and solution of issues, as well as the need to promote high quality education using ICT. In order to achieve subjective, cooperative and bilateral diverse learning, MEXT reported that ICT should be promoted while recognizing the importance of face-to-face instruction of the students. In addition, Sinclair et a [1, 3] stated that by utilizing ICT, students could actively study and could acquire a higher quality of knowledge and skills.

Regarding specific approaches in ICT education involving the use of tablet-based educational materials in the medical field, flipped classrooms, distribution of class documents over the Internet, and video-taking during practice training can be mentioned [4, 5]. In addition, opinions such as “learned something” and “easy to work on” were common among students who received ICT education [6]. Moreover, Vieira, et al. [7] stated that a difference in test achievements was not observed between a group which received conventional style

*Corresponding author: TAKASHI YOSHIZAWA (t.yoshizawa@kyoju.ac.jp)

of class instruction and a group which received e-learning. As such, promotion of ICT education is expected to increase in the future. Consequently, consideration of the educational effect of tablet use in the classroom is considered to be very important.

Bloom's Taxonomy consists of three domains, cognitive, affective and psychomotor, which are useful when teachers are presenting the educational goal of the class to the students [8]. Teachers should be always keep in mind that educational goals function as guidelines to design educational material and class activities and as standards to evaluate the achievement of an exercise [9]. When training teachers to utilize ICT, MEXT [10] reported that identifying the educational goal is important, rather than just using the equipment. Some previous studies on Bloom's Taxonomy considered the correlation between achievement [11] and preparation of a exam questions [12]. However, studies which consider the method of use of ICT according to educational goal, and which consider its effect, could not be found.

At college of physical therapy A (college of A) , a class called “Basic Physical Therapy Ⅰ” was held. As an educational goal, it mainly focused on the development of an affective domain for students who were mainly seeking to become physical therapists. The author has been in charge of this class, and whether an affective domain is actually developed or not is not clear. Moreover, at college of A, ICT education has continued to be actively promoted to a greater extent, and the use of tablets has been introduced in “Basic Physical Therapy Ⅰ” Based on this, whether or not an affective domain, which is also an educational goal, could be developed was considered. According to the results of a similar study targeting 21 and 36 students carried out by the author, et al., an educational effect by the introduction of tablets was observed in the affective domain compared to the cognitive and psychomotor domains [13, 14]. However, the small number of subjects was raised as an issue to be addressed. Many physical therapist training schools in Japan have a capacity of 80 students [15]. Therefore, it is meaningful to examine the educational effect for 80 students. However, there is no research that examined the educational effects based on Bloom's taxonomy after introducing tablets into classes for 80 students and verified whether the educational goals were achieved. Consequently, the number of subjects was increased and the effect of the introduction of tablets into the classroom was considered. Hence, the purpose of this study is to consider the educational goal for introducing tablets into the classroom of the college of physical therapy. To do so, a class questionnaire based on Bloom's Taxonomy was carried out to determine whether or not the educational goal was achieved.

II. PARTICIPANTS AND METHODS

1. Participants

Eighty freshmen students of the college of A were targeted. The objectives of the study, how the results would be processed, and anonymity at the presentation site and during presentation of the study results were fully explained to the students in advance. Next, persons who gave consent to the study and who answered the questionnaire were set as subjects. In addition, this study was carried out with the approval of the ethical committee of the research collaboration facility (Approval No. FW-20-04).

2. Methods

At college of A, all students privately owned a tablet (iPad). A WiFi environment was set up in the school, so students could freely connect to the Internet by inputting a password in advance. At college of A, a class entitled “Basic Physical Therapy Ⅰ” is held during the second semester. As an outline of the class, after studying the basics of physical therapy, the students carried out exercises, group work as a team, and give presentations to the entire class. Regarding contents, for 9 of the 15 classes, the teacher first gave a class lecture, and then based on that, the students carried out research learning and group work in order to find solutions to the problems. For the remaining 6 classes, “wheelchair experience” and “hemiplegia experience” were carried out. As details of “experience” class, the teacher first explained the characteristics of elderly persons, patients with hemiplegia, and methods of assistance. After that, the students imitated and practiced the movements, with the students playing both roles of the patient and the assistant to practice giving assistance. As a result of the group work considering the reasons of the movement process of elderly persons and patients with hemiplegia, and what they could do as a physical

therapist, presentations were prepared by each team based on the practice training of "experience" class and then presented in front of the entire class. Furthermore, tablets were actively used during research and study by the students. In addition to taking videos of each other in scenes practicing the "experience" class with their tablet, students were encouraged to share the videos within the team, and were instructed to perform imitation / assistance practice and group work while watching the videos. Furthermore, presentations were given in front of the entire class with the students playing videos taken with their tablets. A questionnaire prepared by Nakada et al.[16] was used as the class questionnaire on the introduction of tablets (hereinafter referred to as the "class questionnaire"). The class questionnaire consisted of questions on the following 9 items. "Q1. Can you recall and list the keywords taught in class?" "Q2. Can you explain the meaning of the terms you learned?" "Q3. Could you apply what you learned and solve the problem?" "Q4. Could you develop a desire regarding what you learned?" "Q5. Could you communicate with others about what you learned?" "Q6. Could you improve your humanity as a therapist?" "Q7. Could you imitate the practical training, etc.?" "Q8. Could you accurately perform the practical training, etc.?" "Q9. Could you naturally perform practical training, etc.?" Q1-3. correspond to the cognitive domain, Q4-6. to the affective domain, and Q7-9. to the psychomotor domain. Students were informed in advance that, on the last day of the class in December, they would be asked to answer questions regarding the effect of introducing the use of tablets in the classroom. On the last day of class, the students were asked to answer the questionnaire with a number between 0 and 10 (11 - point scale) for each item. Moreover, on the same day, a class evaluation questionnaire was carried out separately. The class evaluation questionnaire consisted of questions such as "Could you actively work in this class?" "Were you satisfied that you took this class?" The students were asked to write their answer on the paper with a number from 1 to 4 (4 - point scale, 1 bad, 4 good). Furthermore, the class questionnaire and class evaluation questionnaire were prepared so that the respondent's name would not be included.

For statistical analysis, correlation in the class questionnaire results were analyzed by Friedman test. After that, Bonferroni test was used for multiple comparison. SPSS Statistics V26.0 was used for statistical analysis, and significant difference was set at 5%.

III. RESULTS

The number of responses and the response rate of the class questionnaire was 80 persons out of 88 persons and 91.0%, respectively.

Results of the class questionnaire are shown in Table 1. The Friedman test was carried out on the combined results of each cognitive, affective and psychomotor domain with significant difference set at ($p < 0.01$). A significant difference in main effect was observed between domains. After that, the Bonferroni test was carried out for multiple comparison, and a significant difference was observed between the affective and psychomotor domains, and between the psychomotor and cognitive domains ($p < 0.01$, Table 1).

Table1. Results of the class questionnaire on the introduction of tablets

	Item	Results for each item	Total results for each item
Cognitive domain	Q1. Can you recall and list the keywords taught in class?	6 (5-8)	
	Q2. Can you explain the meaning of the terms you learned?	6 (5-8)	19 (15-24) †,‡
	Q3. Could you apply what you learned and solve the problem?	6 (5-8)	
Affective domain	Q4. Could you develop a desire regarding what you learned?	8 (7-9)	
	Q5. Could you communicate with others about what you learned?	8 (7-9)	24 (21-27) *,†
	Q6. Could you improve your humanity as a therapist?	8 (7-9)	
Psychomotor domain	Q7. Could you imitate the practical training, etc.?	7 (6-8)	
	Q8. Could you accurately perform the practical training, etc.?	7 (6-8)	21 (17-24) *,‡
	Q9. Could you naturally perform practical training, etc.?	7 (5-8)	

Median (1st quartile-3rd quartile), *p<0.01, †p<0.01, ‡p<0.01

*: Significant difference between Affective domain and Psychomotor domain

†: Significant difference between Affective domain and Cognitive domain

‡: Significant difference between Psychomotor domain and Cognitive domain

IV. DISCUSSION

In this study, introduction of tablets in class by 80 students of the college of A and whether the educational goal was achieved, were considered. As a result, a significant difference between the affective domain and the cognitive and psychomotor domains, and between the psychomotor domain and cognitive domain was observed. Accordingly, achieving the educational goal, which is development of affective domain by the introduction of tablets into the classroom, is considered to have significance. From the results of the class evaluation questionnaire, median values for the questions "Could you actively work in this class?" and "Were you satisfied to take this class?" were 4.0, and the condition that students actively worked in the class, and were satisfied, could be confirmed.

Regarding method of use of tablets in the classroom in this study, tablets were used during research study, sharing videos within the team, practicing while watching the video, group work, and group presentation in front of the entire class. Elements of a tablet which are not possible by paper include "Characteristics as a dynamic tool" such as "watching videos, etc.," "taking videos," "showing videos," "sending video to a friend's tablet." These were found to be important in the class concept for each student to proactively work in their studying [17]. The method of tablet use allows for contents of the research study and videos taken during practice to be easily shared within the team, and confirmed between everyone during group work. Consequently, this is considered to encourage the students to actively develop group work, and positively communicate with other members of the group, as well as eagerly participate in class. In addition, cooperative learning, such as reasoning between students, could be promoted in group work through the use of tablets, and is considered to positively affect the affective domain. Malekigorji, et al. [18] stated that ICT education using a tablet improved communication and eagerness to learn by the students. Moreover, Eurell, et al. [19] stated that classroom which used tablet could encourage cooperative learning by the students. Furthermore, watching the video of practical training during class was thought to promote the psychomotor domain, such as imitating techniques, and accurately carrying them out. Dohms et al. [20] stated that watching the audio-visual educational material increases self-awareness and are useful to improve skills.

According to the result of this study on 80 persons, the introduction of tablets into the classroom for research study, video taking, sharing and group work, etc. in order to promote an educational effect in the affective domain of the students, was considered significant. Moreover, recommending the method of tablet use used in this study was considered for other classes for which the educational goal is the development of the affective domain. However, in the method of tablet use in this study, connecting it to development of the cognitive domain, such as applying what they learned and solving the problem, was considered difficult. In the future, in cases when development of cognitive domain is determined to be the educational goal, a flipped classroom and promoting use at times other than class, such as at home and on the way to school, are considered needed [16].

As a limitation to this study, we were unable to compare before and after the introduction of tablets. In addition, conclusions were determined based on the results of single year. Continued consideration of the effect of tablet use in the classroom and whether the educational goals are achieved, is desired.

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The authors have declared that no competing interests exist.

REFERENCES

1) Masic I: E-learning as new method of medical education. Acta Inform Med, 2008, 16: 102-117.
2) MEXT: G7 Kurashiki Education Ministers' Meeting in Okayama. http://www.mext.go.jp/component/a_menu/other/detail/__icsFiles/afieldfile/2016/06/17/1370953_2_3.pdf. (Accessed Sep.1,2021)
3) Sinclair P, Kable A, Jones TL: The effectiveness of internet-based e-learning on clinician behavior and patient outcomes: a systematic review protocol. JBI Database System Rev Implement Rep, 2015, 13: 52-64.
4) Hew KF, Lo CK: Flipped classroom improves student learning in health professions education: a meta-analysis. BMC Med Educ, 2018, 18: 38.
5) Donkin R, Askew E, Stevenson H: Video feedback and e-Learning enhances laboratory skills and engagement in medical laboratory science students. BMC Med Educ, 2019, 19: 310.
6) Gardner P, Slater H, Jordan JE, et al.: Physiotherapy students' perspectives of online e-learning for interdisciplinary management of chronic health conditions: a qualitative study. BMC Med Educ, 2016, 16: 62.
7) Vieira RA, Lopes AH, Sarri AJ, et al.: Oncology E-Learning for Undergraduate. A Prospective Randomized Controlled Trial. J Cancer Educ, 2017, 32: 344-351.
8) Yamashita M:Emotional aspects in nursing education. Kangogakukenkyukiyo, 2017, 5: 15-23. (in Japanese)
9) Su WM, Osisek PJ: The Revised Bloom's Taxonomy: implications for educating nurses. J Contin Educ Nurs, 2011, 42: 321-327.
10) MEXT: The 7th chapter Improving teachers' ability to teach using ICT. https://www.mext.go.jp/component/a_menu/education/detail/icsFiles/afieldfile/2010/12/13/1259416_12.pdf. （Accessed Sep.1,2021）(in Japanese)
11) Zaidi N, Hwang C, Scott S, et al.: Climbing Bloom's taxonomy pyramid: Lessons from a graduate histology course. Anat Sci Educ, 2017, 10: 456-464.
12) Kim MK, Patel R, Uchizono J, et al.: Incorporation of Bloom's taxonomy into multiple-choice examination questions for a pharmacotherapeutics course. Am J Pharm Educ, 2012, 76: 114.
13) Yoshizawa T, Nakada T: Examination of the Effect on Class of the Introduction of iPad Use in a Vocational School Physical Therapy Department. Rigakuryouhoukagaku, 2020, 35: 575-579. (in Japanese)
14) Yoshizawa T, Nakada T, Yoshida S, et al.: Effect of Learning Outcomes at Professional Training College in Physical Therapy Students using the Tablets: Second Report. Nihonrihabiriteshonkyoikugakkaishi, 2021, 4:77-81. (in Japanese)
15) Japanese Physical Therapy Association: List of Physical Therapist Training Schools. https://www.japanpt.or.jp/about_pt/aim/training/. （Accessed Sep.12,2022）(in Japanese)
16) Nakada T, Konuma R: The effects of ICT education～Using Bloom's Taxonomy～. Igakukyoiku, 2018, 49: 220. (in Japanese)
17) kambara K, Sasaki H: An empirical study on the improvement of lessons using ICT in pre-service teacher training：Efforts of seminar lessons using tablet-type devices in mathematics. Mukogawazyoshidaigakugakokyoikusentanenpo, 2018, 3: 11-22. (in Japanese)
18) Malekigorji M, Hatahet T: Classroom Response System in a Super-Blended Learning and Teaching Model: Individual or Team-Based Learning? . Pharmacy (Basel), 2020, 8: 197.
19) Eurell J, Diamond N, Buie B, et al.: Tablet computers in the veterinary curriculum. J Vet Med Educ, 2005, 32: 113-116.
20) Dohms MC, Collares CF, Tibério IC: Video-based feedback using real consultations for a formative assessment in communication skills. BMC Med Educ, 2020, 20:57.