



Original article

# Impact of social networking service usage on self-learning activity and physical activity in Japanese undergraduate physical therapy students: A cross-sectional study

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## ABSTRACT

**Objective:** The use of social-networking services (SNSs) is increasing among young Japanese people. Previous studies showed that psychological stress via SNS has increased in Japanese undergraduate students, including physical therapy students. However, little is known about the impact of SNS usage on self-learning activity (self-LA) and physical activity (PA) in Japanese undergraduate physical therapy students. In this study, we aimed at clarifying the association between them using a single-university cross-sectional study.

**Methods:** A total of 113 second- to fourth-year undergraduate physical therapy students (aged 19–22 years) volunteered for this study. Using self-administered questionnaires, the participants answered questions regarding SNS usage, such as the purpose of SNS usage (e.g., communicating with friends, self-promotion, collecting information, building friendship), self-LA, and PA, including vigorous-intensity PA (VPA), moderate-intensity PA (MPA), walking, moderate- to vigorous-intensity PA (MVPA), and sitting.

**Results:** Data of 84 participants (65 men and 19 women) were analyzed. Stepwise multiple regression analysis after adjusting for gender showed that self-LA did not change by other variables, VPA decreased in the upper year, MPA was lower in the participants who had the purpose of “self-promotion” through SNS than in those who did not, walking and MVPA decreased in the upper year and were higher in the participants who had the purpose of “building friendship” through SNS than in those who did not. There was no association between sitting and SNS usage.

**Conclusion:** We found that SNS usage had no impact on self-LA; however, it had both a negative and positive impact on PA among participants. Proper assessment and management of SNS usage may be important to increase PA among Japanese undergraduate physical therapy students.

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physical activity



## INTRODUCTION

Social networking services (SNSs) globally connect users through the internet and their use has increased exponentially during the past few decades. SNS applications, including Twitter (Twitter, Inc., San Francisco, CA, USA), Instagram (Facebook, Inc., Menlo Park, CA, USA), Facebook (Facebook, Inc., Menlo Park, CA, USA), and LINE (LINE Corp., Tokyo, Japan) which are distributed across Japan, differ from traditional broadcast media because they allow individuals to communicate with each other, write about themselves or world events, and share images and videos. Hence, SNSs are rapidly changing the way individuals interact<sup>1</sup>.

SNS dependence, which is caused by excessive use of smartphones, tablets, or computers, has gradually increased and has become a serious and common problem. It has been reported that SNS dependence may have a negative impact on individuals' health and personality<sup>2-4</sup>. Moreover, among undergraduate students, the spread of SNS dependence via smartphones has been observed<sup>5-7</sup>, as SNS usage has become an essential element of undergraduate students' daily life<sup>8,9</sup>. SNS dependence manifests in individuals who spend a significant amount of time using SNSs and display addictive behaviors, such as anxiety and compulsive behavior<sup>10-12</sup>.

In Japan, smartphone usage is increasing among young people; in 2018, 90.8% of teenagers 13–19 years old and 99.0% of adults 20–29 years old reportedly used smartphones<sup>13</sup>. Recent evidence suggests that psychological stress caused by smartphone and SNS usage has increased among non-medical Japanese undergraduate students<sup>14,15</sup>. Additionally, passive SNS use (surfing without any purpose) has been positively associated with psychological stress in Japanese physical therapy students<sup>16</sup>.

In university, Japanese undergraduate physical therapy students learn expert skills and train actively to acquire a physical therapy license; thus, self-learning activity (self-LA) and physical activity (PA) may be increased and decreased, respectively, as their year increases. Conversely, previous studies showed that SNS usage induced increased sitting time in adults<sup>2</sup> and negative learning skills, such as lack of critical thinking, inefficient time management, disrupted writing skills, and a decrease in learning time, and physical inactivity in undergraduate students<sup>17</sup>. However, little is

known about the impact of SNS usage on self-LA and PA in Japanese undergraduate physical therapy students. Thus, we hypothesized that self-LA and PA would decrease with an increment in SNS usage. If this were to be confirmed, managing SNS usage could become an important strategy to promote proper self-LA and PA among students.

## METHODS

### Study design

This was a single-university cross-sectional study. Prior to the study, we explained that the survey contents did not affect their grades, and all participants provided written informed consent. Ethical approval was obtained from the institutional review board of Aino University (Ibaraki, Japan; approval number: 2018–026) in accordance with the Declaration of Helsinki.

### Participants

In the present study, we analyzed the same data resource from our previous study<sup>16</sup>; however, it should be noted that this study is not a duplicate report or “salami slicing,” as PA data was collected from some of the aforementioned students; answering the items regarding PA was optional due to time restrictions, such as moving classrooms or preparing for classes. Participants who were diagnosed with diseases that affected their ability to answer the questionnaire and/or their PA performance (such as motor dysfunction), employed, had repeated the year, or participated in clinical training were excluded from the study. Overall, 113 second- to fourth-year physical therapy students (aged 19–22 years, 41.2% of all students in the year groups) who had smartphones participated in this study in April–May 2018.

### Measurements

Using paper-and-pencil mark sheet type self-administered questionnaires, the participants answered questions regarding SNS usage, self-LA, and PA during their free time between classes at the university. Regarding SNS usage, the type of applications used (Twitter, Instagram, Facebook, LINE, and/or other), number of applications used, the frequency of uploads/posts to the timeline

(feed) and/or stories during the usual week (often [at least once every two days], sometimes [once every three days to once a week], or seldom/never [less than once a week or none]), and the purpose of SNS usage (communicating with friends, self-promotion, collecting information, building friendship, seeking counseling services, and/or surfing without any purpose [SNS used passively]) were measured.

Self-LA was assessed with the following question: “For how much time outside of class do you study on weekdays?” The items regarding PA were based on the short version of the International Physical Activity Questionnaire (IPAQ), which has previously been validated for Japan<sup>18,19</sup>. We collected PA data using items divided into four categories. 1) vigorous-intensity PA (VPA): “During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?” and “How much time did you usually spend doing vigorous physical activities on one of those days?” 2) moderate-intensity PA (MPA): “During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking” and “How much time did you usually spend doing moderate physical activities on one of those days?” 3) walking: “During the last 7 days, on how many days did you walk for at least 10 minutes at a time?” and “How much time did you usually spend walking on one of those days?” And 4) sitting: “During the last 7 days, how much time did you spend sitting on a weekday?”<sup>20</sup> According to the results gathered from these items, we calculated the weekly VPA, MPA, walking, and moderate- to vigorous-intensity PA (MVPA) (sum of the previous three PAs): for example, weekly VPA (h/week) = frequency (day/week) × duration (h/day). By “sitting,” we referred to time spent sitting or lying down, such as watching television, reading, or using a computer.

#### Statistical analysis

All values are reported as mean ± standard deviation. Comparisons of variables between the years were analyzed using a one-way analysis of variance followed by the Tukey-Kramer test for continuous variables and the Fisher’s exact test or Chi-squared test for nominal variables. Spearman’s rank correlation coefficient

was used to analyze the correlations among variables while setting nominal variables to absence and men = 0 or presence and women = 1. Additionally, stepwise multiple regression analysis was performed to determine the predictors of self-LA and PA, retaining variables with *p*-values < 0.1 in the correlation analysis as the explanatory variables, while checking the variance inflation factor to evaluate if there was any multicollinearity among the predictor variables. All statistical calculations were performed using IBM SPSS statistics software (version 20.0, IBM, Tokyo, Japan). Significance was set at *p* < 0.05.

## RESULTS

Of all the questionnaires, 29 presented omissions or errors and were excluded. Thus, we analyzed the data from 84 participants (Figure 1). Participants’ characteristics are shown in Table 1. There were significant differences between the groups regarding age, Instagram use, VPA, walking, MVPA, and sitting, whereas no significant differences were found between the groups with respect to the other variables.

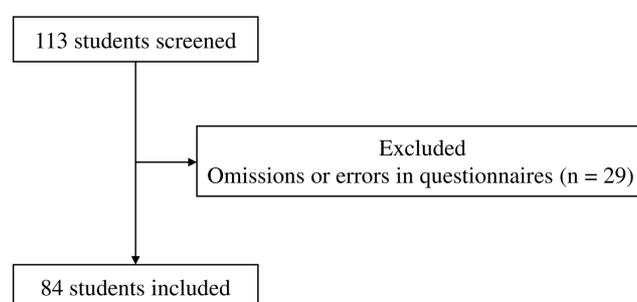


Figure 1 Flow chart of the study population selection

Correlation analysis data of SNS usage (except for LINE) are shown in Table 2. Some parameters of SNS usage correlated with self-LA and PA, although the correlation coefficients were “weak” ( $|\rho| < 0.3$ )<sup>21</sup> except for the variable, “year.” We performed stepwise multiple regression analysis of self-LA and PA; explanatory variables were set based on correlation analysis (variables with a *p*-value < 0.1) (Table 3). As a result, several variables were extracted from explanatory variables as a factor associated with self-LA or PA, although all the values of the adjusted coefficient of

determination were low. After adjusting for gender, 1) self-LA was not influenced by other variables, 2) VPA decreased in the upper year, 3) MPA was lower in the participants who had the purpose of “self-promotion” through SNS than in those who did not, 4) walking decreased in the upper year and was higher in the

participants who had the purpose of “building friendship” through SNS than in those who did not, 5) MVPA decreased in the upper year and was higher in the participants who had the purpose of “building friendship” through SNS than in those who did not, and 6) sitting was not influenced by other variables.

Table 1 Participants’ characteristics

Variables	Total (n = 84)	Second-year (n = 32)	Third-year (n = 31)	Fourth-year (n = 21)
Age (years)	20.0 ± 0.9	19.1 ± 0.3	20.1 ± 0.3**	21.3 ± 0.5**††
Gender (men/women)	65/19	26/6	24/7	15/6
SNS application				
- Twitter, n (%)	70 (83.3)	27 (84.4)	24 (77.4)	19 (90.5)
- Instagram, n (%)	60 (71.4)	28 (87.5)	21 (67.7)	11 (52.4)*
- Facebook, n (%)	11 (13.1)	5 (15.6)	3 (9.7)	3 (14.3)
- LINE, n (%)	84 (100)	32 (100)	31 (100)	21 (100)
- Other, n (%)	0 (0)	0 (0)	0 (0)	0 (0)
- No use, n (%)	0 (0)	0 (0)	0 (0)	0 (0)
Number of applications used	2.7 ± 0.8	2.9 ± 0.8	2.5 ± 0.7	2.6 ± 0.9
Frequency of SNS upload/post				
- Often, n (%)	3 (3.6)	0 (0)	1 (3.2)	2 (9.5)
- Sometimes, n (%)	56 (66.7)	26 (81.3)	19 (61.3)	11 (52.4)
- Seldom/Never, n (%)	25 (26.8)	6 (18.7)	11 (35.5)	8 (38.1)
Purpose of SNS usage				
- Communicating with friends, n (%)	68 (81.0)	26 (81.3)	23 (74.2)	19 (90.5)
- Self-promotion, n (%)	11 (13.1)	2 (6.3)	7 (22.6)	2 (9.5)
- Collecting information, n (%)	60 (71.4)	23 (71.9)	20 (64.5)	17 (81.0)
- Building friendship, n (%)	13 (15.5)	6 (18.7)	5 (16.1)	2 (9.5)
- Seeking counseling services, n (%)	4 (4.8)	0 (0)	3 (9.7)	1 (4.8)
- Surfing without any purpose, n (%)	3 (3.8)	1 (3.1)	2 (6.5)	0 (0)
Self-LA (h/day)	1.9 ± 1.2	1.9 ± 1.3	2.0 ± 1.3	1.5 ± 0.9
PA				
- VPA (h/week)	2.4 ± 1.7	3.0 ± 1.9	2.4 ± 1.3	1.5 ± 1.7**
- MPA (h/week)	2.6 ± 2.1	3.2 ± 2.0	2.1 ± 1.9	2.6 ± 2.1
- Walking (h/week)	4.0 ± 2.8	5.3 ± 2.7	2.9 ± 2.5**	3.6 ± 2.5*
- MVPA (h/week)	9.0 ± 4.4	11.5 ± 4.2	7.3 ± 4.0**	7.7 ± 3.4**
- Sitting (h/day)	9.5 ± 4.1	7.7 ± 4.5	11.7 ± 5.1**	8.8 ± 5.1

Values are presented as mean ± standard deviation. SNS: social networking service; LA: learning activity; PA: physical activity; VPA: vigorous-intensity physical activity; MPA: moderate-intensity physical activity; MVPA: moderate- to vigorous-intensity physical activity. \**p* < 0.05, \*\**p* < 0.01 compared to second-year, ††*p* < 0.01 compared to third-year.

Table 2 Spearman’s rank correlation coefficient ( $\rho$ ) among self-LA, PA, and other variables

Variables	Self-LA	VPA	MPA	Walking	MVPA	Sitting
Year	-0.07	-0.36**	-0.18†	-0.31**	-0.39**	0.14
Gender	0.22*	-0.08	0.01	0.12	0.09	0.21†
SNS application						
- Twitter	0.13	0.19†	<0.01	0.04	0.08	-0.12
- Instagram	0.07	0.17	0.17	0.04	0.16	-0.06
- Facebook	-0.05	0.09	-0.19†	0.11	0.06	0.02
Number of applications used	0.11	0.21†	0.02	0.10	0.17	-0.07
Frequency of SNS upload/post	-0.10	-0.12	-0.10	-0.03	-0.13	0.05
Purpose of SNS usage						
- Communicating with friends	-0.17	-0.04	-0.10	0.16	0.01	0.12
- Self-promotion	0.14	-0.03	-0.24*	-0.02	-0.19†	-0.06
- Collecting information	0.26*	0.11	0.01	0.03	0.06	<0.01
- Building friendship	0.07	0.05	0.02	0.22*	0.23*	-0.13
- Seeking counseling services	0.01	0.13	-0.06	<0.01	-0.01	0.08
- Surfing without any purpose	-0.11	-0.06	0.07	0.09	0.13	0.13
Self-LA	-	0.02	-0.27*	-0.05	-0.10	-0.01

LA: learning activity; PA: physical activity; VPA: vigorous-intensity physical activity; MPA: moderate-intensity physical activity; MVPA: moderate-to-vigorous-intensity physical activity; SNS: social networking service. † $p < 0.1$ , \* $p < 0.05$ , \*\* $p < 0.01$ .

Table 3 Stepwise multiple regression analysis for self-LA and PA

Variables	Crude model					Gender adjusted model				
	Adjusted R <sup>2</sup>	B	95% CI	$\beta$	$p$ -value	Adjusted R <sup>2</sup>	B	95% CI	$\beta$	$p$ -value
Self-LA	0.04					0.05				
Collecting information		0.62	0.05 to 1.18	0.23	0.03*		0.54	-0.02 to 1.13	0.21	0.06
VPA	0.10					0.10				
Year		-42.89	-70.13 to -15.65	-0.33	<0.01**		-41.69	-69.06 to -14.32	-0.32	<0.01**
MPA	0.04					0.05				
Self-promotion		-84.47	-166.40 to -2.54	-0.22	0.04*		-87.23	-165.18 to -2.87	-0.23	0.04*
Walking	0.13					0.15				
Year		-54.87	-97.95 to -11.79	-0.26	0.01*		-58.18	-100.96 to -15.39	-0.28	<0.01**
Building friendship		123.27	29.95 to 216.59	0.27	0.01*		122.21	29.91 to 214.52	0.27	0.01*
MVPA	0.17					0.18				
Year		-118.55	-185.02 to -52.09	-0.36	<0.01**		-123.20	-189.41 to -57.00	-0.37	<0.01**
Building friendship		156.10	12.13 to 300.07	0.22	0.03*		154.61	11.78 to 297.45	0.22	0.03*

LA: learning activity; PA: physical activity; B: partial regression coefficient; CI: confidence interval;  $\beta$ : standardized partial regression coefficient; R<sup>2</sup>: coefficient of determination. \* $p < 0.05$ , \*\* $p < 0.01$ .

## DISCUSSION

To the best of our knowledge, this is the first study to investigate the association between SNS usage and self-LA and PA in Japanese undergraduate physical therapy students. The main finding of the

present study is that some purposes of SNS usage had a weak influence on PA whereas SNS usage did not influence self-LA significantly.

Similar to the rest of the general Japanese population aged 13–69



years, the most used SNS applications by this study's participants was LINE, followed by Twitter, Instagram, and Facebook (82.3%, 37.3%, 35.5%, and 32.8% in general people, respectively<sup>13</sup>); Table 1). Although all participants used LINE, detailed LINE usage (e.g., daily time of usage) was not assessed in this study. LINE users often experience distress, mind-wandering, or irritation that may induce a decrease in LA and/or PA<sup>15</sup> when they do not receive any response from their friends and family (e.g., absence of the "Read" sign). Therefore, it may be important to confirm whether LINE usage influences self-LA and PA.

After adjusting for gender, multiple regression analysis showed that there was no association between SNS usage and self-LA, although the analysis before the adjustment indicated a significant association between them (Table 3). As previously mentioned, we hypothesized that low self-LA would be caused by SNS usage; however, this was not observed in this study. A previous study showed that Twitter use allowed for the gathering of medical information, which enhanced the educational experience of medical students<sup>22</sup> whereas Facebook use did not<sup>3</sup>. Additionally, Japanese undergraduate students often gathered field-relevant information through the internet, including SNS<sup>23</sup>. Therefore, "collecting information" through SNS tended to increase self-LA among Japanese undergraduate students who learn expert skills and train actively to acquire their physical therapy licenses, although the detailed content and the purpose of collection was not evaluated in this study. However, this association was not significant. In this study, as we did not measure the time dedicated to each purpose of SNS usage, further studies need to confirm whether excessive SNS usage influences self-LA, and whether students learn via SNS by searching for medical information.

There was no association between self-LA and year advancement, even though we hypothesized that self-LA scores would increase in parallel with year advancement, as our previous study showed that fourth-year students dedicated more time to self-LA than second- and third-year students<sup>16</sup>. In this study, second- and third-year students usually attended classes from 9 AM to 6 PM, and often had free periods (of up to 90 min) that they could use to learn by themselves. Conversely, fourth-year students studied continuously from 9 AM to 4 PM and while using public transportation (e.g.,

train and/or bus) and upon returning to their homes (home-based LA) in pursuit of their physical therapy licensing. Hence, although the total available learning time might be more extensive in the upper year, self-LA might be similar between different years. Additionally, multiple regression analysis did not indicate an association between gender and self-LA, even though single correlation analysis appeared to indicate so (Table 2). Generally, female students have higher academic performance, especially in science-related fields<sup>24</sup>; they also attend classes more regularly, sit at their desks more frequently, and get evaluated consistently higher than male students<sup>24</sup>. However, the proportion of female students was lower in the present study (22.6%) than in the previous study (34.5%)<sup>16</sup>; hence, the influence of gender on self-LA was not observed in this study.

Regarding PA, multiple regression analysis showed that there were associations between PA and year and SNS usage (Table 3). More extensive "home-based LA" in the upper year might bring a decrease in PA due to less time of club activity, part-time job, and leisure. Thus, there might be an association between PA and year advancement. Furthermore, MPA negatively correlated with the "self-promotion" under the purpose of SNS usage, while walking and MVPA positively correlated with the "building friendship" under that. A previous study showed that excessive Facebook usage was associated with narcissism and self-esteem in undergraduate students<sup>4</sup>. As mentioned earlier, SNS usage may have a negative impact on physical and mental health<sup>2-4</sup>, and may cause anxiety and compulsive behavior<sup>10-12</sup>. Therefore, SNS usage intended for "self-promotion" might represent a waste of valuable time<sup>3,25</sup> and be conducive to a decrease in MPA. Conversely, individuals often interact with others through SNSs to build new relationships as they represent a highly convenient method to meet new people<sup>26</sup>. The positive attitude toward "building friendship" may be related to the increase of PA<sup>27</sup>. Thus, SNS usage dedicated to "building friendship" may induce an increase of PA in this study.

This study has some limitations. First, it is unclear whether the results of the present study apply to all Japanese undergraduate physical therapy students, especially those during or after clinical training, as this was a single-university study performed before the clinical training period for fourth-year students began. Additionally,



little is known about the influence of the year of undergraduate students not using SNS on self-LA and PA. Second, the time spent each day using SNS, including the time of each purpose of SNS usage, was not investigated. Thus, the influence of daily SNS usage time on self-LA and PA was unclear. Medical students, including physical therapy students, may gather medical information, acquire expertise, and exchange information about their occupation through SNS applications, as even non-medical undergraduate students often do so<sup>28</sup>). Third, daily time dedicated to self-LA and PA were not evaluated objectively and might have been underestimated due to recall bias, even though the validity of IPAQ has been confirmed in Japanese individuals<sup>18,19</sup>). Moreover, different periods of time were mentioned in questions about the frequency of SNS uploads/posts and PAs measured by IPAQ; the former asked about the “usual week,” but the latter asked about the “last 7 days.” Hence, a more objective method (e.g., triaxial accelerometer) and survey with completely matched periods may be needed to evaluate these variables. Fourth, information on the quality of sleep which may change psychological status of the individual<sup>29</sup>) was not obtained. Fifth, the influence of other SNS applications, such as TikTok (ByteDance, Ltd., Beijing, China) and mixi (mixi, Inc., Tokyo, Japan), is unclear because they were included as “other” applications in this study and the participants might not have been able to imagine that they were SNS applications. Further studies, such as research of detailed SNS usage among students from multiple universities, should be performed to confirm the impact of SNS usage on self-LA and PA.

In summary, we found that SNS usage had no impact on self-LA, whereas “self-promotion” and “building friendship” SNS usage had a negative and positive influence on PA respectively, although the relationships were weak and PA decreased in the upper year. Proper assessment and management of SNS usage may be important to increase PA among Japanese undergraduate physical therapy students.

### Conflict of Interest

The authors declare no conflict of interest.

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