Threats Posed by Social Media and Computer and Video Games from the Perspective of Sport Education

Chun-Chieh Kao, Chun-Chin Liao(✉), Yu-Jy Luo
Office of Physical Education, Ming Chuan University, Taoyuan, Taiwan (R.O.C.)
luck@mail.mcu.edu.tw

Abstract—Sedentary behaviors are increasingly common, exerting a heavy financial burden on society and becoming a risk factor for chronic diseases and mortality. Taiwan has one of the highest obesity prevalence rates among Asian countries. This cross-sectional study investigated the correlation of sociodemographic characteristics and PE enrollment with the time spent on various sedentary behaviors. The valid responses of 1,195 Taiwanese university students on a survey were analyzed. They were recruited between May and June 2019 using cluster sampling. The survey inquired into demographic characteristics and the self-reported time spent on various sedentary behaviors. Descriptive statistics, one-way analysis of variance, a t test, and effect size analysis were used to analyze the data. The results indicated that university students in Taiwan were sedentary for an average of 474 minutes per day, with use of social media being the most prevalent sedentary activity at 123 minutes per day. The severely overweight group was most sedentary, and female students and students that were not enrolled in a PE class tended to spend more time on video games and social media.

Keywords—physical education curriculum, sedentary behaviors, social media, university students

1 Introduction

1.1 Applying the styles to an existing paper

Sedentary behavior is a term coined by Neville Owen and is based on behavioral epidemiology [1]. Sedentary behavior refers to any activity that a person performs in a sitting or lying position and is typically characterized by a metabolic equivalent range of 1.0–1.5 METs [2], which is lower than the metabolic equivalent range for light, moderate, and vigorous physical activities (i.e., 1.5–6.0 METs) [3]. An increasing amount of evidence suggests that sedentary behaviors lead to overweight, obesity, and other health problems among students [4]–[6]. These behaviors are harmful to one's health [7], [8], serve as crucial indicators of poor health [9], and are related to premature mortality [10]. The increasing prevalence of sedentary behaviors is an emerging trend. Accordingly, inadequate physical activity is responsible for 6% of mortality worldwide (it

constitutes the fourth leading death risk factor globally) [11]. In a study examining global physical activity levels, a large proportion of adults (31%) and adolescents (80%) were classified as being physically inactive [5]. The results of another transnational survey, across 20 countries, indicated that Taiwanese adults, as well as being physically inactive, spent a large amount of time sitting. Taiwan was ranked second among the 20 countries compared in terms of the proportion of the population who spent more than 9 hours a day sitting; the only country for which the corresponding percentage was higher was Japan (34.9%). The percentage of Taiwanese people who spend 6–9 hours sitting was as high as 18.6% [12]. Based on a conservative estimate, the cost of sedentary behaviors to the world health care system in 2013 was US$53.8 billion [13]. Therefore, sedentary behavior not only exerts a heavy financial burden but is also slowly becoming a risk factor for chronic diseases and mortality.

Exercise is crucial for the growth and development of adolescents [14]. An appropriate amount of physical activity is generally beneficial for maintaining good health, and it can significantly reduce the risk of contracting a variety of diseases [15]. The young-adult stage is a crucial period in life. Regular physical activity at this stage could reduce the loss of bone tissue and maintain the mass of soft and hard bones, which, in turn, helps to sustain the functions of the aging body and improves the health and health-related behaviors of people emerging into adulthood [16]–[19]. However, a large proportion of the world's population is still highly sedentary [20]. Attending university is typically considered to be a stage in life that paves the way to adulthood, and evidence suggests that engagement in physical activity during this period is negatively correlated in interaction with the level of sedentary behaviors [21]–[23]. Research has examined and tracked personal physical activity levels from young adulthood to adulthood, suggesting that being at university is the period during which students form habits of either being sedentary or engaging in physical activity that they will carry with them throughout their lives [21]. Therefore, physical education (PE) courses taught at university level have a gatekeeping influence on personal exercising habits.

Obesity is caused by a complex series of factors, including the lack of physical activity and engagement in sedentary behaviors [15]. Studies have revealed a significant relationship between obesity and sedentary behaviors; specifically, obesity risks can be significantly reduced through an increase in physical activities and a reduction in sedentary behaviors (e.g., watching television) [16], [17], [24]. A reduction in sedentary behaviors has been demonstrated to be significantly related to the lowering of obesity levels in adolescents [18]. Accordingly, many medical, public health, and educational institutions consider physical exercise to be a key strategy for solving the problem of increasing obesity rates in the general population [19]. Some experts urge students to participate in minimum levels of PE each week to maintain their physical health [20]. This indicates that school-based PE could be key to the formation of one's concept of health because students' physical activity levels and exercise habits affect their physical fitness and health.

A health priority for developed countries is to decrease the proportion of adolescents who engage in prolonged sedentary behaviors [25]. With regard to PE, school is regarded as an ideal setting for facilitating physical exercise; it is able to provide the

facilities, equipment, and personnel required to run PE courses [26]. PE potentially improves students' health [27], [28] as well as provide a learning opportunity that is crucial for the development of a healthy lifestyle in adolescents [29]. Although school-based PE has been proved to be a valuable channel for promoting physical activity [30], the instruction time that schools spend on PE is decreasing [31], [32]; in Taiwan, this time is currently considerably less than that of other developed countries. In addition, the majority of Taiwanese adolescents adopt a sedentary lifestyle; they engage in insufficient physical activity and have a low level of physical fitness. Taiwan is ranked among the top Asian countries in terms of obesity prevalence, and this greatly affects how competitive its workforce is.

1.2 Research purpose and questions

These studies have demonstrated that sedentary behavior not only exerts a heavy financial burden on health care systems but is also a potential risk factor for mortality. Engaging in appropriate amounts of physical activity is generally beneficial for maintaining one's health. In addition, it can significantly reduce the risk of contracting a variety of diseases. Experts from various public health and educational institutions have urged students to participate in a minimum level of PE each week to be physically active and ensure healthy physical development. Therefore, this study investigated the correlations of basic characteristics and PE class participation with sedentary behaviors in university students, which can be used as a reference for future PE class improvement. The four research questions were as follows: (1) what types of sedentary behaviors do university students engage in? (2) what are the sedentary behaviors of different genders? (3) is body mass index (BMI) correlated with engagement in sedentary behavior? and (4) is enrollment in a PE class correlated with engagement in sedentary behavior?

1.3 Study limitations

The cross-sectional design of this study precluded causal inference, for which longitudinal or experimental studies are required. In addition, the study only recruited Taiwanese students; thus, the results may not be generalizable to students from other countries.

2 Materials and methods

2.1 Participants and procedures

This cross-sectional study collected data between May and June 2019 from 1, 421 Taiwanese students who were recruited through cluster sampling; 226 of them were excluded from the final sample because they provided incomplete responses, resulting in a final sample size of 1,195 respondents. All procedures, including the informed consent and the recruitment of participants, were reviewed and approved by the Thai

Clinical Trials Registry Committee (NRTC-1227) and satisfied the criteria of the Trial Registration Data Set required by the World Health Organization.

2.2 Research tools

A two-part survey was administered. The first part inquired into demographic information, including gender, height, and weight, and PE class enrollment status. The second part contained questions where the respondent subjectively rated how long they typically engage in a given sedentary behavior; for this second part, the subjective measurement method described in Arundell et al. [33] was used. The intraclass correlation coefficients of this measurement method ranged between 0.51 and 0.93. The sedentary behaviors covered were watching television or videos, playing video games, using social media, completing their homework (including reading and writing), reading (including comics), and sitting in a vehicle. The response options were "No" (0), "15 minutes/day" (0.25), "30 minutes/day" (0.5), "1 hour/day" (1), "2 hours/day" (2), "3 hours/day" (3), and "more than 4 hours/day" (4). The average time spent on each sedentary behavior (in hours/day) could then be calculated.

2.3 Data analysis

SPSS software was used for data analysis, and a total of three statistical methods were used: (1) a descriptive statistical analysis was used to analyze the distribution of variables and the study sample's demographic characteristics; (2) a one-way analysis of variance (ANOVA) was used to examine differences in students at different BMI levels with respect to sedentary behaviors; and (3) a t-test was used to examine the correlation of gender and PE class participation with sedentary behaviors, and (4) an analysis of effect size (specifically, η^2) was used to examine the magnitude of correlations between the variables, as suggested by Cohen [34]. The level of significance for all data analysis was set at $\alpha < .05$.

3 Results

3.1 Overview of study sample

As indicated in Figure 1, among the 1,195 participants, 726 were female (60.75%) and 469 were male (39.25%). With regard to BMI, 278 participants were severely underweight (23.26%), 280 were underweight (23.43%), 284 had a healthy weight (23.77%), 164 were slightly overweight (13.72%), and 189 were severely overweight (15.82%). During the semester in which the study data were collected, 326 of the participants (27.28%) did not enroll in PE classes and 869 (72.72%) of them did.

Comparison of descriptive characteristics based on the research sample status.

Gender	**N=1195**	Percentage(%)
➡ Female	726	60.75%
➡ Male	469	39.25%

Body Mass Index (BMI)	**N=1195**	
➡ Severely Underweight	278	23.26%
➡ Underweight	280	23.43%
➡ Moderate	284	23.77%
➡ Overweight	164	13.72%
➡ Severely Overweight	189	15.82%

PE Course	**N=1195**	
➡ No	326	27.28%
➡ Yes	869	72.72%

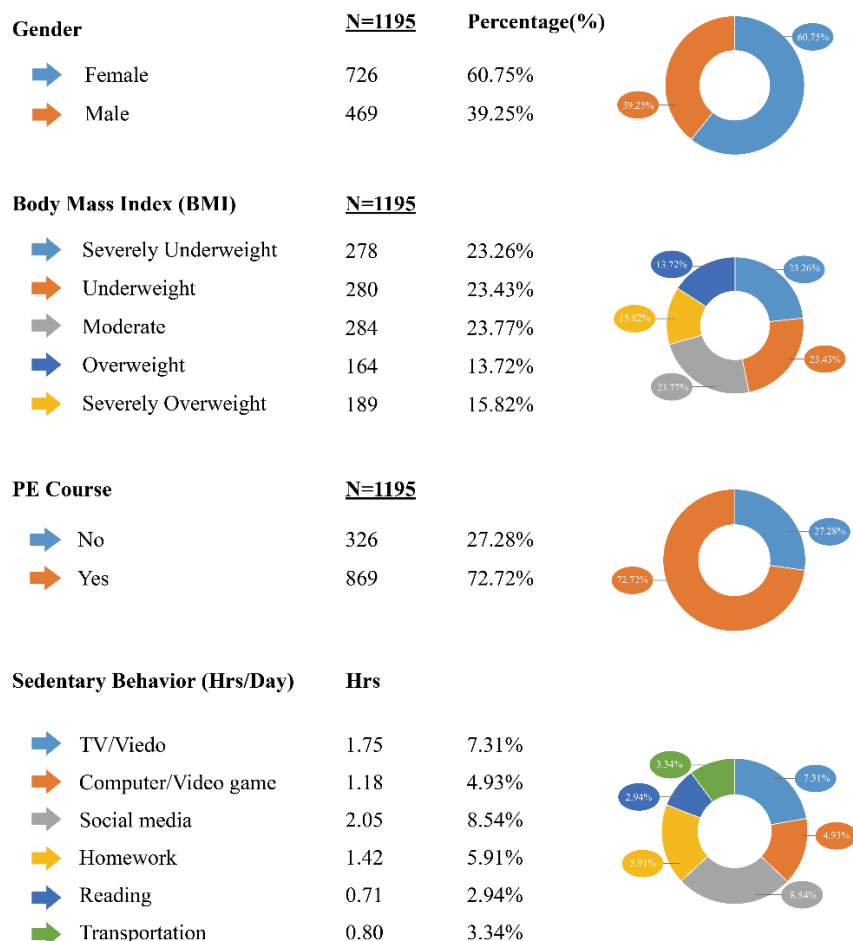| Sedentary Behavior (Hrs/Day)	**Hrs**	
➡ TV/Viedo	1.75	7.31%
➡ Computer/Video game	1.18	4.93%
➡ Social media	2.05	8.54%
➡ Homework	1.42	5.91%
➡ Reading	0.71	2.94%
➡ Transportation	0.80	3.34%

Fig. 1. Comparison of descriptive characteristics based on the research sample status

As illustrated in Figure 2, the participants spent an average of 7.91 hours (32.97% of the day) on sedentary behaviors, most of which was spent using social media (2.05 hours/day; 8.54%), followed by watching television or videos (1.75 hours/day; 7.31%), completing their homework (1.42 hours/day; 5.91%), playing video games (1.18 hours/day; 4.93%), sitting in a vehicle (0.80 hours/day; 3.34%), and reading (0.71 hours per day; 2.94%).
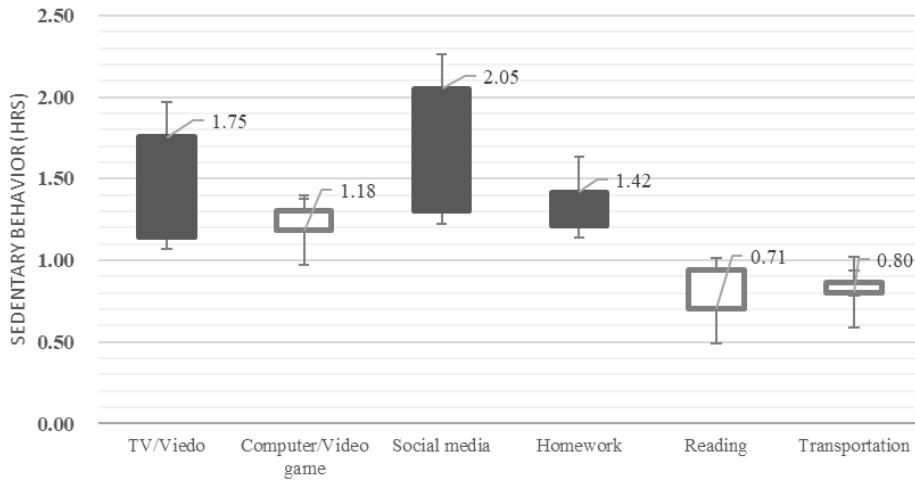
Fig. 2. Time spent daily engaging in sedentary behaviors

3.2 Effect of gender on sedentary behaviors

As indicated in Figure 3, female students spent an average of 7.91 hours engaging in sedentary behaviors per day, most of which was spent using social media (2.22 hours/day), followed by watching television and videos (1.83 hours/day); they spent the least time reading (0.68 hours/day). Similarly, male students, spent an average of 7.92 hours engaging in sedentary behaviors per day, most of which was spent watching television or videos (1.83 hours/day), followed by using social media (1.79 hours/day); they spent the least time reading (0.72 hours/day).
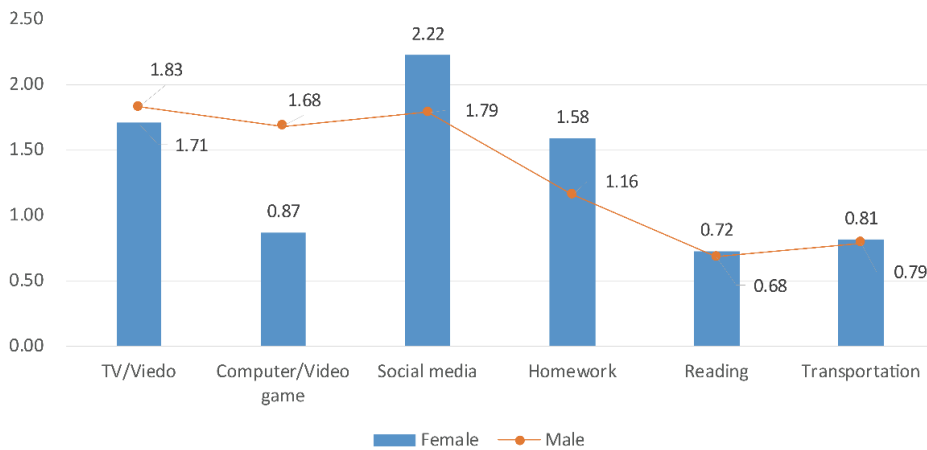

Fig. 3. Time spent by female and male students on various types of sedentary behaviors

As indicated in Table 1, male and female students significantly differed in how much time they spent on some sedentary behaviors but not others. They differed in their time spent playing video games (t = −11.08, p < .05, d = 0.67), using social media (t = −5.70, p < .05, d = 0.35), and completing their homework (t = 5.99, p < .05, d = 0.36) but not in their time spent watching television and video (t = −1.81, p > .05, d = 0.11), reading (t = 0.72, p > .05, d = 0.04), sitting on in a vehicle (t = 0.43, p > .05, d = 0.03). They also did not differ in their total time spent on all sedentary behaviors (t = −0.08, p > .05, d = 0.01). Male students (M = 1.68) spent more time than female students (M = 0.87) in playing video games, whereas female students (M = 2.22) spent more time on social media than male students (M = 1.79) and more time on (M = 1.58) homework than male students (M = 1.16).

Table 1. T-test results of differences between gender in time spent on sedentary behaviors

Sedentary Behaviors	Gender	N	M	SD	t	p	d
TV/Video	Female	726	1.71	1.15	−1.81	0.07	0.11
	Male	469	1.83	1.13			
Computer /Video game	Female	726	0.87	1.16	−11.08*	0.00	0.67
	Male	469	1.68	1.35			
Social media	Female	726	2.22	1.30	5.70*	0.00	0.35
	Male	469	1.79	1.26			
Homework	Female	726	1.58	1.28	5.99*	0.00	0.36
	Male	469	1.16	1.06			
Reading	Female	726	0.72	0.98	0.72	0.47	0.04
	Male	469	0.68	0.88			
Transportation	Female	726	0.81	0.90	0.43	0.67	0.03
	Male	469	0.79	0.81			
Total	Female	726	7.91	3.21	−0.08	0.94	0.01
	Male	469	7.92	3.42			

*p < .05.

3.3 Analysis of the effect of students' BMI levels on their sedentary behaviors

One-way ANOVA was used to examine the effects of BMI on time spent on sedentary behaviors (Table 2). Severely overweight students spent the most time on TV and videos, social media, and transportation, and severely underweight and severely overweight students spent more time on video games. Students with a healthy weight tended to spend more time on homework, and overweight students spent more time reading. Severely overweight students spent the most time being sedentary, followed by overweight students; severely underweight students spent the least time being sedentary.

Table 2. Students' BMI levels in relation to time spent engaging in sedentary behaviors

Sedentary Behaviors	B1	B2	B3	B4	B5
TV/Video	1.68 (1.13)	1.69 (1.14)	1.71 (1.11)	1.61 (1.09)	2.14 (1.20)
Computer /Video game	1.56 (0.37)	0.98 (0.20)	0.82 (0.49)	1.10 (0.36)	1.55 (1.10)
Social media	1.76 (1.24)	2.10 (1.29)	2.15 (1.29)	2.09 (1.34)	2.22 (1.34)
Homework	1.18 (1.14)	1.43 (1.21)	1.63 (1.27)	1.46 (1.26)	1.38 (1.16)
Reading	0.66 (0.32)	0.66 (0.22)	0.67 (0.39)	0.82 (0.26)	0.79 (0.67)
Transportation	0.77 (0.64)	0.82 (0.70)	0.74 (0.57)	0.82 (0.80)	0.90 (0.87)
Total	7.62 (3.38)	7.69 (3.27)	7.73 (2.89)	7.89 (3.25)	8.98 (3.62)

B1 = Severely Underweight, B2 = Underweight, B3 = Moderate, B4 = Overweight, B5 = Severely Overweight.

Table 3 details the correlations between BMI and time spent on each sedentary behavior. BMI was significantly correlated with watching television or videos ($F = 6.79$, $p < .05$, $\eta^2 = 0.31$), playing video games ($F = 18.17$, $p < .05$, $\eta^2 = 0.03$), using social media ($F = 4.86$, $p < .05$, $\eta^2 = 0.12$), completing their homework ($F = 4.99$, $p < .05$, $\eta^2 = 0.03$), and total time spent on sedentary behaviors ($F = 6.13$, $p < .05$, $\eta^2 = 0.23$) . The Scheffé method indicated that severely overweight students ($M = 2.14$) were significantly more likely than severely underweight students ($M = 1.68$) and overweight students ($M = 1.61$) to spend more time watching TV or videos. Severely underweight students ($M = 1.56$) and severely overweight students ($M = 1.55$) were more likely than healthy-weight students ($M = 0.82$) to spend more time playing video games. Severely overweight students ($M = 2.22$) were more likely than severely underweight students ($M = 1.76$) to use social media, and healthy-weight students ($M = 1.63$) were significantly more likely than severely underweight students ($M = 1.18$) to spend more time doing homework. BMI was also significantly correlated with time spent on overall sedentary behavior, with severely overweight students ($M = 8.98$) spending the most time being sedentary relative to severely underweight ($M = 7.62$), underweight ($M = 7.69$), moderate ($M = 7.73$), and overweight ($M = 7.89$) students.

Table 3. One-way ANOVA for BMI and sedentary behaviors

Source	SS	DF	MS	F	p	P.C.	η^2
TV/Video	34.86	4	8.71	6.79*	0.00	B5>B1-B4	0.31
	1526.37	1190	1.28				
Computer /Video game	116.36	4	29.09	18.17*	0.00	B1,B5>B3	0.03
	1904.98	1190	1.60				
Social media	32.56	4	8.14	4.86*	0.01	B5>B1	0.12
	1991.76	1190	1.67				
Homework	29.14	4	7.28	4.99*	0.03	B3>B1	0.03

	1736.60	1190	1.46				
Reading	4.81	4	1.20	1.36	0.24		0.01
	1050.88	1190	0.88				
Transportation	3.09	4	0.77	1.04	0.39		0.01
	884.90	1190	0.74				
Total	261.43	4	65.36	6.13*	0.00	B5>B1-B4	0.23
	12689.22	1190	10.66				

B1 = Severely Underweight, B2 = Underweight, B3 = Healthy Weight, B4 = Overweight, B5 = Severely Overweight.
*$p < .05$.

3.4 Analysis of the effect of students' PE class enrollment status on their sedentary behaviors

As indicated in Figure 4, the student group who enrolled in PE classes spent an average of 7.87 hours engaging in sedentary behaviors per day, most of which were spent using social media (2.02 hours/day), followed by watching television and videos (1.81 hours/day); they spent the least time reading (0.68 hours/day). Those who did not enroll in PE classes spent the most time using social media (2.06 hours/day), followed by watching television or videos (1.73 hours/day); they spent the least time reading (0.72 hours/day).
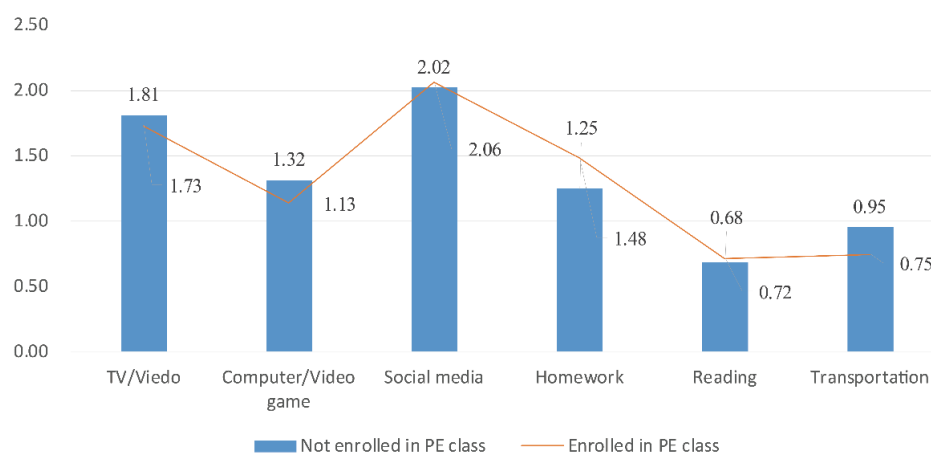

Fig. 4. Time spent on different sedentary behaviors by students who enrolled in PE classes and those who did not

As indicated in Table 4, PE class enrollment was significantly correlated with time spent playing video games (t = 2.15, p < .05, d = 0.14), completing homework (t = 2.92, p < .05, d = 0.19), and sitting in a vehicle (t = 3.71, p < .05, d = 0.24) but not with television and videos (t = 1.07, p > .05, d = 0.07), using social media (t = 0.46, p > .05, d = 0.03), reading (t = 0.51, p > .05, d = 0.03), and the total time spent on all sedentary behaviors (t = 0.78, p > .05, d = 0.05). Students not enrolled in PE class (M = 1.32)

spent more time playing video games than students enrolled in PE class (M = 1.32). Furthermore, students enrolled in PE class (M = 1.48) spent more time doing their homework than students not enrolled in PE class (M = 1.25). Finally, students not enrolled in PE class (M = 0.95) spent more time in a vehicle than students enrolled in PE class (M = 0.75).

Table 4. T-test results for correlation between PE class enrollment and time spent on sedentary behaviors

Sedentary Behaviors	PE Class	N	M	SD	t	p	d
TV/Video	Did't enroll	326	1.81	1.11	1.07	0.29	0.07
	Enrolled	869	1.73	1.16			
Computer /Video game	Did't enroll	326	1.32	1.12	2.15*	0.03	0.14
	Enrolled	869	1.13	1.36			
Social media	Did't enroll	326	2.02	1.25	0.46	0.64	0.03
	Enrolled	869	2.06	1.32			
Homework	Did't enroll	326	1.25	1.11	2.92*	0.00	0.19
	Enrolled	869	1.48	1.25			
Reading	Did't enroll	326	0.68	0.96	0.51	0.61	0.03
	Enrolled	869	0.72	0.93			
Transportation	Did't enroll	326	0.95	0.87	3.71*	0.00	0.24
	Enrolled	869	0.75	0.85			
Total	Did't enroll	326	8.04	3.17	0.78	0.44	0.05
	Enrolled	869	7.87	3.34			

*$p < .05$.

4 Discussion

This study aimed to investigate the correlation of sociodemographic characteristics and PE class enrollment with time spent on various sedentary behaviors. This study reports four main findings. First, Taiwanese university students spend an average of 7.91 hours engaging in sedentary behaviors per day, and they were found to spend a total of 3.80 hours per day (15.85%) on social media and watching television or videos; these values are slightly higher than those reported in other developed countries. Second, male students spend more time on video games, and female students tend to spend more time on social media and homework more. However, the overall time spent on total sedentary behaviors was not statistically significant. Third, severely overweight students engaged in more unhealthy behaviors than others, with higher significance attributed to watching television or videos, using social media, and the total of all the sedentary behaviors. Fourth, students without PE class enrollment spend more time on video games and transportation, but students enrolled in PE classes spend more time on homework.

These findings are similar to the results obtained by other studies [35], [36] that students are significantly less likely to be sedentary if they participate in PE classes. A

study also reported that shorter PE classes are correlated with more unhealthy behaviors among students [37]. Currently, increasing the number of PE classes appears to be an effective and popular strategy for reducing sedentary behaviors among adolescents [38]. In addition, the results of this study in relation to gender, BMI levels, and PE class enrollment are consistent with those obtained by other studies [39] and indirectly correspond with the results of [40]–[42]. Other studies have partially attributed the increase in time spent on sedentary behaviors to the prolonged time people spend sitting in cars, on trains, or on public buses. Some studies have also revealed that adults and young adults who rely heavily on vehicles and tend not to walk are more sedentary [43], [44]. Evidence from these cross-sectional studies indicate that engagement in sedentary behaviors does not simply indicate a lack of physical activity; it may also involve participation in various behaviors that require low energy expenditure. Students' engagement in more sedentary behaviors may therefore reflect longer screen time or time spent commuting on motorized transport. PE classes provided in school should focus on achieving the following key goals: promoting health information with respect to obesity and sedentary behaviors, educating students on maintaining regular exercise behaviors, and fostering reverse thinking in students from a health perspective; reflection on the "whys" and "hows" of physical activity participation through PE is crucial for the formation of students' health-related cognition. Students are otherwise unable to recognize how healthy exercise behaviors can benefit their lives outside school.

According to this study's findings, severely overweight student group were more sedentary (at 9 hours a day) than the average participant; these findings are consistent with the results obtained by other studies [45]–[47]. Obesity is closely related to the sedentary activities of watching television and videos and using social media apps, and watching television while sitting down is a critical risk factor for metabolic disturbance and weight gain in many youths [4]. BMI indicates obesity [24] and is directly related to health risks and mortality rates [48]. Studies have revealed a significant and positive relationship between obesity and sedentary behaviors [25], [26]. Accordingly, many medical, public health, and educational institutions consider physical exercise a key strategy for solving obesity [28], with some experts urging students to participate in minimum levels of PE each week to maintain their physical health [29]. This indicates that school-based PE could be critical for the formation of the student's conception of health because of the relationship of level of physical activity with physical fitness and health.

Studies [49], [50] have clearly identified the public health risk that the use of social media and playing of video games pose to younger individuals, and increasing their PE time might help to reduce the amount of time that young people spend on sedentary activities [50]. Even if schools fail to increase students' physical activity levels, weight loss effects could still be achieved simply by schools campaigning to reduce the time students spend watching television [51]. Evidently, the weight loss effect would be more prominent if the aim of encouraging students to exercise could be achieved through campaigning. The sedentary behaviors of watching television and using social media apps are highly correlated with screen use; engaging in these behaviors on a long-term basis can lead to increased weight gain and vision damage, and this could, in turn, negatively affect students' concentration and academic performance [17]. Health

promotion campaigns should emphasize PE's significant contribution to reducing sedentary behaviors in young people. Physical activity is a crucial factor in obesity reduction [51], and its functionality should be strengthened through schools' holistic health plans. PE should not only center on physical activity but also, more crucially, promote an active lifestyle.

5 Conclusion

Subjectively recalled data indicated that Taiwanese university students spent an average of 474 minutes per day engaging in sedentary behaviors (with most time spend using social media); this value is slightly higher than those reported in other developed countries. Sedentary behavior relating to the use of social media and playing video games (which feature new technology) constitutes a health risk to this population. For policymakers, school is an ideal place to intervene in these sedentary behaviors, and PE is particularly useful.

6 Acknowledgment

7 References

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8   Authors

Chun-Chieh Kao was born in Taiwan in 1973. He is a Ph. D. candidate in Shanghai University of Sport presently and his master's degree in health physical education and recreation from University of South Dakota in 1997. He is currently a full-time associate professor of physical education in Ming Chuan University, Taiwan. His research mainly concentrates on action development in physical education and sport pedagogy.

Chun-Chin Liao was born in Taiwan in 1974. He received a master degree in Health and Physical Education, from Louisiana Tech University Master of Science (2000). He is currently a full-time assistant professor of physical education in Ming Chuan University, Taiwan. Her research mainly concentrates on health development in physical education and sedentary behaviour.

Yu-Jy Luo was born in Taiwan in 1973. She is candidate in Shanghai University of Sport presently and her master's degree in physical education from Henderson State University in 2000. She is currently a full-time associate professor of physical education in Ming Chuan University, Taiwan. Her research mainly concentrates on health development in physical education and sedentary behaviour.