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INTERNATIONAL ARTICLE

Computer Usage and Its Relationship With Adolescent Lifestyle in Hong Kong

SAMUEL M.Y. HO, Ph.D., AND TATIA M.C. LEE, Ph.D.

Purpose: **To determine the patterns of computer usage among adolescents in Hong Kong and to examine whether computer usage is associated with less physical activity and social support among adolescents.**

Methods: **A total of 2110 secondary school students (52% boys and 48% girls) in Hong Kong completed a set of questionnaires to measure their computer usage and lifestyle. Mean age of the respondents was 14.16 years (SD = 1.81 years). Computer usage was taped by asking the students to indicate how much time (in minutes) they spent on the computer each day for doing homework assignments; playing computer games; "surfing" the Internet; and communicating with others. The students also provided information on their social-physical lifestyle. Student's *t*-tests and analysis of variance were used to examine group differences. Pearson product moment correlations were used to explore relationships between computer usage and lifestyle.**

Results: **Boys who use computers for doing homework, "surfing" the Internet, and communicating with others engage in more social-physical activities than others. Boys who use computers to play games tend to be more social-behaviorally inactive. For girls, patterns of computer usage are not related to lifestyle.**

Conclusions: **Computer users tended to engage in social-physical activities more frequently and had higher social support than nonusers. But among computer users, the amount of time spent daily on the computer was not associated with lifestyle. Instead, *patterns* of computer usage are more related to lifestyle and the relationship is moderated by gender. © *Society for Adolescent Medicine, 2001***

From the Department of Psychology, The University of Hong Kong, Pokfulam, Hong Kong, China

Address for correspondence to: Dr. Samuel M.Y. Ho, Assistant Professor, Positive Psychology Laboratory, Department of Psychology, The University of Hong Kong, Pokfulam, Hong Kong. E-mail: munyin@hkucc.hku.hk.

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With advancement in information technology, computers have penetrated into almost every part of our life including work and study, entertainment, and social activities. This phenomenon has resulted in many studies investigating the impact of computer usage on people's health. Empirical data have generated two conflicting views that dominate current debate. Some researchers found that excessive use of computers has negative effects on the psychological and social well-being of people [1–3]. Heavy computer users have been portrayed as people who are lonely, lack self-esteem, and often with comorbid current or lifetime psychiatric diagnoses. The proliferation of indulgence in computers among certain groups of people has made "Internet Addiction" become a viable diagnosis in mental disorders [4].

Two hypotheses were proposed by Kraut et al. [2] to explain the above findings. The Displacing Social Activity hypothesis posits that the use of computer may compete with, and substitute for, other social and physical activities. Excessive computer usage may, therefore, lead to social withdrawal and decline in psychological well-being. Acknowledging the fact that many people use computers for social interaction through "chat" lines and electronic mail, Kraut et al. [2] proposed a second hypothesis to support their argument. According to the Displacing Strong Ties hypothesis, the Internet and electronic mail lack

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the media richness [5] to enable the development of strong social ties. In other words, people who use computers for social purposes are replacing strong ties formed by face-to-face interaction with weak ties established on the Internet.

Although the above findings seem to provide convincing evidence to support the negative effects of computer usage on people's well-being, another group of researchers holds an opposite point of view. They argued that the stereotypes of lonely and dysfunctional people being attracted to computers were not supported by their observations and studies. For instance, Rocheleau [6] analyzed 5 years of data from a national longitudinal study of American youth on computer usage. The results showed that heavier computer users performed better academically and had more self-confidence. Contrary to the prediction of the Displacing Social Activities hypothesis, heavier computer users were similar to others students in social activities. In response to Kraut et al. [2], Silverman [7] described her experience in an online support group and how it helped members to consolidate their already established relationships. Parks and Floyd [8] conducted a study among 176 respondents on the Internet and showed that people formed moderate to high levels of breadth and depth in personal relationships online. A significant proportion of the respondents in the study of Parks and Floyd [8] also supplemented computer-mediated communication with other forms of contact including telephone, postal mail, and face-to-face communication. It is possible that media richness is not a necessary condition for the development of relationships and that online communication can complement other modes of social contact like the telephone and face-to-face interaction to maintain relationships.

One of the methods to examine these two sharply contrasting views is to investigate the relationship between computer usage and lifestyle. If the Displacing Social Activities hypothesis is correct, heavier computer usage should be associated with a more sedentary lifestyle involving less physical and recreational activities. The Displacing Strong Ties hypothesis also predicts that heavier computer users should have less social support in time of difficulties. In addition, data on the patterns of computer usage in Hong Kong are lacking at present. Consequently, the present study is conducted: (a) To collect data on the patterns of computer usage among adolescents in Hong Kong, and (b) To examine the relationships between computer usage and the lifestyle of adolescents.

Table 1. Participants' Demographic Profile (n = 2110)

	n	(%)
Gender		
Male	1009	47.8
Female	1101	52.2
Form		
One	740	35.1
Three	705	33.4
Five	665	31.5
Type of school		
Boys' school	750	35.5
Girls' school	829	39.3
Co-educational school	531	25.2
Employment status of parents (n = 1594*)		
Both parents working	650	40.8
Single parent working	884	55.5
Both parents not working	60	3.8
Age (years)	M = 14.16	SD = 1.81
Form 1	M = 12.25	SD = .83
Form 3	M = 14.20	SD = .79
Form 5	M = 16.24	SD = .79

* 516 (24.45%) respondents failed to report the employment status of their parents

Methods

Participants

The Hong Kong education system provides 7 years of high school education from Form 1 to Form 7. This study collected data on students studying in Form 1, Form 3, and Form 5 among 6 high schools in Hong Kong. Students in this study were comparable to those studying in Grade 7, Grade 9, and Grade 11 in the U.S. system. The six high schools were selected by convenient sampling to represent different levels of academic achievement of students in Hong Kong. All 2627 students studying in Form 1, Form 3, and Form 5 of the six schools completed the assessment package. Out of the 2627 questionnaires collected, 517 questionnaires were discarded owing to significant missing data (rejection rate = 19.7%). Data from 2110 students were used in the present study. Table 1 summarizes the demographic profile of these 2110 students.

Procedure

Students first read a brief introduction explaining the procedures and purposes of the study. They then completed an assessment package including a consent form and a set of questionnaires in class. Students provided the information on an anonymous basis. A research assistant was available to answer questions from the students during the whole data

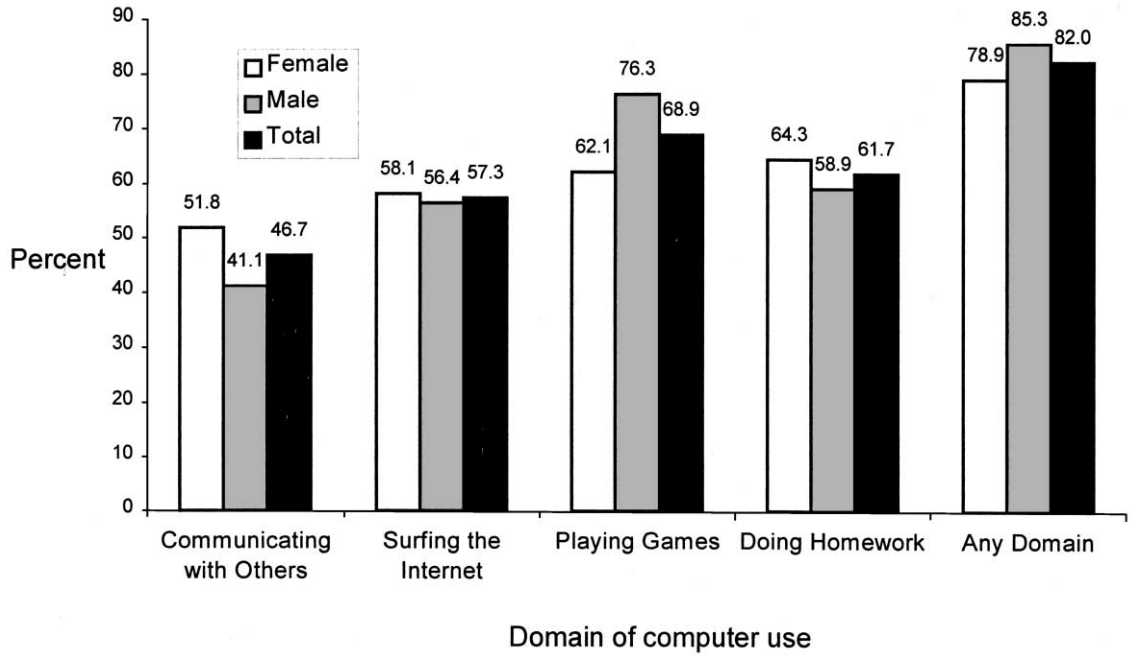

Figure 1. *Percentage of computer users by gender.*

collection session as well as to check all questionnaires before closing the assessment session. The Departmental Research Committee of the Psychology Department, The University of Hong Kong, and the school administration of each participating school had scrutinized and provided ethics approval to the procedures and assessment tools of the present study.

Measures

Computer usage. The present study investigated the pattern of computer usage by asking respondents to indicate how much time (in minutes) they spent on the computer each day for: (1) doing homework assignments; (2) playing computer games; (3) "surfing" the Internet; and (4) communicating with others through emails or "chat" lines.

Social-physical lifestyle. Four questions were adapted from the Lifestyle Appraisal Questionnaire [9] to tap four domains of social-physical lifestyle of the adolescents. Respondents were asked to answer each of the questions according to a 4-point Likert scale with higher score implying *less* activity in that domain. The four domains and their corresponding questions were: (a) *Exercise*: How often do you exercise or go for a walk? (For at least 15 minutes each time) (b) *Recreation*: How frequently do you participate in an activity or recreation you enjoy (e.g. reading, sport etc.)? (c) *Relaxation*: How often do you do any relaxation exercises? (0 – at least once a week; 1 – about once a month; 2 – once every 6 months; 3 – not at all) and (d) *Social support*: Do you have close friends and family to help you with problems?

Results

The Prevalence of Computer Usage

By gender. Figure 1 shows the percentage of computer users by domains of use and gender. Chi-square analyses were used to examine gender differences in prevalence of computer usage among our students. Overall, 82% of the students reported that they had used computers on at least one of the four domains under investigation. There are more male than female computer users ($X^2(1) = 14.62, p < .001$). More female students tended to use computers for doing homework and for communicating with others than their male counterparts (doing homework: $X^2(1) = 6.58, p = .01$; communicating with others: $X^2(1) = 23.95, p < .001$). On the other hand, significantly more male students used computers for playing games than the female students ($X^2(1) = 49.47, p < .001$). There is no gender difference in using computers for surfing the Internet ($X^2(1) = .65, p > .05$).

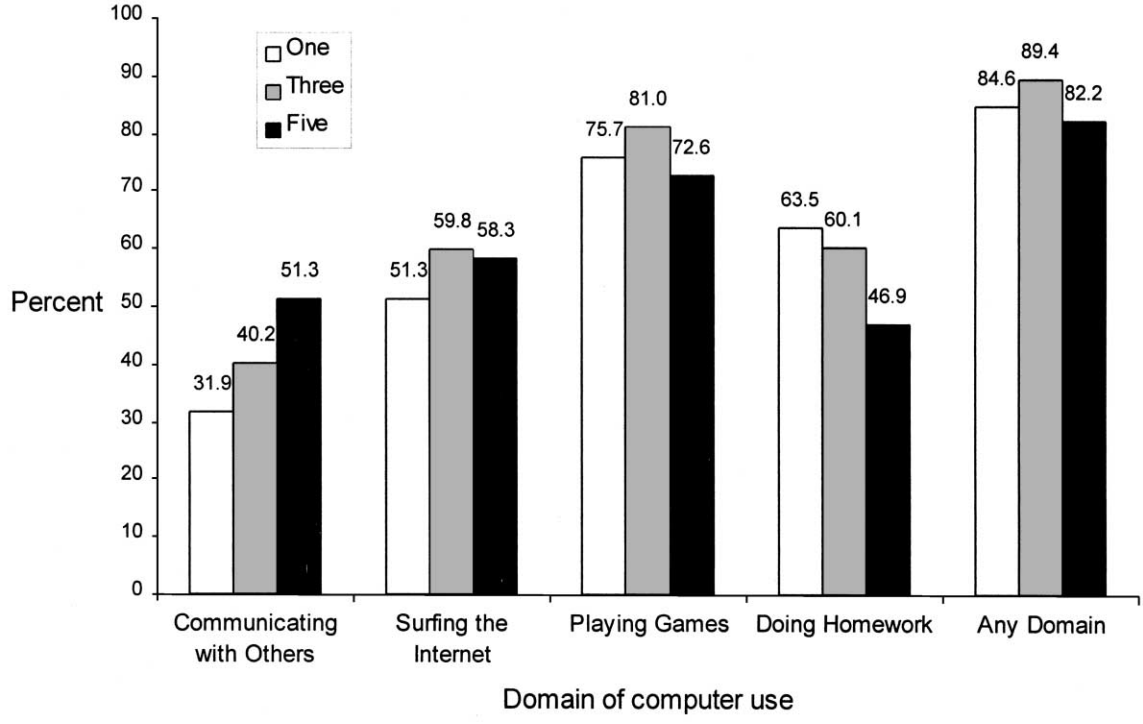

Figure 2. *Percentage of computer users by form of study, male students.*

By form of study. We next examined whether the prevalence of computer usage was different among Form 1, Form 3, and Form 5 students. Chi-square analyses were employed again to investigate whether there were differences in percentage of computer users among students in different forms of study. Since, there was a gender difference in percentage of computer users, we separate the analyses by male and female students. Figures 2 and 3 show the percentage of computer users by form of study for male and female students, respectively. For the male students, there was a general decline in using computers for doing homework from junior to senior forms ($X^2(2) = 8.01$, $p < .05$). In contrast, using computers for communicating with others increased gradually from Form 1 to Form 5 ($X^2(2) = 26.99$, $p < .001$). More Form 3 students used computers for playing games as compared to both Form 1 and Form 5 students ($X^2(2) = 6.60$, $p < .05$). About 50% to 60% of male students used computers for surfing the Internet across all forms ($X^2(2) = 5.67$, $p > .05$).

For the female students, no form of study differences were obtained on using computers for doing homework, playing games, and surfing the Internet (doing assignments: $X^2(2) = 5.27$, $p > .05$; playing games: $X^2(2) = 4.34$, $p > .1$; surfing the Internet: $X^2(2) = .36$, $p > .1$). Like the male students, using computers for communicating with others increased gradually from junior to senior forms for the female students ($X^2(2) = 19.21$, $p < .001$).

In summary, there were more computer users among male than female students. Using computers for communicating with others increased gradually from junior to senior forms for both genders. For male students, using computer for doing homework declined from junior to senior forms. No such decline was observed among female students.

Amount of Computer Usage Among Users

In order to describe the amount of time spent on computers by domains of use, we selected only the computer users for further analyses. Table 2 shows the amount of time (in minutes) per day spent on each domain of computer usage among the users. Student's *t*-tests and one-way analysis of variance (ANOVA) were used to examine gender and form of study differences on the *total amount of time* spent on computers, respectively. Multivariate analysis of variance (MANOVA) was employed to study gender and form of study differences on the *four domains* of computer usage.

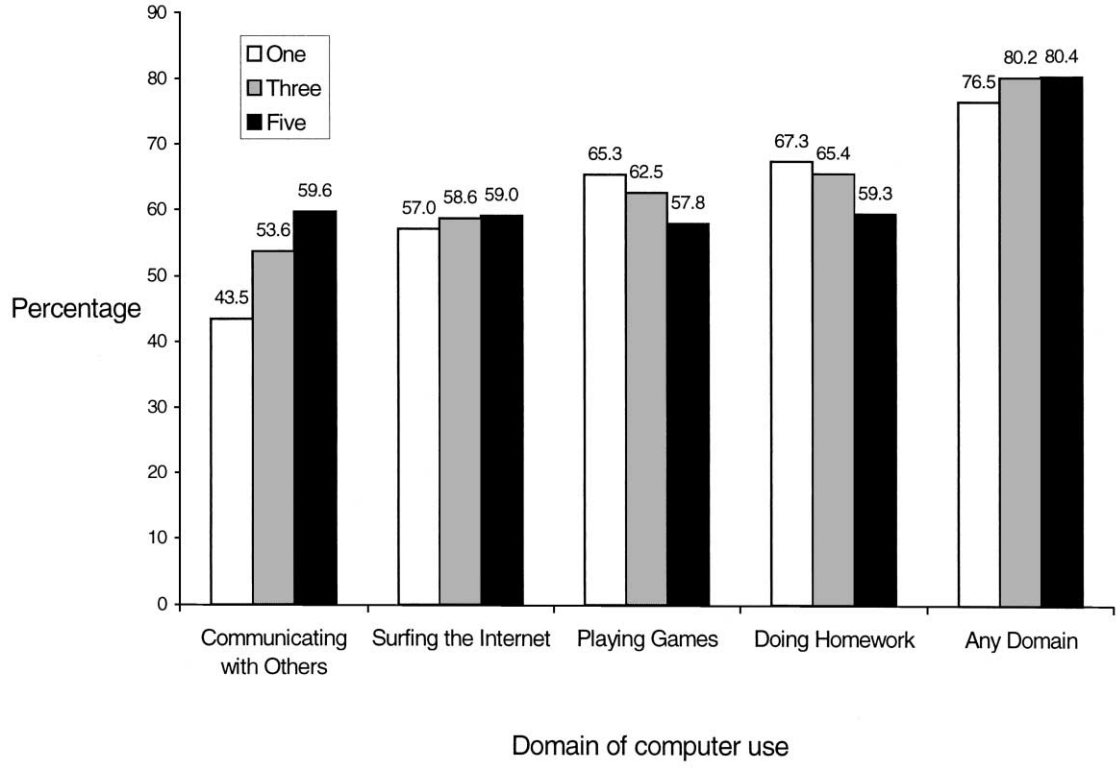

Figure 3. *Percentage of computer users by form of study, female students.*

Total amount of time spent on computer per day. On average, the computer users spent 2.5 hours each day using computers for any of the four domains under investigation. There was no gender difference in total time of computer usage ($t(1728) = 1.71$, $p > ,05$). However, one-way ANOVA showed a significant form of study effect ($F(2,1727) = 5.86$, $p < .01$). Scheffe *post hoc* comparisons revealed that Form 1 users spent less time on computers as compared to both the Form 3 and Form 5 users. No difference on total computer time per day was obtained between users of Form 3 and Form 5.

Amount of time spent on the four domains of computer usage. A 2 (gender of students) × 3 (form of study) MANOVA was conducted on the four domains of computer usage. The multivariate interaction effect between gender and form of study was not significant (Wilks' Lambda = .99, $F(8,3442) = 1.95$, $p = .05$, effect size = .005). However, the multivariate main effects were significant for both gender (Wilks' Lambda = .90, $F(4,1721) = 48.11$, $p < .001$, effect size = .10) and form of study (Wilks' Lambda = .98, $F(8,3442) = 5.57$, $p < .001$, effect size = .01). Follow up univariate F-tests revealed that among the computer users, female students spent more time on computers doing homework ($F(1,1724) = 5.59$, $p < .05$, $\eta^2 = .003$); surfing the Internet ($F(1,1724) = 12.75$, $p < .001$, $\eta^2 = .01$); and communicating with others ($F(1,1724) = 30.18$, $p < .001$, $\eta^2 = .02$) whereas male users tended to spend more time playing computer games ($F(1,1724) = 139.27$, $p < .001$, $\eta^2 = .08$). Univariate F-tests also revealed that the amount of time spent on the computer surfing the Internet and communicating with others was different among the Form 1, Form 3 and Form 5 users (surfing the Internet: ($F(2,1724) = 8.32$, $p < .001$, $\eta^2 = .01$; communicating with others: ($F(2,1724) = 17.03$, $p < .001$, $\eta^2 = .02$). Scheffe post hoc comparisons showed that Form 5 users spend more time surfing the Internet as compared to Form 1 users. Besides, there was a gradual increase in the amount of time spent on the computer for communicating with others among the users from junior to senior forms.

In summary, the present results revealed that male and female students spent an equal amount of time on computer per day. However, there was a gender difference in the patterns of computer usage. Female computer users used computers more for

Table 2. The Amount of Time (in minutes) Spent On Computers Per Day by Gender and Form of Study

	Total	Form 1	Form 3	Form 5
Domain of use	M (SD)	M (SD)	M (SD)	M (SD)
Doing homework				
Male	32.19 (42.20)	33.53 (38.52)	31.05 (42.06)	31.96 (45.92)
Female	37.18 (41.84)	41.52 (46.16)	36.74 (38.31)	32.63 (40.18)
Total	34.70 (42.08)	37.59 (42.73)	34.00 (40.23)	32.28 (43.23)
Playing games				
Male	61.75 (59.94)	59.34 (62.59)	64.33 (57.92)	61.61 (59.25)
Female	33.88 (35.39)	30.39 (26.91)	37.89 (41.01)	33.20 (36.52)
Total	47.75 (51.09)	44.62 (50.00)	50.64 (51.57)	48.01 (51.64)
Surfing the Internet				
Male	27.77 (34.54)	22.17 (28.29)	26.81 (34.59)	34.55 (39.05)
Female	33.87 (36.62)	30.64 (33.49)	35.82 (37.93)	35.33 (38.36)
Total	30.84 (35.72)	26.48 (31.30)	31.47 (36.61)	34.92 (38.69)
Communicating with others				
Male	19.44 (31.61)	13.29 (25.46)	17.31 (28.47)	27.99 (38.01)
Female	28.35 (36.09)	22.01 (32.74)	33.19 (40.27)	30.00 (33.51)
Total	23.92 (34.21)	17.72 (29.68)	25.53 (35.94)	28.95 (35.91)
Total use				
Male	141.15 (97.06)	128.33 (92.21)	139.50 (94.64)	156.10 (102.53)
Female	133.28 (94.50)	124.55 (89.77)	143.64 (99.31)	131.15 (93.18)
Total	137.20 (95.83)	126.41 (90.92)	141.64 (97.03)	144.16 (98.87)

doing homework; surfing the Internet; and communicating with others than male computer users. On the other hand, male computer users tended to spend more time playing computer games than their female counterparts. Among the computer users, there was a gradual increase in the amount of time spent on communicating with others from junior to senior forms for both male and female students.

The Relationship Between Computer Usage and Lifestyle

We employed two strategies to examine the relationship between computer usage and lifestyle. First, we compared the lifestyles between computer users and nonusers. A 2 (gender) $\times$ 2 (computer user) MANOVA was performed on the four domains of lifestyle under examination. MANOVA allows us to control for the gender differences in prevalence and pattern of computer usage. Second, we investigated the relationships between amount of time spent on computers and lifestyles among the computer users. Pearson product-moment correlations were employed. Separate analyses were conducted for boys and girls owing to the gender difference in computer usage.

Computer users vs. nonusers. Table 3 depicts the mean social-physical lifestyle scores by gender and computer user. The MANOVA results revealed no significant multivariate interaction effect (Wilks' Lambda = 1.00, $F(4, 2103) = 2.35$, $p > .05$, $\eta^2 = .004$). Both gender and computer user main effects were significant (gender: Wilks' Lambda = .97, $F(4, 2103) = 16.91$, $p < .001$, $\eta^2 = .03$; computer user: Wilks' Lambda = .98, $F(4, 2103) = 13.06$, $p < .001$, $\eta^2 = .02$). Univariate F-tests revealed that boys tended to exercise more frequently than girls ($F(1,2106) = 18.77$, $p < .001$, $\eta^2 = .01$) but girls tended to have more frequent relaxation activities and higher self-perceived social support than boys (relaxation: $F(1,2106) = 13.15$, $p < .001$, $\eta^2 = .01$; social support: $F(1,2106) = 30.10$, $p < .001$, $\eta^2 = .01$). No gender difference on recreation was obtained ($F(1,2106) = 2.68$, $p > .1$, $\eta^2 = .001$).

More relevant to the objective of the present study, it was revealed that computer users had more frequent exercise, recreational and relaxation activities as well as higher self-perceived social support as compared to the nonusers (exercise: $F(1,2106) = 7.52$, $p < .01$, $\eta^2 = .004$; recreation: $F(1,2106) = 31.30$, $p < .001$, $\eta^2 = .02$; relaxation: $F(1,2106) = 22.02$, $p < .001$, $\eta^2 = .01$; social support: $F(1,2106) = 14.84$, $p < .001$, $\eta^2 = .01$).

Amount of computer usage and lifestyle. The correlation results are shown in Table 4.

For both of the male and female users, the total

Table 3. Social-Physical Lifestyle by Gender and Computer User

		Computer User	
	Total (N = 2110)	Yes (n = 1730)	No (n = 380)
Domain of lifestyle	M (SD)	M (SD)	M (SD)
Exercise			
Male	.76 (.84)	.75 (.81)	.85 (.97)
Female	.96 (.77)	.93 (.75)	1.08 (.85)
Total	.86 (.81)	.84 (.79)	.99 (.90)
Recreation			
Male	.64 (.68)	.61 (.66)	.78 (.79)
Female	.68 (.69)	.62 (.64)	.90 (.79)
Total	.66 (.69)	.62 (.65)	.85 (.79)
Relaxation			
Male	.28 (.74)	.24 (.69)	.51 (1.05)
Female	.21 (.59)	.19 (.54)	.28 (.75)
Total	.24 (.67)	.21 (.61)	.37 (.88)
Social support			
Male	1.38 (.95)	1.35 (.95)	1.52 (.97)
Female	1.07 (.90)	1.02 (.88)	1.27 (.94)
Total	1.22 (.94)	1.19 (.93)	1.37 (.96)

amount of time spent on computers was not related to any of the four domains of social-physical lifestyle under investigation. The male computer users who spent more time on computer-mediated communication, surfing the Internet, and doing homework tended to have a more active lifestyle as well as higher self-perceived social support. On the contrary, using computers for playing games tended to be associated with less exercise and relaxation activities as well as less social support among the male users. For the female users, the amount of time spent on the computer had very weak, if any, correlation with social-physical lifestyle.

In summary, computer nonusers tended to have a more sedentary lifestyle as compared to computer users. Among the computer users, male students who spent more time on computers for communicating with others, surfing the Internet, and doing homework tended to have a more active lifestyle and higher self-perceived social support. Those male students who spent more time on playing computer games tended to report less frequent exercises and relaxation activities as well as less social support. The relationships between lifestyle and patterns of computer usage were weak among female students.

Discussion

The proliferation of computer usage among teenagers in Hong Kong is confirmed by the present findings. A majority of over 80% of the students use computers in one way or another in our sample. On average, computer users spend about 2.5 hours per

Table 4. Intercorrelations of Variables Among Computer Users

	1	2	3	4	5	6	7	8	9
1. Doing Homework	—	**.04**	**.06**	**−.02**	**.47****	**−.06**	**−.04**	**.06**	**−.02**
2. Playing Games	−.04	—	**.33****	**.30****	**.63****	**−.01**	**.00**	**−.04**	**.03**
3. Surfing the Internet	.14**	.03	—	**.55****	**.75****	**−.04**	**−.07***	**−.06**	**.01**
4. Communicating with others	.07*	.00	.60**	—	**.70****	**−.02**	**−.01**	**−.07***	**−.02**
5. Total time use	.49**	.61**	.63**	.57**	—	**−.06**	**−.05**	**−.04**	**−.01**
6. Exercise	−.03	.08*	−.07*	−.13**	−.03	—	**.34****	**.11****	**.06**
7. Recreation	.01	.03	−.06	−.09**	−.03	.35**	—	**.19****	**.13****
8. Relaxation	−.09**	.08*	−.03	−.03	−.01	.16**	.13**	—	**.16****
9. Social Support	−.05	.10**	−.08*	−.09**	−.02	.10**	.14**	.10**	—

* $p < .05$; ** $p < .01$

Note. Female data (n = 869) are presented in the upper triangle (in **bold**) and male data (n = 861) are presented in the lower triangle of the correlation matrix

day or 18 hours per week on computers. This figure is similar to the 19 hours per week reported by the respondents in Brenner's study [1] . Consistent with previous findings, more male students have computer experience than female students [10]. It has been reported that boys tend to have less computer anxiety, more positive attitudes toward computers, and higher computer confidence than girls [10,11]. Such factors may contribute to the higher percentage of computer users among male than female students. Among the computer users, male and female students spend almost equal amounts of time on computers per day according to our findings. This is in accord with the findings of Rocheleau [6], who conducted five surveys among school-aged children from 1988 to 1992, which showed that the male students dominated the heavier computer-user group from 1988 to 1991 but the gender gap became narrower and insignificant in 1992.

The present study contributes to our understanding of the use of computers by documenting the patterns of computer usage among high school students in Hong Kong, which is lacking in existing literature. Essentially, it is revealed that girls tend to use computers more for doing homework and communicating with others (e.g. through chat-lines or email) than boys. Similar to the findings of Griffiths and Hunt [12], male students play computer games significantly more than female students.

The patterns of computer usage also differ among junior, middle, and senior high school students. The most consistent and relevant findings are that the prevalence and amount of computer time spent on computers for communicating with others increases gradually from junior to senior forms. These results apply to both boys and girls in our sample.

One of the major goals of this study is to examine the relationship between computer usage and lifestyle. It is shown that the total amount of time spent on computers is not associated with any of the four domains of social-physical lifestyles under investigation. Hence, contrary to the prediction of both the Displacing Social Activities and the Displacing Strong Ties hypotheses [2], computer usage does not compete for the time spent on other social and recreational activities and also does not adversely affect the self-perceived social support of users. In fact, our data clearly show that computer users have a more active social-behavioral lifestyle including more exercise, more recreational and social activities as well as higher self-perceived social support than the noncomputer users. It has been proposed that people often supplement computer-mediated communication with other forms of social contacts such as face-to-face interaction [8]. However, our present data do not allow the examination of the underlying mechanisms of the relationship between computer usage and lifestyles. More studies are needed to clarify the phenomenon.

Another important finding of the present study is that the amount of time spent on different domains of computer usage has different effects on the social-physical lifestyle of students, with the relationships being moderated by gender. For girls, different domains of computer usage have insignificant effect on lifestyle. However, for boys, heavier users tended to exercise more, participate more in recreational activities as well as have higher self-perceived social support. On the other hand, boys who play computer games more frequently tend to lead a more sedentary lifestyle including less physical activity, less relaxation activities, and have a lower self-perceived social support. The negative effects of computer games on psychological and social well-being have been well-documented. Recently, it was reported that more time with computer games is associated with larger body mass index (BMI) increases [13]; lower self-perceived behavioral conduct [14]; physical inactivities [15]; and less prosocial behavior [16].

In summary, our data indicate that the type of activities being conducted online and the gender of the respondents moderate the effect of computer usage on social-physical lifestyle. It is not informative to talk about the effect of the Internet *per se* since different activities can be conducted on the Internet including entertainment, information seeking, communication, shopping, and playing games. Future studies should differentiate the domains of computer usage and investigate their effects on boys and girls separately.

Some limitations of the present study need to be mentioned. First, consistent with the findings of Kraut et al. [2], the effect sizes of the relationships are generally small. However, it has been noted that the direction of the relationships is equally important in information technology study because tens of millions of people are using the Internet and computers daily [17]. Second, the present cross-sectional study does not allow the examination of the change in computer usage as students mature. For example, web camera allows a "face-to-face" interaction among users and is becoming more popular among web users. It is interesting to investigate whether computer-mediated communication will substantially reduce the frequency of personal social contacts, and its effect on lifestyle of adolescents if such

phenomenon occurs. Finally, it should be cautioned against generalizing the results of this study to adolescents outside of Hong Kong. Future studies should examine whether the present findings can be replicated in other countries.

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