



# Impact of Internet Use on Subjective Well-Being Among Future Elderly in China: The Mediation Role of Loneliness

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**Abstract.** With the rapid popularity and promotion of Internet in China, the age of people using Internet has been gradually spreading from young group to middle-aged and elderly, and the Internet use has become an integral part of their lives. In order to explore the potential of Internet for the elderly service industry in the future and its impact on the subjective well-being of the future older adults, this study selected 459 Chinese people aged 45–60 as the research object, and adopted the UCLA Loneliness Scale, Subjective Well-Being Scale and Internet use questionnaire to explore the impact of Internet use on subjective well-being of the future elderly in China, using loneliness as a mediation variable. The result shows that: First, the Internet use of future elderly people in China will mainly focus on five aspects including social interaction, entertainment, life service, information acquisition, and personal development. Second, the ability of Internet use degree of elderly people will be significantly affected by some demographic variables include age, occupation, income, and education level while other variables like gender, marital status and housing way do not have significant influences. Last but not least, Internet use will have a significant positive impact on the subjective well-being of future elderly in China, and among them, loneliness will have a complete mediation effect. To sum up, it is concluded that Internet use can significantly promote the subjective well-being of future elderly in China by reducing their loneliness level.

**Keywords:** Internet use · Subjective well-being · Loneliness · Future elderly · Chinese · Mediation effect · Empirical research

## 1 Introduction

As the most populous country in the world, the aging population in China will reach 235 million in 2030 and 333 million in 2050 [1]. China will become the country with the largest number of aging populations in the world and will encounter with serious aging challenges in the coming decades. Facing the severe problem of aging, Internet and Intelligent technology will become one of the most important approaches for China to cope with the aging society dilemma in the future [2]. On one hand, the rapidly growing population of elderly people will bring tremendous pressure to the whole

Chinese society, but on the other hand, large number base of aging population in China means tremendous aging industry market opportunities [3]. This study will explore the impact of Internet use on subjective well-being for future elderly, taking loneliness as the mediating variable, to analyze its mediation mechanism between Internet use and subjective well-being. The reason why the author focus on loneliness is because it is one of the most serious psychological problems of the elderly and is the culprit of many mental and physical diseases for them [4]. If the research could find that the Internet use could positively affects the subjective well-being of future elderly and could reduce the loneliness level to improve the quality of life for older adults, then it will provide the evidence of Internet technology will affect the happiness of Chinese elderly, at the same time, means there is huge and prosperous elderly market of Internet in China and it will have great potential in dealing with the aging society challenges in the future.

## 2 Literature Review

Subjective well-being (SWB), as one of the important research fields of Positive Psychology [5], has received extensive attention from researchers. It is an individual's overall evaluation of his own quality of life, and it is one of the important indicators of the individual's mental health level [6]. It has two main components: life satisfaction and emotion experience, including positive and negative emotion [7]. Since the concept of subjective well-being was proposed, related scholars have paid close attention to the standardized measurement of subjective well-being and proposed a series of measurement indicators. Diener has developed a subjective well-being scale, which includes two parts, namely the positive and negative affect scale (PANAS) and the Satisfaction with life scale (SWLS), has been widely adopted [8]. Other scales, like the Index of Well-Being (IWB) compiled by Campbell includes two parts which are the satisfaction of life and perceived stress [9]. Memorial University of Newfoundland Scale of Happiness (MUNSH), which is applicable to the elderly and has been widely used [10].

Loneliness refers to the subjective experience of an individual who feels isolated or lacks interpersonal contact resulting in unpleasantness or pain [11]. It is also one of the most serious psychological problems of the elderly, and is the culprit of many mental and physical diseases [4]. Regarding the measurement of loneliness, different researchers have proposed different measurement scales. The commonly used one is the third edition of UCLA (University of California at Los Angeles) revised by Russell in 1988 [12]. Wittenberg compiled an Emotional versus Social Loneliness Scale based on the theory of social needs proposed by Weiss in 1973. This scale was widely used in the measurement of adult loneliness [13].

According to the Law of the People's Republic of China on Protection of the Rights and Interests of the Elderly, people over the age of 60 are positioned as the elderly, while those aged 45–60 are defined as the middle-aged [14]. There are many studies on the physical and psychological health field of the elderly, but few studies focusing on how the Internet use could affect them, no mention to focus on Chinese future elderly group. Some international researchers put forward internet could improve the

psychological well-being of people, but the majority of them are focused on young group and adolescence [15–17], few of them focus on elderly group and they have not explored the mechanism and conduct empirical research [18–20], no mention taking the Chinese future elderly group as research object.

### 3 Method

This study compiled a questionnaire based on the literature review and the characteristics of Chinese future elderly people, along with the characteristics of the Chinese Internet industry. Using the UCLA loneliness scale compiled by Russell and the Subjective Well-being Scale proposed by Diener as the measurement of the loneliness and subjective well-being level of future elderly in China. The Internet use part refers to the questionnaire of young people's, combined with the questionnaire for the elderly compiled by Lagana in 2008 [21]. We randomly distributed questionnaires on Chinese Internet platforms, and received a total of 482 responses, of which 459 were valid questionnaires, with a recovery rate of 95.23%. According to the reliability and validity analysis, the Cronbach's  $\alpha$  coefficient of the scale is 0.930, which is close to 1, and the KMO value is  $0.972 > 0.9$ , which shows that the research scale has good reliability and validity.

The paper uses path analysis and Structural Equation Modeling (SEM) to conduct data analysis and was performed by IBM SPSS25.0 and AMOS24.0. The following is the main assumptions having been proposed:

- H1*: Internet use will positively affect the subjective well-being of future elderly.
- H2*: Internet use will negatively affect the loneliness of future elderly.
- H3*: Loneliness will negatively affect the subjective well-being of future elderly.
- H4*: There is mediation effect of Loneliness between Internet use and the subjective well-being of future elderly.
- H5a*: The age variable could significantly affect the Internet use.
- H5b*: The gender variable could significantly affect the Internet use.
- H5c*: The marital status variable could significantly affect the Internet use.
- H5d*: The housing way variable could significantly affect the Internet use.
- H5e*: The education level variable could significantly affect the Internet use.
- H5f*: The occupation variable could significantly affect the Internet use.
- H5g*: The monthly income variable could significantly affect the Internet use.

## 4 Result and Analysis

### 4.1 Internet Use Characteristics of Future Elderly and the Influencing Factors

The demographics information statistics of these 459 respondents are shown in Table 1. In order to analyze the potential of Internet technology in the elderly industry in the coming decades, the researcher has picked up the people whose age are between

45–60 years, which will enter the aging stage in 15 years. They are the group witnessing the development and prosperity of Internet industry in China and staying very suitable for research subject.

**Table 1.** Sample demographics information statistics.

	Gender		Age			Marital status			
Type	Male	Female	45–50	51–55	56–60	Single	Married	Divorced	Widowed
N	183	276	377	60	22	62	382	13	2
Percentage	39.9	60.1	82.1	13.1	4.8	13.5	83.2	2.8	.4
	Way of living								
Type	Alone	With spouse		With children	With spouse and children			With others	
N	57	211		52	123			16	
Percentage	12.4	46.0		11.3	26.8			3.5	
	Education level								
Type	<High school		High school	Associate		Bachelor	Master	Doctor	
N	36		57	103		235	23	5	
Percentage	7.8		12.4	22.4		51.2	5.0	1.1	
	Monthly income (RMB) *1k = 1000RMB								
Type	<1k	1k–3k	3k–5k		5k–7k	7k–10k		>10k	
N	21	62	138		122	59		57	
Percentage	4.6	13.5	30.1		26.6	12.9		12.4	

**Table 2.** Basic internet use features.

	Internet use experience		Internet use age (Year)				
Type	Yes	No	<1 year	1–3 years	4–5 years	6–10 years	>10 years
N	448	11	19	61	99	130	139
Percentage	97.6	2.4	4.1	13.3	21.6	28.3	30.3
	Internet use frequency						
Type	One time/week	1 time/several days		1 time/day		Many times/day	
N	1	25		46		376	
Percentage	.2	5.4		10.0		81.9	
	Duration of a single use						
Type	0–30 min	30–60 min	1–2 h		2–4 h	>4 h	
N	44	127	129		72	76	
Percentage	9.6	27.7	28.1		15.7	16.6	

Table 2 shows a descriptive analysis of the middle-aged Internet use situation. We can see that the majority of Chinese future elderly already have Internet use experience, and more than 80% of them have been internet citizen longer than 4 years and has the behavior of using Internet many times a day, and a single use of more than half an hour has accounted for more than 90% of the surveyed people.

As can be seen from Table 3, most of the future elderly in China have already reached and beyond the general Internet use level, can benefit from many Internet functions. The most frequently used are chat & social, then, online shopping, information acquisition, leisure & entertainment, and current affairs news.

**Table 3.** The usage frequency of different Internet function.

Internet function	Frequency of usage					Ave.
	1 never	2 rarely	3 general	4 often	5 always	
Affair news	2(0.43%)	41(8.74%)	135(28.78%)	223(47.55%)	68(14.5%)	3.67
Chat & Social	1(0.21%)	28(5.97%)	98(20.9%)	183(39.02%)	159(33.9%)	4.00
Leisure & amusement	4(0.85%)	34(7.25%)	119(25.37%)	199(42.43%)	113(24.09%)	3.82
Online games	42(8.96%)	125(26.65%)	130(27.72%)	117(24.95%)	55(11.73%)	3.04
Office work	17(3.62%)	61(13.01%)	115(24.52%)	199(42.43%)	77(16.42%)	3.55
Online education	28(5.97%)	95(20.26%)	170(36.25%)	128(27.29%)	48(10.23%)	3.16
Information acquisition	2(0.43%)	22(4.69%)	95(20.26%)	227(48.4%)	123(26.23%)	3.95
Financial management	46(9.81%)	121(25.8%)	146(31.13%)	110(23.45%)	46(9.81%)	2.98
Travel service	27(5.76%)	117(24.95%)	149(31.77%)	130(27.72%)	46(9.81)	3.11
Health & medicine	30(6.4%)	115(24.52%)	134(28.57%)	146(31.13%)	44(9.38%)	3.13
Online shopping	7(1.49%)	23(4.9%)	87(18.55%)	218(46.48%)	134(28.57%)	3.96
Daily life services	20(4.26%)	56(11.94%)	118(25.16%)	195(41.58%)	80(17.06%)	3.55

Figure 1 reveals the device, place and main applications of Internet use of future elderly in China, we can see that, more than 85% of the current middle-aged population in China already has their own smart phone, 75% has personal computer, nearly half have a pad, and a quarter of them have smart TV (a). Home and bedroom is the most popular place to use internet, followed by leisure places, transportation, workplaces, canteens and restaurants (b). From these two types of information, we can roughly describe the Internet use scenery of the middle-aged people. With regard to the Internet applications, Wechat is the most frequently used one, followed by Taobao online shopping platform and Alipay from Alibaba Group. QQ and Weibo are welcome too. Applications for life services such as Meituan and entertainment applications including

Tencent Video, Iqiyi and Tiktok also receive high attention among middle-aged groups, which shows that the Internet has gradually penetrated into all aspects of life for the future elderly in China.

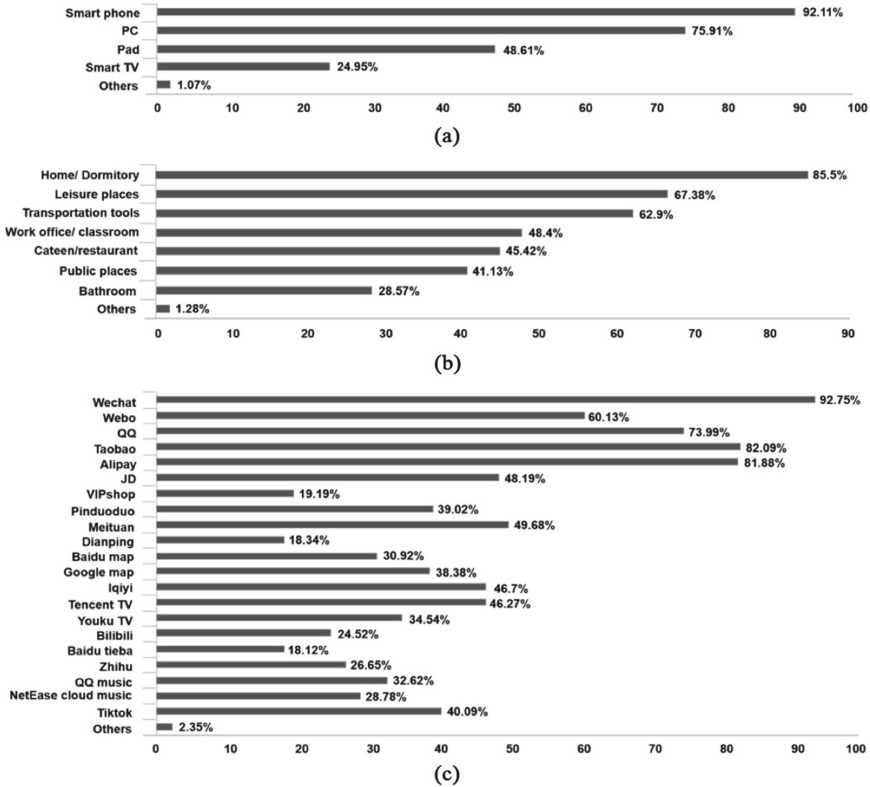


Fig. 1. The device (a), place (b) and application (c) distribution of Internet use.

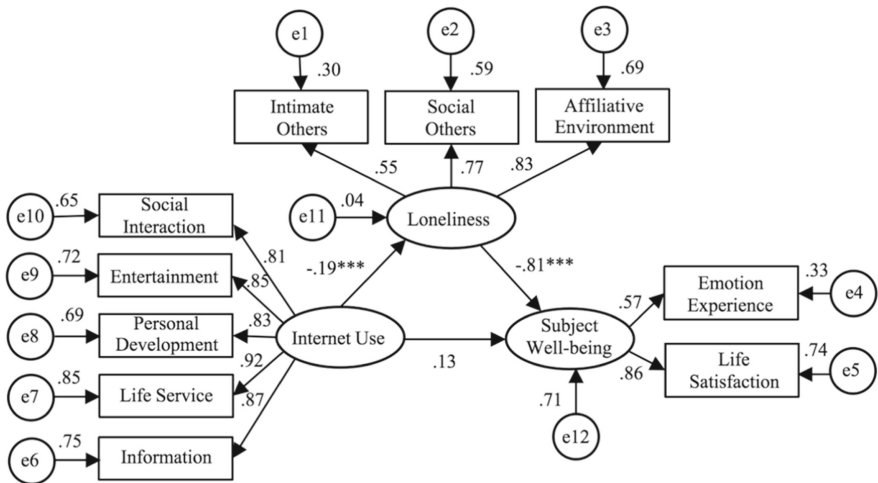
Besides all the features of the Internet use above, this survey also finds that demographic differences in Internet use among future elderly people are mainly reflected in the following aspects: In the age difference of Internet use level among the research group, young elderly are significantly higher than older elderly, and the difference is significant ( $F = 3.434, p = 0.000 < 0.05$ ); When it comes to gender difference, the Internet use level of male is slightly higher than female, but the difference is not significant ( $t = 0.629, p = 0.858 > 0.05$ ); For marital status, there is no significant divergence among different marital status ( $F = 1.124, p = 0.302 > 0.05$ ), so does the housing way ( $F = 0.549, p = 0.976 > 0.05$ ); In terms of the impact of income on Internet use, the higher the monthly income, the higher the level of Internet use, and the difference between low-income people, middle-income and high-income people is obvious ( $F = 2.571, p = 0.000 < 0.05$ ); Judging from the impact of education level on

Internet use, the higher the degree, the higher the level of Internet use, showing a linear growth trend, and the level of Internet use of the highly educated population is significantly higher than low education level people ( $F = 1.652, p = 0.018 < 0.05$ ); Moreover, there is significant differences in Internet use due to the occupation types, the Internet use level of high brain activity occupation is significantly higher than in occupations with low brain activity. such as business management, private enterprise owners, civil servants, teachers, technicians, administrative staff, etc. are higher than drivers, farmers, workers, and domestic service staff ( $F = 1.467, p = 0.000 < 0.05$ ).

### 4.2 Model Analysis of Internet Use, Loneliness and Subjective Well-Being

The following will test and analyze the basic fitness, overall fitness, and mediation effect of the hypothetical model.

**The Basic Fitness Analysis:** 1.  $e1$ - $e10$  error variation value is between 0.050–4.202, all are positive numbers. 2. The CR value of all error variability are between 3.846–13.129, and all reach significant levels above 0.001. 3. The standard error of the parameter is between 0.024 and 0.318, and there is no large standard error. 4. The factor load between the latent variable and its measurement index is between 0.551–0.920, which meets the criteria of bigger than 0.50 and less than 0.95. The above analysis indicates that the model is basically appropriate (Refer Fig. 2).



Note: \*\*\*path is significant at the 0.001 level, \*\*path is significant at the 0.01 level, \*path is significant at the 0.05 level

Fig. 2. Standardized estimates of the default model.

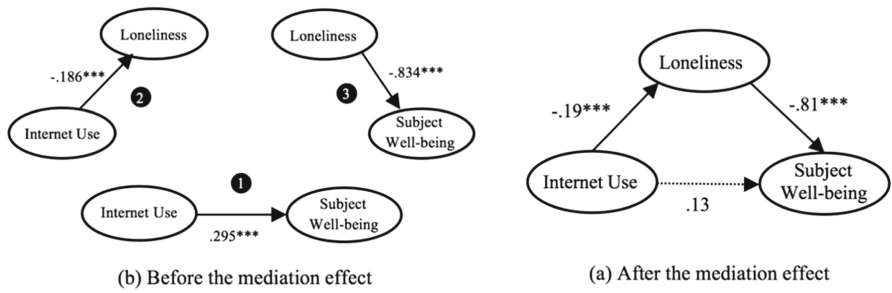
**The Model Fit Analysis:** As shown in Table 4, the GFI value of this default model is  $0.906 > 0.9$ . The NFI in this study is 0.94 indicates that the hypothetical model in this study has a better proportion of adaptation than the independent model. The CFI of this study is 0.927, which shows that compared with the independent model, the improvement degree is within an acceptable range. The IFI value of this study is 0.927, revealing that the model adaptation degree is good and does not need to be reset. Both PGFI and PNFI in this study are above 0.5, indicating that the hypothetical model in this study is simple. In summary, the analysis of basic fitness and overall fitness shows that the hypothetical model is appropriate, so the intermediary effects are further analyzed.

**Table 4.** Implied correlations of default model.

Index	GFI	NFI	IFI	CFI	PGFI	PNFI
Default model	.906	.917	.927	.927	.527	.652
Recommended threshold	>.9	>.9	>.9	>.9	>.5	>.5

**Verification of the Mediation Effect of Loneliness:** As shown in Fig. 3(a), before the mediation effect, the standardized path coefficient for Internet use to subjective well-being is .295 ( $p < .001$ ), to loneliness is  $-.186$  ( $p < .001$ ), loneliness to subjective well-being is  $-.834$  ( $p < .001$ ), they are all significant. After establishing the mediation model, as we can see in Fig. 3(b), the Internet use has significant influence on loneliness, and the path of loneliness on subjective well-being is significant too, but the path of Internet use to subjective well-being has changed from significant to in significant. Moreover, the indirect effect value of Internet use on subjective well-being is  $(-.20) \times (-.82) = 0.164$ , which is greater than the direct effect 0.12 ( $0.164 > 0.12$ ). According to what has been discussed above, it is proved that loneliness has a complete mediation effect between Internet use and subjective well-being of future elderly in China. The total effect of internet on subjective well-being is direct effect plus indirect effect, which is  $0.164 + 0.12 = 0.284$ , that means the total influence of Internet use on subjective well-being is 28.4%. As for whether the intermediary effect has statistical significance, another intermediary effect test is performed. For 95% CI, LL = 0.064 and UL = 0.229, that is, the upper and lower bounds of 95% CI are between 0.064–0.229, excluding 0, The indirect effect two-tailed test result  $p = 0.005$ , less than 0.01, reaching a significant level. From the two-tail test results of 95% CI and indirect effects. To sum up, according to all the analysis above, the mediation effect of loneliness is significant and has statistical significance.





Note: \*\*\*path is significant at the 0.001 level, \*\*path is significant at the 0.01 level, \*path is significant at the 0.05 level

Fig. 3. The mediation effect test of loneliness.

### 5 Discussion and Conclusion

With the analysis above, we can get the validation results about our hypothesis, they are showed in Table 5. The internet use of Chinese future elderly is significantly influenced by the demographic variables of education level, occupation, age and monthly incomes, while there is no obvious differences between different gender, marital status and housing way types. Internet use has a significantly positively effect on subjective well-being of future elderly and loneliness plays a complete mediation role.

Table 5. Hypotheses validated results.

Hypothesis	Estimate	T/F test	Result
H1 Internet use → Subjective well-being	.295***		Supported
H2 Internet use → Loneliness	-.186***		Supported
H3 Loneliness → Subjective well-being	-.834***		Supported
H4 Internet use → Loneliness → Subjective well-being	.154***		Supported
H5a Age → Internet use		3.434***	Supported
H5b Gender → Internet use		.629	Rejected
H5c Marital Status → Internet use		1.124	Rejected
H5d Housing Way → Internet use		.549	Rejected
H5e Education Level → Internet use		1.652*	Supported
H5f Occupation → Internet use		1.467*	Supported
H5g Monthly Income → Internet use		2.571***	Supported

Note: \*\*\*path is significant at the 0.001 level, \*\*path is significant at the 0.01 level, \*path is significant at the 0.05 level

In summary, this study finds that Internet use will significantly positively affect the subjective well-being of future elderly in China, and loneliness plays a complete mediation role among them, which provide the evidence and theory support to use internet technology to deal with the aging society challenges, reduce the loneliness level of future elderly and improve the aging's quality of life and well-being.

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## References

1. Zeng, Y.: The main features of population aging and policy considerations in China. *Popul. Econ.* **5**(3), 3–9 (2001)
2. Lam, J., Lee, M.: Bridging the digital divide—the roles of Internet self-efficacy towards learning computer and the internet among elderly in Hong Kong, China. In: 38th International Proceedings on annual Hawaii International Conference on System Sciences, pp. 1–10. IEEE, Hawaii (2005)
3. Lu, J.: Theoretical deliberation on current status, imagine and prospects of China's aged industry. *Popul. Econ.* **4**, 59–64 (2001)
4. Donaldson, J.M., Watson, R.: Loneliness in elderly people: an important area for nursing research. *J. Adv. Nurs.* **24**(5), 952–959 (1996)
5. Cummins, R.A.: Positive psychology and subjective well-being homeostasis: a critical examination of congruence. In: Efklides., A., Moraitou., D. (eds.) *A Positive Psychology Perspective on Quality of Life. Social Indicators Research Series*, vol. 51, pp. 67–86. Springer, Dordrecht (2012)
6. Diener, E., Suh, E., Lucas, M., Smith, R.E., Heidi, L.: Subjective well-being: three decades of progress. *Psychol. Bull.* **125**(2), 276–302 (1999)
7. Diener, E., Robert, A.E.: The independence of positive and negative affect. *J. Pers. Soc. Psychol.* **47**(5), 1105–1117 (1984)
8. Diener, E., Robert, A.E., Randy, J.L., Griffin, S.: The satisfaction with life scale. *J. Pers. Assess.* **49**(1), 71–75 (1985)
9. Campbell, A.: Subjective measures of well-being. *Am. Psychol.* **31**(2), 117–124 (1976)
10. Kozma, A., Stones, M.J.: The measurement of happiness: development of the memorial university of newfoundland scale of happiness (MUNSH). *J. Gerontol.* **35**(6), 906–912 (1980)
11. Berg, J.H., Peplau, L.A.: Loneliness: the relationship of self-disclosure and androgyny. *Pers. Soc. Psychol. Bull.* **8**(4), 624–630 (1982)
12. Russell, D., Peplau, L.A., Cutrona, C.E.: The revised UCLA loneliness scale: concurrent and discriminant validity evidence. *J. Pers. Soc. Psychol.* **39**(3), 472–480 (1980)
13. Wittenberg, M.T., Reis, H.T.: Loneliness, social skills, and social perception. *Pers. Soc. Psychol. Bull.* **12**(1), 121–130 (1986)
14. Standing Committee of the National People's Congress: *Law of the People's Republic of China on Protection of the Rights and Interests of the Elderly*. Standing Committee of the National People's Congress, Beijing (1996)
15. Gross, E.F., Juvonen, J., Gable, S.L.: Internet use and well-being in adolescence. *J. Soc. Issues* **58**(1), 75–90 (2002)

16. Van den Eijnden, R.J.J.M., et al.: Online communication, compulsive internet use, and psychosocial well-being among adolescents: a longitudinal study. *Dev. Psychol.* **44**(3), 655–665 (2008)
17. Subrahmanyam, K., Lin, G.: Adolescents on the net: internet use and well-being. *Adolescence* **42**(168), 659–677 (2007)
18. Sum, S., Mathews, R.M., Campbel, H.A.: Internet use and loneliness in older adults. *CyberPsychol. Behav.* **11**(2), 208–211 (2008)
19. Shapira, N., Barak, A., Gal, I.: Promoting older adults' well-being through Internet training and use. *Aging Ment. Health* **11**(5), 477–484 (2007)
20. Mellor, D., Firth, L., Moore, K.: Can the internet improve the well-being of the elderly? *Ageing Int.* **32**(1), 25–42 (2008)
21. Laganà, L.: Enhancing the attitudes and self-efficacy of older adults toward computers and the internet: results of a pilot study. *Educ. Gerontol.* **34**(9), 831–843 (2008)