

Effects of Internet use on self-efficacy: perceived network-changing possibility as a mediator

Kaichiro Furutani · Tetsuro Kobayashi · Mitsuhiro Ura

Received: 8 August 2006 / Accepted: 10 April 2007 / Published online: 6 July 2007
© Springer-Verlag London Limited 2007

Abstract The effect of Internet use as a mediating variable on self-efficacy as it relates to the cognition of network-changing possibility (i.e., connecting people or groups with different social backgrounds) was examined. The results showed that Internet use (i.e., the frequency of sending e-mail, friends made on the Internet) had a positive effect on the cognition of network-changing possibility. The cognition that it is possible to connect people with different social backgrounds by using the Internet also had a positive effect on self-efficacy. On the other hand, the cognition that it is possible to find people or groups who share beliefs and interests by using the Internet negatively affected self-efficacy. Hence, it was found that the effect of Internet use on self-efficacy was different as a function of cognition of network-changing possibility.

Research for this study was supported by grants from the Japan Society for the Promotion of Science, KAKANHI15330137.

K. Furutani (✉)
Faculty of Contemporary Culture, Hijiya University,
4-1-1 Ushidashinmachi, Higashi-Ward, Hiroshima-city, Hiroshima, Japan
e-mail: kaichiro@hijiya-u.ac.jp

T. Kobayashi
Information and Society Research Division, National Institute of Informatics,
2-1-2 Hitotsubashi, Chiyoda-ku, Tokyo, Japan
e-mail: k-tetsu@parkcity.ne.jp

M. Ura
Graduate School of Integrated Arts and Sciences, Hiroshima University,
1-7-1 Kagamiyama, Higashihiroshima-city, Hiroshima, Japan
e-mail: urappie@hiroshima-u.ac.jp

Introduction

Background

Recently, the Internet usage population in Japan was about 80 million (Ministry of Internal Affairs and Communications 2005). Internet use has greatly changed the modality of communications, and has had an effect at multiple levels such as the individual, relationships, groups and societies (Kobayashi and Ikeda 2005a, b; Miyata 2005; Quan-Haase and Wellman 2002). This study aims to clarify what influence Internet use has on our lives by examining the effect of Internet use on self-efficacy against the background of social capital theory (Putnam 2000), which explains diverse levels such as the individual, relationships, groups and societies overall.

Self-efficacy is the cognition of being able to do certain things (i.e., I can take on new challenges). A highly self-efficacious person can receive various psychological benefits (Bandura 1977, 1997). Such a person has improved motivation to contribute to groups (Miyata 2005). Consequently, it is quite likely that self-efficacy positively influences psychological adjustment and social participation. Therefore, by examining the influence of Internet use on self-efficacy, we feel we can offer a new perspective to the research on Internet use and psychological adaptation or social participation.

Social capital is defined as a network and the trust and reciprocity generated from it (Miyata 2005). A positive result of social capital is an increase of social participation, political participation and mental health, and a decrease of transaction cost (Miyata 2005; Putnam 2000). Among the three elements of social capital, we focus on social networks. The study of the extending or strengthening of social networks has accumulated (Kobayashi and Ikeda 2005a; Miyata 2005; Quan-Haase and Wellman 2002), but we focus not on the objective extending or strengthening of social networks, but on the subjective cognition of being able to change the network (cognition of network-changing possibility). Subjective cognition that the social network can be changed differs from measures of network structure (i.e., social network size) and can be used as a psychological indicator.

Cognition of network-changing possibility

Putnam (2000) has argued that social capital is of two types (bonding social capital and bridging social capital). Bonding social capital exists in high-density networks of homogeneous people (for example, ethnic fraternal organizations) and is good for supporting specific reciprocity and mobilizing solidarity (Miyata 2005; Putnam 2000). But, if this density is too high, tolerance levels toward heterogeneous people decline (Portes 1998; Portes and Landolt 1996). By contrast, bridging social capital occurs in heterogeneous networks and is outward looking, and encompasses people spanning diverse social backgrounds (as in, for example, civil rights movements). Bridging social capital is better for linkage to external assets and for information diffusion (Putnam 2000).

We used two measure concepts corresponding to the bonding social capital concept. These measure concepts were “strengthening ties among existing social

groups” and “finding people or groups who share beliefs and interests.” Also, we used a measure concept corresponding to the bridging social capital concept. This measure concept is cognition of “connecting people or groups with heterogeneous social backgrounds.”

Several studies have been made on strengthening or extending social networks by using the Internet (Ikeda and Shibanaï 1997; Kobayashi and Ikeda 2005a; Miyata 2005; Norris 2003; Quan-Haase and Wellman 2002). From these studies, it is clear that Internet use has a positive influence on cognition of network-changing possibility.

Cognition of network-changing possibility and self-efficacy

Bandura (1977, 1997) argued that one factor that positively influences self-efficacy is learning by one’s own experience. The feeling of accomplishment for a certain action is enhanced after experiencing a success feeling because the action was performed. Judging from the above, we believe that if success is not felt from Internet use, there will be no effect on self-efficacy. Therefore, we think that a person’s self-efficacy increases with the recognition that people can strengthen and extend their own network by using the Internet. However, we also think that Internet use and the objective result of strengthening and extending a network by Internet use does not itself influence self-efficacy. Hence, the most important point is the subjective recognition that an Internet user can strengthen and extend his own network by Internet use.

Does the increase of cognition of network-changing possibility improve self-efficacy? To answer this question, we constructed a hypothesis from social capital theory (Putnam 2000). Social capital theory predicts that interaction with socially and politically heterogeneous people positively affects general trust and political efficacy (Putnam 2000). Interaction with others who are heterogeneous causes more social conflict than with those who are homogeneous. However, a person can pick up the skill of understanding his own opinion from interaction with heterogeneous people (Berelson et al. 1954; Mutz 2002a, b). Therefore, we believe that the recognition of success in connecting with heterogeneous people enhances the will to take up new challenges, which is, in a word, self-efficacy. In contrast, since interaction with homogeneous people only involves a slight conflict and has low risk, this interaction precludes the chance of interaction with heterogeneous people, and tends to exclude heterogeneous people (Portes 1998). The person loses the motive for interaction with heterogeneous people. Hence, interaction with homogeneous people may decrease self-efficacy.

Hypotheses

Relationship of Internet use and cognition of network-changing possibility

Our first hypothesis was that using the Internet affects cognitive abilities, based on a number of studies that have documented strengthening and extending of social

networks as a result of using the Internet (Ikeda and Shibanaï 1997; Kobayashi and Ikeda 2005a; Miyata 2005; Quan-Haase and Wellman 2002).

H1-1 Frequency of using e-mail: E-mail use is the most popular use of the Internet. There is evidence that e-mail and mobile phone-mail play a role in strengthening and holding together strong as well as weak ties among existing social groups (Kobayashi and Ikeda 2005a; Miyata 2005; Quan-Haase and Wellman 2002). Therefore, e-mail use has a positive effect for strengthening ties among existing social groups.

H1-2 Using the Internet for various purposes: People who use the Internet for various purposes have a chance to share ideas with others and can meet others who share similar beliefs and interests (Ikeda and Shibanaï 1997; Norris 2003). There is a positive correlation between using the Internet for many different purposes and finding people and groups who share similar beliefs and interests.

H1-3 Basic skill: Basic skill is defined as the minimal skills needed for using technology. Responses to questions such as the following were used to measure basic skill: I can send a fax, I can set a video player to record programs. Since a person with the basic skill needed to use technology can use technology (Miyata 2005), it is expected that basic technological skills would have a positive effect on cognition of network-changing possibility.

H1-4 The number of acquaintances made through the Internet: It is possible to make acquaintances with others with heterogeneous social backgrounds through the Internet (Ikeda and Shibanaï 1997). Therefore, the number of people with whom one gets acquainted through the Internet should positively affect connections with people and groups with heterogeneous social backgrounds.

Relationship of cognition of network-changing possibility and self-efficacy

We argued the hypothesis that cognition of network-changing possibility affects self-efficacy. There is a greater risk of conflict in interaction with heterogeneous people than in interaction with other homogeneous people. However, people gain a better ability to understand their own opinions and develop the skill of collaborating with others who have heterogeneous opinions (Berelson et al. 1954; Mutz 2002a, b). Thus, according to our hypothesis, the recognition of success in connecting with heterogeneous people enhances self-efficacy. On the other hand, the recognition of strengthening homogeneous interactions lessens the motive for interaction with heterogeneous people. As a result, interaction with homogeneous people has a negative influence on self-efficacy.

H2-1 “Strengthening ties among existing social groups” negatively affects self-efficacy.

H2-2 “Finding people or groups who share beliefs and interests” negatively affects self-efficacy.

H2-3 “Connecting with people or groups with heterogeneous social backgrounds” positively affects self-efficacy.

Method

The study was based on a random sample survey of 1,320 adults in Yamanashi prefecture in Japan. Yamanashi is a mixed rural and urban area, located in the mountainous center of Japan, more than 100 km west of central Tokyo. Yamanashi was chosen for the survey because it is typical of Japan (outside of Tokyo and Osaka urban agglomerations) in the characteristics of its population and Internet users.

In this study, we used a two-stage stratified random sampling procedure. First, 40 neighborhoods in Yamanashi prefecture were randomly selected based on the postal code. Then, a further 33 individuals were randomly selected within each of those neighborhoods. Potential respondents were chosen from the list of voters aged 20–65 years (i.e., the entire population in this age range). From November to December 2002, hard survey forms were hand delivered to respondents. They were collected by hand three weeks after delivery. Of the selected individuals, 75.9% completed the survey, giving us a total sample size of 1,002 respondents.

After collecting the first wave data, we conducted the second and third panel surveys in February 2004 and February 2005 by sampling the same respondents as in the first wave. The total sample size for second and third waves were 646 (64.5%) and 432 (43.1%), respectively.

We analyzed the relationship between Internet use and self-efficacy by focusing on first and third wave data to identify changes in self-efficacy.

Results

Analysis 1: How does Internet use affect cognition of network-changing possibility?

Independent variables

Frequency of using e-mail: We used two types of e-mail (the most common form of Internet use) as independent variables to examine the extent of Internet use. Because interactive communication among people is essential for building social capital and underlying social networks, we excluded web-page use as an independent variable because web-page use by mobile phone and PC is almost exclusively limited to non-communicative uses such as obtaining information. The frequency of sending email through mobile phones was measured by analyzing responses to the question: “About how many private (non-work-related) emails have you sent yesterday by using your cellular phone/PHS, with the exception of e-mail sent to mailing lists?” We also measured the frequency of sending PC e-mail by analyzing the responses to the question: “About how many private (non-work-related) e-mails have you sent yesterday using your PC, with the exception of e-mail sent to mailing lists?”

Using the Internet for various purposes: We asked “Please tell me if you ever do any of the following when you go online, including Internet access with cellular phone/PHS and PC”. And participants answered the following items in Yes or No”. “Receive/send instant messages”, “Get news online or check the weather”, “Look

for the information about movies or books”, “TV programs or other leisure activities”, “Get travel information”, “Get information from a local, state, or federal government web site or information about politics and the campaign”, “Gather information relating to your work or education”, “Search for a map or driving directions or traffic timetables”, “Download music file or other files such as software, games, video or pictures”, “Buy a product online, or make a reservation for tickets or travel service or online auction”, “Home banking or investing”, “Take part in online discussion groups with other people (including chat, newsgroup, message board, mailing lists)”. These item was measured on a 2-point scale (1. yes, 0. no). These items were summed in one scale.

Basic Skill: Basic Skill was two items “I can send a fax”, “I can set a video player to record programs”. Each item was measured on a three-point scale: “(1) I can, (2) I can a little, (3) I cannot”. These items were summed in one scale. Then, this scale point was reversed.

The number of acquaintances made through the Internet: We asked “Do you have any friends whom I met in these online discussion groups?”. This item was measured on a four-point scale: “(1) None, (2) 1–2 person(s), (3) 3–5 persons, (4) more than 6 persons”.

Dependent variables

Cognition of network-changing possibility: Cognition of network-changing possibility was measured by using seven items under three factor structures (Furutani and Ura 2005): (1) “Strengthening ties among existing social groups”; (a) I could become more strongly related to the organizations and groups to which I belong, and (b) I could become related to the organizations and groups of neighbors: (2) “Finding people and groups who share similar beliefs and interests”; (a) I can relate to people who have identical concerns, and (b) I can seek people who have identical beliefs: (3) “Connecting people and groups with heterogeneous social backgrounds”; (a) I can get along with people from other countries, (b) I can get along with people from different economic classes, and (c) I get along with people of different generations. Responses were scored on 4-point scale that ranged from 1 (Strongly Disagree) to 4 (Strongly Agree). We used the mean score for each factor for the analysis.

Control variables: Gender, age, years of residence, and occupation were used as control variables.

We analyzed the effects of demographic and Internet use variables on strengthening ties among existing social groups by using multiple regression analysis (left column of Table 1). The results indicated that only the frequency of sending PC e-mail had a significant effect on this variable. A similar analysis was also conducted on the effects of finding people and groups that share similar beliefs and interests, and results indicated that the variability of Internet use and basic skills had a marginally significant effect on this variable. A similar analysis on the effects of connecting with people and groups with heterogeneous social backgrounds indicated that the number acquaintances made on the Internet significantly effected

Table 1 The effects of Internet use on cognition of network-changing possibility

Dependent variables (3rd wave)	Strengthening ties among existing social groups	Finding people or groups who share beliefs and interests	Connecting people or groups with heterogeneous social backgrounds
	Coef. (β)	Coef. (β)	Coef. (β)
Demographic variables (1st wave)			
Female	0.02	0.06	0.03
Age	0.02	-0.03	-0.08
Education	-0.05	0.03	-0.03
Years of residence	-0.01	-0.05	-0.06
Manager	0.08	0.06	0.07
Profession	-0.05	-0.07	-0.05
Internet use (1st wave)			
Frequency of sending mobile phone e-mail	-0.04	-0.03	-0.02
Frequency of sending PC e-mail	0.13*	0.03	0.01
Variety of Internet use	-0.02	0.10+	0.09
Basic skill	0.07	0.12+	0.07
Number of people got to know on the Internet	0.09	0.06	0.10*
Number of observations	407	406	405
R^2	0.02*	0.02+	0.05*

+ Significant at 10%; * significant at 5%

this variable. There were no significant effects of demographic variables. These results supported Hypothesis 1.

Analysis 2: Relationship between Internet use and self-efficacy

Next, we investigated the relationship between Internet use and social adaptation. We hypothesized that Internet use would indirectly effect social adaptation, mediated by cognition of network-changing possibility, and therefore we first clarified the mediating effect of this variable, and then we identified the contingencies that affected this variable and self-efficacy.

Dependent variables

We measured self-efficacy by two items: (1) If I can't do a job the first time, I keep trying until I can, and (2) I avoid trying to learn new things when they look too difficult for me (reversed) (Narita et al. 1995). The correlation between these two items was 0.27 in the first wave and 0.22 in the third wave. The scores for these two

items were summed in each wave. Because the distribution was skewed in each wave, we treated the self-efficacy variable as an ordered dependent variable.

Independent variables

Independent variables in Analysis 2 were independent variables in Analysis 1 and cognition of network-changing possibility.

Lagged variable

Self-efficacy in the 1st wave was included as an independent variable in order to control for the initial level of self-efficacy. This enabled us to control for the effect of omitted variables in the model that were assumed to have a constant effect on self-efficacy in each wave. This is an advantage of using panel data.

Control variables

These variables were identical to Analysis 1.

Because we treated the self-efficacy variable as ordered, an ordered logit model was estimated (Table 2). In Model 1 (left column of Table 2), the variable of cognition of network-changing possibility had only a marginal effect on self-efficacy. Recognizing that Internet use enables finding people and groups that share similar beliefs and interests had a negative effect on self-efficacy. In contrast, recognizing that the Internet makes it possible to connect with people and groups with heterogeneous social backgrounds had a positive effect on self-efficacy, whereas recognizing that Internet use makes it possible to strengthen ties among existing social groups had no effect on self-efficacy.

Internet use variables had no direct effect on self-efficacy, suggesting an indirect effect of Internet use on self-efficacy via cognitive variables, because some items did have a significant effect on the variable of cognition of network-changing possibility (Table 1). Predicting self-efficacy only by using demographic variables (Table not shown) also revealed no direct effect of demographic factors. A lagged dependent variable (self-efficacy at 1st wave) indicated a highly significant effect, suggestive of the stability of the measure of self-efficacy as well as effective control of omitted independent variables.

The effects of cognition of network-changing possibility in Model 1 were, however, only marginally significant. We were able to identify a possible moderating variable in this effect. Cognition of network-changing possibility can be measured even in non-Internet users. However, for this cognition to be effective on self-efficacy, a real social context is required through which these cognitions can be verified by communication with others. In this context the variable “collective use of Internet in informal groups”¹ played an important role because it measured whether respondents received e-mail from informal groups,

¹ Informal groups were classified by three categories: “out of hours co-worker group”, “study/training group”, and “hobby circle”.

Table 2 Ordered logit model predicting self-efficacy at 3rd wave

	Model 1	Collective use of the Internet in informal groups	
		No Model 2	Yes Model 3
Demographic variables			
Female	-0.07	-0.19	0.13
Age	-0.01	0.00	-0.10
Education	-0.19	-0.13	-0.40
Years of residence	0.00	-0.01	0.01
Manager	0.42	0.55	0.45
Profession	0.36	0.23	0.81
Lagged dependent variable			
Self-efficacy (1st wave)	0.73**	0.72**	0.72**
Internet use (1st wave)			
Frequency of sending mobile phone e-mail	0.23	0.34	-0.13
Frequency of sending PC e-mail	0.03	0.29	-0.28
Variety of Internet use	0.01	-0.06	0.14
Basic skill	0.08	0.09	-0.02
Number of people got to know on the Internet	0.11	0.40	-0.35
Cognition of network changing possibility			
Strengthening ties among existing social groups	0.05	0.02	0.05
Finding people or groups who share beliefs and interests	-0.13+	-0.06	-0.47**
Connecting with people or groups with heterogeneous social backgrounds	0.10+	0.05	0.29*
Cutpoint1	-1.74	-0.28	-1.79
Cutpoint2	-0.08	1.60	0.50
Cutpoint3	1.88	2.90	1.51
Cutpoint4	3.10	5.00	4.03
Cutpoint5	5.25	6.26	5.41
Cutpoint6	6.53	-	-
Number of observations	383	271	106
LR Chi square(15)	95.27	75.51	32.4
Prob > Chi square	0.00	0.00	0.01
Pseudo R^2	0.08	0.09	0.11

+ Significant at 10%; * significant at 5%; ** significant at 1%

visited websites of informal groups, or read or posted messages on mailing lists and BBS of informal groups. Because of the distribution of these variables, we created dummy variables that measured whether respondents had at least one of the above experiences. Results indicated that 26% of respondents had at least one of the experiences. This variable directly measured the experience of collective

use of Internet. People can find and connect with new people, both heterogeneous and homogeneous, through the collective use of the Internet (Kobayashi et al. 2006). Therefore, Internet use in a collective context can be a good indicator of the existence of a social context in which cognition of network-changing possibility can be verified. Whether cognitions of possibilities have a direct effect on self-efficacy is thought to be contingent on the collective context. We hypothesized that the cognition of possibility has significant effects on self-efficacy among respondents who have experienced collective use of the Internet, but not among those without such experiences.

Results of the analysis are shown in Models 2 and 3 in Table 2. These two models suggest clear-cut contrasts between “collective users” and “non-collective users.” Effects of the cognition of possibility considered to be contingent on this collective context, which are only marginal in Model 1, are clearly significant among the respondents who have experienced collective use of Internet, but insignificant among those without such experiences. Consistent with Model 1, recognizing that Internet use facilitates finding people and groups that share similar beliefs and interests had a negative effect on self-efficacy. In contrast, recognizing that the Internet makes it possible to connect with people and groups with heterogeneous social backgrounds had a positive effect on self-efficacy. These results indicate the effectiveness of collective use of the Internet as a moderator variable. In short, cognition of network-changing possibility can affect self-efficacy only when it is used in a collective context.

Discussion

Internet use and cognition of network-changing possibility

In Analysis 1, we addressed the question: does Internet use affect recognizing the potential for change through the Internet? The results supported studies on the effect of Internet use on social networks. The effect of e-mail use on strengthening ties among existing social groups has been supported Miyata (2005). Also, the variety of Internet use and skill level affected finding people and groups who share similar beliefs and interests. This indicated that people with minimal technology skills and a variety of activities on the Internet recognized that people were able to find others who shared similar beliefs and interests. Moreover, the number of others who discovered each other affected connecting with people and groups with heterogeneous social backgrounds.

Mobile phone e-mail use did not affect cognition of network-changing possibility. This may be because the variable measured in this study, sending e-mail, measured by the question “have you sent e-mail yesterday,” may have had a large measurement error. There is the possibility that people who interacted by mobile phone e-mail may not have been network members. They may have gotten to know each other in face-to-face situations, rather than through the Internet (Miyata et al. 2005; Tsuji and Mikami 2001). Therefore, recognition of finding or

connecting with people using the Internet was not affected. However, it is suggested that this issue be further investigated in future studies.

Cognition of network-changing possibility and self-efficacy

Recognizing that using the Internet enables us to find homogeneous people had a negative effect on self-efficacy. In contrast, recognizing that the Internet has possibilities for making connections with heterogeneous people had a positive effect on self-efficacy. Moreover, recognition of the possibilities of the Internet to strengthen ties among existing social groups that was measured by two items, (1) I could become more strongly related to organizations and groups to which I belong, and (2) I could become related to organizations and groups of neighbors, had no effect on self-efficacy. However, in the third wave, the number of respondents who belonged to self-governing/residential organizations and used the Internet among members of those organizations was only 27 members. It is possible that awareness of this concept among some respondents (including non-Internet users) was extremely low. If this were indeed the case, the non-significant effect of cognition of network-changing possibility to strengthen ties among existing social groups can be interpreted as being due to high measurement error for these items or the absence of a construct to measure.

Self-efficacy measures the tendency of respondents to start or continue doing new and difficult things. There is an inherent risk involved in starting to learn new things and in continuing to do difficult tasks that cannot be accomplished immediately. Physical and cognitive resources invested to accomplish new and difficult tasks can be fruitless if a person fails to accomplish them. On the other hand, communicating with homogeneous people who share beliefs and interests does not induce social conflicts compared to communicating with heterogeneous people. They are likely to share assumptions, thus less risk is entailed in initiating communication with them. The negative finding related to finding people and groups who share beliefs and interests on the Internet indicates that staying in low-risk communication situations with homogeneous others can undermine the self-efficacy that is necessary for social adoption. Social capital theory predicts that discussion with politically or socially heterogeneous others work as a ‘school of democracy’ by giving rise to experiences that nurture a sense of political efficacy and generalized trust (Putnam 2000). As a consequence of heterogeneous encounters, individuals have chances to shape opinions that are understandable to a broad audience and to polish their skills of coordinating exchanges (Berelson et al. 1954; Mutz 2002a, b). In other words, staying in interactions with homogeneous people carries the risk of reducing the possibility of enhancing self-efficacy. Although the network variable investigated in this study was not “the recognition of possibilities for change through the Internet by interactions with homogeneous others,” it is noteworthy from a psychological perspective that even recognizing the possibility can have an effect on self-efficacy.

Conversely, consistent with social capital theory, cognition of network-changing possibility by connecting with people and groups with heterogeneous social

backgrounds had a positive effect on self-efficacy. Moreover, this recognition had a positive correlation with the number of acquaintances that were made on the Internet (Table 1). People can indeed get to know heterogeneous others on the Internet. Such experiences can have an indirect, positive effect on self-efficacy mediated by cognition of network-changing possibility. This can be thought of as one of the positive consequences of Internet use at the individual level.

Collective use of the Internet in informal groups had a contextual effect as a moderator. Somewhat ambiguous effects of cognition of network-changing possibility (Model 1 in Table 2) were clarified based on the context of collective use of the Internet. Our interpretation is that that recognition of possibilities has a clear effect on self-efficacy only when the respondents had experienced collective use of the Internet. Through the collective use of the Internet, people can verify cognition of network-changing possibility and actualize it to real interactions with others. Collective use of the Internet has positive effects on trust and reciprocity in the online world (Kobayashi et al. 2006).

In addition, the results of this study indicate that collective use of the Internet can moderate cognition of network-changing possibility. Collective users of the Internet who think that the Internet makes it possible to develop homogeneous (bonding) ties might enhance the homogeneity of their personal network through Internet use and thus become reluctant to get on high-risk and high-uncertainty interaction with heterogeneous others. This causes a negative effect on self-efficacy because people become satisfied and remain in stable and homogeneous networks without initiating new actions and attempting to do difficult tasks that involve risks and uncertainties. Conversely, collective users of the Internet who believe that the Internet makes it possible to create a bridge to heterogeneous others might enhance the heterogeneity of their personal network through Internet use and polish their skills of coordinating and exchanging with others who do not share common knowledge or social backgrounds. As a result, they become less reluctant to start new things and attempt to do difficult tasks. This in turn is manifested in the enhancement of self-efficacy.

Conclusion

Our findings suggested that Internet use did not affect self-efficacy, but cognition of network-changing possibility affected self-efficacy. Particularly, the cognition that a person could connect with people or groups with heterogeneous social backgrounds by using the Internet positively affected his or her self-efficacy. On the other hand, the cognition that a person could find people or groups who shared beliefs and interests negatively affected self-efficacy. In future study, we should investigate the strategy of how to deal with this negative effect. In addition, it is suggested that future studies investigate the process by which Internet use affects social behavior through network-changing possibility and self-efficacy.

Acknowledgments We thank Hiroshi Hirano (Gakushuin University), Kakuko Miyata (Meijigakuin University), and Ken'ichi Ikeda (The University of Tokyo) for their collaboration in the design of this survey.

References

- Bandura A (1977) Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev* 84:191–215
- Bandura A (1997) Self-efficacy: the exercise of control. W. H. Freeman and Company, New York
- Berelson BR, Lazarsfeld PF, McPhee WN (1954) Voting: a study of opinion formation in a Presidential election. University of Chicago Press, Chicago
- Furutani K, Ura M (2005) The effect of mail on connecting heterogeneous people and collecting group: a view point of moderate effect of social network diversity. In: Proceedings of the 46th annual meeting of the Japanese society of social psychology (in Japanese). Kanseigakuin University, Japan, pp 102–103
- Ikeda K, Shibana Y (1997) The logic of social networking and constitution of group. In: Ikeda K (ed) Networking community. University of Tokyo Press, Japan pp 2–25 (in Japanese)
- Kobayashi T, Ikeda K (2005a) Networking and dis-networking of mobile communication. In: Ikeda K (ed) Internet community and daily social world. Seishin Shobo, Japan, pp 67–84 (in Japanese)
- Kobayashi T, Ikeda K (2005b) Social capital in online communities. In: Ikeda K (ed) Internet community and daily social world. Seishin Shobo, Japan, pp 148–184 (in Japanese)
- Kobayashi T, Ikeda K, Miyata K (2006) Social capital online: collective use of the Internet and reciprocity as a lubricant of democracy. *Inf Commun Soc* 9:582–611
- Ministry of Internal Affairs and Communications (2005) White Paper 2005, Gyosei, Japan (in Japanese)
- Miyata K (2005) Social psychology of internet. Kazama syobo, Japan (in Japanese)
- Miyata K, Wellman B, Boase J, Ikeda K (2005) The Mobile-izing Japanese: Connecting to the Internet by PC and Webphone. In: Yamanashi, Mizukoshi I, Okabe D, Matsuda M (eds) The personal, portable, pedestrian: mobile phones in Japanese life. MIT Press, Cambridge pp 143–164
- Mutz DC (2002a) Cross-cutting social networks: testing democratic theory in practice. *Am Polit Sci Rev* 96:111–126
- Mutz DC (2002b) The consequences of cross-cutting networks for political participation. *Am J Polit Sci* 46:838–855
- Narita K, Shimonaka Y, Nakazato K, Kawai C, Sato S, Osada Y (1995) A Japanese version of the generalized self-efficacy scale: Scale utility from the life-span perspective (in Japanese). *Jpn J Educat Psychol* 43:306–314
- Norris P (2003) Social capital and ICTs: widening or reinforcing social networks?. Presentation paper at the “International Forum on Social Capital for Economic Revival”. The Economic and Social Research Institute, Tokyo, 24–25th March 2003. Session 5 ‘Social capital and ICTs’
- Portes A (1998) Social capital: its origins and applications in modern sociology. *Annu Rev Sociol* 24:1–24
- Portes A, Landolt P (1996) The downside of social capital. *Am Prospect* 26:18–21 [online] <http://www.esri.go.jp/en/workshop/030325/030325paper6-e.pdf>
- Putnam RD (2000) Bowling alone: the collapse and revival of American community. Simon and Schuster, New York
- Quan-Haase A, Wellman B (2002) Capitalizing on the net. In: Wellman B, Haythornthwaite C (eds) The Internet in everyday life. Blackwell, Amsterdam, pp 291–324
- Tsuji D, Mikami T (2001) A preliminary student survey on the e-mail uses by mobile phones. [online] http://homepage3.nifty.com/dt/paper/r02/rsm_0106.pdf (in Japanese)