

Comparing the Effect of Personal Communication and Mass Media on Energy saving Behaviors: Cross - Cultural Study in Japan, China and Germany

Kaori ANDO* Susumu OHNUMA** Gundula HÜBNER*** Li Dong HUI****

Abstract : To understand the impact of personal communication on environmental behavior, the present study compared the role of the mass media and personal communications in three countries: Japan, China and Germany. It is pointed out that information from the mass media is non-specific to individuals. Compared to the information from mass media, the target of communication is clear when communicated through personal channels. Therefore we predicted that personal communications would be more effective in inducing pro-environmental behaviors compared to mass media. Questionnaire survey was conducted with university students in Japan, China and Germany. The results of structural equation modeling showed that personal communication had stronger effects on the awareness of consequences and needs, subjective norms, and perceived behavioral control (PBC) compared to information from mass media. The effects of personal communications were observed in both Asian and Western cultures. This result indicates that information through personal communication can be processed with higher attention, and this process is universal across cultures. The present study showed that mass media alone was not sufficient to motivate people to conduct pro-environmental behavior, which highlighted the need to promote communications among individuals on environmental issues.

Key Words : communication, environmental behavior, information processing, Theory of Planned Behavior, cultural comparison

1. INTRODUCTION

Climate change has become a serious concern worldwide, such that at COP21 in Paris, 196 countries signed the Paris Protocol which obligated them to reduce CO₂ emissions. In Japan, electricity consumption at home has increased for 46.8% in 2015 compared to 1990¹⁾. It is urgently required that each individual take behaviors to save energy at home. In this paper, we focus on communications to promote energy saving behaviors.

As the mass media coverage of environmental issues is increasing, people are more likely exposed to topics concerning environmental issues on the mass media, including television and newspapers (Sampei & Aoyagi-Usui, 2009; Boykoff & Boykoff, 2007). At the same time, people have daily conversations with friends and family members, and it is rather likely that daily conversations on

environmental issues influence our environmental attitudes and behaviors. So far, direct comparisons whether mass media or personal communication have a stronger impact on environmental behavior are rare.

Furthermore, the determinants of pro-environmental behavior vary between countries (e.g., Aoyagi-Usui, Vinken, & Kuribayashi, 2003; Eisler, Eisler, & Yoshida, 2003; Tam & Chan, 2017). For example, Tam and Chan (2017) found that the association between environmental concern and behavior is stronger for countries with high individualism. This result would suggest that in countries with collectivistic culture, behavior is determined by the variables other than own values, such as expectation from others, as importance of keeping harmonious relationship with others is higher in Asian culture (Markus & Kitayama, 1991). To better understand the impact of personal communication on energy saving behavior, the

* Nara Women's University, Japan, ** Hokkaido University, Japan, *** Martin-Luther-University Halle-Wittenberg, Germany, Medical School Hamburg, Germany, **** Dalian University of Foreign Languages, China

present study aims to compare the role of the mass media and personal communications cross-culturally.

In the present study, we focus on conversations with friends and family as personal communication. Personal communication can involve communication with various others such as neighbors, colleagues, etc., but we focus on communication with most close others to contrast with broad communication by mass media.

The present study focuses on energy-saving behaviors as environmental behaviors. As noted above, climate change is getting a very serious problem that we should tackle world-wide. To solve the problem, changing individual behaviors are required, thus it is an urgent issue to find out the effective way to promote energy-saving behaviors.

1.1 Mass media and Pro-environmental Behaviors

Previous studies on the effect of the mass media on pro-environmental behaviors seem to have produced mixed results. Östman (2014) reported that frequency of news media use was related to environmental behavior among Swedish adolescents. The study also found that media use can facilitate conversations with family and friends on environmental issues, which is strongly related to environmental behavior. Östman's study (2014) showed that mass media affect environmental behavior rather indirectly by facilitating personal communication. In Japan Sampei and Aoyagi-Usui (2009) analyzed newspaper coverages on global warming and its relationship with public concern about this issue and reported that increasing newspaper coverage on climate change issues was correlated with the public concern about the issue. However, the relationship between newspaper coverage and pro-environmental behaviors were not investigated in the study.

On the other hand, several studies have indicated that the effect of the mass media on pro-environmental attitudes and behaviors are limited, or inefficient. Staats, Wit, and Midden (1996) reported that a campaign lead by the Ministry of Environment in the Netherlands increased knowledge among the public, but did not change

pro-environmental attitudes, nor energy saving behaviors. Klöckner (2015) suggested that the mass media campaigns could increase people's knowledge, but very often the information from mass media is non-specific to each individual to affect their behaviors. That may weaken the impact of mass media, which makes it difficult for mass media to overcome the behavioral barriers. Stern (1999) reported that providing information on environmental behaviors was effective only for low-cost behaviors because behavioral barriers have a larger influence on high-cost behaviors.

Studies on the effect of the mass media on pro-environmental attitudes and behaviors seem to show that the mass media can increase knowledge among people but often lacks the power to change people's attitudes and behaviors. The reason that mass media has limited effects would be because information from the mass media is non-specific to individuals because the mass media messages are targeted to the general public and not to each specific individual (Klöckner, 2015). Fujii (2003) pointed out that when the intended receiver of a message is unclear, people do not even recognize the message as communication. Only when people can perceive that a message is targeted at them, they have the motivation to attend to the message. This process can be also explained by the elaboration likelihood model (Petty & Cacioppo, 1986): the information will be processed in an elaborative way only when an individual has the motivation to process the information. Information from mass media is not targeted to the specific individual, which will lower the motivation to process the information, that result in information is not processed through central route.

1.2 Role of Personal Communications on Pro-environmental Behaviors

Compared to the information from mass media, the target of communication is clear when communicated through personal channels, such as conversations with family and friends. Some studies showed that personal communication is very important to promote environmental behaviors. Archer, Pettigrew, Constanzo, Iritani, Walker, and White (1987) indicated that the

strongest determinant of buying a photovoltaic system was information from close others. Personal communications also had an effect on recycling behavior: Everett and Peirce (1991) examined the effect of network in the neighborhood on curbside recycling and reported that areas with dense social networks had higher recycling participation rates. Ando and Hirose (1999) showed that personal communications are an important factor in encouraging participation in collective pro-environmental activities: In a survey with participants of environmental groups and university students, the most frequent reason for participating in the environmental group was 'invitation by friends.' They also showed personal communications are not just one way, but that it is usually bilateral. The study by Ando and Hirose (1999) suggested that when participants of environmental activities perceive their close friends are interested in environmental issues, they had more conversations on these issues with the friends and provided more information on such activities.

1.3 Comparison of The Mass Media and Personal Communication

As noted above, various studies have been conducted on the effects of the mass media and personal communications. However, only a few studies have directly compared the effect of the mass media and personal communications on pro-environmental attitudes and behaviors. In one such study, Nonami, Sugiura, Ohnuma, Yamakawa, and Hirose (1997) compared the role of the mass media, local media and personal communications on recycling behaviors. The result showed that personal communications directly affected recycling behaviors and through social norms. The mass media, on the other hand had an effect on the perception of efficacy and feasibility but did not affect the behavior. The study suggested that personal communications not only deliver information but also deliver the social norms of the reference group.

Adopting new pro-environmental behaviors might be understood as a process of social diffusion (Rogers & Shoemaker, 1971). Costanzo, Archer, Aronson, and Pettigrew (1986) suggested that

adoption of energy conserving devices can be conceptualized as an instance of social diffusion. They suggested that information received through personal channels is more favorably evaluated and remembered, and therefore, social diffusion is more likely to occur through the existing social networks. Again, this idea can be applied to the elaboration likelihood model (Petty & Cacioppo, 1986). Information through personal channels tend to draw more attention of the receiver and the receiver is more likely to have higher motivation to process the information, which lead to processing the information through the central route.

The above arguments seem to suggest that personal communication can have strength in affecting environmental attitudes/behaviors compared to mass media. However, as noted above, only a very few studies have directly compared the effect of the mass media and personal communications on pro-environmental attitudes and behaviors. Thus, the present study aims to compare the role of the mass media and personal communications in affecting pro-environmental behavior in a study of three countries.

1.4 Model of The Present Study

The model of the present study is shown in Figure 1. We referred to the theory of planned behavior (Ajzen, 1985, 1991) and Schwartz's norm activation model (Schwartz, 1977) to analyze the processes through which communications affect pro-environmental behaviors. The theory of planned behavior (TPB) (Ajzen, 1985, 1991) has been validated in many countries and found to be

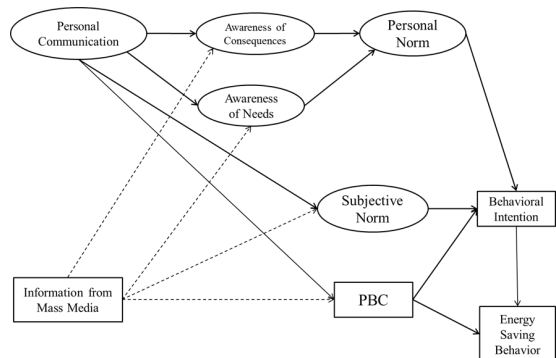


Figure 1 Model for the present study

useful in explaining behaviors related to the environmental behaviors (Ando, Ohnuma, Blöbaum, Matthies, & Sugiura, 2010; Groot & Steg, 2007; Heath & Gifford, 2002; Kaiser, Hübner, & Bogner, 2005). Schwartz's norm activation model has also been applied to pro-environmental behaviors, and personal norm were consistently found to be the central variable that explain pro-environmental behaviors (Bratt, 1999; Hunecke, Blöbaum, Matthies, & Höger, 2001; Stern, 2000).

The present model assumes that subjective norms and perceived behavioral control (PBC) determine behavioral intentions, and the behavioral intention determine the behavior together with PBC according to TPB. PBC refers to the evaluation of whether it is difficult or easy to conduct the behavior. In the original TPB, attitudes toward the behavior is one of the determinants of the behavioral intention, however we used personal norm from Schwartz's model (Schwartz, 1977) instead of attitudes because the concept of personal norm which involve moral obligation is more limited and concrete than attitude. Personal norm is defined as 'the feeling of personal moral obligations based on the personal values of the individual' (Schwartz, 1977). The second reason personal norms were chosen for this study was because the item of personal norm involves the words "no matter what other people do", which enable us to measure personal values which are completely independent from others. Therefore, they are of special interest for cross-cultural comparisons with subjective norms, which is defined as the willingness to comply with expectations of close others (Ajzen, 1985, 1991). The antecedents of personal norms are 'awareness of needs' and 'awareness of consequences' in Schwartz's model (1977), thus these variables are also included in the model.

Energy-saving behaviors are usually conducted at home, and relatively low-cost behaviors among other environmental behaviors. Personal norms and PBC would have effect on energy-saving behaviors since it is individual behaviors conducted at home, where nobody except family members are watching. Although it is individual behaviors,

subjective norms may also have effects in interdependent cultures, where fulfilling others expectations can be important for oneself.

The main aim of the study is to compare the effect of personal communications and information from mass media on the determinants of pro-environmental intention. In the model, we assumed that personal communications and information from mass media affect subjective norms and PBC, and they are also assumed to affect awareness of needs and awareness of consequences which are antecedents of personal norm.

Regarding the effect of personal communications, personal communications would facilitate understanding that the communicator is concerned about environmental issues, which was expected to affect the subjective norm that others are expecting them to conduct pro-environmental behaviors. In Nonami *et al.*'s study (1997) it was found that personal communications affected behaviors through social norms. Give these reasons, we predicted that personal communications would have a stronger impact on subjective norms than the mass media. As was discussed above, information through personal channels is more likely to be processed with increased attention, which would affect the precedents of personal norm, awareness of consequences and awareness of needs more than the mass media information. As for PBC, personal communications with well-acquainted people could deliver the message on how to conduct pro-environmental behaviors in daily life according to the person's lifestyle, compared to information from the mass media that is directed at non-specified targets. Therefore, personal communications would play a stronger role in affecting PBC. Taken together, we predicted that personal communications would have stronger effects on the determinants of behavioral intentions and behaviors, including subjective norms, awareness of consequences, awareness of needs, and perceived behavioral control compared to mass media.

The second aim of the study was to examine cultural differences in the impact of the mass media and personal communications on pro-

environmental attitudes and behaviors. Markus and Kitayama (1991) suggested that in Western countries an independent view of the self is more dominant, which lead greater emphasis on independence and individual values in the West. The interdependent view of the self is dominant in Asian countries where interdependent relationships with others are considered to be more important. In the cultures where interdependent self is dominant, people are expected to be more sensitive to the expectations of others, in order not to break the harmonious relationship with them. According to Markus and Kitayama (1991), we can expect that personal communications have a stronger impact on environmental attitudes in Asian countries because personal communications also deliver the expectations of the communicator. It is reported that subjective norms have stronger impact on behavioral intentions in Japan (Abrams, Ando & Hinkle, 1998; Ando *et al.*, 2010; Ando, Ohnuma & Chang, 2007), suggesting that fulfilling expectations from others are placed higher importance in Asian countries.

The present study aims to compare Japan and China as Asian countries where interdependent relationships are more important, and Germany as a Western country where independent self is more dominant. It has been reported that there are certain differences even among East Asian countries. A study by Zhang, Lin, Nonaka, and Beom (2005) reported that in China, higher importance is placed on interpersonal relationships than in other countries. There are also arguments that the Japanese society is changing. Hayashi (2009) argued that Japan is in the fluid stage changing from the culture of 'Harmony (Wa)' toward culture of 'Difference (Sa)'. These studies may suggest that we need to reconsider the meaning of 'interdependent' culture in Japan. Germany was selected for the study because its economic level is comparable with Japan, and it employs advanced environmental policies such as Renewable Energy Act (EEG).

The mass media does not involve communications between individuals. Therefore, we expected that cultural differences in personal

relationships would have little influence upon the effects of mass media communications on pro-environmental behaviors.

2. METHODS

2.1 Procedures

This study took place between April and June 2012. Surveys were conducted with university students in Germany, Japan, and China by distributing and collecting questionnaires in classrooms by researchers in each country. In Germany, the study was conducted in a university in Halle. In Japan, it was conducted in seven universities in five regions, whereas in China, the students in a university in Dalian participated in the study.

2.2 Responses

In Germany, 308 responses were collected. Among them, responses that contain missing values in one or more pages and those of students that were non-nationals of the country were excluded from the analysis. We obtained 296 valid responses in Germany after applying these criteria. In Japan, we collected 662 responses and obtained 611 valid responses after using the above criteria. In China, 195 responses were collected resulting in 184 valid responses after applying the identical criteria.

2.3 Measures

The Japanese and German scales for the present study were chosen from the previous cross-cultural study (Ando *et al.*, 2010; Ando, Yorifuji, Ohnuma, Matthies & Kanbara, 2015) except for personal communication and information from the mass media. Scales for personal communication and mass media were first developed in Japanese and translated into German by native speakers of these languages. Chinese version was translated from Japanese by a native speaker and then checked by back-translation. All items except perceived behavioral control were measured by using a five-point scale ranging from 1 (not at all) to 5 (always) for the behaviors, and a five-point scale ranging from 1 (do not agree at all) to 5 (agree completely) for the other scales. Perceived behavioral control

was measured by a 7-point scale ranging between 1 (easy) to 7 (difficult). Means of the items were used as the scale scores except for the scales with a single item.

1) Energy saving behavior. Energy saving behaviors was measured by one item: “Avoid using heating or air conditioning too much”²⁾. We chose this behavior because heating and air conditioning is reported to be major consumption of energy at home in most of the industrial countries (Nakagami, Murakoshi, & Iwafune, 2008). In Germany, heating consists of 78% of energy consumption at home, with the corresponding of number for Japan is 29 % and 44 % in China (Nakagami *et al.*, 2008). In Japan, air conditioning consists of 53 % of energy consumption at home in summer afternoon³⁾.

We chose to use single item for measuring behavior in order to measure the same aspect as the other scales (awareness of consequences, awareness of needs, personal norms, subjective norms, perceived behavioral control, and behavioral intention). These scales all asked specifically about the behavior to avoid using heating or air conditioning too much.

2) Personal communication. Personal communications were measured by asking about the frequency of having conversations with friends and family on the topic of saving electricity by using two items: “I talk about electricity saving with my

university friends/ my family”.

3) Information from the Mass media. We inquired about the frequency of obtaining information from the mass media on saving electricity by using the item: “I read/watch information about electricity saving in newspapers/ television”.

4) Awareness of consequences. Awareness of consequences was measured by two items: ex. “If I try not to use heating or air conditioning too much, that would contribute to energy issues”.

5) Awareness of needs. Respondents were asked about their perception of the awareness of needs on energy issues by using two items, ex. “If many people wouldn’t observe temperature setting, the energy issue will be worse”.

6) Personal norms. Personal norms were measured by two items that inquired about feelings of individual obligation for conducting a behavior, ex. “No matter what other people do, my own values tell me that I have to avoid using heating or air conditioning too much with regard to the environment”.

7) Subjective norms. Subjective norms were measured by two items asking about expectations from family and university friends, ex, “My family expect me to avoid using heating or air conditioning too much”.

Table 1 Mean scores of each variable in Japan and China and Germany

| | Japan | | China | | Germany | | F value | | | | |
|-----------------------------|-------|------|-------|------|---------|----|---------|------|---|--------|-----|
| | M | SD | M | SD | M | SD | | | | | |
| Energy saving behavior | 3.89 | 1.09 | a | 4.31 | 1.06 | b | 3.76 | 1.14 | a | 14.87 | *** |
| Behavioral intention | 3.76 | 1.09 | b | 4.28 | 0.98 | c | 3.33 | 1.43 | a | 37.06 | *** |
| Personal norms | 3.24 | 0.92 | a | 3.88 | 0.89 | b | 3.38 | 1.11 | a | 30.28 | *** |
| Subjective norms | 2.25 | 0.92 | a | 3.64 | 0.99 | b | 2.26 | 1.06 | a | 154.47 | *** |
| PBC | 2.66 | 1.60 | b | 2.21 | 1.53 | a | 2.08 | 1.42 | a | 16.06 | *** |
| Efficacy | 3.45 | 1.03 | b | 3.99 | 0.81 | c | 3.12 | 0.97 | a | 44.75 | *** |
| Seriousness perception | 4.09 | 0.88 | b | 4.53 | 0.72 | c | 3.49 | 0.89 | a | 89.05 | *** |
| Personal communication | 2.37 | 0.92 | a | 3.53 | 0.87 | c | 2.58 | 0.86 | b | 118.87 | *** |
| Information from mass media | 3.64 | 1.10 | b | 4.02 | 0.89 | c | 2.57 | 1.18 | a | 128.47 | *** |

Note: Means in the same raw with different alphabets are significantly different at $p < .05$.

Means of the items were used as the scale scores except for the scales with a single item.

Note: Means in the same raw with different subscripts are significantly different at $p < .05$.

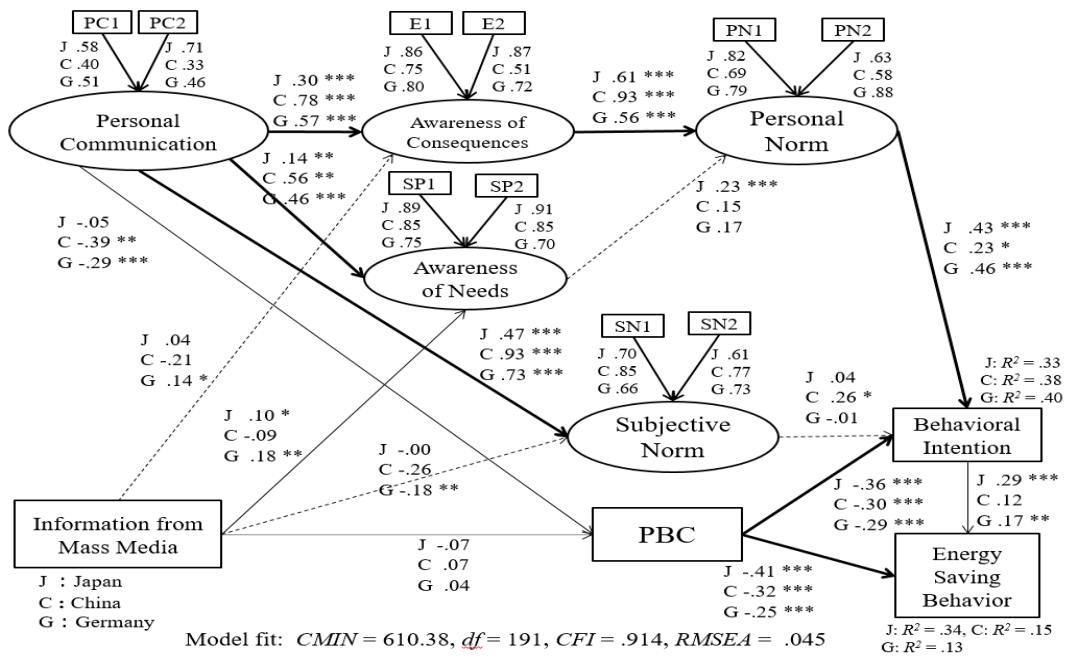


Figure 2 The result of SEM for multiple groups

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

8) **Perceived behavioral control (PBC).**

Perceived behavioral control was measured by one item: "Avoiding using heating and air conditioning too much would be easy/difficult for me."

9) **Behavioral intention.**

Behavioral intentions were measured by asking about the willingness to conduct a behavior in the next few months by using one item: "I intend to avoid using heating or air conditioning too much in the next couple of months."

3. Results

3.1 Demographics

Undergraduate students in Japan and China and Germany responded to the questionnaire. Mean age of participants were 19.1 years in Japan, and 20.6 years in China and 22.4 years in Germany. About half the respondents in Japan and Germany were women (50.0 % in Japan, 59.1 % in Germany), whereas 85.2% of respondents in China⁴ were women.

3.2 Cultural Differences in Behavioral and Cognitive Variables

Personal communications, information from the

mass media and the antecedents of behaviors were compared by using a one-way analysis of variance (ANOVA) to examine cultural differences (See Table 1).

Results indicated that China had the highest mean score among the three countries for most variables: For energy saving behavior, China scored highest, whereas Japan and Germany did not differ significantly. China scored highest for behavioral intention, whereas Germany had the lowest score. Chinese respondents scored highest for personal norms, whereas Germany and Japan did not differ significantly. Additionally, subjective norms were significantly higher in China, whereas there was no significant difference between Germany and Japan. Also, awareness of consequences was significantly high in China, whereas Germany scored lower than the other countries. Awareness of needs was also the highest in China, whereas it was lowest in Germany. The same was the case for personal communications, which was highest in China, whereas it was lowest in Japan. Finally, China also scored highest for information from the mass media, whereas Germany scored the lowest. On the other

hand, Japan scored highest among the three countries for PBC. Japanese participants perceived it more difficult to avoid using heating or air conditioning than in the other countries.

3.3 Role of Personal Communications and The Mass Media on Energy Saving Behaviors in The Three Countries

Multi-group analysis using SEM was used to examine the influence of personal communications and the mass media information on antecedents of energy saving behaviors in the three countries. The analysis was conducted using AMOS 21. The results are shown in Figure 2.

The model fit statistics for multi-group analysis indicated a satisfactory fit for the model (CMIN = 610.38, df = 191, CFI = .914, RMSEA = .045). The model fit for the analysis for the whole sample was also satisfactory (CMIN = 476.99, df = 63, CFI = .924, RMSEA = .075). RMSEA was over .05 for the model for whole sample although CFI was slightly larger, indicating model for multi-group analysis has better fit. Since the aim of the present study is to examine the cultural differences in the role of personal communication and mass media, the multi-group analysis was used for the following analysis.

Personal communications were strongly connected to subjective norms in all three countries (.47 in Japan, .93 in China, .73 in Germany). The paths from personal communications to awareness of consequences (Japan .30, China .78, Germany .57) and awareness of needs (Japan .14, China .56, Germany .46) were also significant in three countries. The path from personal communications to PBC was significant only in China (-.39) and Germany (-.29).

The mass media was related to subjective norms only in Germany (-.18), but somehow it was in the opposite direction: those who received more information from mass media perceived less expectations from others to take energy saving behavior. Information from the mass media did not have a significant relationship with PBC in the three countries. The path from mass media to awareness of consequences was significant only in Germany (.14) and to awareness of needs was

significant in Germany (.18) and Japan (.10). These coefficients were smaller than those of personal communication.

We compared the path coefficients of personal communications and information from the mass media with other variables using pairwise comparisons. The result showed that the paths from personal communications to subjective norm and awareness of consequences were significantly stronger than those of information from the mass media in all three countries. The path from personal communications to awareness of needs and PBC was significantly stronger than that of information from the mass media in Germany and China, but not in Japan.

Awareness of consequences was associated with personal norms (Japan .61, China .93, Germany .56), whereas awareness of needs had a weaker relationship with personal norms. Personal norms (Japan .43, China .23, Germany .46) and PBC (Japan -.36, China -.30, Germany -.29) were significantly connected to behavioral intentions in all three countries, whereas subjective norms had significant associations with behavioral intentions only in China (.26).

The path from behavioral intention to energy saving behaviors was significant only in Japan and Germany (Japan .29, Germany .17), whereas PBC affected behaviors in all three countries (Japan -.41, China -.32, Germany -.25).

Overall, personal communications had indirect effects on behavioral intention through the awareness of consequences and personal norms. Personal communications also affected energy saving behaviors through PBC in China and Germany. Personal communications were connected to subjective norms, but the path from subjective norms to behavioral intentions in Japan and Germany was not significant, and the path from intentions to the behavior was not significant in China. Therefore, the path from personal communications to energy saving behavior through subjective norms was not significant in the present study. Compared to personal norms, the connections of the mass media with the antecedents of energy saving behavior was weaker.

4. Discussion

4.1 Personal Communications and The Mass Media

The present study compared the role of personal communications and the mass media in the model of energy saving behavior. The result of SEM showed that personal communications consistently affected awareness of consequences, awareness of needs and subjective norms in the three countries, whereas the mass media had little impacts on these variables. The comparison of paths in SEM revealed that paths from personal communications were significantly stronger than that of the mass media.

Personal communications strongly affected subjective norms in all three countries, which suggest that personal communications deliver not only information but also social norms. This finding was consistent with the study by Nonami *et al.* (1997), which found that personal communications affected social norms regarding recycling behaviors.

Personal communications had effects on PBC in both China and Germany, whereas the mass media did not have an influence on PBC in all three countries. This result indicated that friends and family who know the lifestyle of an individual could give practical advices that are easy to follow, which facilitated higher PBC. PBC also had a direct effect on energy saving behaviors through behavioral intentions. These results showed that personal communications could affect behavioral intentions and energy saving behaviors through PBC.

Overall, these results suggest that personal communications had a stronger association with subjective norms, the awareness of consequences, awareness of needs and PBC than the mass media. This result indicates that information through personal communication can be processed with higher attention as suggested by Costanzo *et al.* (1986). Information through personal communications was more likely to be processed through central route in elaboration likelihood model (Petty & Cacioppo, 1986) or heuristic-systematic model (Chaiken, 1980). The reasons

for this would be that it is information from close others and that communication is clearly targeted to the individual. The present study demonstrated that personal communication affects major antecedents of pro-environmental behaviors.

The mass media can simultaneously spread information to a vast number of people, and therefore, it is very powerful in spreading knowledge in a society. However, the results of the present study showed that information from the mass media alone was not powerful enough to motivate people to conduct pro-environmental behavior. Personal communication can affect only a limited number of people at a time, but the information can be processed with higher motivations, which can result in change in behaviors. The mass media could play an important role in informing that climate change is becoming a serious problem to the planet. However, there is still a need to increase personal communications on energy saving to motivate people to go one more step and undertake energy saving behaviors.

4.2 Cross-cultural Differences in The Model

The result of SEM demonstrated that personal communications affected awareness of consequences, awareness of needs and subjective norms in all three countries. We hypothesized that personal communications have stronger effects in Japan and China from previous studies (e.g. Markus & Kitayama, 1991), however the results did not support the hypothesis in the present study. The results showed that the role of personal communications was rather universal in these countries. Personal communications played a significant role even in Germany, where independence is highly valued. These findings corroborated the prediction that the role of the mass media is weak and does not differ greatly among countries. The result may indicate that the difference in importance of interpersonal relationships in East Asian and Western culture is smaller than it was assumed. Takano and Osaka (1997, 1999, 2018) argued that Japan is not collectivistic as it is believed to be, and similarly Oyserman, Coon & Kimmelmeier (2002) reported that Japan was less collectivistic than the U.S. in a

review of individualism-collectivism although the U.S. was higher in individualism than Japan was. The present study indicated that personal communications are also important in Western culture.

In this study, a path to energy saving behaviors through subjective norms was not observed in Germany and Japan, although subjective norms have been significant predictors of pro-environmental behavior in Japan in previous studies (Abrams, Ando & Hinkle, 1998; Ando *et al.*, 2010; Ando, Ohnuma & Chang, 2007). The present study measured the behaviors of avoiding the use of heating or air conditioning, which are mainly conducted inside individual house, and not visible to others. This may explain why the path from subjective norms was not significant in Japan. Thus we cannot yet refute the possibility that subjective norms affect behavioral intentions, as well as pro-environmental behaviors in other domains in Japan.

Taken together, for German sample, personal communication affected energy saving behavior through personal norm and through PBC. For Japanese sample, personal communication affected energy saving behavior through personal norm, while personal communication affected the behavior only through PBC for Chinese participants. China and Japan said to possess both interdependent culture, however the result showed different pattern for China and Japan. The result indicated that interpersonal relationships are more valued in China as proposed in Zhang *et al.* (2005). The larger number of female respondents in China may have affected the results. It may have affected the strong relationship between personal communication and subjective norm.

4.3 Cultural Differences in Means

Comparison of mean scores indicated that personal communications regarding electricity saving were most frequent in China, and information from the mass media was also more available in there, which is suggestive of higher concerns regarding environmental issues among Chinese university students. Environmental issues such as air and water pollution are becoming very serious problems as a result of the economic growth

in China (Shao, 2008; Tanaka, 2007). Thus it is not surprising that people in China have higher concerns regarding environmental issues. China also had the highest behavioral scores. This result was consistent with the study by Yu, Fukada, and Tozuka (2005), which reported that pro-environmental behaviors were higher among Chinese, compared to Japanese university students. This is also consistent with data that energy consumption per person is much lower in China compared to Japan and Germany⁵⁾. Even if energy consumption per person were the lowest in China, energy consumption in China as a whole was the largest in the world in 2017⁶⁾. Thus, further research to understand factors contributing to promoting energy saving behaviors in contemporary China is highly needed.

Summary

The present study found that personal communications have stronger effects on antecedents of pro-environmental behaviors. This result indicates that exposure to information from the mass media is insufficient to motivate individual pro-environmental behaviors. There is a need to increase communications between individuals on environmental issues in order to promote environmental behaviors. This result was universal, even among countries with different interpersonal orientations, which is suggestive of the cross-cultural robustness of the results. Implications for our society is that when policy makers want to promote pro-environmental behaviors, they should try to give more opportunities for citizens to talk with each other about their experiences on their environmental behaviors.

One of the limitations of this study was that the respondents were limited to university students. Further studies would be needed to examine the effect of personal communications and the mass media in a broader context. The second limitation of the study was that it is based on questionnaire data, which is insufficient to

examine causal relationships in the effect of personal communications and the mass media.

Despite these limitations, we believe that this study has strengths. The present study was conducted in three countries including both Eastern and Western cultures, which enabled us to examine cross-cultural aspects of how personal communications and the mass media affected environmental behaviors. Various studies have examined the effect of mass media information (e.g., Staats et al., 1996; Stern, 1999; Syme, Seligman, Kantola, & MacPherson, 1987) and of personal communications (e.g., Ando & Hirose, 1999; Archer et al., 1987; Everett & Peirce, 1991) on environmental behaviors separately, however the studies that compared the effects of information from mass media and personal communications on environmental behaviors are very few, and the studies that compared these effects cross-culturally are even fewer. The present study contributes to our understanding of the role of personal communication and mass media on promoting environmental behaviors.

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NOTES

- ¹⁾ Ministry of the Environment (2017). Statistics in environment, Ch.1. <http://www.env.go.jp/doc/toukei/contents/pdfdata/h29/2017_1.pdf>, 01/20/2021 referred.
- ²⁾ In Germany, air conditioning was not included in the items because air conditioning is not usually used. Over-using air conditioning was not included in the other scales as well in Germany for the same reason.
- ³⁾ Agency for Natural Resources and Energy. (2011 updated). Japan's Energy White Paper 2011. Ministry of Economy, Trade and Industry. <<https://www.enecho.meti.go.jp/en/category/whitepaper/>>, 08/28/2020 referred.
- ⁴⁾ The percentage of female students were larger in China probably because the university in China focused on foreign

language.

- ⁵⁾ International Energy Agency Atlas of Energy. (2020 updated). CO2 Emissions from Fuel Combustion. <<http://energyatlas.iea.org/#!/tellmap/1378539487/4>>, 28/8/2020 referred.
- ⁶⁾ BP. (2018 updated). BP Statistical review of world energy 67th edition. <<https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf>>, 08/28/2020 referred.

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