

Local and Global Messages for Prompting Energy Conservation Behaviour: An Experimental Study in University

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Article history

Received :1 November 2014

Received in revised form :

31 March 2015

Accepted :30 April 2015

Abstract

To create a cost effective environment during the management of building facilities, energy conservation is important among building users as it can help to conserve energy and reduce energy cost. To promote energy conservation, the behavior of user should be focused where their behavior should be improved to reduce energy wastage. Prompt is among the simplest and inexpensive behavioural interventions to improve energy conservation behavior. The prompt has been used wisely in healthcare sectors to promote healthy lifestyles, but no recent study on energy conservation behavior. The aim of this research was to investigate the effectiveness of prompt in prompting energy conservation behavior among the building users in university. An experiment was designed and carried out to examine the effectiveness of local and global types prompt messages for prompting efficiency use of energy. This research findings show that there was no significant difference between local and global types prompt messages, however, the findings indicate that both prompt messages were able to prompt the behavior change among the energy users and local type prompt message was more able to prompt the users than global types prompt messages. This finding could provide the useful information to society nowadays on using prompt to manage the energy efficiently.

Keywords: Prompt message; behavior interventions; energy consumption; energy conservation behavior; experimental study

Abstrak

Untuk mewujudkan persekitaran kos efektif dalam pengurusan kemudahan bangunan, pemuliharaan tenaga adalah penting di kalangan pengguna untuk memelihara sumber tenaga dan mengurangkan kos tenaga. Untuk mempromosikan pemuliharaan tenaga, kelakuan pengguna perlu diberi tumpuan, di mana kelakuan pengguna perlu diperbaiki bagi tujuan mengurangkan pembaziran tenaga. "Prompt" merupakan salah satu intervensi tingkah laku yang paling mudah dan murah untuk memperbaiki kelakuan pengguna. "Prompt" telah digunakan secara meluas dalam mendorong cara hidup yang sihat dalam sektor kesihatan, tetapi tiada kajian terkini yang dijalankan ke atas kelakuan pemuliharaan tenaga. Jadi, tujuan kajian ini adalah untuk mengkaji keberkesanan "prompt" dalam mendorong kelakuan pemuliharaan tenaga di kalangan pengguna. Satu eksperimen telah direka dan dijalankan untuk mengkaji keberkesanan mesej "prompt" jenis tempatan dan global untuk mendorong penggunaan tenaga dengan cekap. Keputusan kajian ini menunjukkan bahawa tiada perbezaan yang signifikan antara mesej jenis tempatan dan global, akan tetapi kajian ini menunjukkan bahawa kedua-dua mesej ini dapat mendorong perubahan tingkah laku di kalangan pengguna tenaga, dan mesej jenis tempatan lebih mampu untuk mendorong pengguna daripada mesej jenis global. Keputusan ini boleh memberikan maklumat yang berguna kepada masyarakat pada masa kini tentang penggunaan mesej "prompt" dalam pengurusan tenaga yang efektif.

Kata kunci: Mesej Prompt; intervensi tingkah laku; penggunaan tenaga; kelakuan pemuliharaan tenaga; kajian eksperimen

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1.0 INTRODUCTION

Energy plays an important role in human society and economic development (San *et al.*, 2012). It is a resource that is essential for people to continue daily activities, notably in providing food, shelter, water, sanitation, healthcare service and access to information. However, the continuous growth of world energy consumption has increased the rate of global warming and

worsened the ecological environment (Kofi *et al.*, 2012). When increasing energy consumption has come to the issues, the energy management is now becomes the area to be concerned in the management of building facilities as proper energy management can help to reduce the building energy consumption. Energy management usually includes planning and operation of energy-related production and consumption units with the aims of resource conservation, climate protection

and cost savings, while the users' daily activities would not be disturbed. To facilitate these aims, an energy conservation culture must be fostered among users.

Energy conservation is the best inexpensive option available to reduce energy consumption and hence the emission of CO₂ (Blok, 1993). To create a sustainable future, universities must be at the forefront to lead a sustainable development since they mainly educate and bring up students who would become future leaders (Choong, Chong, Low, & Hakim, 2012). Education centres such as universities should be targeted to improved energy efficiency, with the establishment of International Sustainable Campus Network (ISCN). With the need for universities to conserve energy being well recognized, universities should establish energy management programs to integrate a sustainability concept into campus operations in order to be responsible for a sustainable future (Pike *et al.*, 2003).

Many environmental problems, such as energy use, are related to human behaviour and, consequently, could be reduced through behavioural changes (Abrahamse, Steg, Vlek, & Rothengatter, 2005). According to Herring (2006), changing consumer behaviour may offer a further, substantial contribution to the energy-saving capacities of modern technology. While 'most policy making efforts to reduce the environmental impact of energy consumption focused on energy-efficient technology and renewable energy resources...changing people's behaviour may also significantly reduce energy consumption' (Kok, Lo, Peters, and Ruiters, 2011, p. 5280-5286). Energy conservation behaviour is an increasingly important area in energy management.

According to Sussman and Gifford (2012), one of the easiest ways to begin curbing the use of household electricity is to reduce waste by changing behaviours that minimally affect quality of life. They also found that although other behavioural interventions could be applied to encourage turning off the lights in unoccupied rooms, using a prompt is one of the simplest. A prompt is anything used to stimulate or trigger someone to take action or serve as a reminder. It has been used and tested by researchers in promoting the use of the staircase instead of a lift (Lewis & Eves, 2012; Nocon *et al.*, 2010; Webb and Eves, 2007) and proved to be effective. In recent research carried out by Scannell and Gifford (2011), local and global prompt messages were investigated to examine their effectiveness in prompting citizens' climate change engagement. In their research, local messages were found to be more effective than global messages in influencing the citizens' climate change engagement.

To date, there has been little investigation on the effectiveness of prompts in promoting efficient use of energy. Questions have been raised about the effectiveness of prompts in stimulating energy conservation behaviour among building users. Even though Sussman and Gifford (2011) studied the effectiveness of visual prompts for energy conservation purposes, more empirical evidence should also be presented to show how effectively a prompt cultivates energy conservation behaviour. Scannell and Gifford's (2011) research on local and global messages influencing the citizens' climate change engagement could be applied for energy conservation purposes, as energy consumption can directly lead to climate change. With the rising energy consumption in today's society, local and global messages could be applied to prompt greater engagement of individuals in conserving energy and indirectly, help to reduce climate change. The purpose of this paper is to investigate the effectiveness of local and global prompt messages as interventions in promoting energy conservation behaviour among staff in educational settings.

The paper has been organized in the following way: Section 2 provides the explanation of a prompt as a behavioural intervention. Section 3 and Section 4 illustrate our research methodology and experimental design. Section 5 provides an

explanation of results. Section 6 discusses our findings and Section 7 provides the conclusion for this study.

■2.0 PROMPT AS BEHAVIOURAL INTERVENTION IN STIMULATING ENERGY CONSERVATION BEHAVIOUR

A prompt is anything that triggers people to act or functions as a reminder. A prompt can be available in different forms such as a verbal prompt or a visual prompt. In recent years, there has been an increasing use of prompts in healthcare studies, notably on examining its effectiveness in promoting the use of the staircase instead of a lift among the users. Previous studies (Lewis & Eves, 2012; Nocon *et al.*, 2010; Webb and Eves, 2007) have revealed that a prompt is effective in promoting use of the staircase instead of a lift with the condition that it occurs in the right setting with an appropriate persuasive message. A considerable number of studies have been done on prompt messages for other domains such as transportation (Huybers, Van Houten, & Malenfant, 2004), health (Bungum, Meacham, & Truax, 2007; Mayer *et al.*, 2001; Webb and Eves, 2007) and pro-environmental behaviour (Austin, Hatfield, Grindle, & Bailey, 1993; Werner, Rhodes, & Partain, 1998). However, there is a lack of research in recent years examining the effectiveness of prompts on energy conservation behaviour. Most literature published on prompts for energy consumption (e.g., verbal reminders, notices, and flyers [Hayes & Cone; Kohlenberg, Phillips, & Proctor; Palmer, Lloyd, & Lloyd] and information brochures [Winett & Nietzel] as cited in Luyben, 1980) shows that prompts were effective in stimulating behaviour improvement among users to conserve energy. However, these studies were conducted over 30 years ago and it is unclear if the findings still persist in light of changes in society's lifestyle over the years.

More recent research by Sussman and Gifford (2011) proved that visual prompts increased the frequency of "lights off" behaviour among users at a university. In their research, signs prompting individuals to turn off lights upon leaving were placed in university washrooms and the findings showed that more lights were turned off when the signs were presented than when no signs were presented. The findings also showed that larger signs are more effective in attracting the attention of users and stimulating behaviour improvement in taking action to conserve energy.

Local and global messages are two types of prompts that are proven effective in prompting the climate change engagement of citizens in the research carried out by Scannell and Gifford (2011) and local messages are found to be more effective than global messages in prompting climate change engagement of citizens. One commonly held reason for climate change is inefficient use of energy. Thus, the engagement of energy users in conserving energy is highly encouraged. The local and global messages which are proven effective in prompting the engagement of citizen in reducing climate change might be suitable in the context of prompting energy conservation behaviour among users because both focus on individuals' engagements. However, the effectiveness of both local and global messages for prompting energy conservation behaviour still needs to be examined through research.

■3.0 METHODOLOGY

An experiment was designed and carried out for this research in order to examine the effectiveness of prompts. The prompt messages employed in this research were adapted from the types of messages used by Scannell and Gifford (2011) to influence citizens' climate change engagement. The prompt messages employed were local and global. The messages focused on an air-conditioning system asking the participants to

set the temperature at 24 degrees Celsius which is in line with the new ruling, in 2011, for government offices to set the temperature of air-conditioning no lower than this for energy efficiency purposes. The local and global messages are shown below:

Local Prompt Message:

*Let's set the air-conditioning's thermostat at 24°C!
It helps UTM to save money on electricity bills!
It grants extra money for better facilities for UTM!!!*

Global Prompt Message:

*Let's set the air-conditioning's thermostat at 24°C!
It helps the world mitigate climate change!
It grants a better environment for future generations!!!*

The experiment was conducted in the lecturers' offices from a selected three blocks in Universiti Teknologi Malaysia (UTM). The participants included 30 lecturers from the selected faculties whose offices were equipped with an individual air-conditioning unit. A small sample was chosen because of the expected difficulty to obtain cooperation from lecturers to participate in this study.

■4.0 EXPERIMENTAL DESIGN

The participants were grouped equally into three groups: two experimental groups and one control group. A control group was used as a baseline measure. The control group had no manipulation, therefore the changes in the other groups were more easily observed. Figure 1 shows the design of the experiment for the experimental groups and the control group.

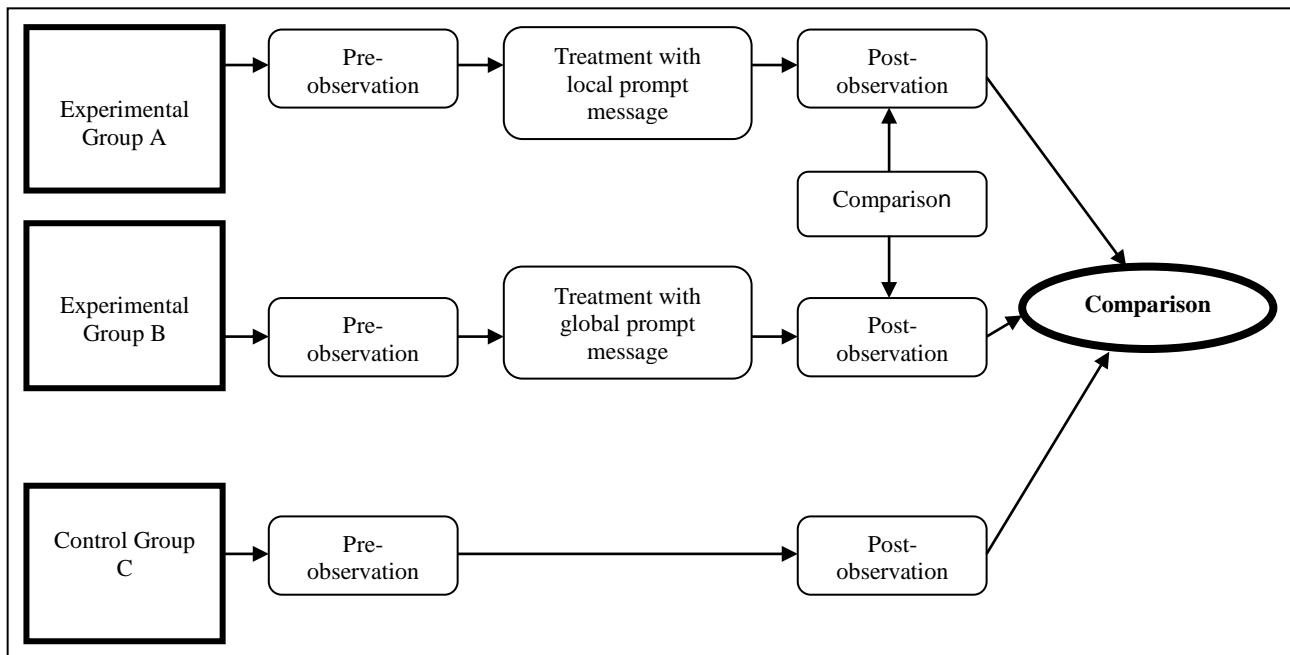


Figure 1 Designation of experiment

As shown in the Figure 1, there were experimental Groups A and B, and control Group C. Pre-Observation were carried out for all three groups before any prompt message was given to the participants. The purpose of this pre-observation was to examine the existing air conditioning use behaviour among the participants by recording the temperatures set by the participants. After this, Experimental Group A received the Local Prompt Message while Experimental Group B received the Global Prompt Message. There was no message given to control Group C. After two weeks following the Pre-Observation, the Post-Observation was carried out for all three groups. The temperatures of air-conditioning set by the participants during the Post-Observation were recorded to examine the effectiveness of the local and global prompt messages in prompting energy conservation behaviour among the participants. The data collected in Post-Observation for all the three groups was compared to reveal the difference of the participants' air-conditioning use behaviour between the experimental groups and control group, and also between the two experimental Groups A and B.

There were three hypothesis of this research:

1. Alternative Hypothesis (H₁): Local prompt message is effective in prompting energy conservation behaviour.
2. Alternative Hypothesis (H₂): Global prompt message is effective in prompting energy conservation behaviour.
3. Alternative Hypothesis (H₃): Local prompt message is more effective than the global prompt message in prompting energy conservation behaviour.

The alternative hypotheses H₁ and H₂ will only be accepted if the results of data analysis for Local Message Group and Global Message Group satisfy the two conditions in this research. The first condition is that there is an improvement of means from Observation I to Observation II for both groups. The second condition is a significant difference at p value < 0.05 for Observation I and Observation II using a paired-sample t -test.

The third alternative hypothesis (H₃) will be accepted if the two conditions are satisfied when comparing the results of Observation II for Local Group and Global Group. The first condition is the change in means in Observation II for Local

Group is higher than Global Group. Then, followed by the second condition, there is a significant difference at p value < 0.05 for the result of Observation II between Local Group and Global Group through the independent-samples t -test.

5.0 DATA ANALYSIS AND RESULTS

The Pre-Air-conditioning Use Behaviour Observation and Post-Air-conditioning Use Behaviour Observation were used to examine the participants' behaviour. Based on participant actions, one score was given to participants who performed the setting of air-conditioner temperature no lower than 24°C. Those who did not set the air-conditioning temperature lower

than 24°C would receive no score. The raw scores collected were used in the interpretation of the results. Statistical Package for the Social Sciences (SPSS) was used as a tool to analyse the data collected in this research. To compare the scores for Observation I (before treatment) and Observation II (after treatment), paired-sample t -test was carried out in analysing the data collected. Observation II was carried out 2 weeks after the treatments were given in Observation I. Table 1, Table 2 and Table 3 below show the results of the descriptive analysis and paired-sample t -tests. The scores state in the Table 1 below show the number of participants set the air-conditioning at 24 degree Celsius for each group for both Observation I and Observation II.

Table 1 Comparison between the descriptive analysis of observation I and observation II for experimental groups and control group

Group	N	Observation I scores (out of 10)	Observation II scores (out of 10)	Observation I Mean	Observation II Mean	Changes
A	10	5	7	0.50	0.70	20%
B	10	6	7	0.60	0.70	10%
C	10	5	4	0.50	0.40	-10%

Table 2 Paired-Sample t -Test for observation I and observation II for experimental groups and control group

Group	Variables	Mean	Sig. (2-tailed)
A	Observation I Observation II	-0.200	0.443
B	Observation I Observation II	-0.100	0.343
C	Observation I Observation II	0.100	0.591

Table 3 Independent-samples t -Test for local message group and global message group for observation II

Pair	Mean Difference	Standard Deviation Difference	df	Sig. (2-tailed)
Local Group - Global Group	0.000	0.816	9	1.000

6.0 FINDINGS AND DISCUSSIONS

Comparison of Observation I and Observation II scores illustrated a slight improvement for Group A and Group B, and a slight reduction for Group C (see Table 1). Meanwhile, the results of paired-sample t -test for Observation I and Observation II shown in Table 2 indicated that there was no significant improvement for any group.

As shown in Table 1, there was slight increase in the mean for Group A (Local Message Group), where the mean rose from 0.5 (Observation I) to 0.7 (Observation II). However, the analysis of a paired-sample t -test (see Table 2) showed that there was no significant difference between Observation I and Observation II at $p > 0.05$. Therefore, the first alternative hypothesis (H_1) which was local message is effective in prompting energy conservation behaviour, was rejected and the null hypothesis (H_0) was accepted.

The mean of Group B (Global Message Group) rose from 0.6 (Observation I) to 0.7 (Observation II; see Table 1). Even though a slight increase of mean score from Observation I to Observation II was observed, there was no significant difference between these two observations at $p > 0.05$. Hence, the second hypothesis (H_2) which was global message is effective in prompting energy conservation behaviour, was rejected in this case and the null hypothesis was accepted.

For Group C (Control Group), Table 1 showed that there was no increase but rather a reduction in mean from Observation I to Observation II. Furthermore, the results of a paired-sample t -test showed that there was no significant difference between Observation I and Observation II for this group.

The mean scores for Group A (Local Message Group) and Group B (Global Message) rose from 0.5 to 0.7 (20%) and 0.6 to 0.7 (10%) respectively. On the other hand, the mean scores

of Group C for Observation I were 0.5 and mean scores for Observation II decreased to 0.4. However, further paired-sample *t*-test indicated that there was no significant improvement for any group.

Overall, a difference could be seen when the results of control Group C were compared to the results of the experimental Groups A and B combined. The control Group C showed no significant improvement and the mean scores slightly dropped from 0.5 to 0.4. For experimental Group A and Group B, although the interpretation of the paired-sample *t*-test results indicated that there was no significant difference between Observation I and Observation II for both experimental Group A and Group B, but from the mean scores obtained, it indicated that there was no reduction of mean scores within the group and yet there were slightly increases for the mean scores within groups. From this, it could be seen that there was slight difference between the experimental groups and control group. Hence, it could be concluded that both local and global messages were able to improve the behaviour of participants as the increase in the mean scores occurred in experimental groups (which received the treatment of prompt message), while reduction of the mean scores occurred in the control group (which received no message at all) for Observation I (before treatment) and Observation II (after treatment).

Further, comparing the increment of mean scores for both experimental Groups A (Local Message Group) and B (Global Message Group), the mean score of Group A rose more than that of Group B, where the increment for Groups A and B were 20% and 10%, respectively (see Table 1). In these data, the local message was slightly more effective than the global message in improving energy conservation behaviour among the lecturers. Nevertheless, the independent-samples *t*-test presented in Table 3 showed that there was no significant difference between Local Message Group and Global Message Group for Observation II at $p > 0.05$. Due to the two specified conditions were not fulfilled, the third alternative hypothesis (H_3) which was local message is more effective than the global message in prompting energy conservation behaviour, was rejected in this case, and the null hypothesis was accepted.

This study revealed that there was no significant behaviour improvement either for the Local or Global Message Group and there was no significant difference between these groups. This is in contrast to the findings of Scannell and Gifford (2013) where local messages were more effective than global messages in changing climate engagement than receiving no message at all. In our study, even though significant improvement could not be seen from the statistical analysis, it could be noted that the increase of mean scores for local message group was slightly higher than the global message group and both local and global messages were able to improve the energy conservation behaviour of the lecturers. These results may be due to differences in sample size between these two studies. We also discovered that many of the staff utilised these air-conditioning practices independent of our study.

7.0 CONCLUSION, LIMITATION AND DIRECTION OF FUTURE RESEARCH

The findings of this research show that prompt messages applied in the experimental study improved energy conservation behaviour among participants. By comparing the experimental groups and control group, the findings show that, a slightly behaviour improvement happened in the experimental groups, meanwhile declination happened in control group. Although, the Pre- and Post-Score within each group did not differ significantly due to the limitations described above. However, the findings show that both experimental groups which had behaviour intervention of prompt message showed greater improvement than control group which did not have any intervention of prompt message, where control group showed a

decline in participants' energy conservation behaviour. Until today, there are fewer studies done on examining the effectiveness of prompt message for energy conserving purposes. So, more research is strongly encouraged in the coming future to investigate the effectiveness of prompt messages and explore how any intervention is better than none.

There are several recommendations for future researchers in conducting similar research regarding the use of prompt messages in conserving energy. Our recommendations aim for future studies to examine the effectiveness of a prompt message in conserving energy. The major limitation of this research is a small sample size. Sample size may affect the validity of the results. Hence, the recommendation for the future researchers is to enlarge the sample size of the experimental study.

After reviewing previous research, there is little research is done on prompts in terms of energy conservation purposes. More research examining prompts for the purpose of energy conservation should be carried out in the coming future to truly examine its effectiveness. There are many types of prompts such as visual prompts, brochures, etc., and future researchers are encouraged to expand their research field to other types of prompts instead of prompt messages. More future research is important to help expose more information to today's society for using a prompt as one of the efforts for energy conservation.

Acknowledgement

Author would like to acknowledge that this work is supported by the UTM Flagship Project with Cost Centre No. Q.J130000.2427.01G48.

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