Original Paper

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Message Framing and Exercise Effects in Mobile Fitness Application: Repeated Measure Design and Playtest Experimental Study

Abstract

Background: The ultimate goals of exercise contents in the form of apps are to manage and nurture users’ exercise habits. To promote and maintain their desire for exercise, app developers focus not only on the utilization of various media characteristics for fitness apps, but also on the composition and effects of messages that stimulate and reward users’ exercise behaviors.

Objective: This study sought to verify differences in user experiences and exercise experiences depending on the message framing provided by a mobile fitness app, based on evaluation of the variables of perceived benefit, exercise interest, exercise flow, and exercise attitude.

Methods: The research was designed following the repeated measures design and the playtest method, in which experiments were repeated multiple times for the same group based on the type of message on the fitness app (male 50, female 50). This enabled effective verification of the difference between experimental treatments. Participants were instructed to use two types of fitness app that presented gain or loss messages about exercise outcomes while performing exercises. Thereafter, they were surveyed with a self-administered questionnaire.

Results: Users who were exposed to gain-framed messages in the mobile fitness app showed higher perceived benefit, exercise interest, and exercise flow than those who
were exposed to loss-framed messages. Furthermore, gain-framed messages also led to a positive attitude toward exercise. 

**Conclusions:** The present study is meaningful due to its investigation of the influences and persuasive effects of gain- and loss-framed messages given by a health fitness app. This study, which demonstrated that gain-framed messages enhanced the exercise experiences of users compared to loss-framed messages when persuasive messages were presented through a health functional app, provides a theoretical foundation for health message framing in exercise apps.

**Keywords:** Fitness App; Message Framing; Perceived Benefit; Exercise Interest; Exercise Flow; Exercise Attitude

**Introduction**

**Background**
As personal and social expectations for a healthy life increase, modern individuals have become more interested in quality of life, and have an increased desire to enhance and manage their health. In particular, the popularization of smartphones has been used to broaden the range of applications (hereafter, apps), resulting in a number of app-type contents, and health app contents have gradually been diversified to target the various needs of health management. Modern individuals can now easily manage their health using smartphone health apps at any place and any time. Moreover, the scope of health management has expanded to various areas, ranging from diet and management of chronic diseases to exercise. In other words, mobile health app contents have become more specialized by area and function, for easier health management [1].

On the other hand, staff in the media communication area are seeking various methods to induce various and positive responses from users. Such methods include the design and development of messages presented by the media. Users can differently interpret the messages delivered depending on the message type; this in turn entails the possibility of forming user attitudes and behavioral decisions [2]. In other words, its effects change depending on the meaning of the message as interpreted by the users. Therefore, during media communication, it is highly important for users to be exposed to messages that are appropriate to their situations and goals.

In addition, studies on the persuasive effects of media have revealed that consumers show different responses to media with the same characteristics depending on whether the message contents are positive or negative [3]. In other words, the persuasive effects of messages were altered depending on the subjective environmental characteristics and goals, as there are differences in subjective value and the standard of messages that users perceive.

The ultimate goals of exercise contents in the form of apps are to manage and nurture users’ exercise habits. To promote and maintain their desire for exercise, app developers focus not only on the utilization of various media characteristics for fitness apps, but also on the composition and effects of messages that stimulate and
reward users’ exercise behaviors [4].

In the same context, studies have focused on how the exercise message design of fitness apps, which is the major component of such apps, affects the exercise environment of users. Many studies have been conducted in relation to health message framing in previous health-related campaigns. For instance, one study reported that when exposed to messages that induce a particular health behavior, people tended to make decisions about their behaviors in consideration of the gain or loss that may accrue from that behavior [5]. In other words, people tended to decide their attitudes toward a behavior depending on the intended frame of the message. Thus, such health message framing can be applied to the design of exercise messages on fitness apps. However, few studies have been conducted on the messages given in health media, and on the consequent causal relationships between user experiences and exercise effects.

Thus, the present study divided content messages with a fitness function in the mobile app environment into gain and loss messages. In this way, the effects of each message framing on the exercise experiences of users were analyzed.

**Theoretical Background**

**Message Framing**

To date, studies on message framing have focused on the development of messages for effective health promotion campaigns [6, 7, 8]. When health messages are written for health promotion, messages framing how effectively the same content is composed and delivered to users is a critical factor in terms of the persuasive effects of the messages. The theoretical foundation of message framing effects is based on prospect theory [9]. According to this theory, when exposed to messages that induce particular behaviors or alternatives in certain situations, people tend to process the messages considering the gains and losses resulting from the behaviors encouraged by the messages. Therefore, depending on the framing in which the messages are delivered, users interpret different meanings in the messages.

In prospect theory, gain-framed messages emphasize the benefits that users may accrue by engaging in the behavior suggested by the message, whereas loss-framed messages focus on the disadvantages of not engaging in certain behaviors; that is, they emphasize the losses [10]. Hence, in the present study, gain messages suggest the benefits that users may accrue by doing the exercise proposed by the messages, while loss messages indicate the negative consequences of not doing that exercise.

Studies on gain and loss framing have focused on which framing has a greater persuasive effect, depending on various health-related themes, in which the effects of messages changed depending on the behavioral attribute recommended by the messages [11]. According to a previous study, the target behaviors frequently presented in health messages are largely prevention and detection behaviors. For example, it was reported that gain framing was effective for the message of obesity prevention, because obesity preventive behavior related in the message could lead to the idea that the risk caused by obesity should be prevented [12]. In contrast, it was found that loss framing was more effective for messages recommending users to
take actions to monitor and detect diseases, such as endoscopy or self-diagnosis of cancer [13]. As such, the persuasive effects of health messages differ depending on the goal and type of framing.

On the other hand, a meta-analysis study of gain-loss framing found that the effects of messages and users’ attitudes are not always clearly distinctive [14]. Nevertheless, many studies reported that the messages in gain framing had higher persuasive effects in terms of preventive behavior, which helps personal health management and maintenance [15].

**Perceived Benefit**

Perceived benefit refers to the desirable outcomes and benefits perceived by individuals, meaning personal perception of the efficiency of the recommended behavior [16]. In a study on the effects of health messages, perceived benefit is a critical factor affecting behavioral decisions by positively influencing personal belief that health issues can be prevented. In addition, perceived benefit can be regarded as the psychological outcomes that users expect, because users are affected by surrounding stimuli before making a decision in relation to intended behavior [17]. Messages can be one of the surrounding stimuli that users receive, in which health promotional behavior is also affected by framing the mode of messages for users. In particular, gain framing was found to have higher persuasive effects on health targeting activities than loss framing. In addition, since gain framing shows the expected positive outcomes that users would obtain from exercises, it was predicted to be easier for users to perceive the benefits of health behavior. Thus, we proposed the following study hypothesis 1.

H1: Gain message framing in a mobile fitness app would have a higher level of perceived benefit for users than loss message framing.

**Exercise Interest**

Exercise interest refers to the degree of attention or interest in the outcomes of exercise behavior that users would obtain [18]. In terms of communication, interest is the first step in inducing users to become involved in contents, so that it is highly important to create interest in health promotional behavior, which has the possibility of inducing a positive attitude in users towards health behavior and improve their behavioral intentions [19]. In particular, we postulated that a fitness app that presents gain-framed messages would give users positive feedback in terms of exercise outcomes and increase their expectations for behavioral outcomes, which would maintain their psychological interest in future exercise behaviors. Therefore, we established study hypothesis 2 as follows:

H2: Gain-framed messages in a mobile fitness app would create a higher level of exercise interest in users than loss-framed messages.

**Exercise Flow**

While in the flow state, people experience pleasure and self-contentment from their behaviors by focusing all of their consciousness and physical organs on a single
H3: Gain-framed messages in a mobile fitness app would result in a higher level of users’ exercise flow than loss-framed messages.

Exercise Attitude

Exercise attitude refers to the positive will and conviction that users have in relation to exercise behavior itself [22]. In the results of a previous study on health message framing and exercise attitude, it was found that positively framed messages motivated regular exercise and formed a positive behavioral intention more than negatively framed messages [23]. In another study, which sent either gain- or loss-framed messages encouraging regular exercise to students who took no exercise, gain framing had a larger persuasive effect on exercise, which is a preventive health behavior [24].

As such, those studies that applied prospect theory to both the exercise and physical activity areas, and then investigated the persuasive effects of the message, commonly concluded that gain-framed messages had a relatively higher persuasive power than loss-framed messages. In other words, gain framing presenting the future outcomes of exercise in a positive manner can be a more effective message strategy for forming a positive will and attitude toward exercise. Thus, based on such discussion, this study established study hypothesis 4 as follows:

H4: Gain-framed messages in a mobile fitness app would result in a higher level of users’ exercise attitude than loss-framed messages.

Methods

Research Design

The present study sought to verify the effects of gain- or loss-framed messages in a mobile fitness app on perceived benefit, exercise interest, exercise flow, and exercise attitude. The research was designed following the repeated measures design and the playtest method, in which experiments were repeated multiple times for the same group based on the type of message on the fitness app. This enabled effective verification of the difference between experimental treatments. Participants were instructed to use two types of fitness app that presented gain or
loss messages about exercise outcomes while performing exercises. Thereafter, they were surveyed with a self-administered questionnaire. Investigators analyzed the collected data and conducted ANCOVA analysis using SPSS 19.0 to test the study hypotheses, by which the difference between the two groups (gain/loss messages) and the effects by covariance were investigated.

One hundred study participants were divided into two groups (50 each) to be exposed to either gain or loss messages from the fitness app. The fitness app that was used was “Enjoy Your Fitness” and was created by the researchers for this experiment. It was designed to send gain or loss messages in different versions, which were the major experimental treatments in this study.

Before the experiment, participants were given explanations about the experimental methods and precautions from the researchers, completed the consent procedure for this experiment, and then filled out a pre-questionnaire. The pre-questionnaire items included participants’ demographic characteristics and exercise involvement to identify the level of usual involvement in exercise. Thereafter, participants used the app, which gave messages in different message framing, for 10 minutes, followed by a post-survey.

**Operational Definition and Measurements**

For operation and measurement based on the theoretical background to this study and the hypotheses made, variables were designed as shown in Table 1 and each item was measured by a survey using a 5-point Likert scale.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Operational Definition</th>
<th>Number of Item &amp; Cronbach's α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Benefit</td>
<td>The degree to which an individual considers the goals and values of exercise feasible, or the degree of feeling that they are provided with a high level of usefulness and value for exercise</td>
<td>5 [25]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gain α: .771 Loss α: .888</td>
</tr>
<tr>
<td>Exercise Interest</td>
<td>The degree of an individual’s attention or interest in exercise behavior</td>
<td>5 [19]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gain α: .877 Loss α: .913</td>
</tr>
<tr>
<td>Exercise Flow</td>
<td>The state in which unnecessary outer information is unable to penetrate one’s thoughts or mind due to a complete flow in exercise</td>
<td>5 [26]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gain α: .831 Loss α: .800</td>
</tr>
<tr>
<td>Exercise Attitude</td>
<td>Positive will and attitude of an individual toward exercise behavior</td>
<td>6 [22]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gain α: .832 Loss α: .947</td>
</tr>
</tbody>
</table>
Results

Exercise Effects Difference Verification of Fitness App by Message Framing Type

To investigate the difference in effects of the gain and loss messages of the mobile fitness app on user experiences and exercise experiences, ANCOVA was performed measuring the exercise involvement of participants as covariance. The user experience variable (perceived benefit), as well as exercise experience variables (exercise interest, exercise flow, and exercise attitude) were used as dependent variables. In addition, exercise involvement was set as covariance to more clearly ascertain the difference in experience, depending on the message given by the fitness app. Since users’ previous recognition and attitudes toward exercise, termed exercise involvement and referring to their personal relationship with exercise, might have an impact as an exogenous variable of the dependent variables, it was considered necessary to control exercise involvement as covariance.

Table 2. ANCOVA on Difference in Exercise Effects by Message Type

<table>
<thead>
<tr>
<th>Variable</th>
<th>Source</th>
<th>df</th>
<th>F</th>
<th>η²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Benefit</td>
<td>Covariate: EI</td>
<td>1/97</td>
<td>6.251</td>
<td>.061</td>
<td>.01</td>
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<tr>
<td></td>
<td>Gain/Loss Messages</td>
<td>16.965</td>
<td>.149</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Exercise Interest</td>
<td>Covariate: EI</td>
<td>1/97</td>
<td>3.348</td>
<td>.033</td>
<td>.07</td>
</tr>
<tr>
<td></td>
<td>Gain/Loss Messages</td>
<td>17.738</td>
<td>.155</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Exercise Flow</td>
<td>Covariate: EI</td>
<td>1/97</td>
<td>.807</td>
<td>.008</td>
<td>.37</td>
</tr>
<tr>
<td></td>
<td>Gain/Loss Messages</td>
<td>16.805</td>
<td>.148</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>Exercise Attitude</td>
<td>Covariate: EI</td>
<td>1/97</td>
<td>4.644</td>
<td>.046</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td>Gain/Loss Messages</td>
<td>25.883</td>
<td>.211</td>
<td>.000</td>
<td></td>
</tr>
</tbody>
</table>

Note: EI = Exercise Involvement

Study hypothesis 1 related to user experiences depending on the message given by the fitness app. In other words, it was predicted that users exposed to gain messages by the fitness app would have a higher perceived benefit during their performance of exercise. This hypothesis was tested using the ANCOVA statistical method, and the results are shown in Table 1 above. There was a significant difference in perceived benefit, which was the user experience variable (F(1,97)=16.96, p < 0.01, η²=.149)), between gain and loss messages. Even when the exercise involvement of participants was controlled, the p-value of perceived benefit was .014, indicating a significant difference; however, its impact was lower than that of message difference.

Study hypotheses 2, 3, and 4 were formulated to test exercise experiences depending on the message of the fitness app. It was predicted that participants exposed to gain messages would have higher degrees of exercise interest and exercise flow, and be more positive in their exercise attitude. As in study hypothesis 1, ANCOVA was applied, which resulted in significant differences between the
exposed messages as shown in the values for exercise interest ($F(1,97)=17.73, p < 0.01, \eta^2 = 0.155$), exercise flow ($F(1,97)=16.80, p < 0.01, \eta^2 = 0.148$), and exercise attitude ($F(1,97)=25.88, p < 0.01, \eta^2 = 0.211$). Therefore, it could be interpreted that there should be differences in the effects of the message on exercise experience variables (exercise interest, exercise flow, and exercise attitude) according to the message difference of the fitness app. Even when the exercise involvement of participants was controlled, the p-value of exercise attitude was $0.034$, also indicating a significant meaning; however, its impact was smaller than that of message difference.

**Discussion**

**Conclusions**

The present study verified the exercise experiences and attitude differences of users, depending on the messages given by a mobile fitness app. The effects of messages in gain and loss framing respectively on perceived benefit, exercise interest, exercise flow, and exercise attitude were analyzed, for which purpose we created the mobile fitness app to present gain and loss messages in order to measure such effects.

Consequently, the group exposed to gain-framed messages showed higher degrees of perceived benefit, exercise interest, and exercise flow than the group exposed to loss-framed messages. In addition, exercise attitude was also more positive when exposed to gain-framed messages. These results were consistent with the results of previous studies as mentioned above [17, 19, 21, 24]. In other words, when using a fitness app that recommends exercise as a target behavior while focusing on health promotion, gain-framed messages can lead to more positive psychological experiences in users than loss-framed messages, resulting in exercise effects. Therefore, it is expected that gain-framed messages in relation to the outcomes of exercise, which is the target behavior, given through a positive rhetoric should have a more persuasive effect in future health communication. Thus, it seems more appropriate for media targeting behaviors such as exercise and health prevention to send users gain-framed messages rather than loss-framed messages in terms of their composition and design.

Based on the results of this study, it is also important for health functional media to deliver contents framed appropriately for the situations and goals of users in terms of the effects of health communication. The present study is considered significant due to its investigation of the influences and persuasive effects of gain- and loss-framed messages given by a health fitness app. In addition, this study is also considered meaningful due to its suggestion in relation to the theoretical and practical implications for future message design strategy in the development of functional apps or games with similar media characteristics.

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Conflicts of Interest
None declared.

Abbreviations
App: Application
EI: Exercise Involvement

References


