

# How Online Social Network and Wearable Devices Enhance Exercise Well-Being of Chinese Females?

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**Abstract.** Firstly, in the context of exercise, the current study explored the effects of online social network and wearable devices in the enhancement of Chinese females' subjective well-being. An in situ 2\*2 experiment design was conducted. Result showed that online social network was significantly related to positive affects. Wearable devices didn't show significance due to problems of accessibility. Secondly, this study explored the potential linguistic variables that could predict Chinese females' emotional well-being according to exercise-based online tweets. Regression model was applied to explore the relation between potential variables and participants' self-reported emotional states. Positive additional activities and number of likes were two important variables that could be referred for further analysis.

**Keywords:** Exercise · Subjective well-being · Social network · Wearable devices

## 1 Introduction

### 1.1 Enhancement of Subjective Well-Being

In recent years, exercise has become an important activity for Chinese people than ever before. According to a national survey [1], more than 49 % of the population participated in exercise, and the number is continuously rising. However, doing exercise for women is often not as enjoyable as for men due to motivational difference. Men are often driven by self-determined goals like competence, enjoyment and social interaction, while women often endorse weight and body-related reasons for exercise [2, 3]. It is reported that, under those external motivations, women experience body dissatisfaction and poor emotional well-being [4]. The bad exercise experience is associated with lack of autonomy and body dissatisfaction, making it difficult to fully benefit from exercise.

On the other point of view, improving women's exercise experience would help them gain more from the activity. For example, research showed that higher enjoyment

and mood enhancement could bring greater body satisfaction and self-esteem [5], and contribute to exercise adherence [6]. Therefore, to help enhance the cognitive level of exercise experience is crucial for women to get involved in the activity.

Subjective well-being (SWB) represents the self-perceived level of enjoyment based on two measurements: emotions and satisfaction with life. [7]. Two solutions were examined to improve SWB of exercise: online social network and wearable devices. Exploring their effects forms the first contribution of the present study.

Chinese females tend to express their experiences on social network sites (SNSs) after exercise. SNSs give them a platform for self-disclosure and communication. It is shown that these two functions of SNSs have positive effects on well-being. For example, study showed that the amount of self-disclosure on SNSs was positively related to affective balance and satisfaction with life [8]. Positive feedback from SNSs friends helped enhance self-presented SWB and psychological well-being through social support [9]. Moreover, SNSs remind users of their social connections and increase their self-esteem [10], which in turn, have positive effect on well-being.

Wearable devices have developed rapidly in China and exercise monitoring is the most important usage for customers. Some kinds of wearable devices can track physiological parameters (e.g., burnt calories, number of steps, distances) and provide performance feedback or exercise suggestions to users. Researches in this field now focus mainly on wearable technologies and applications. Our goal is to see if wearable devices have influences on SWB in the context of exercise.

## 1.2 Prediction of Emotional Well-Being

For some health-related organizations or companies, they show great interests in the general conditions of public exercise, such as collective exercise performance, public emotive trends, public opinions, etc. For example, government may be interested in the opinions towards public exercise facilities or wearable devices companies may concern users' emotional reaction of certain coaching plans. With the intervention of online social network, it is now possible for them to access exercise participants' emotional feedback based on online tweets.

Sentiment analysis is often used to evaluate users' opinion or affective state. Researchers have successfully showed the consistency of collective online sentiment and real-life contextual information [11, 12] Due to technological challenges, sentiment analysis now mainly focused on emotional words. For example, Dodds [13] looked at variation in emotional used in tweets and Facebook.

In the present study, we concentrate on the potential linguistic variables in online tweets, give a more complete linguistic analysis to the text than emotional words alone provide. Instead of mining millions of tweets by program, linguistic variables was manually recognized and classified by researchers in a small sample size. We considered that firstly, for some contextual linguistic variables, it was really challenging to find an effective way to implement the AI program and secondly, our goal here was not to try all possible candidate variables, but explore the potential variables that have not been tested ever, to better understand the components that contribute to the prediction. That was the second contribution of the study.

The results would be helpful to further sentiment analysis job when we seek for more independent variables to analyze the tweets of exercise.

## 2 Methodology

An in situ assessment was conducted to evaluate the main effects of online social network and wearable devices in the enhancement of subjective well-being. Online tweets were collected for the phase of sentiment analysis.

### 2.1 Participants

Twenty-eight Chinese female students from Tsinghua University participated in the experiment. Participants ranged in age from 19 to 26. Nearly 18 % exercise less than 30 min/week, 71 % between 30 min/week and 90 min/week, and 11 % exercise more than 90 min/week. All of them use SNS. 50 % use it more than 1 h/day, 14 % less than 0.5 h/day. Only 21 % of them have the experience of using a wearable device.

### 2.2 Measurement

Positive/Negative Affects Schedule [14] is a 12-item scale that is used to assess participants' emotional states. Six items represent the positive affect (pleasure, affection, joy, gratefulness, cheer, pride) and the other 6 items represent the negative affect (anger, shame, envy, anxiety, compunction, sadness).

The Satisfaction with Life Scale (SWLS) is a 5-item scale that was used to evaluate participants' cognitive judgment of satisfaction of life [15]. Both of the two schedules were answered on a 7-scale Likert form.

### 2.3 Procedure

All participants were asked to do the recommended level of exercise: jogging in the gymnasium no less than 30 min per time, 3 times per week and 3 weeks during a month. They were divided into 4 groups: with/without wearable devices and with/without online sharing. Participants in online sharing groups were asked to publish an online tweet on Wechat, currently the most popular SNS in China, in the context of exercise. It could be pure text, or text with emoticon, or with pictures, etc. Participants in wearing wearable device group were provided with Gudong's smart loop 2 and they were asked to use the device while doing exercise.

Self-reported emotional states were collected on the day when they did exercise. Satisfaction with life was obtained by SWLS at the beginning and the end of the experiment. Finally, participants were asked to take a 30 min interview individually with researchers. The interviews aimed at figuring out how social network and wearable devices influenced their self-reported SWB.

## 2.4 Sentiment Analysis: Recognition of Potential Variables

The online tweets published in the experiment were collected and there were 99 validate samples. 13 potential linguistic variables were defined as *Number of positive/negative emotional lexicons* (The classification of the emotional words refers to *HowNet Sentiment Dictionary* [16] ), *Number of positive/negative emoticons*, *Number of positive/negative physiological feeling lexicons*, *Number of exercise process words*, *Number of positive/negative additional activities* (topics, except exercise, mentioned in the tweet), *Number of exercise related pictures*, *Occurrence of self-portrait picture*, *Number of likes*, and *Number of replies*. The group of researchers manually recognized all the variables. Multiple linear regression model was applied to explore the relation between the variables and participants' self-reported emotional status.

## 3 Results

### 3.1 Main Effects of Online Social Network and Wearable Device

Descriptively, the level of positive affect ( $M = 25.366$ ,  $SD = 2.027$ ) was generally higher than that of negative affect ( $M = 10.104$ ,  $SD = 1.087$ ). On average, the group of social network sharing ( $M = 27.919$ ,  $SD = 2.002$ ) and using wearable device ( $M = 26.119$ ,  $SD = 2.179$ ) both reported more positive emotions than control group. However, wearable devices brought more negative emotion as well, which is not as expected. Online sharing group ( $M = 28.071$ ,  $SD = 2.784$ ) reported higher level of satisfaction with life than the control group ( $M = 25.964$ ,  $SD = 4.359$ ).

Two-way repeated ANOVA was conducted to examine the main effects of online social network and wearable device for positive/negative affects and each emotional state. Results showed that social network sharing had significant influence on positive emotions such as pleasure ( $p = .015$ ), joy ( $p = .034$ ) and cheer ( $p = .033$ ). Thus it was significantly related to positive affects as a whole ( $p = .046$ ). It had also significant influence on satisfaction with life ( $p < .01$ ). No significance was found for negative emotions. For wearable devices, only anxiety showed significance ( $p = .042$ ). Using wearable devices tended to make users more anxious.

### 3.2 Regression Model of Sentiment Analysis

It was shown that the number of negative emotional lexicons was significantly related to anger ( $p < .01$ ), anxiety ( $p < .01$ ), compunction ( $p = .025$ ), and sadness ( $p < .01$ ), while no significance was reported to positive emotional lexicons. It was interesting to note that number of positive emoticons was significantly related to anxiety ( $p = .012$ ). The more positive emoticons a young woman use, the more chance she may suffer from anxiety.

The number of exercise process words was positively related to cheer ( $p = .027$ ), pride ( $p = .018$ ), and it was negatively related to anxiety ( $p < .01$ ).

The number of positive additional activities was significantly related to all positive emotions: pleasure ( $p = .022$ ), affection ( $p = .019$ ), joy ( $p = .032$ ), gratefulness ( $p < .01$ ), cheer ( $p = .015$ ), and pride ( $p = .038$ ).

The number of likes showed significance to cheer ( $p < .01$ ), gratefulness ( $p < .01$ ), pleasure ( $p = .038$ ), and joy ( $p < .01$ ).

## 4 Discussion

### 4.1 Effects of Online Social Network & Wearable Device

The use of social network is positively related to the enhancement of positive affects and satisfaction with life. This result is consistent to existing conclusions as SNS is a platform of self-disclosure. Actually, there are two different types: honest self-presentation and positive self-presentation. Chinese females prefer the latter one because they try to maintain a positive self-portrait. According to Kim's path model [17], positive self-presentation could directly influence well-being, which emphasizes the result. It also explains that as Chinese females don't often send negative emotional expressions, it is difficult for them to relieve negative emotions through SNS.

Except for the enhancement of positive affects, the use of SNS helps to gain positive feedback and strengthens the relatedness with others. This can become one of the motivations of exercise. Intrinsic motivation based on social interaction is related to exercise adherence and intentions, especially for women [18]. Information feeding is another main function of SNS. It can make people stay motivated to exercise. Research suggested that an exercise-based SNS would give a social-supportive environment to encourage people to get involved in exercise [19].

Wearable devices showed no influence on positive affects and were significantly related to anxiety. According to participants' opinions reported in interviews, Davis's Technology Acceptance Model [20] could be useful to explain the results.

**Perceived Ease of Use.** The functionality of the device is not so user-friendly that 50 % of the participants reported that it was sometimes difficult to perform a task. The inconvenience made users pay great efforts and led to a decrease in autonomy. Participants felt unwilling to use it and it contributed little to the SWB.

**Perceived Usefulness.** Nearly 80 % of the participants reported that the tracking data (steps, distances, burnt calories) did not mean much for them. All participants complained that system errors existed while tracking data and they didn't believe that incorrect information would help them enhance exercise performance.

### 4.2 Prediction of Subjective Well-Being

The results of negative emotional lexicons were consistent to their polarity. As a classical variable, emotional lexicon showed its effects in many researches of sentiment analysis [13]. Positive emoticons were negatively related to gratefulness and pride, positively related to anxiety. This is due to the fact that female users have added more emotional dimensions in the expression of emoticon [21]. Participants reported that

positive emoticons were used to express self-mockery in some cases. Unlike the direct textual information as lexicons and emoticons, additional topics are difficult to be recognized by algorithm. Results showed that the positive additional topic had significant influence on all dimensions of positive affects.

Further job can be conducted to explore how the additional topics in tweets can be identified, how the polarity of the topic can be judged and how it reveals users emotional states. The number of likes had significant influence on positive affects because of the fact that likes give a way to provide positive feedback in SNS and it brings social support [9]. The number of replies is not significantly related to affects but as another source of text, it can be analyzed as well.

## 5 Conclusion

Social networking would be an indispensable part of tomorrow's exercise by improving experience, providing social supports and information. However, wearable devices today don't show their effects as expected. Design of the functionality and the information provided should be concerned to improve the accessibility.

Besides explored variables like lexicons and emoticons, positive additional activities and number of likes were found useful in the prediction of SWB. Further studies can try to find new valuable predictors, such as punctuations, through the same manually approach, and not necessarily in the context of exercise.

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