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Wearable fitness technology: A structural investigation into acceptance and perceived fitness outcomes

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ABSTRACT

Wearable fitness technologies (WFT) track physical activity, such as steps taken, calories burned and workout intensity, through a device that is typically worn at all times. While the market for WFT devices continues to grow, current theoretical understanding of adoption is lacking. Thus, in an attempt to extend the Technology Acceptance Model (TAM), the current study employs a structural equation model to increase current understanding of wearable technology use. Further, to better understand the outcome of WFT use, the current study examines the relationship among health related outcomes of WFT use such as overall exercise behavior and perceptions of health. Results support the TAM and WFT use was significantly related to perceived health outcomes.

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1. Introduction

Recent developments in technology have made monitoring fitness and health easy for consumers – anytime, anywhere, on any device. One such innovation is wearable technology, a category of devices that can be worn by a consumer and often includes tracking information. With an estimated growth of $485 million in annual shipments by 2018 (ABI Research, 2013), wearable technology such as trackers, notifiers and sensors continues to gain traction among consumers. According to Loechner (2015), 31% of consumers identified themselves as "self-trackers," defined as those who monitor health via apps, smart watches, wearable fitness trackers and/or websites, while 25% of non-users indicated interest in using self-trackers, and 20% lived with someone who was currently using a wearable self-tracker.

"Wearables" can be divided into three categories: "notifiers" that give information about the world around you, such as smart watches, "glasses" which use eyeglasses to create augmented virtual reality, and "trackers" which use sensors to record data (Stein, 2014). Wearable fitness trackers (WFTs), which fall into the latter category, have grown exponentially into an over $330 million industry (NPD Group, 2014). Moreover, according to ABI Research (2013), 61% of the wearable technology market is attributed to sports or activity trackers.

Research regarding WFT devices is still in its early stages and to date largely focuses on establishing accuracy and reliability (Byun, Barry, & Lee, 2016; Diaz et al., 2015; Huang, Xu, Yu, & Shull, 2016; Leininger, Cook, Jones, Bellumori, & Adams, 2016; Mahar, Maeda, Sung, & Mahar, 2014; Takacs et al., 2014). Thus, the current study seeks to better understand how, why, and with what effect people are using wearable activity devices. Specifically, this research will investigate the adoption of WFT devices and the subsequent impact on perceptions of health. First, to better understand why users have adopted WFT devices, this study seeks to test the Technology Acceptance Model (TAM) as it applies to WFT device use. Subjective norms and attitude will also be examined in the adoption process. Secondly, this study explores the relationship between WFT use and perceived health benefits.

2. Literature review

2.1. Adoption of wearable fitness trackers

Smartphone use continues to grow to unprecedented levels. According to Nielsen (2016), smartphones are the most used platform across all adult demographic groups. As smartphone technology continues to evolve, there has also been an increase in the use of complementary technology and content, such as mobile applications and syncing devices. This is evident in the growing

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WFT device market (Nielsen, 2014).

WFT devices track physical activity, such as steps taken, calories burned or workout intensity, through a device that usually worn on the wrist in the form of a bracelet. The 24/7 data collected by the device is transferred to a mobile application, either through wireless Bluetooth syncing or plugging the device into a phone, where goals, progress and activity can be tracked. Of all wearable technology products, WFT devices enjoy the highest levels of awareness among consumers, with one-third of Americans saying they have heard of the category and 28% saying they are likely to buy a device in the future (NPD Group, 2014).

While the market for WFT devices continues to grow, researchers have responded with a new wave of research. However, research has largely focused on establishing the accuracy and reliability of WFT devices (Byun et al., 2016; Diaz et al., 2015; Huang et al., 2016; Leininger et al., 2016; Mahar et al., 2014; Takacs et al., 2014). In contrast, little research has focused on WFT device adoption. For example, Kim and Shin (2015) examined psychological determinants of smart watch adoption. Findings revealed that the affective quality and relative advantage were associated with perceived usefulness, while mobility and availability led to greater perceived ease of use (Kim & Shin, 2015). Kim and Shin investigated smart watches, which are a type of WFT device, but its capabilities extend beyond simply tracking health and fitness activity (Low, 2015). While Kim and Shin also applied the TAM, they did not investigate smart watches as they pertain to health and fitness. Therefore, the purpose of this study is two-fold: (1) test the TAM model and (2) explore the relationship between WFT device use and perceived health benefits.

2.2. Technology acceptance

Introduced by Davis (1989), the TAM provides a framework for understanding the likelihood that individuals will adopt a new technology. Built as an extension of the theory of reasoned action (Fishbein & Ajzen, 1975), the TAM postulates that two key factors predict a technological acceptance: perceived usefulness and perceived ease of use. Defined as “the degree to which a person believes that using a particular system would enhance his or her performance” (Davis, 1989, p. 320), perceived usefulness describes the value users believe they could find in a WFT device. Meanwhile, perceived ease of use is “the degree to which a person believes that using a particular system would be free of effort” (Davis, 1989, p. 320). According to the model, perceived usefulness and perceived ease of use combine to develop behavioral intentions, which in turn lead to the adoption of a technology (Davis, Warshaw, & Bagozzi, 1992, p. 660). Moreover, these beliefs are assumed to determine a person's attitude towards using the technology. Thus, if using a new technology is evaluated favorably, meaning the attitude towards use is positive, the individual is expected to form an intention to use.

Research conducted by Gong, Xu, and Yu (2004) found that by increasing the perception of usefulness and preparing logical arguments, such as advantages of a new technology, users were more inclined to accept the new technology. Similarly, Zaremohzzabieh et al. (2015) found a positive relationship between perceived usefulness and behavioral intention to adopt a new form of information or communication technology. Additionally, perceived usefulness also impacts WFT adoption through attitudes. While the TAM has yet to be applied to wearable fitness technology, studies have examined the model within the context of other forms of wearable technology, such as solar-powered clothing. For instance, Hwang (2014) found perceived usefulness influenced consumers' attitudes towards purchasing solar-powered clothing.

The current study believes that consumers will form positive attitudes toward the WFT device, and as a result, influence WFT use. Thus, we hypothesize:

H1a. Perceived WFT usefulness will be positively related to WFT use.

H1b. Perceived WFT usefulness will be positively related to attitude toward WFT devices.

2.3. Perceived ease of use

Perceived ease of use is the second determinant of technology acceptance within the TAM (Davis, 1989). Within this study, perceived ease of use refers to the degree to which users believe that using a WFT device is easier than another system expected to be used by other fitness and health conscious consumers. According to Morgan (2012), “if the platform isn't easy to use and intuitive don't bother with it” (p. 119). This is confirmed by researchers who found perceived ease of use positively impacts intention to use technology (Bhattacheijee & Hikmet, 2008; Gefen & Straub, 2000; Lepervanche, 2006; Sentosa & Mat, 2012; Teo & Noyes, 2011). In addition to influencing behavioral intention, perceived ease of use is also believed to impact technology adoption through consumer attitudes (Davis, 1989). This aligns with studies suggesting a positive association between perceived ease of use and attitude (Gong et al., 2004; Moon & Kim, 2001; O'Cass & Fenech, 2003; Sánchez-Franco & Roldan, 2005). Similarly, Hsiao, Tang, and Chen (2013) found that perceived ease of use influenced the attitudes of elderly consumers in their acceptance of mobile wireless healthcare technology.

Thus, we hypothesize

H2a. Perceived ease of use of a WFT device will be positively related to WFT use.

H2b. Perceived ease of use of a WFT device will be positively related to attitude toward WFT devices.

2.4. Perceived health benefits

Previous research shows that fitness and exercise are most strongly influenced by a consumer's attitude toward physical behavior, support of others, perceived behavioral control and motivation (Kerner & Grossman, 1998). Guided by the theory of planned behavior (Ajzen, 1985, 1991), which describes the close relationship between specific behaviors and attitudes of an individual, “perceived health benefits” represent the overall perspective consumers have towards fitness and exercise and includes attitude in addition to subjective norms. Defined as “perceived social pressure to perform or not perform the behavior” (Norman & Smith, 1995, p. 440), subjective norms illustrate how others impact one's motivation to exercise or live a healthy lifestyle, and, as a result, adopt a WFT device. Prior research has applied the TPB to fitness-related studies, such as physical activity participation (Dzewaltowski, Noble, & Shaw, 1990; Gatch & Kendzierski, 1990; Kimiecik, 1992; Wankel, Mummery, Stephens, & Craig, 1994); however, the influence of subjective norms is generally unknown when it come to wearable fitness technology.

Since its inception, many studies have used the TPB to confirm that an individual's behaviors can be predicted by his or her intention to use a given product, service, or technology (Ajzen & Fisnbein, 1977; Ajzen, 1991; Sheppard, Hartwick, & Warshaw, 1988). As such, the TPB has often been used in TAM studies (Davis, 1989; Davis et al., 1992) to examine the relationship between attitude and intention to use (Shiro, 2008; Zhang & Aikman,

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