INTERNATIONAL JOURNAL OF RESEARCH AND INNOVATION IN SOCIAL SCIENCE (IJRISS)
ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue II February 2025

Effects of User Experience (UX) on Fitness Band Adoption and Health Behaviour in Malaysia

***Nurdayana Mohamad Noor, Izzal Asnira Zolkepli, Bahiyah Omar**

School of Communication, Universiti Sains Malaysia, Malaysia

DOI: https://dx.doi.org/10.47772/IJRISS.2025.9020049

Received: 26 January 2025; Accepted: 30 January 2025; Published: 02 March 2025

ABSTRACT

Numerous research has shown the importance of health communication in influencing health behaviour and the effectiveness of technology in assisting healthcare. This study investigated the potential of fitness bands adoption as wearable fitness technology in influencing health behaviour by identifying the user experience (UX) factors that are significant in affecting adopters' decision to adopt this device. For pragmatic and hedonistic adoption factors, the study expands the Technology Acceptance Model (TAM) by adding coolness factors and the need for self-tracking. The research is being carried out in Malaysia, a country with extraordinarily high rates of obesity and diabetes as a result of a sedentary lifestyle and a poor diet. Based on the study sample of 280 respondents of Malaysian citizens from diverse age group and education level, it is concluded that utility and usability are more significant in driving the adoption along with the need for self-tracking, and the adoption does influence health behaviour. The data shows that the moderating factors of fitness band self-efficacy had no significant impact on adoption while perceived coolness as driver to adoption was also insignificant.

Keywords: Smart Wearable Device, Health Behaviour, Technology Adoption, Human Computer Interaction, User Experience

INTRODUCTION

Health communication exerts a significant impact on individuals' knowledge, beliefs, attitudes, and behaviour, where communication can be presented as health warnings, communication campaigns [1]. It also helps them make better-informed decisions in health-related matters that can improve lifestyle [2]. Hence public health professionals, organizations and the governments could leverage their expertise to explore diverse forms of health communication such as new technology. Wearable activity trackers as one of the current new technology are believed to be able to ideally improve health and well-being while self-tracking which induces positive effects in the observed behaviour is increasingly popular as smart devices and applications are used to generate huge amounts of data about individuals' behaviour [3–5].

Activity trackers, smartwatches and fitness apps are expected to support consumers in their goal of achieving a healthy lifestyle since healthy living is recognised as one of the eight megatrends through to 2030 [6]. Fitness bands, the wrist-worn models come with displays that show times hence function as watches extend the adoption beyond health purposes and self-tracking . This potentially implies that this new technology can serve as a medium outside the particular context of its use as the intended message and form a new behaviour, as suggested by McLuhan [7]. Fitness bands therefore can reach the non-self-trackers provided that the factors to adopt is understood and amplified. Studying the phenomenon of fitness bands is crucial to understand the gradual growth of the adoption pattern and their user experience.

Therefore this study identifies elements that explain consumers' intention to use fitness bands by expanding the Technology Acceptance Model (TAM) [8] to user experience (UX) factors representing utility and usability. UX incorporates both pragmatic and hedonic product which contribute to positive experience as the ultimate goal of UX in order to produce better, more satisfying and pleasurable experience [9,10]. Despite being used excessively in technology adoption studies, most research that used TAM believed that it is necessary to extend this model by incorporating external variables due to wearable technologies' different features that can affect the adoption behaviour differently [11,12]. By understanding the complicated and context-sensitive topic of a fitness band's UX, this study also examines the influence of pragmatic attributes of fitness bands and the psychological needs representing the hedonic attributes of the devices by integrating perceived coolness [13] and need for self-tracking based on need fulfilment of Self-Determination Theory (SDT) [9,14]. Besides the predictors, efficiency in using technology can also influence behaviour. Research on health behaviour change interventions shows that a successful behaviour change on one aspect of lifestyle, such as quitting smoking, has the potential to increase confidence or self-efficacy in individuals with low motivation to attempt to change another aspect of their lifestyle behaviour, such as eating habits [15,16].

Theoretical Underpinning

There are over 350,000 mobile health applications (also known as mHealth) on major app stores in the healthcare arena [17]. The widespread use of social media leads to countless applications on wellness, exercise, and food plans, which are largely of interest to the youth [18]. As a result, health-related wearable devices that can be paired with mobile apps for health-monitoring, such as the Fitbit and Nike Fuel Band, have grown in popularity [19]. According to studies, user motivation, self-efficacy, utilitarian benefit, and visibility are a few factors that influence the intention to use these wearable devices [6,11,20,21]. However, the UX factors that drive the adoption of fitness bands for health-related purposes by the public are not widely studied. Even in clinical practice, the application of wearable device is limited since healthcare professionals do not acknowledge the extent of its capabilities, although they recommend it [22].

Long-term dedication to activity trackers positively affects health yet the public's unawareness of their existence and functions limits their ability to motivate healthier behaviour [21]. This indicates that there are barriers that delay its acceptance and usage. The devices being useful and usable in UX is a concern of its pragmatic attributes or values, which is imperative in defining its effectual usage as a product.

Besides pragmatic factors, technological acceptance had also been associated with the coolness factors in the determination and prediction of the success of new technology and new technological features [13]. Coolness factors epitomizes the hedonic product attributes in the field of UX that concentrates on the aspects of a product that amazes and excites users emotionally and psychologically [9]. Another hedonic factor that this study chose as a predictor to fitness band adoption is need for self-tracking which refers to the psychological need satisfaction in self-tracking for optimal motivation and personal well-being [14].

In this study, fitness band adoption is the conception to predict fitness band's diffusion as indicator of success based on the theory of the Diffusion of Innovation Theory (DOI) by Rogers where the term adoption is often associated with continuous usage [23]. As the outcome of the adoption, an improved health behaviour is predicted to occur as an influence from continuous usage of the device. Health behaviour involves actions taken to maintain good health and prevent diseases, like regular exercise and a balanced diet [2]. The effectiveness of using a fitness band may or may not enhance its impact on health behaviour, making fitness band self-efficacy a crucial factor in health behaviour change and promotion. As such, fitness band self-efficacy is considered a moderator in the relationship between adoption and health behaviour.

The study took a different approach where it focuses on adoption rather than acceptance, and on respondents who were actual fitness band users. Their perception can thus be more accurately analysed by capturing the reasons for adopting fitness bands as opposed to assessing their response on the ideation of fitness bands to them.

Diffusion of Innovation

Roger's DOI describes the pattern of new innovation adoption by explaining the innovation's momentum in diffusing through a population or social system where people adopt the new idea, behaviour, or product [24,25]. It is instrumental to anticipate technology acceptance and diffusion represented by its usage and adoption to measure success in various disciplines such as digital business [26]. Meanwhile, public health programmes used this theory to understand the target population and factors influencing their adoption rate [27]. Furthermore, successful communication transpires in a homophilous social system, where the rate of innovation may grow if it is compatible with the existing demands of potential adopters [28].

Health Behaviour and Self-Efficacy

Healthy lifestyle characteristics (HLCs), including diet, physical activity, and other habits like smoking and alcohol use, can directly impact and evaluate health behaviour [2,15]. Health behaviour encompasses any activity or habit undertaken to maintain, restore, or enhance health and improving it aligns with the United Nations' Sustainable Development Goals, aiming to promote health and well-being for all [16]. Enhancing health behaviour can be challenging for some individuals, requiring adjustments to daily routines to incorporate exercise [29]. Wearable fitness bands, acting as convenient health communication tools, contribute to promoting healthy behaviour through continuous self-tracking, particularly crucial in addressing the significant risk of diabetes associated with physical inactivity in Malaysia [30,31].

The widespread use of mobile health (mHealth) apps emphasizes the need for further research on adopting wearable technology for health management [32]. From 2013 to 2017, there were 463 studies on wearable devices, mostly experimental, with 26 percent focusing on technology's data collection quality and performance assessment (Shin et al., 2019). The prediction is that wearable fitness devices will align with the trend of prioritizing healthy living, listed as one of the eight megatrends until 2030 [6].

Therefore, understanding users' perspectives, such as motivations, self-efficacy, and utilitarian value in the context of wearable technology adoption become crucial, motivating this study to specifically address health behaviour impacted by user experience (UX) aspects. Additionally, self-efficacy, defined as an individual's belief in their ability to perform a specific behaviour, plays a crucial role in the adoption of wearable healthcare devices and health practices [34,35]. Studies suggest that successful behaviour changes in one aspect of lifestyle can boost confidence or self-efficacy, potentially leading to changes in other areas, such as diet or exercise habits [36]. By being context-specific, self-efficacy perceptions can measure its effect on user attitude. Therefore, self-efficacy is also explored in this study.

User Experience

UX is the experience created and shaped through technology, while in practice, UX is defined as every experience the user is going through when using a certain product, system or service[9,37]. In order to manipulate the environment using a product, these two pragmatic attributes are crucial; utility and usability [10]. Although both pragmatic and hedonic qualities are crucial for a holistic understanding, UX emphasizes that the pursuit of UX is not solely pragmatic. UX aims to comprehend users' experiences with technology, considering psychological aspects such as users' hopes and trust [20,38].

Exploring the hedonic attributes, specifically the enjoyment and fun associated with using a technology, is crucial. However, these traditional aspects are deemed inadequate in today's advanced society and consumer culture, where users are more discerning, critical, and analytical in deciding to adopt new products [39,40]. Additionally, exploring the coolness factor, a contemporary aspect influenced by consumerism, is essential in understanding users' demands and decisions to adopt new products, particularly in the context of fitness bands.

Pragmatic Attributes

The pragmatic attribute in UX design focuses on the practicality and functionality of a product, emphasizing its ability to meet user needs efficiently. This attribute is best represented with TAM’s framework that understand user attitudes toward technology adoption. According to TAM, users are more likely to adopt a technology if they perceive it as useful and easy to use, which is influenced by its pragmatic attributes such as efficiency and usability.

Technology Acceptance Model

Research over the decades has focused on identifying factors influencing technology use, particularly through this model. TAM, based on the theory of planned behaviour, predicts individual technology use based on perceived usefulness (PU) and perceived ease of use (PEOU) [41]. PU assesses the belief that technology enhances work performance, while PEOU gauges the belief that using technology requires minimal effort [41].

PU is borrowed to embody the utility of fitness bands in this study as the quality of design is primarily assessed based on its utility, which revolves around its usefulness [42]. Meanwhile PEOU is used to measure usability because it is well-established and widely used in information systems or technology adoption studies to measure user-friendliness of a technology [43]. Therefore, integrating pragmatic attributes in UX research with the concept of TAM enhances the understanding of user acceptance and satisfaction, facilitating successful technology adoption.

Hedonic Attributes

Practical product features like usefulness and ease of use are crucial, particularly for users with specific goals in mind. However, for those not driven by goals, psychological needs such as pleasurable stimulation become more significant, making hedonic qualities important [44]. Simply emphasizing practical aspects or hedonic features alone will not create engaging products; a balance is needed. Understanding how product attributes relate to individual needs and motives in a specific context is essential. Thus, both practical and enjoyable qualities are crucial for creating a positive overall experience with technology as UX aims to understand users' experiences, enhance technology's success, and explore the fun and playfulness associated with it [45].

Perceived Coolness

Prior studies (see Hardeman et al., 2019; Milne-Ives et al., 2020), extensively explore the nexus of technology intervention and behavioural change [29,46]. As example, earlier research on coolness has link the perceived coolness's association with smoking among adolescents, and another one link it with an improved health behaviour among wearable device users [47]. Furthermore, a patient in a Neurological Rehabilitation Hospital referred to Ekso Bionic Exoskeleton as a "cool technology," emphasizing the importance of technology in healthcare settings [48]. Ashfaq et al., (2020)'s has refined the predictive power of coolness model by looking into the aspect of attractiveness, originality and subcultural appeal [13].

Self-Determination Theory

In UX, beyond the pleasure of social appeal, motivation is a crucial psychological aspect. Intelligent technologies, by fulfilling users' needs and providing positive experiences, have a significant impact on human behaviour, emphasizing the importance of meeting user needs rather than wants for product acceptance [49]. In this study, the well-established Self-Determination Theory (SDT) by Deci and Ryan [14] is borrowed to explore the motivational factors influencing fitness band adoption, representing another hedonic factor of fitness band adoption.

SDT emphasizes the degree to which behaviours are self-driven versus externally controlled, with autonomy, competence, and relatedness fulfilling psychological needs that directly predict health outcomes. Aligning with this theory, research suggests that hedonic attributes contributing to psychological need fulfilment may precede the functionality aspect [10,50]. Within the paradigm of health innovation, SDT is used in providing novel motivations in response to the changes brought about by innovations [14].

Self-tracking practices are influenced by individual motivation within the context of everyday activities, with technology, like fitness trackers, offering motivational insights through personal data-based feedback for health improvement [5,20]. Self-tracking technologies as digital media are not only shaping social use and user needs, but its quick and easily understood analytics of biometric data that requires less effort, potentially motivates users to continue self-tracking.

Hypothesis Development

Given the above review of the literature on TAM, DOI, HB, UX pragmatic and hedonic and SDT; this section will introduce the hypothesis developed for this study. In assessing pragmatic attributes in the adoption of fitness band, PEOU is used to measure usability as it is synonymous with usability and its simplified and precise description fits this study's approach of not focusing exclusively on the technological dimension for back-end UX designers. Hence the following hypothesis is proposed:

H_1: Usability of fitness bands positively drives the adoption of fitness bands.

Additionally, PU in this study is defined as how well users believe fitness bands can be integrated into their lifestyle; able to be worn daily during their fitness activity without disturbing their target performance. The way users perceive fitness bands to be useful will likely lead to adoption. In line with this, the following hypothesis is proposed:

H_2: Utility of fitness bands positively drives the adoption of fitness bands.

Understanding coolness can deepen insights into user experience, as emotions play a significant role in human-computer interaction (HCI), representing users' responses to technological artifacts (Kim & Park, 2019). Coolness as a hedonic attribute plays a crucial role in the adoption of fitness bands by addressing psychological needs. Through originality, attractiveness, and subcultural appeal, it may influence user adoption intentions. Understanding these dimensions is essential for designing interactive technologies that resonate with users' perceptions and preferences as it has the potential to be influencing aesthetic diversity, cultural creation, and innovation [10,43]. Recognizing coolness as a driving factor, this study proposes the hypothesis that adopting fitness bands; which is viewed as a cool technology, can contribute to healthier behaviour for users, doctors, and physicians involved in patient monitoring.

H_3: Perceived coolness positively affects the adoption of a fitness brand.

In adopting fitness bands, users who willingly track their activities demonstrate autonomy, leading to improved health awareness and motivation [20]. This emphasizes the positive impact of psychological relatedness on the user experience. Meeting basic psychological needs correlates with optimal well-being and linked to fulfilling autonomy, competence, and relatedness. It is expected to have positive effects universally, with variations based on need fulfilment [14,51]. This study proposes a hypothesis that the internalization of self-tracking, fulfilling psychological needs for autonomy, competence, and relatedness, drives users to adopt fitness bands.

While the internalization of self-tracking is considered a hedonic attribute driving fitness band adoption, this study aims to explore how the UX of wearable fitness technology influences motivation based on SDT to self-track and eventually influence health behaviour. This study posits that the internalization of self-tracking practices, such as recording fitness activity and biometric health stats, constitutes a key aspect of the hedonic product attributes of fitness bands, influencing their adoption. The overall experience serves as an extrinsic motivation. Three psychological needs—autonomy, competence, and relatedness—form important sub-components driving the need for self-tracking. Autonomy involves independence in self-tracking or related physical activities, competence relates to the desire for excellence in these practices, and relatedness fosters a sense of connection with others who share similar interests. Ultimately, they drive these potential users to adopt fitness bands. Hence this study proposes the following hypothesis:

H_4: Need for self-tracking positively drives the adoption of fitness bands.

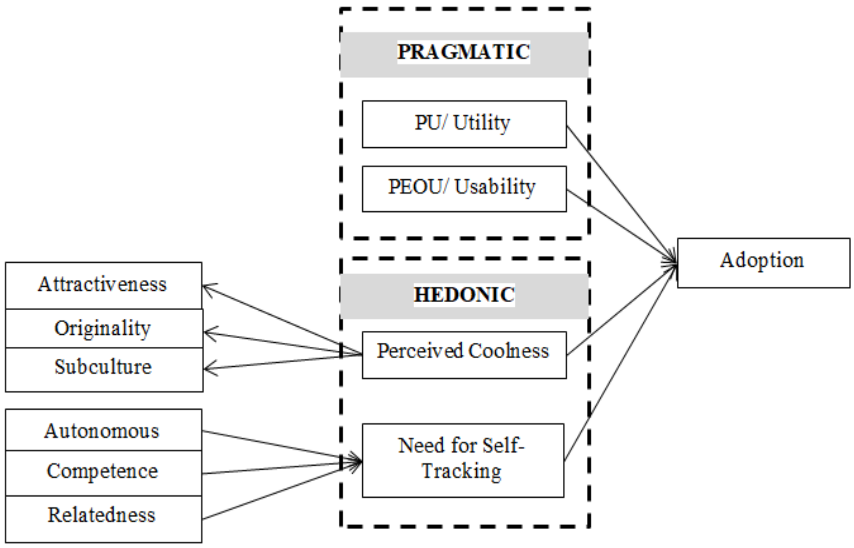

Figure 1: Two Dimensions of UX Attributes; Pragmatic and Hedonic in Driving the Adoption.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue II February 2025

This study investigates the fitness band adoption's effect on health behaviour to confirm whether there is a significant positive effect or not by the adoption, as shown in Figure 1. Influencing behaviour for healthier habits is challenging; where many research in behavioural science targets underlying psychological beliefs to address obesity and overweight while in health communication, research include mass media interventions and technology like social media and pedometers (Goh et al., 2020; Ilhan et al., 2019). The adoption of fitness bands is believed to influence the health behaviour of users. The objective is to assess the significance and positivity of this influence. Therefore, the following hypothesis is proposed:

H_5: The adoption of fitness bands may positively influence health behaviour.

Self-efficacy is a broad and general concept; hence by breaking it into its context, the concept becomes more precise in explaining the variables in the study. As such, the UX that complements wearables will be critically analysed and design in order to help users interpret, understand, get motivated and act on their data. By reviewing the literature on context-specific self-efficacy factors, healthcare technology self-efficacy (HTSE) scale [20] is found to be more suitable to be used in assessing the self-efficacy in using fitness band due to it being specifically related to health-purpose technology such as fitness band. This research therefore assumes that self-efficacy moderates the relationships between adoption of fitness bands and health behaviour. It is envisioned that after the adoption, adopters who become familiar with the functions of fitness bands develop proficiency in using fitness bands and it increases their confidence of sustaining the self-tracking activity and later influencing their health behaviour. It implies that adopters with higher self-efficacy in using fitness bands have a stronger tendency to change their health behaviour. Hence, this study believes that after adopting fitness bands, self-efficacy increases and likely influences the health behaviour of the adopters and proposes the following hypothesis:

H_6: Self-efficacy affects the relationship between the adoption of fitness bands and health behaviour.

Thus, adopting fitness bands for self-tracking could serve as an intervention to improve overall health behaviour, including diet and health literacy.

Research Framework

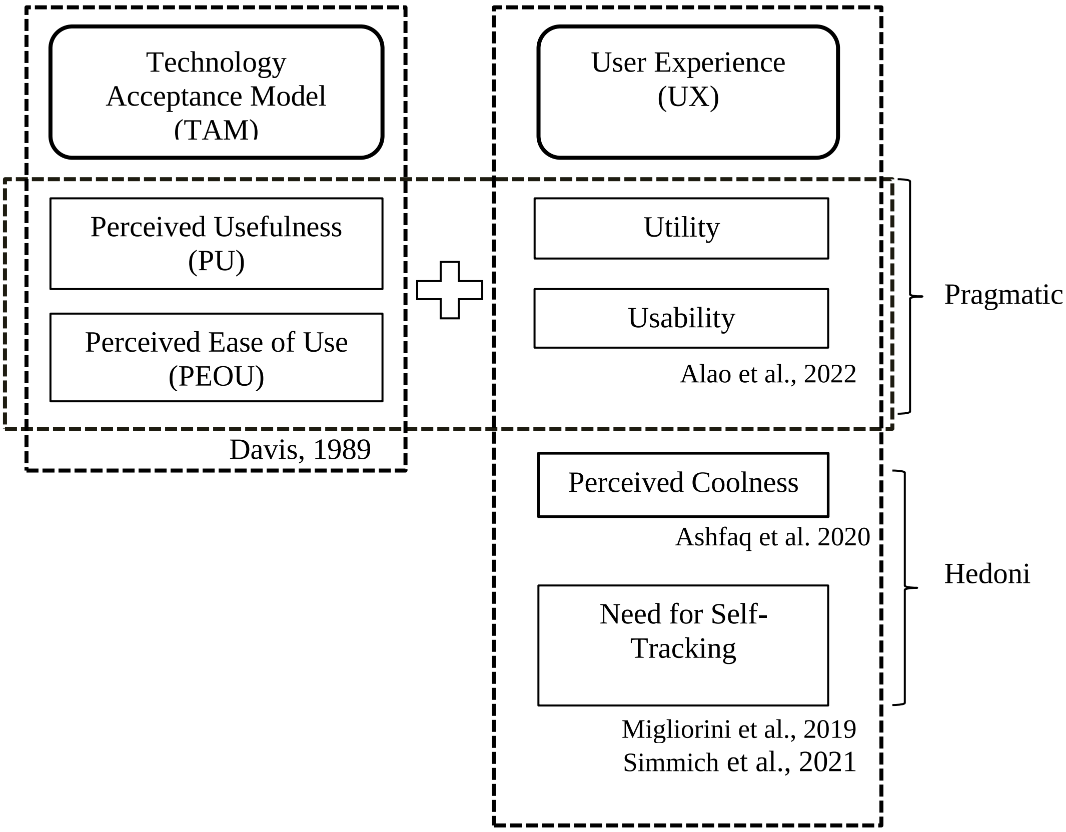

Figure 2: Integration of TAM and UX elements as antecedents in this study.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue II February 2025

This study explores the adoption of fitness bands through two key user experience constructs: perceived pragmatic qualities and perceived hedonic qualities. The perceived convenience and ease of use of fitness bands facilitate user engagement in self-tracking activities. Additionally, the study investigates perceived coolness as a potential influencer of adoption among users new to self-tracking or previously inactive individuals. User motivation represented by need for self-tracking, rooted in health improvement goals and aligned with SDT, further drives engagement in self-tracking practices facilitated by fitness bands. These constructs are integrated within a UX framework, illustrated in Figure 2.

This study also aims to explore the impact of fitness band adoption on the health behaviour of non-health-conscious and inactive individuals. By understanding their perceptions of this technology, developers can enhance inclusivity in their product designs beyond the traditional user base of healthy and active individuals. The research model proposed in this study as shown in Figure 3 is based on all the established theories and models discussed earlier.

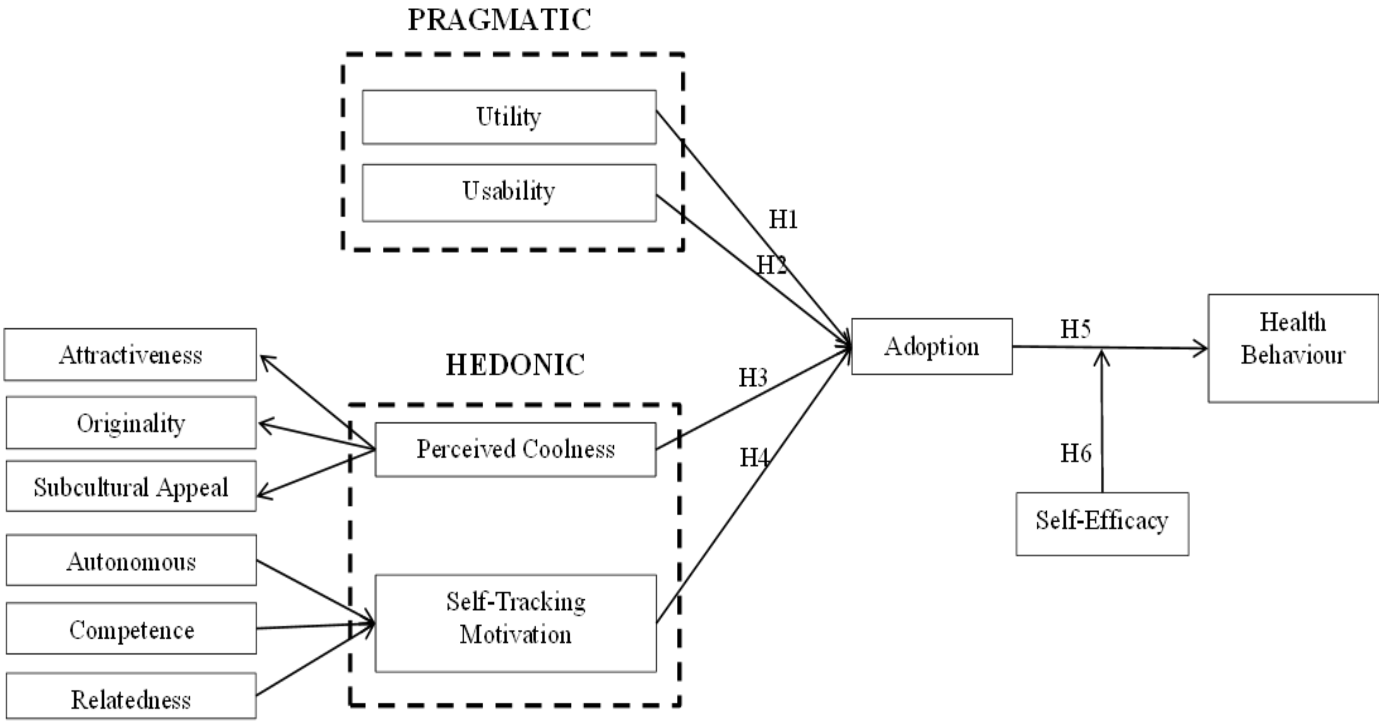

Figure 3: Proposed Research Framework

METHODOLOGY

This study examines users' perceptions of fitness bands and their impact on health behaviour using a quantitative approach to analyse unbiased data collected from a cross-sectional survey of Malaysian fitness band adopters between March and July 2019. The study gathered survey data from 280 users of fitness bands in Malaysia. The sampling size followed a common guideline based on prior research, where 200 responses were deemed adequate [54]. The study also evaluated two crucial types of validity—content and construct—to ensure the questionnaire included a comprehensive and representative set of items relevant to the study's concept [55]. Face validity was examined as well, although the findings were considered preliminary. Before data collection, a pilot study involving 51 respondents was conducted to confirm the feasibility of the study protocol [56]. The main study employed an online survey method using Google Forms. Sampling was carried out through researchers' discretion by distributing the survey link via social media and employing snowball sampling, where respondents were encouraged to refer others who met the research criteria (Malaysian users of fitness bands). Due to challenges in accurately determining the exact number of Malaysian fitness band users, non-probability sampling was chosen as the most efficient method, considering time and cost constraints where probability sampling was impractical. The sample demographics were diverse in terms of age, gender, and geographic location. Purposive sampling was ultimately chosen as it effectively targeted knowledgeable users within a specific cultural context [57].

Demographic details are presented in Table 1. Measurement scales employed a five-point Likert format to enhance response quality and mitigate respondent fatigue [58], measuring degrees of agreement and disagreement. The study employed structural equation modelling (SEM) and partial least squares (PLS) on SmartPLS 3 to analyse the model, assessing predictive, discriminant, and convergent validity. PLS path modelling was selected due to its suitability for modelling latent variables in behavioral research, accommodating complex models and various constructs without strict data distribution assumptions[59,60].

Table 1: Demographic Data and Analysis.

		Frequency, *n*	Percentage %
Gender	Female	128	46
	Male	152	54
Age	18 – 25	34	12
	26 – 35	150	54
	36 – 45	80	29
	46 – 60	14	5
	61 and above	2	1
Education	Primary school	3	1
	Secondary school	15	5
	Diploma or equivalent degree	51	18
	Bachelor's degree	154	55
	Master's degree	46	16
	Doctorate's degree	11	4
Location	Urban (highly populated and mostly by working people, comprised of buildings and corporate establishments)	85	30
	Suburban (populated by working people and family, a handful of public or private institutions, mostly residential area)	178	64
	Rural (lowly populated and mostly by family and older people, comprised of villages, farms and agricultural estates)	17	6

DATA ANALYSIS AND RESULTS

This study employed Partial Least Squares Structural Equation Modelling (PLS-SEM) using SmartPLS 3.1 to validate the proposed model, following the recommended two-stage approach: assessment of the measurement model and evaluation of the structural model (Hair et al., 2017; Ramayah et al., 2018). With Figure 3 illustrating the PLS algorithm output, the analyses validated the hypothesised relationships and provided insights into the drivers of fitness band adoption and their influence on health behaviour.

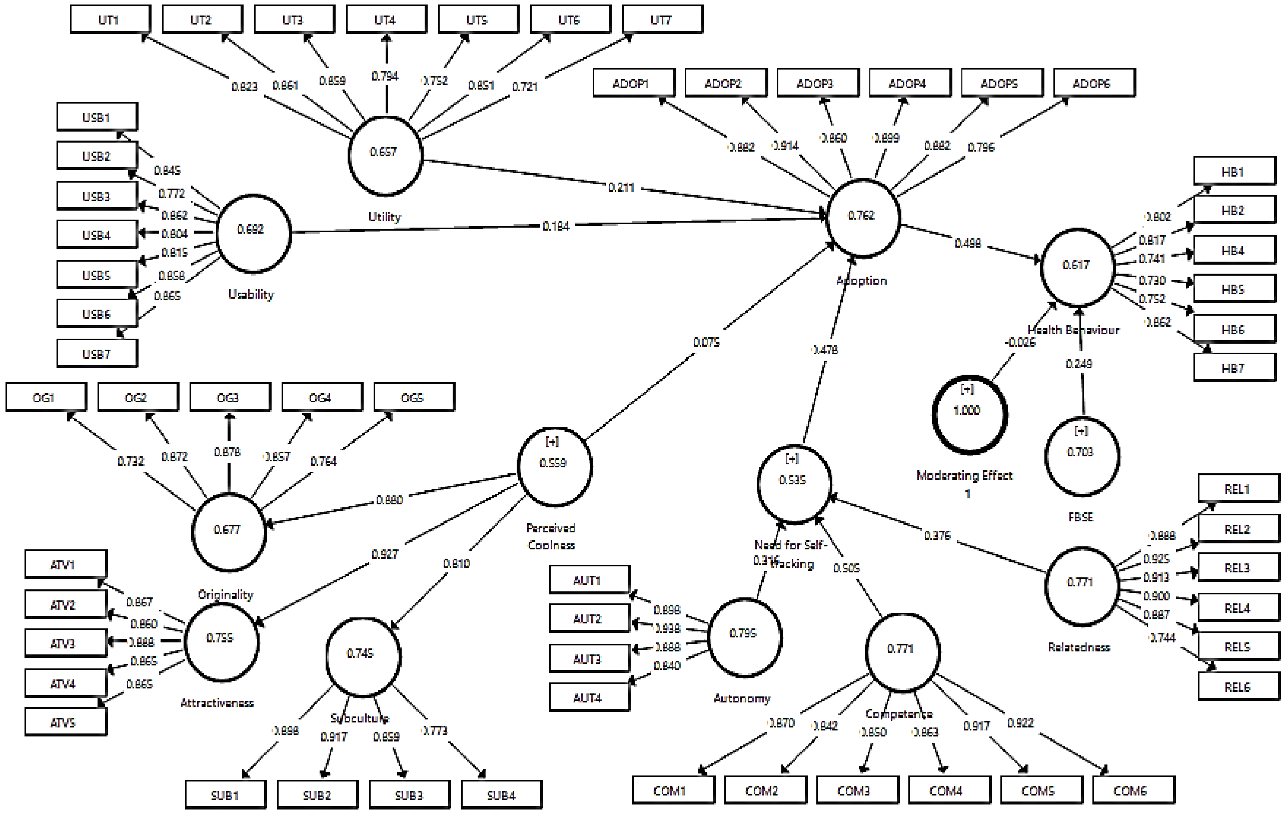

Figure 3: PLS Algorithm Output

Measurement Model

The reflective-reflective and reflective-formative higher-order constructs (HOCs) were assessed using the repeated indicators approach [61]. Composite reliability (CR) and Cronbach's alpha values exceeded the threshold of 0.70, confirming internal consistency [60]. Convergent validity was established with Average Variance Extracted (AVE) values above 0.50 [62], and item loadings exceeding 0.70, except REL6 (loading = 0.503), which was retained for theoretical relevance [63].

Discriminant validity was confirmed using the Heterotrait-Monotrait (HTMT) criterion, with all inter-construct HTMT values below 0.90 [59]. Consistent with Sarstedt et al. (2019), discriminant validity was not assessed between lower-order constructs and their higher-order components.

Structural Model

The structural model was evaluated for multicollinearity, explanatory power (R^2), predictive relevance (Q^2), and effect sizes (f^2), in line with the guidelines of Hair et al. (2017) and Ramayah et al. (2018) [63,64]. Variance Inflation Factor (VIF) values for all constructs were below 5, indicating no collinearity issues [65]. Substantial R^2 values were observed: adoption (64.7%), explained by utility, usability, perceived coolness, and the need for self-tracking; and health behaviour (53.2%), explained by adoption.

Predictive relevance (Q^2) values for endogenous constructs exceeded zero, confirming the model's predictive capacity [61]. The effect size analysis revealed the need for self-tracking as the strongest predictor of adoption ($f^2 = 0.293$), while perceived coolness showed no significant effect ($f^2 = 0.007$) [66].

Path Coefficients and Hypothesis Testing

Bootstrapping (1,000 resamples) was conducted to assess the significance of path coefficients (Hair et al., 2019). The results supported four of six hypotheses. As shown in Table 2, the need for self-tracking was the strongest predictor of adoption ($\beta = 0.478$, $p < 0.001$), followed by utility ($\beta = 0.211$, $p < 0.01$) and usability ($\beta = 0.184$, $p < 0.01$). Perceived coolness was not a significant driver ($\beta = 0.075$, $p = 0.237$). Adoption significantly influenced health behaviour ($\beta = 0.498$, $p < 0.001$). The hypothesised moderating effect of fitness band self-efficacy on the relationship between adoption and health behaviour was not significant (β = -0.026, p = 0.287).

Table 2: Direct Effects of Structural Model.

	Beta (β)	**Std. Error**	**t-value**	**p-value**	**LL 2.50%**	**UL 97.50%**
Usability -> Adoption	0.184	0.057	3.254	0.001***	0.063	0.282
Utility -> Adoption	0.211	0.072	2.942	0.003***	0.091	0.372
Perceived Coolness -> Adoption	0.075	0.063	1.184	0.237	-0.045	0.212
Need for Self-Tracking -> Adoption	0.478	0.065	7.313	0.000***	0.334	0.591
Adoption -> Health Behaviour	0.498	0.069	7.187	0.000***	0.356	0.64

* $p \leq 0.05$, ** $p < 0.01$, *** $p < 0.001$, NS – Not Significant

Moderating Effect Analysis

The moderating role of Fitness Band Self-Efficacy (FBSE) in the relationship between adoption and health behaviour was assessed using the interaction term approach in SmartPLS. The orthogonalization technique was applied to mitigate potential collinearity issues, and bootstrapping (1,000 resamples) was used to evaluate the significance of the interaction effect [63]. The analysis revealed that FBSE did not significantly moderate the relationship (β = -0.026, t-value = 1.126, p = 0.287), as shown in Table 3. The confidence interval further confirmed this result, as it included zero. These findings suggest that users' self-efficacy in using fitness bands does not alter the influence of adoption on health behaviour, indicating a direct rather than contingent relationship. This result highlights the complexity of behavioural change, where intrinsic motivation factors, such as self-efficacy, may play a less pronounced role compared to direct adoption drivers like usability and utility [67,68].

Table 3: Moderating Effect of FBSE.

Moderating Effect of FBSE	Beta	Std. Error	t-value	p-value	LL 2.50%	UL 97.50%	*Decision*
Moderating Effect 1 -> Health Behaviour	-0.026	0.023	1.126	0.26	-0.07	0.021	Not significant

Note: Moderating Effect 1 = Adoption*FBSE

Based on the table 4, it highlights the key factors driving fitness band adoption and their impact on health behaviour. Self-tracking, utility, and usability were significant predictors of adoption, with self-tracking being the most influential (β = 0.478). However, perceived coolness had no significant effect on adoption (β = 0.075) and showed negligible impact (f^2 = 0.007). Adoption was strongly linked to improved health behaviour (β = 0.498), but fitness band self-efficacy (FBSE) did not moderate this relationship.

The model demonstrated robust predictive relevance (Q^2 = 0.636 for adoption, 0.515 for health behaviour) and strong explanatory power (R^2 = 0.647 for adoption, 0.532 for health behaviour). These findings suggest that developers and marketers should focus on enhancing functional features like self-tracking and usability rather than aesthetic appeal, positioning fitness bands as effective tools for promoting healthier lifestyles. Hence, Table 5 summarize the findings with the respective hypotheses.

Table 4: Key Findings Summary of the Data Analysis

Key Analysis	Finding	Supporting Metrics
Drivers of Adoption	The need for self-tracking, utility, and usability are significant drivers of fitness band adoption.	- Need for self-tracking ($\beta = 0.478$, $p < 0.001$) - Utility ($\beta = 0.211$, $p < 0.01$) - Usability ($\beta = 0.184$, $p < 0.01$)
Perceived Coolness	Perceived coolness was not a significant predictor of adoption.	- $\beta = 0.075$, $p = 0.237$
Adoption and Health Behaviour	Adoption positively influenced health behaviour.	- $\beta = 0.498$, $p < 0.001$
Moderating Effect	Fitness Band Self-Efficacy (FBSE) did not moderate the relationship between adoption and health behaviour.	- $\beta = -0.026$, $p = 0.287$
Predictive Relevance (Q^2)	The model demonstrated substantial predictive relevance for all endogenous variables.	- Adoption ($Q^2 = 0.636$) - Health Behaviour ($Q^2 = 0.515$)
Explanatory Power (R^2)	The model showed strong explanatory power for adoption and health behaviour.	- Adoption ($R^2 = 0.647$) - Health Behaviour ($R^2 = 0.532$)
Effect Size (f^2)	Need for self-tracking had the largest effect on adoption, while perceived coolness had no effect size.	- Need for self-tracking ($f^2 = 0.293$, medium) - Perceived coolness ($f^2 = 0.007$, no effect)

Table 5: Result of the hypotheses based on PLS-SEM analysis.

Hypotheses	Relationship	Std. Beta (β)	t-value	p-value	LL 2.50%	UL 97.50%	Decision
H_1	USB-> ADOP	0.184	3.254	0.001	0.063	0.282	Supported
H_2	UT-> ADOP	0.211	2.942	0.003	0.091	0.372	Supported
H_3	PC -> ADOP	0.075	1.184	0.237	-0.045	0.212	Not supported
H_4	NST -> ADOP	0.478	7.313	0.000	0.334	0.591	Supported
H_5	ADOP -> HB	0.498	7.187	0.000	0.356	0.64	Supported
H_6	FBSE*ADOP -> HB	-0.026	1.066	0.287	-0.07	0.021	Not supported

USB = Usability, UT = Utility, PC = Perceived Coolness, NST = Need for Self-Tracking, ADOP = Adoption, FBSE = Fitness Band Self-Efficacy, HB = Health Behaviour, Beta= Regression weight, t-values are computed through bootstrapping procedure with 280 cases and 1000 samples.

KEY FINDINGS

The findings of this study highlight the role of fitness bands as an innovative health communication tool that not only supports self-tracking but also enhances user experiences through both pragmatic and hedonic attributes. This section discusses the findings based on each variable that has been tested.

Pragmatic Attributes and Technology Acceptance

The results align with the Technology Acceptance Model (TAM), where perceived usefulness (PU) and perceived ease of use (PEOU) were critical factors influencing adoption. Fitness bands' utility, represented by their ability to support health-related goals such as physical activity tracking and fitness monitoring, was strongly correlated with perceived usefulness. Similarly, perceived ease of use reflected the usability of fitness bands, reaffirming that pragmatic attributes are central to user satisfaction and continuous adoption. This finding corroborates earlier studies [42,43], emphasizing that a product's functional efficiency directly impacts user acceptance.

Hedonic Attributes: The Role of Perceived Coolness and Self-Tracking Needs

While pragmatic attributes are foundational, this study highlights the significant influence of hedonic attributes, such as perceived coolness and the psychological need for self-tracking, in driving adoption. The coolness factor, representing emotional and psychological excitement, demonstrates how the fitness bands' design and branding contribute to their desirability. This supports findings from Ashfaq et al. (2020) and Stiegemeier et al. (2024), which suggest that coolness enhances engagement and motivates users to adopt new technologies.

Moreover, the need for self-tracking, rooted in Self-Determination Theory (SDT), adds a nuanced understanding of how fitness bands fulfil psychological needs for autonomy, competence, and relatedness. This intrinsic motivation not only sustains usage but also links to improved health behaviours. The alignment of this study's findings with prior research [9,14] reinforces the relevance of integrating psychological need fulfilment into the design and promotion of wearable technologies.

Diffusion of Innovation and Continuous Usage

The findings also align with Rogers' Diffusion of Innovation (DOI) theory, where continuous usage is a critical indicator of successful adoption. Fitness bands' compatibility with users' health and lifestyle goals facilitates their diffusion within social systems. The homophily of fitness band users—sharing similar health-conscious values—further amplifies their adoption rate. This observation is consistent with studies by Naglis and Bhatiasevi (2019) and Dearing and Singhal (2020), which emphasize the importance of aligning new technologies with user demands for sustained engagement.

Impact on Health Behaviour and the Role of Self-Efficacy

Adopting fitness bands positively influences health behaviours, such as increased physical activity and better health monitoring. However, this study found that self-efficacy does not significantly moderate the relationship between adoption and health behaviour change. While self-efficacy is an important psychological construct [15,36], it may not play a critical role in enhancing the impact of fitness band adoption on health behaviours within the context of this study. Furthermore, the potential association between successful behaviour change and enhanced self-efficacy, as suggested by prior research [34], may not be as influential in this context. Instead, users' engagement in health-promoting activities appears to be influenced more by the adoption of the technology itself rather than by their confidence in using it. This highlights the need for future research to explore other psychological factors, such as intrinsic motivation or habit formation, that might better explain the mechanisms behind behaviour change associated with fitness band usage.

Practical Implications

This study offers several practical implications for developers, marketers, and public health professionals.

Developers should prioritize both pragmatic and hedonic UX elements to create fitness bands that are not only functional but also emotionally engaging. Marketers can leverage the coolness factor and self-tracking needs to position fitness bands as essential lifestyle tools rather than mere health devices. For public health initiatives, promoting fitness bands as accessible and user-friendly tools could support broader health behaviour change campaigns, particularly in addressing sedentary lifestyles and the growing prevalence of non-communicable diseases.

Limitations and Future Research

While this study provides valuable insights into the factors influencing fitness band adoption and its impact on health behaviour, several limitations should be noted. First, focusing solely on current fitness band users limits the generalisability of the findings to non-users or potential adopters. Future research should broaden the sample to include non-users and individuals who have not yet adopted fitness bands to identify barriers to adoption and uncover factors that could encourage acceptance, especially among those who are less health-conscious.

Additionally, the cross-sectional design restricts understanding of the long-term effects of fitness band adoption. Conducting longitudinal studies could offer deeper insights into the sustainability of health behaviour changes over time, helping determine whether observed behavioural changes are maintained and how factors like self-efficacy evolve with continued device usage. Moreover, the psychological constructs examined, such as self-efficacy, did not significantly moderate the relationship between adoption and health behaviour. Future studies should explore other psychological constructs, such as motivation, habit formation, or behavioural intention, and how self-efficacy develops over time with increased technology familiarity.

Lastly, expanding demographic analysis could provide a more nuanced understanding of fitness band adoption. Future research should incorporate socio-cultural and demographic variables, such as socio-economic status, education level, and cultural attitudes towards fitness and technology. Additionally, exploring other hedonic attributes like gamification and social connectivity, alongside pragmatic features such as battery life and device integration, could offer a more comprehensive picture of the factors driving adoption and sustained use.

CONCLUSION

The results validate the theoretical framework and underscore the importance of pragmatic and hedonic factors in technology adoption. These findings provide actionable insights for designing user-centric fitness technologies to enhance adoption and promote healthier behaviours. In conclusion, this study bridges gaps in understanding the adoption and usage of fitness bands by integrating pragmatic and hedonic UX attributes into the Technology Acceptance Model. By highlighting the roles of perceived coolness, self-tracking needs, and self-efficacy, the findings offer valuable insights into how fitness bands can effectively promote health behaviours and foster long-term engagement. As wearable technologies continue to evolve, their potential to contribute to public health initiatives and individual well-being remains substantial, emphasizing the need for ongoing research and innovation in this domain.

Ethical Approval: The ethical approval has been obtained by the university's board of human research ethics. The ethical clearance letter can be provided if requested. The study protocol code is USM/JEPeM/19070399.

Conflict of Interest: There is no potential conflicts of interest in this study.

Data Availability: All data will be provided if requested.

REFERENCE

1. Cornacchione Ross J, Noar SM, Sutfin EL. Systematic Review of Health Communication for Non-Cigarette Tobacco Products. Health Commun 2019;34:361–9. https://doi.org/10.1080/10410236.2017.1407274.
2. Zimmerman MS, Shaw G. Health information seeking behaviour: a concept analysis. Heal Inf Libr J

2020;37:173–91. https://doi.org/10.1111/hir.12287.
3. Ilhan A, Fietkiewicz KJ. Learning for a Healthier Lifestyle Through Gamification: A Case Study of Fitness Tracker Applications. Perspect. Wearable Enhanc. Learn., Cham: Springer International Publishing; 2019, p. 333–64. https://doi.org/10.1007/978-3-319-64301-4_16.
4. Ryan J, Edney S, Maher C. Anxious or empowered? A cross-sectional study exploring how wearable activity trackers make their owners feel. BMC Psychol 2019;7:42. https://doi.org/10.1186/s40359-019-0315-y.
5. Simmich J, Mandrusiak A, Russell T, Smith S, Hartley N. Perspectives of older adults with chronic disease on the use of wearable technology and video games for physical activity. Digit Heal 2021;7. https://doi.org/10.1177/20552076211019900.
6. Stiglbauer B, Weber S, Batinic B. Does your health really benefit from using a self-tracking device? Evidence from a longitudinal randomized control trial. Comput Human Behav 2019;94:131–9. https://doi.org/10.1016/j.chb.2019.01.018.
7. Euchner J. The Medium is the Message. Res Manag 2016;59:9–11. https://doi.org/10.1080/08956308.2016.1209068.
8. Davis FD. Perceived Usefulness, Perceived Ease Of Use, And User Acceptance of Information Technology. MIS Q 1989;13:319. https://doi.org/10.2307/249008.
9. Stiegemeier D, Kraus J, Baumann M. Why drivers use in-vehicle technology: The role of basic psychological needs and motivation. Transp Res Part F Traffic Psychol Behav 2024;100:133–53. https://doi.org/10.1016/j.trf.2023.11.014.
10. Salminen J, Santos JM, Jung S gyo, Jansen BJ. How does an imaginary persona’s attractiveness affect designers’ perceptions and IT solutions? An experimental study on users’ remote working needs. Inf Technol People 2023;36:196–225. https://doi.org/10.1108/ITP-09-2022-0729.
11. Ferreira JJ, Fernandes CI, Rammal HG, Veiga PM. Wearable technology and consumer interaction: A systematic review and research agenda. Comput Human Behav 2021;118:106710. https://doi.org/10.1016/j.chb.2021.106710.
12. Lim WM. Dialectic Antidotes to Critics of the Technology Acceptance Model: Conceptual, Methodological, and Replication Treatments for Behavioural Modelling in Technology-Mediated Environments. Australas J Inf Syst 2018;22. https://doi.org/10.3127/ajis.v22i0.1651.
13. Ashfaq M, Yun J, Yu S. My Smart Speaker is Cool! Perceived Coolness, Perceived Values, and Users’ Attitude toward Smart Speakers. Int J Human–Computer Interact 2020:1–14. https://doi.org/10.1080/10447318.2020.1841404.
14. Migliorini L, Cardinali P, Rania N. How could self-determination theory be useful for facing health innovation challenges? Front Psychol 2019;10:459478. https://doi.org/10.3389/fpsyg.2019.01870.
15. Backa KE, Nguyen H. Health information-seeking styles and health information literacy in relation to anticipated health-promoting behaviour - results from an online diabetes risk test survey. Int J Telemed Clin Pract 2020;3:192. https://doi.org/10.1504/IJTMCP.2020.104893.
16. Macassa G. Can sustainable health behaviour contribute to ensure healthy lives and wellbeing for all at all ages (SDG 3)? A viewpoint. J Public Health Res 2021;10. https://doi.org/10.4081/jphr.2021.2051.
17. Byambasuren O, Beller E, Glasziou P. Current Knowledge and Adoption of Mobile Health Apps Among Australian General Practitioners: Survey Study. JMIR MHealth UHealth 2019;7:e13199. https://doi.org/10.2196/13199.
18. Lupton D. Lively Data, Social Fitness and Biovalue: The Intersections of Health and Fitness Self-tracking and Social Media. SAGE Handb. Soc. Media, 1 Oliver’s Yard, 55 City Road London EC1Y 1SP: SAGE Publications Ltd; 2017, p. 562–78. https://doi.org/10.4135/9781473984066.n32.
19. Goodyear VA, Armour KM, Wood H. Young people learning about health: the role of apps and wearable devices. Learn Media Technol 2019;44:193–210. https://doi.org/10.1080/17439884.2019.1539011.
20. Jansson M, Vuorinen AL, Harjumaa M, Similä H, Koivisto J, Puhto AP, et al. The digital patient journey solution for patients undergoing elective hip and knee arthroplasty: Protocol for a pragmatic randomized controlled trial. J Adv Nurs 2020;76:1436–48. https://doi.org/10.1111/jan.14343.
21. Attig C, Karp A, Franke T. User diversity in the motivation for wearable activity tracking: A predictor for usage intensity? Adv. Intell. Syst. Comput., vol. 822, Springer Verlag; 2019, p. 431–40. https://doi.org/10.1007/978-3-319-96077-7_46.

22. Sandic Spaho R, Uhrenfeldt L, Fotis T, Kymre IG. Wearable devices in palliative care for people 65 years and older: A scoping review. Digit Heal 2023;9. https://doi.org/10.1177/20552076231181212.
23. Naglis M, Bhatiasevi V. Why do people use fitness tracking devices in Thailand? An integrated model approach. Technol Soc 2019;58:101146. https://doi.org/10.1016/j.techsoc.2019.101146.
24. Ax C, Greve J. Adoption of management accounting innovations: Organizational culture compatibility and perceived outcomes. Manag Account Res 2017;34:59–74. https://doi.org/10.1016/j.mar.2016.07.007.
25. Min S, So KKF, Jeong M. Consumer adoption of the Uber mobile application: Insights from diffusion of innovation theory and technology acceptance model. J Travel Tour Mark 2019;36:770–83. https://doi.org/10.1080/10548408.2018.1507866.
26. Jünger M, Mietzner M. Banking goes digital: The adoption of FinTech services by German households. Financ Res Lett 2020;34:101260. https://doi.org/10.1016/j.frl.2019.08.008.
27. Dearing JW, Singhal A. New directions for diffusion of innovations research: Dissemination, implementation, and positive deviance. Hum Behav Emerg Technol 2020;2:307–13. https://doi.org/10.1002/HBE2.216.
28. Yousaf Z, Palazzo M. Influential role of homophily on innovative work behavior: evidence from innovation management of SMEs. Int Entrep Manag J 2023;19:1239–56. https://doi.org/10.1007/s11365-023-00865-2.
29. Hardeman W, Houghton J, Lane K, Jones A, Naughton F. A systematic review of just-in-time adaptive interventions (JITAIs) to promote physical activity. Int J Behav Nutr Phys Act 2019;16:31. https://doi.org/10.1186/s12966-019-0792-7.
30. Attig C, Franke T. I track, therefore I walk – Exploring the motivational costs of wearing activity trackers in actual users. Int J Hum Comput Stud 2019;127:211–24. https://doi.org/10.1016/j.ijhcs.2018.04.007.
31. Aizuddin AN, Chan CM, Anwar AR, Ong YX, Chin K-YY. Performance of Body Mass Index in Identifying Obesity Defined by Body Fat Percentage and Hypertension Among Malaysian Population: A Retrospective Study. Int J Gen Med 2021;Volume 14:3251–7. https://doi.org/10.2147/IJGM.S316360.
32. Rivera-Romero O, Gabarron E, Ropero J, Denecke K. Designing personalised mHealth solutions: An overview. J Biomed Inform 2023;146:104500. https://doi.org/10.1016/j.jbi.2023.104500.
33. Shin G, Jarrahi MH, Fei Y, Karami A, Gafinowitz N, Byun A, et al. Wearable activity trackers, accuracy, adoption, acceptance and health impact: A systematic literature review. J Biomed Inform 2019. https://doi.org/10.1016/j.jbi.2019.103153.
34. Pope Z, Barr-Anderson D, Lewis B, Pereira M, Gao Z. Use of Wearable Technology and Social Media to Improve Physical Activity and Dietary Behaviors among College Students: A 12-Week Randomized Pilot Study. Int J Environ Res Public Health 2019;16:3579. https://doi.org/10.3390/ijerph16193579.
35. Farley H. Promoting self-efficacy in patients with chronic disease beyond traditional education: A literature review. Nurs Open 2020;7:30–41. https://doi.org/10.1002/nop2.382.
36. Maio S Di, Keller J, Hohl DH, Schwarzer R, Knoll N. Habits and self-efficacy moderate the effects of intentions and planning on physical activity. Br J Health Psychol 2021;26:50–66. https://doi.org/10.1111/BJHP.12452.
37. Seong D, Ha K-S. The Framework of the Transition of UX Design Workshops into the non-Face-to-Face. J Korea Contents Assoc 2022;22:309–21. https://doi.org/10.5392/JKCA.2022.22.03.309.
38. Jin D, Halvari H, Maehle N, Olafsen AH. Self-tracking behaviour in physical activity: a systematic review of drivers and outcomes of fitness tracking. Behav Inf Technol 2022;41:242–61. https://doi.org/10.1080/0144929X.2020.1801840.
39. Lucius HW, Hanson JH, Chester W. Consumerism and marketing in the digital age. Am J Manag 2019;Vol 16. https://doi.org/10.33423/ajm.v16i3.1871.
40. Tiwari AA, Chakraborty A, Maity M. Technology product coolness and its implication for brand love. J Retail Consum Serv 2021;58:102258. https://doi.org/10.1016/J.JRETCONSER.2020.102258.
41. Mlekus L, Bentler D, Paruzel A, Kato-Beiderwieden AL, Maier GW. How to raise technology acceptance: user experience characteristics as technology-inherent determinants. Grup Interaktion Organ Zeitschrift Fur Angew Organ 2020;51:273–83. https://doi.org/10.1007/s11612-020-00529-7.
42. Alomari HW, Ramasamy V, Kiper JD, Potvin G. A User Interface (UI) and User eXperience (UX)

evaluation framework for cyberlearning environments in computer science and software engineering education. Heliyon 2020;6:e03917. https://doi.org/10.1016/j.heliyon.2020.e03917.

43. Alao OD, Priscilla EA, Amanze RC, Kuyoro SO, Adebayo AO. User-Centered/User Experience Uc/Ux Design Thinking Approach for Designing a University Information Management System. Ing Des Syst d'Information 2022;27:577–90. https://doi.org/10.18280/isi.270407.
44. Kashfi P, Feldt R, Nilsson A. Integrating UX principles and practices into software development organizations: A case study of influencing events. J Syst Softw 2019;154:37–58. https://doi.org/10.1016/j.jss.2019.03.066.
45. Kim J, Park E. Beyond coolness: Predicting the technology adoption of interactive wearable devices. J Retail Consum Serv 2019;49:114–9. https://doi.org/10.1016/j.jretconser.2019.03.013.
46. Milne-Ives M, LamMEng C, de Cock C, van Velthoven MH, Ma EM. Mobile apps for health behavior change in physical activity, diet, drug and alcohol use, and mental health: Systematic review. JMIR MHealth UHealth 2020;8:e17046. https://doi.org/10.2196/17046.
47. Park E, Kwon M, Gaughan MR, Livingston JA, Chang YP. Listening to adolescents: Their perceptions and information sources about e-cigarettes. J Pediatr Nurs 2019;48:82–91. https://doi.org/10.1016/j.pedn.2019.07.010.
48. Read E, Woolsey C, McGibbon CA, O'Connell C. Physiotherapists' Experiences Using the Ekso Bionic Exoskeleton with Patients in a Neurological Rehabilitation Hospital: A Qualitative Study. Rehabil Res Pract 2020;2020:1–8. https://doi.org/10.1155/2020/2939573.
49. Hinderks A, Schrepp M, Domínguez Mayo FJ, Escalona MJ, Thomaschewski J. Developing a UX KPI based on the user experience questionnaire. Comput Stand Interfaces 2019;65:38–44. https://doi.org/10.1016/j.csi.2019.01.007.
50. Kokil U, Harwood T. The Interplay Between Perceived Usability and Quality in Visual Design for Tablet Game Interfaces. J User Exp 2022;17:89. https://doi.org/https://uxpajournal.org/perceived-usability-quality-visual-design-game/.
51. Neubauer AB, Lerche V, Koehler F, Voss A. What do you (think you) need? Perceived vs. experienced effects of need fulfillment on well-being. J Res Pers 2020;86:103938. https://doi.org/10.1016/j.jrp.2020.103938.
52. Ilhan N, Peker K, Yildirim G, Baykut G, Bayraktar M, Yildirim H. Relationship between healthy lifestyle behaviors and health related quality of life in turkish school-going adolescents. Niger J Clin Pract 2019;22:1742. https://doi.org/10.4103/njcp.njcp_190_19.
53. Goh E Von, Azam-Ali S, McCullough F, Roy Mitra S. The nutrition transition in Malaysia; Key drivers and recommendations for improved health outcomes. BMC Nutr 2020;6:1–14. https://doi.org/10.1186/S40795-020-00348-5/TABLES/5.
54. Green SB. How Many Subjects Does It Take To Do A Regression Analysis. Multivariate Behav Res 1991;26:499–510. https://doi.org/10.1207/s15327906mbr2603_7.
55. Sekaran U, Bougie R. Research Methods for Business: A Skill Building Approach 7th Edition. 7th ed. London: John Wiley & Sons; 2016.
56. Johanson GA, Brooks GP. Initial scale development: Sample size for pilot studies. Educ Psychol Meas 2010. https://doi.org/10.1177/0013164409355692.
57. Tongco MDC. Purposive sampling as a tool for informant selection. Ethnobot Res Appl 2007. https://doi.org/10.17348/era.5.0.147-158.
58. Russo GM, Tomei PA, De Campos Serra BP, Mello SF. Differences in the Use of 5- or 7-point Likert Scale: An Application in Food Safety Culture. Organ Cult 2021;21:1–17. https://doi.org/10.18848/2327-8013/CGP/v21i02/1-17.
59. Henseler J, Ringle CM, Sarstedt M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J Acad Mark Sci 2015;43:115–35. https://doi.org/10.1007/s11747-014-0403-8.
60. Hair JF, Risher JJ, Sarstedt M, Ringle CM. When to use and how to report the results of PLS-SEM. Eur Bus Rev 2019;31:2–24. https://doi.org/10.1108/EBR-11-2018-0203.
61. Sarstedt M, Hair JF, Cheah J-H, Becker J-M, Ringle CM. How to Specify, Estimate, and Validate Higher-Order Constructs in PLS-SEM. Australas Mark J 2019;27:197–211. https://doi.org/10.1016/j.ausmj.2019.05.003.
62. Fornell C, Larcker DF. Evaluating Structural Equation Models with Unobservable Variables and

Measurement Error. J Mark Res 1981;18:39. https://doi.org/10.2307/3151312.
63. Hair JF, Hult GTM, Ringle CM, Sarstedt M. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). 2017.
64. Ramayah T, Cheah J, Chuah F, Ting H, Memon MA. Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3.0: An updated and practical guide to statistical analysis. 2nd ed. Kuala Lumpur: Pearson Malaysia Sdn Bhd; 2018.
65. Hair JF, Black WC, Babin BJ, Anderson RE. Multivariate Data Analysis (7th ed.). 7th ed. Edinburgh Gate Harlow Essex: 2006.
66. Cohen J. Statistical Power Analysis for the Behavioural Science (2nd Edition). Stat. Power Anaylsis Behav. Sci., 1988.
67. Bandura A. Self-efficacy: The exercise of control. New York, NY, US: W H Freeman/Times Books/ Henry Holt & Co; 1997.
68. Venkatesh V, Morris MG, Davis GB, Davis FD. User Acceptance of Information Technology : Toward a Unified View. MIS Q 2003;27:425–78.