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Master's Thesis of Global Sport Management

Effects of Fitness App UX
Attributes on Users' Flow,
Psychological Well-being and
Continuance Intention

August 2023

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Global Sport Management

August 2023

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Abstract

The rapid growth and widespread adoption of mobile fitness applications can be attributed to the proliferation of smartphones. However, the turnover rate of health app users which a national survey' results indicated is 45.7%. Many users discontinue use of fitness apps after initially trying them, and psychological factors may can explain this continued use. Prior research on continuance intention has suggested incorporating psychological aspects alongside technology-related factors to better account for patterns of technology usage. Drawing on cognitive evaluation theory, this study investigates how users' assessment of fitness app UX attributes influences their flow and psychological well-being; how continuance intention is affected by flow and psychological well-being; and how flow affects psychological well-being. An online questionnaire survey was conducted among Chinese individuals who have used the 'Keep' fitness app. With SPSS 26.0 and Amos 26.0, demographic characteristic analysis, CFA, and SEM was performed. Empirical results demonstrate that usefulness ($\beta=.11, p<.05$), enjoyment ($\beta=.12, p<.05$), convenience ($\beta=.11, p<.05$), and personalization ($\beta=.55, p<.001$) significantly impact flow; enjoyment ($\beta=.15, p<.05$), convenience ($\beta=.17, p<.01$), and personalization ($\beta=.19, p<.01$) have substantial effects on psychological well-being; flow ($\beta=.27, p<.001$) and psychological well-being ($\beta=.17, p<.01$)

significantly influence continuance intention; and flow ($\beta=.18, p<.05$) has a notable impact on psychological well-being. This study aimed to give contributions on the content of research on fitness app usage and the social media industry as a whole. For fitness app developers and the broader social media sector, focusing on aspects such as interactivity, personalization, and convenience can amplify users' flow experience and psychological well-being, ultimately fostering higher levels of user engagement and retention. These valuable insights provide essential guidance for the design and development of more captivating and effective fitness apps and social media platforms.

Keyword: *mobile fitness app, UX attributes, flow, psychological well-being, continuance intention*

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Chapter 1. Introduction

Study Background

The world is currently experiencing a period of significant technological and digital progress, which has profound effects on various aspects of daily life, including work, education, and leisure activities. With the proliferation of smartphones, the development and adoption of mobile applications promoting positive changes in people's behavior have been significantly accelerated. There were 45,478 and 43,285 mobile health apps available for iOS and Android, respectively, in the first quarter of 2020. The management and prevention of diseases are the primary objectives of these applications. A 66% lower risk of early death was linked to leading a healthy lifestyle, which includes eating well, exercising frequently, and keeping a healthy body weight. At the same time, the pace of people's lives is quickening, their awareness of their health is growing, internet technology is becoming more sophisticated, and the quick growth of mobile fitness offers chances and technological assistance. By participating in physical exercise, people are able to achieve the purpose of preventing diseases, strengthening physical fitness, helping to enhance their resistance, and forming a correct view of sports. Research has proven particularly effective in promoting physical activity and encouraging individuals to engage in regular exercise (Chang, Yan, & Tseng, 2012). Indeed, for a fitness mobile app to achieve its intended impact, users must consistently use the app over a period of time.

Through this continuous engagement, the desired behavioral changes can gradually become integrated into their daily lives.

However, due to the coexistence of various different issues such as practice and experience of fitness, online and offline interaction barriers, network delay, unstable service quality, users and fitness trainers out of sync, as well as various problems, the willingness of mobile fitness software users to continue to its usage can be substantially impacted. On the other hand, despite the positive impact of mobile fitness apps, there is a concerning turnover rate among health app users, as indicated by a survey conducted in the United States, with a high percentage of 45.7%. Additionally, there is a noticeable decline in the frequency of app usage within the first six months after initial adoption (Pellegrini, Conroy, Phillips, Pfammatter, & McFadden, 2018). Despite the increasing popularity of fitness apps, many users tend to discontinue their usage shortly after the initial adoption, indicating a relatively low continuance intention of using such apps (Cheng, Sharma, S., Sharma, P., & Kulathunga, 2020). After utilizing a health app for the first time, many users cease using it; psychological reasons may account for continuous use or abandonment. In order to better understand technology use patterns, psychological elements as well as technology-related ones have been suggested in prior CI research (e.g., Lin & Filieri, 2015; Hong, Xu, Wang, & Fan, 2017). Through their research, Kim, M. and Kim, H. (2022) expanded the cognitive appraisal theory (Lazarus, 1982), demonstrating that it

was equally applicable to the digital environment. They suggested that digital qualities might shape social media users' emotional states. Additionally, emotional states influence consumers' behavioral intentions in a favorable way. Their research indicates that numerous fitness applications have distinct features and functionalities that users can employ to exercise and that the cognitive assessment of features can influence users' emotional moods. In the cognitive appraisal theory (Lazarus, 1982), flow and psychological well-being were introduced by Kim (2021) as the primary outcomes of mobile application characteristics. Hence, this served as the research for this paper's foundation. Exercise with a mobile fitness app may be more hampered by more things compared with regular exercise instruction (e.g., standard fitness class), so users ought to pay more attention and participate more actively. Users should experience “flow” when exercising with a mobile fitness app, focusing solely on digital activity and consumption. Fitness apps can provide unbiased feedback and comprehensive information which is related with bodily states and processes. The development of self-care and health-related habits is reportedly supported by collecting body-related data, according to other studies (Zhong, Liu, Fan, & Zhou, 2020).

Purpose of the Study

This study aims to explore how users' evaluation of user experience (UX) attributes in mobile fitness apps influences their experience of flow and psychological well-being. The study highlights the role of flow in the field of fitness app.

This study identifies flow and psychological well-being as significant outcomes resulting from the evaluation of UX attributes in mobile fitness apps, contributing to users' sustained engagement and intention to exercise. By examining the effects of various fitness app UX attributes on flow, psychological well-being, and continuance intention, this research aims to provide valuable insights for mobile fitness app design and development.

The research questions are as follows :

Does using a fitness app for workouts cause users to experience a state of flow, which raises their psychological well-being, and can we anticipate users' intentions of employing a fitness app for workouts in the future based on their emotional states?

Question 1. How does different fitness app UX attributes affect the flow and psychological well-being?

Question 2. How do flow and psychological well-being affect continuance intention?

Question 3. How does flow affect psychological well-being?

Significance of the Study

It is challenging for developers of fitness and health apps to garner user feedback and advance the technology without consistent usage of the app. Furthermore, it is less probable that the app creators will profit financially from factors like advertising, in-app sales, subscriptions, sponsorship, as well as other types of revenue.

Certainly, the discontinuation of fitness app usage can have adverse effects on users' health-related behaviors, as demonstrated by Cheng et al. (2020). Therefore, gaining a comprehensive understanding of how to encourage users to continue using the fitness app for exercise is important.

Researchers are paying attention as fitness apps surge in popularity. Previous research has examined the way users of fitness apps behave, including whether they can reach their health objectives, maintain their health, or lose weight. The acceptance and intention to use fitness applications have also been examined in recent studies. However, there are relatively minimal studies (Beldad & Hegner, 2018) that examined what drives users' continuation intention (CI) for exercising through fitness applications.

After utilizing a health app for the very first time, numerous users cease using it and psychological reasons may account for continuous use or abandonment. In order to more thoroughly comprehend technology usage patterns, psychological elements, as well as technology-related elements have

been identified in the prior study on CI (e.g., Lin & Filieri, 2015; Hong et al., 2017).

Mobile fitness apps can facilitate flow by providing clear goals, rapid feedback, and a balanced mix of abilities and difficulties. However, the impact of well-being on users' continued intention for innovative technologies, like smartphone watches, remains relatively unexplored. Existing research has predominantly focused on utility-based factors for technology adoption and usage, leaving a gap in understanding the role of flow and psychological well-being.

Chapter 2. Literature Review

The Cognitive Appraisal Theory

Lazarus (1982) introduced the cognitive appraisal hypothesis, which suggests that a person's emotions are influenced by their cognitive evaluation of a situation or event. Additionally, different individuals may respond differently to identical information based on the relevance of the stimulus. The study employs fitness app attributes based on this methodology to evaluate aspects as app users utilize digital data for their health and exercise needs. By understanding how consumers appraise stimuli and experience emotions, marketers can better comprehend their reactions and decision-making processes, which, in turn, can aid in developing more effective marketing strategies and improving consumer experiences. It has been identified, in particular, that consumers' emotional states have an impact on how they process information prior to making decisions about purchases and taking part in goal-oriented activities (such as continuing to work out using the fitness app). For instance, researchers have looked into how users' cognitive assessments of a website influence their privacy-related behavior (Li, Luo, Zhang, & Xu, 2017). Additionally, service experiences (i.e., cognitions and emotions) are related to repurchase intention (Manthiou, Kang, & Hyun, 2017). Kim (2022) looked into how viewers' propensity to engage with fitness-related YouTube was influenced by the live broadcasters' and the channel's characteristics on fitness-related YouTube channels. He believed that digital

features influence users' emotional and cognitive assessments. Positive thoughts and feelings later enhanced users' commitment to using digital services. The cognitive appraisal theory, which forms the basis of this study, holds that customers' cognitive evaluations of the digital features of a fitness program produce either positive or negative feelings (such as flow and psychological well-being). Forecast their behavioral intentions as well (specifically, their intention to continue based on their emotional differences).

Mobile Fitness App UX Attributes

Application is abbreviated as APP. These days, it generally refers to an application that is downloaded from the Internet and installed on mobile terminal devices in order to offer users a service or convenience. Mobile fitness applications are smartphone programs that assess fitness and health metrics utilizing data acquired from a smartphone's built-in features. Fitness apps commonly integrate a variety of behavioral change strategies to motivate and support users in adopting healthy exercise habits. These strategies include exercise guidance, providing users with expert recommendations and personalized workout plans to achieve their fitness goals effectively. Performance feedback is another essential aspect, giving users real-time information about their progress and achievements, which enhances their sense of accomplishment and motivates further effort (Middelweerd, Mollee, Van Der Wal, Brug, & Te Velde, 2014).

There were 45,478 iOS and 43,285 Android mHealth apps in the first quarter of 2020. These apps aim to prevent and control diseases, such as diabetes (Goyal & Cafazzo, 2013), and promote a healthy diet and physical activity. The market for mobile application development has been assessed in previous research (e.g., Azar, 2013). The purpose of mobile fitness apps is to encourage exercise. Informational and emotional-social assistance is available to app users in the form of both practical and emotional social assistance.

Mobile fitness app features include various sub-features aimed at enhancing the overall user experience and engagement (Yan, Filieri, Raguseo, & Gorton, 2021). Indeed, in online marketplaces potential fitness apps users are influenced by perceived user experience (UX) design elements. These elements include aesthetics, usability, credibility, and usefulness. Users' decisions that whether to use these fitness apps are based on their subjective perceptions of these factors. Positive perceptions of aesthetics, usability, credibility, and usefulness in these apps are likely to attract and retain users, while negative perceptions may deter users from using them. Therefore, optimizing these UX design elements is crucial for enhancing the appeal and adoption of fitness apps in the competitive marketplaces.

Human-computer interaction (HCI) research has become increasingly prevalent due to the growing demand from consumers for HCI systems that are not only functional but also aesthetically beautiful, intellectually interesting, as

well as entertaining. Fitness apps are relatively new to the market alongside other persuasion tools intended to encourage pleasant user experiences and motivate users to engage with them in order to influence their behavior changes (Meredith, 2020). Research has shown that consumers may discontinue using mobile fitness apps if they have an unpleasant user experience, such as encountering poor usability. As a consequence of these negative experiences, approximately 25% of fitness apps from the market are unlikely to be continued to used.

In HCI, UX is a complex and multifaceted concept, lacking a clear consensus on its exact meaning. It should not be mistaken for usability and interface, as researchers in the field emphasize (Stage, 2006). UX is defined as the overall experience when people using. It encompasses aspects like product delivery, service consumption, and post-sale support, influencing how customers perceive value, service quality, and loyalty. UX research pays attention to the emotional components of HCI, as highlighted by researchers like Hassenzahl (2003). Usability, on the other hand, includes effectiveness and efficiency as integral components (Følstad & Rolfsen, 2016).

With recent advancements in HCI design, the definition of UX has expanded to include new dimensions. Designers now focus on creating systems that are not just functional but also appealing, delightful, and enjoyable, such as games (Stage, 2006). Thus, a comprehensive, unified approach is needed to embrace both pragmatic (utilitarian) and hedonistic (enjoyment) facets of HCI system design.

As a subjective concept, users' actual experiences with HCI systems vary based on their personal preferences and the intentions of the designer (Hassenzahl, 2003).

The user experience continuously evolves during users' interactions with the outside world and others.

So far, there have recently been a variety of prevalent ideas about the composition of User Experience, including the Flow Experience theory (Csikszentmihalyi, 1975), User Engagement theory (Kearsle & Shneiderman, 1998), as well as the episodic experience theory (Toffler, 1984). User experience can be divided into direct and indirect experiences according to situational experience theory. The user involvement hypothesis categorizes user experience into sensory attraction, aesthetics, utility, emotion, challenge, and feedback. The usefulness, user skill, attention, pleasure, arousal challenge, and presence subcategories in the optimal experience theory characterize user experience.

In Emotional Design, from the standpoint of cognitive psychology, Norman (2004) examined the level of contemporary human cognition of a thing and separated it into three primary categories: the instinct level, the behavior level, and the reflection level.

According to Hassenzahl (2001), user experience is comprised of four aspects: recognition, operability, motivation, and creative inspiration. Subsequently, it is further separated into pragmatism and hedonism on this premise (Kayvan, Moridpour, Young, & Majid, 2011). Schmitt (2004) categorized

the user experience into seven aspects: ease of finding information, satisfaction, perceived value, availability, perceived usefulness, usability, and reliability. Similarly, Roto, Obrist, and Mattila (2009) classified the user experience into three distinct groups: usability and pride, pleasure, and function. And user experience encompasses the user's own value, availability, and use of emotion. The user's own value is constructed predominantly of pleasure, individualized desires, self-satisfaction, added product significance, and social representation (Park, Parsons, & Ryu, 2013). According to the information effectiveness necessary to complete user tasks, Deng and Zhang (2008) divided user experience into three dimensions: technical, aesthetic, and functional, in order to ensure that users can obtain the most beneficial data most straightforwardly and conveniently possible while acquiring relatively high-quality psychological and visual experiences. This division has its foundation in fully learning from predecessors' division of user experience dimensions and starting from the perspective of product design theory. Lu and Bin (2022) also classified the components of the user experience into five categories: entertainment, ease of use, usefulness, interactivity, and personalization.

In this paper's context, and considering relevant research on fitness app attributes, the fitness app user experience (UX) attributes can be classified into usefulness, enjoyment, convenience, interactivity, and personalization. These attributes represent the hedonic and practical dimension which influence users'

decisions on whether to continue using the app. Users utilize these characteristics to determine if they will continue employing the fitness apps.

Table 1*UX Attributes Related Literature Review*

User Experience Dimension	Source
Direct experience、 Indirect experience	Toffler (1984)
Usability、 User skill、 Challenge、 Attention、 Pleasure、 Arousal presence	Csikszent mihalyil (1975)
Operant、 Identification、 Incentive、 Revelatory	Hassenzl (2003)
Usability、 Usefulness、 Reliability、 easy to find、 Desirability、 Valuable	Schmitt (2004)
Functional experience、 Technology experience、 Aesthetic experience	Deng & Zhang (2008)
Enjoyment、 Function、 Usability、 Pride	Roto et al. (2009)
Usability、 Emotion、 User value (e.g., enjoyment, personalization)	Park et al. (2010)
Aesthetic experience、 Emotional experience、 Social experience、 Cognitive experience、 Functional experience	Sun (2014)
Enjoyment、 Ease of use、 Usefulness、 Interactivity、 Personalization	Lu et al. (2022)

Usefulness

In the technological acceptance model (TAM), usefulness is a crucial contributing component, and perceived usability is the second most significant factor emphasized by the model (Davis, Bagozzi, & Warshaw, 1989). Usefulness has increasingly grown in importance as a defining characteristic of relevant consumers' attitudes with the growing adoption of technology acceptance models. In Tahar's study (2020), the adoption of the e-Filing system by target users was assessed by examining the perceived utility of the system. This was done by evaluating how much the users' job performance had improved as a result of using the system. They discovered that users' willingness to utilize the program can be enhanced by boosting its perceived usefulness.

Users' opinions will be influenced by elements like how simple a technology is to utilize and how outstanding the associated technology is. Perceived usefulness is person's belief, that the products can enhance their performance of work, which can affect their continuance intention (Davis et al., 1989).

The accomplishment of fitness objectives, increased fitness effectiveness, and improved health conditions are the ways in which scholars define the value of mobile fitness apps. Usefulness is defined as having the capacity to adapt to users, which can additionally assist them to learn more about exercise as well as recording and sharing their performance with other users. The usefulness of

fitness apps entails that they can effectively enhance users' exercise routines and physical appearance (Zhong, Liu, Fan, & Zhou, 2020).

In this paper, the usefulness of a fitness app is the degree of people perceived that fitness apps may enhance users' exercise performance (by offering fitness courses and pertinent fitness-related knowledge).

Enjoyment

Enjoyment has been thoroughly investigated. The feelings acquired from utilizing products—the enjoyment and the ensuing pleasure—are referred to as enjoyment as a specific hedonic experience (Holbrook & Hirschman, 1982).

Hedonistic pleasure is intrinsic and meaningful on a personal level (Hirschman & Holbrook, 1982). An inner drive to 'maintain' a person in their ideal, preferred state of comfort, consistent with external stimulation, is positively associated with this inherent quality of hedonic delight (Fiore, Kim, & Lee, 2005).

Enjoyment is reinforced if the experience of using affirms or positively refutes the anticipated pleasurable emotion; otherwise, such enjoyment is diminished or eliminated. Utilization of the early mobile service has been found to be favorably correlated with enjoyment as an intrinsic incentive. (Davis, 1992).

As part of a marketing strategy, mobile application makers are increasingly including appealing and compelling components in their products' looks, contents, and functions, fostering a culture of personal hedonism. Mobile application users can derive hedonic benefits from accessing desired stimuli, such

as online gaming, fascinating news feeds, and social networking experiences. Empirical studies have shown promising results, indicating that users' decision whether use mobile shopping websites can be affected by enjoyment, even though it was not originally included in the Technology Acceptance Model (Lu & Su, 2009). Recent studies revealed that should use both utilitarian (usefulness) and hedonic (enjoyment) components to predict consumers' intention. In this study, hedonic pleasure experience of users serves as an indicator of their enjoyment of fitness apps.

Convenience

Self-determination theory identifies two primary motivations for accepting new technology: extrinsic motivation (action for external benefits) and intrinsic motivation (action for inherent enjoyment). These motivations significantly influence individuals' decisions to adopt and use new technology (Roca & Gagné, 2008). Intrinsic impulses are driven by pleasure, while extrinsic incentives involve seeking rewards (Ryan & Deci, 2000). The self-determination theory (Chang & Zhu, 2012) revealed that convenience is that users believe that technology will help them complete their tasks. Prior studies have used convenience as a predictor of technological usage intention (i.e., Hossain & Prybutok, 2008; Yoon & Kim, 2007).

Convenience is related to time (offering products at a more convenient time), place (providing products more conveniently), acquisition (simplifying the purchasing process), use (enhancing product ease of use), and execution (providing obvious convenience to customers).

In various contexts, convenience plays a positive role in online shopping success (Chen, Gillenson, & Sherrell, 2002). It influences user satisfaction and increases the value for consumers (Lin & Lu, 2015). In the case of this paper, convenience is determined by users' perception of its user-friendliness and its ability to enable exercise anytime and anywhere.

Interactivity

Interactivity encompasses actions like modifying website images, customizing content, and using feedback tools like chatbots or moderators (Fiore et al., 2005). This greater interactivity allows users to have more control over information during online transactions (Wu, 2019).

Different technology products offer various options and interactions, but the limitations of mobile devices can pose significant challenges for communication and interaction (Nandi, S. & Nandi, M., 2015).

Skills and online interaction are two categories of interactivity. Although skill interaction is the media-focused engagement between people and media, communication interaction is the conversation between people. To address the communication needs between information senders and receivers, James (1998)

defined interactivity as the amount of feedback provided and received during the communication process. The interaction of a fitness app relates to user-to-user communication as well as user-to-app platform contact. Associated information, social interaction, and platform feedback are among the main topics. In this paper, the term “interactivity” refers to a fitness app’s capacity to facilitate communication between users and its platform.

Personalization

Personalization is the process by which customers obtain products or services that have been developed specifically for them in accordance with their distinctive preferences (Montgomery & Smith, 2009). It is also a typical word for preference matching. In order to cater to the technical characteristics of content, delivery, and communication arrangements, it is essential to consider the explicit and implicit preferences that individual users register (Sunikka & Bragge, 2012). Personalization plays a crucial role in businesses as it fosters long-term customer relationships (Halimi, Chavosh, & Choshaly, 2011). Likewise, integrating user data for personalized services in fitness apps may cultivate a one-to-one relationship with users and foster long-term cooperation. According to Lu and Bin (2022), the personalization of fitness apps entails giving users access to the appropriate fitness-related content by examining user traits and recognizing their various demands. The approach of providing fitness app users with

information or services that are tailored to their unique tastes utilizing their data is referred to in this paper as the personalization of fitness apps.

Outcomes of Mobile Fitness App UX Attributes

Flow

One of the most significant subfields of psychology is flow. Mihaly Csikszentmihalyi, a Hungarian-American psychologist who researched people in numerous fields and their work, introduced the term “flow” in the 1960s. Through further research, Mihaly noticed that these professionals in professional activities exist in common; that is, when they perform their duties, they are full of compatible and harmonious feelings. He additionally discovered that when entering a state of near-perfect concentration, rock climbers, artists, athletes, chess players, and other professionals in professional activities alter the way they perceive their surroundings (Csikszentmihalyi, 1988). Csikszentmihalyi defined flow as a kind of fully input to the ongoing activities of the spirit, it represents the people who are so immersed in an activity rather than for a time and is in a special state. He also stated that the happiest people are in flow conditions. Although flow theory has been regarded as a critical theory in positive psychology, to some extent, the development of positive psychology has been significantly molded by flow theory.

The conditions for flow to be present are mainly composed of eight elements. First, there is an activity experience to be attained; Second, attention is

highly focused on the activity; Third, activities should possess distinct objectives; Fourth, direct and timely feedback; Fifth, the coordination of consciousness and action; Sixth, the freedom to control their own activities; Seventh, the temporary disappearance of self-consciousness; Eighth, the change of time conscious (Csikszentmihalyi, 1997).

The act itself is viewed as a psychological reward in this scenario, and the person's attention is exclusively on the pleasure it delivers. Immersion allows users to perform their tasks to their full potential while simultaneously enjoying an optimal experience, which enhances performance and produces favorable emotions like fulfillment. Because of this conclusion, flow is viewed as a crucial component for understanding consumer behavior (Hsu & Lu, 2004).

Flow states can be used to physical activity background with digital material according to prior research, as mobile fitness apps can inform users about exercise techniques, plans, and goals while offering feedback. The flow state that user experiences while working out on a fitness app link with their exercise prowess, task challenge, goal clarity, as well as the real-time feedback the app offers. In this paper, flow refers to the state in which mobile fitness consumers experience complete immersion and intense focus when working outdoors with the fitness app, with little or no interest in everything else.

Psychological Well-being

Happiness can be defined as a positive existence and the realization of human potential when confronting various difficulties and challenges, and is interpreted from the perspective of human development in psychological well-being (PW), which emerged from the philosophical idea of realization theory. People believe that happiness includes a sense of independence as well as subjective emotional experiences and feelings. It boasts the realization of one's own potential through an effort of striving to achieve perfection and development.

According to Waterman (1993), psychological well-being has two dimensions: the first is hedonic happiness, which refers to the satisfaction of one's life or psychological needs; the second is personal expressive happiness, which refers to the realization of one's potential as a result of total involvement in something as well as the experience and pleasure of self-realization. According to Ryff (1989), psychological well-being should be an objective experience of "striving to perform perfect and true potential," which rejects happiness as happiness, emphasizes self-realization and self-perfection, self-achievement, and the perfect realization of one's potential, and does not take into account people's subjective consciousness as a transfer. Ryff (1989) proposed a comprehensive evaluation index of psychological well-being, incorporating developmental psychology and other psychological theories. Empirical research has demonstrated their significance in assessing psychological well-being. The following content summarized the psychological traits of the six dimensions of

psychological well-being. Autonomy: Individuals who perform better are more prone to evaluate themselves using their own standards. They make decisions on events independently, without being dictated to by others, and with their own independent judging system, self-determination, and independence. They do not depend on the strength of others to survive. People who score lower are more likely to alter their views and rely on others, as well as to be influenced by others' judgments. Control of the environment: A person with a higher score will be more able to manage complex external activities in response to changes in the environment, wisely select the opportunities offered by the surroundings in order to design a setting that fulfills his own needs, as well as be capable of making reasonable utilization of the opportunities offered by the immediate environment. Low scorers struggle with daily duties and feel powerless to influence or alter their surroundings. Personal development: Those who score higher are more able to maximize their potential, discover new things, continually enrich, grow, strive, and develop, as well as occasionally notice their own progress and changes in behavior, which more accurately reflect changes in their knowledge and effectiveness. Low scorers are less interested in their surroundings, feel stagnant, and are hesitant to embrace new ideas. Positive relationships: the higher the score, the more in tune people are with one another, caring for and appreciating one another, transmitting on their greatest qualities to others, and possessing an excellent understanding of how to obtain and contribute. People with low scores

find it challenging to socialize with others, lack mutual understanding, have intimate friendships, and experience difficulty communicating with others. They also frequently feel isolated and frustrated. Higher scorers exhibit a stronger sense of direction and purpose in life. They possess faith in life, a sense of meaning in their past and present lives, along with the determination to strive hard toward their objectives. People who do poorly struggle to understand the meaning of life, and perform carelessly without a sense of direction and purpose. Self-acceptance: Those that score higher are more inclined to acknowledge the positive and negative aspects of themselves, and they additionally possess a good outlook on themselves or their prior lives, thereby helping them confront life with optimism. People who perform poorly are dissatisfied and frustrated with themselves and their circumstances in life. Thus, they are eager to radically transform themselves.

According to Ryan and Deci (2000), psychological well-being encompasses three fundamental components: autonomy, relatedness, and competence needs. In this paper, psychological well-being is defined as the integration of high levels of positive emotion and life satisfaction, along with low levels of negative emotion.

Continuance Intention

Researchers have looked into how consumers' behavioral intentions related to virtual environments, like a virtual community, as a key factor in determining their loyalty to that environment (Lin, 2006). The concept of behavioral intention is crucial because it links users' actual behaviors, such as active participation and continuous engagement with digital information in daily life, to their impact on the virtual environment (Kim, 2021).

The concept of continuance intention (CI) originated from behavior intention, which Fishbein and Ajzen (1977) defined as a measure of the effectiveness of a given aim. Simply expressed, behavioral intention is the individual's subjective choice to carry out a specific action or behavior. Kim (2022) defined continuous usage as users' readiness to determine whether to continue using a product after using it, based on their personal experience and comprehensive evaluation of relevant factors.

As a result, the continuity focus in this paper is the biased behaviors of fitness apps' users, which include the habit of maintaining engagement with the app for workouts, encouraging word-of-mouth, and recommendations of exercises via the app. Users who employ the fitness app to exercise are more likely to recommend it to others and spread the word about it, and they are also more probable to establish a lasting relationship with the app. This paper examines continuance intention by investigating the link between specific

behaviors and commitment. The combination of these elements in the continuance intention construct provides fitness apps with competitive advantages in a fiercely competitive fitness market (Kim, 2021).

Chapter 3. Hypothesis Development

Fitness App UX Attributes and Flow

Firstly, flow is inextricably linked to the learning process in educational systems. Employing a mobile learning application affects the manner in which this learning process proceeds forward (Park et al., 2010). Perceived usefulness boosts user engagement with technology since it motivates users to utilize more of a given technology, and enhanced user experiences increase students' chances of achieving a flow state (Kiili, 2005). Corresponding to this, users of mobile fitness apps are going to become more invested in exercise routines if they perceive that the app is able to improve their performance while exercising. People have positive opinions of technology when they are able to evidently notice its benefits (e.g., mobile fitness apps). As a result, consumers' opinions are highly influenced by perceived utility (Chung, Han, & Joun, 2015). In other words, users of mobile fitness apps would adopt a positive mindset and hence enjoy the workout process more if they believe the fitness app to be effective. And the antecedents of a flow state are concentrations and enjoyment (Huang, Wei, & Leung, 2020).

Secondly, enjoyment and concentration are the prerequisites for entering a flow state (Zhong et al., 2020). Mobile application providers are increasingly incorporating entertaining and engaging elements into their product designs, content, and functions to offer users a context for hedonistic enjoyment and gratification. Users of mobile applications can experience hedonic benefits

through the accessibility of desired stimuli, such as online gaming, fascinating news feeds, and social networking experiences. Users of the fitness software for smartphones exhibited a substantial positive correlation between enjoyment and flow (Zhong et al., 2020).

Thirdly, feasibility considerations posit a significant influence on flow (Ghani, 1995). People are more inclined to be attentive and enjoy using smartphones for their intended purposes if they perceive using them requires less effort and is untainted by time or space constraints. Furthermore, his research demonstrates that flow and convenience have a mutually beneficial relationship (Kim & Ko, 2019).

Fourthly, people's social interactions or their responses to technological advancements may be interactive. Media and psychological aspects that alter through communication situations, media or technological features, and people's perceptions are related to interaction (Kiousis, 2002). Various emotional, behavioral, and cognitive responses connected to consumer flow experiences are actually strongly stimulated by interaction (Javornik, 2016). And customer involvement with technology may generate the flow experience in virtual and digital settings, just as flow experiences can produce interactivity (Animesh, Pinsonneault, Yang, & Oh, 2011). And by forming intimate connections with other users through social interaction on fitness app, users drive others to exercise with them in order to conform to the internally constructed group norm (Lee &

Kim, 2017). Users of fitness app may become more motivated to exercise as a result of this social connection. According to Kim's results from 2022, YouTube's interactive features offer an advantageous effect on bodybuilders' flow experience.

Fifthly, because a personalized message is paid more attention to than a public message, customization could have an impact on the consumer flow experience (Alwitt & Prabhaker, 1994). Users of fitness app are expected to locate important messages among a deluge of information. Users are more likely to zero in on the content when they receive customized content. Users undertake an effort to pay attention to details and avoid disregarding the information. The audience's focused attention, interest, or desire may be sparked by the targeted message, creating a state of flow (Hoffman, 1996). Therefore the following research hypotheses was proposed (Figure1):

H1a. Usefulness will positively (+) influence flow

H1b. Enjoyment will positively (+) influence flow

H1c. Convenience will positively (+) influence flow

H1d. Interactivity will positively (+) influence flow

H1e. Personalization will positively (+) influence flow

Fitness App UX Attributes and Psychological Well-being

Firstly, applications in online environments that deliver high-quality information (i.e., utility) cause favorable consumer sentiments (Pantano, Rese, & Baier, 2017). Additionally, customers who view mobile fitness apps as helpful workout tools will believe the fitness app is more suitable and, so that, their attitude will be more positive (Huang, Wei, & Leung, 2020). Kim (2022) discovered that the content of gaming apps is highly connected with psychological well-being when it comes to positive emotions. Users' psychological well-being will be generated through such pleasant emotions and mindsets. In addition, the majority of users opt to utilize mobile fitness applications with a specific goal in mind, such as enhancing their health, eating healthier, or discovering inner peace. Therefore, if the program is deemed beneficial, it must be able to satisfy user demands and training satisfaction. When a user's desires are satisfied, feelings of satisfaction will be produced, resulting in psychological well-being. In addition, Kim (2022) also discovered that an application's usability possesses a favorable impact on a user's psychological well-being.

Secondly, according to Csikszentmihalyi (1975), enjoyment has been considered to be essential to well-being. The fulfillment of fundamental psychological requirements results in psychological well-being (Deci & Ryan, 2012). Furthermore, enjoyment exhibited favorable correlations with the

fulfillment of each psychological demand. Consequently, we hypothesize that enjoyment may benefit users' psychological well-being.

Thirdly, convenience could be related to high levels of users' psychological well-being (Kim, 2022). Ryff (1989) contends that autonomy is one of the six dimensions of psychological well-being. Hence, when users employ fitness apps to exercise, they are not restricted by time and place, so they are able to possess more autonomy over their exercise and their psychological demands will be successfully satisfied. As such, people will feel more psychological well-being.

Fourthly, positive relationships represent yet another aspect of psychological well-being (Ryff, 1988). Users of fitness apps are able to encourage one another through online communities and communicate with people who share their interests in fitness in order to become healthy, while also taking advantage of fitness classes, to build positive interpersonal relationships. We hypothesize that interaction can positively affect psychological well-being because Kim (2022)'s research demonstrates that people who have more communication with the live streamer will feel more psychological well-being. Additionally, interaction with others through the app's virtual community can be viewed as a form of social friendship. Therefore, we hypothesize that interaction may benefit users' psychological well-being.

Fifthly, according to Meredith (2000), personalization of the workplace environment exerts a substantial impact on employees' psychological well-being. A fitness app can be thought as a type of fitness environment. Users can access more useful fitness information and programs in a personalized fitness environment, making it simpler for them to accomplish their objectives and achieve psychological well-being. As a result, we anticipate that the tailored feature of the fitness app will enhance users' psychological well-being. In light of this notion, the following research hypotheses was developed (Figure1):

H2a. Usefulness will positively (+) influence psychological well- being

H2b. Enjoyment will positively (+) influence psychological well- being

H2c. Convenience will positively (+) influence psychological well- being

H2d. Interactivity will positively (+) influence psychological well- being

H2e. Personalization will positively (+) influence psychological. well-
being

Flow, Psychological Well-being and Continuance Intention

In addition to focus, enjoyment is a prerequisite for flow. People frequently concentrate on a single endeavor, especially when they are content (Huang et al., 2020). In other words, users of mobile fitness apps are motivated to fully commit to their activities by a sense of satisfaction. In-flow fitness YouTube users are satisfied with fitness YouTube channels as Kim (2022) recently highlighted. Likewise, flow is favorably associated with well-being in those who engage in their preferred activities (Carpentier, Mageau, & Vallerand, 2012). Happiness, quality of life, and life satisfaction have been identified as the components of psychological well-being by Gilbert and Abdullah (2004). Life pleasure is positively correlated with enthusiasm for a chosen pastime. On the basis of this, it is conceivable that mobile fitness app users' contentment with exercise may translate into their feeling satisfied in life and, as a result, to psychological well-being. The following hypotheses are put out by this study in light of this notion (Figure1):

H3a. Flow will positively (+) influence psychological well- being

Customers' levels of satisfaction and happiness when utilizing goods or services have an impact on their propensity to continue doing so and their perception of such goods and services. And a customer's flow state, which is

the ideal emotional state for an experience, raises their level of loyalty to an excellent service or product (Kim & Ko, 2019). It can be explained by that it presents users with challenges, enjoyment, focus, and control, which influences their desire to make a repeat purchase (Zhou, Li, & Liu, 2010). Moreover, participating in the consumption of digital content may lead to an enjoyable flow experience, which in turn increases users' attachment to the digital environment (Zhou et al., 2010). Therefore, this paper speculated that the flow state experienced by mobile fitness users when exercising with fitness apps will positively affect their continuance intention. As such, based on this notion, the following hypotheses was developed (Figure1):

H3b. Flow will positively (+) influence continuance intention

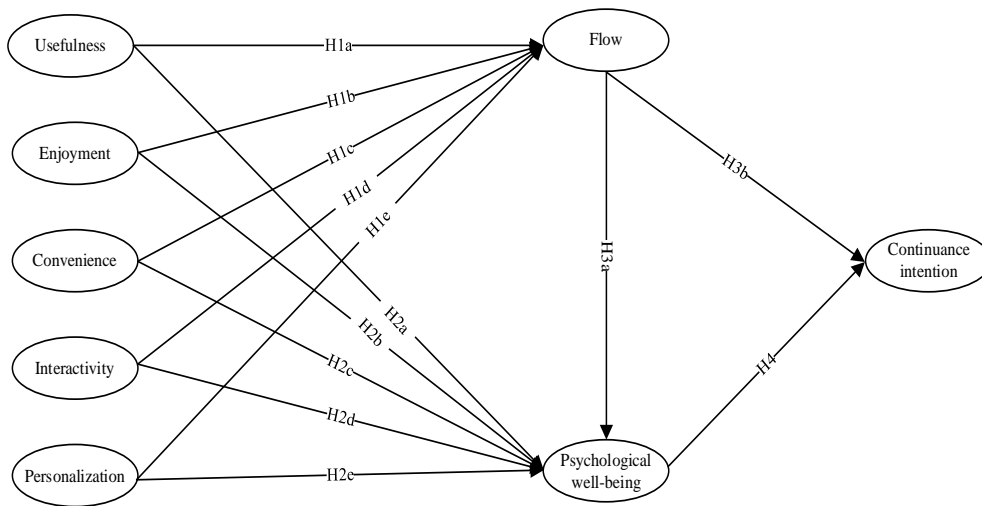
According to Gilbert and Abdullah (2004), the happiness includes a person's momentary emotional state about the current situation and reflects feelings of joy and ecstasy. Mannell (1993) discovered that elderly individuals who report higher levels of life satisfaction are far more inclined than those who report lower levels of satisfaction to choose and partake in recreational activities on a regular basis. The intention to return to the hot spring tourist location was influenced by his psychological health. In other words, psychological health influences re-consumption favorably (Chung at al., 2015). According to Kim's

research from 2022, Twitch users who are more psychologically healthy are more likely to be devoted when they utilize Twitch apps to watch live broadcasts of their favorite anchors. This indicates that consumers tend to have stronger intentions to watch again when they are in a better psychological state. Therefore (Figure1):

H4. Psychological well-being will positively (+) influence continuance intention

Figure 1

Conceptual Model



Chapter 4. Method

‘Keep’ app

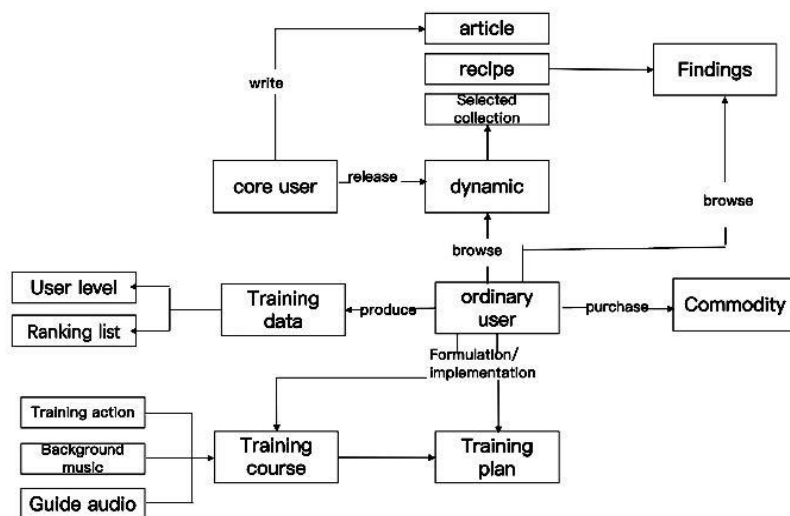
Sports fitness app has become a form of fitness outside the gym. Because it can be free from the restrictions of time and place, it is favored by many sports and fitness enthusiasts. At present, there are more than 2,500 sports and fitness software in China. As shown in Table 2, ‘Keep’ ranked first among many apps in the ranking of monthly active number of fitness apps in 2022. 'Keep,' launched in 2005, quickly garnered significant attention and experienced explosive growth in the number of users. Within just a year, the user count surpassed 10 million, making a remarkable impact in the fitness + social communication domain. Currently, the number of 'Keep' users has exceeded 200 million. Due to its high user retention, this study selects 'Keep' as the subject for investigating the research problem.

‘Keep’ App is mainly aimed at leisure and fitness, facing sports and fitness white users. In terms of course design, it provides courses without equipment or only simple sports equipment (e.g., dumbbells, skipping rope, etc.), mainly including running, fitness teaching, cycling and other contents. In terms of business, it also provides online social community, fitness and diet guidance and equipment purchase. As an online fitness software, ‘Keep’ has continuously polished its content and formed a rich course system. Compared with most similar fitness app, ‘Keep’ performs much better in this aspect. And the business

structure diagram, information structure diagram, and business flow diagram of 'Keep' from various websites, which are displayed in Figure 2.

Table 2*2022 China Mobile Fitness App Monthly Active Ranking List*

Ranking	Fitness app	Active participants (millions)
1	Keep	13.83
2	Codoon	7.50
3	Zeep Life	6.64
4	Joyrun	5.50
5	Funrun	4.18

(source: <https://www.iimedia.cn/c880/91725.html>)**Figure 2***Function/Contents of 'Keep'*(Source : <https://www.jianshu.com/p/9d708536bc12>)

Participants and Procedures

People who have exercised through the ‘Keep’ app will be investigated through online questionnaire in this study. The survey included a screening question: “Do you use or have you ever used the ‘Keep’ app for exercise? (i.e., participants had to answer ‘yes’ to this question or the participants will be forcibly moved to the end).”

And the ‘Tengxun Questionnaire’ was used to create the questionnaire, which was randomly distributed via ‘WeChat’ and ‘Keep’ online communities and collected from April 14 to April 18, 2023. 489 samples were collected and 44 invalid questionnaires were removed. Finally, an empirical analysis of the 455 valid questionnaires was carried out. The data collected were collated, and demographic characteristic analyses, correlation analysis, the CFA and SEM were performed with a SPSS 26.0 and Amos 26.0.

Item Development

Elements from previous research on mobile fitness apps and physical activity were carefully selected. Rigorous data analysis methods were employed to ensure high reliability and validity. Each item was measured by a 7-point Likert scale. To encourage honest responses and protect participants' anonymity, the cover letter included a statement stating that there are no standard answer (Kim, M. & Kim, H., 2022).

Table 3*Indicators and Contents of the Questionnaire*

Variables	Number of items	Reference
Usefulness	5	Davis et al. (1989) Huang et al. (2020) Lu & Bin (2022)
Enjoyment	5	Huang et al. (2020)
Convenience	5	Ozturk, Bilgihan, Nusair, & Okumus (2016) Chotigo & Kadono (2021)
Interactivity	5	Wu (2019) Lu & Bin (2022) Utami, Ekaputra, & Japutra (2022)
Personalization	5	Cheng et al. (2020) Liu, Wang, & Li (2021) Lu & Bin. (2022)
Flow	5	Chang & Zhu (2012) Wu (2019)
Psychological		
Well-being	5	Chen & Chang (2019) Kim, M. & Kim, H. (2022)
Continuance		
Intention	5	Roca & Gagné (2008) Chang & Zhu (2012)
Demographic Characteristics	4	
Total	44	

Usefulness. The construct of usefulness was measured with five items. They are from the studies of Davis et al. (1989), Lu & Bin (2022), and Huang et al. (2020). These items were used to evaluate users' perception of how a fitness app can enhance their athletic performance. The specific items can be found in Table 4.

Table 4

Measures of Usefulness

Items
1. This fitness app can provide me with scientific and effective exercise guidance.
2. This fitness app helps me learn more about health and fitness-related knowledge.
3. Using this fitness mobile apps for exercise can improve my performance in physical activity.
4. This fitness app can allow me to get my exercise goals faster and more effectively.
5. Using this fitness can reduce the time I spend on unproductive exercise

Enjoyment. The construct of enjoyment was measured with five items. They are from the study by Huang et al. (2020). These items can be found in Table 5.

Table 5

Measures of Enjoyment

Items
1. Using this fitness app for exercise brings me pleasure.
2. Using this fitness app for exercise makes life fun.
3. I find using this fitness apps for exercise to be interesting.
4. Using this fitness apps for exercise makes me feel happy and relaxed.
5. Using this fitness apps for exercise is exciting.

Convenience. The convenience construct was measured through five items from Chotigo & Kadono (2021) and Ozturk et al. (2016) to assess users' perceptions of how convenient fitness apps are during workouts and their belief in the app's ability to facilitate workouts at a more convenient time and place. The items used for measurement can be found in Table 6.

Table 6

Measures of Convenience

Items
1. Using this fitness app enables me to exercise at any time I want.
2. Using this fitness app enables me to exercise at any place I want.
3. This fitness app provides me with a variety of services (e.g., stretch, body shape).
4. I find this fitness app convenient for exercise.
5. This fitness app is very convenient to use.

Interactivity. The interactivity construct was measured by five items from Wu (2019), Lu & Bin (2022), and Utami et al. (2022) to examine the level of communication between users and fitness apps, as well as how users interact with each other. The specific items used for measurement can be found in Table 7.

Table 7

Measures of Interactivity

Items
1. This fitness app can quickly respond to my specific needs.
2. The platform can promptly answer any questions I have while using this fitness app.
3. I can interact with other fitness enthusiasts in this fitness app community.
4. The quality of interaction offered by this fitness app is excellent for meeting my exercise tasks.
5. This fitness app will launch relevant fitness information and activities according to the latest fitness news.

Personalization. Five items from Cheng et al. (2020), Liu et al. (2021), and Lu & Bin (2022) was used to measured personalization construct. The specific items used for measurement can be found in Table 8.

Table 8

Measures of Personalization

Items
1. The exercise method selected and recommended by this fitness app is very suitable for my physical condition.
2. This fitness app can provide me with more relevant information tailored to my preferences or personal interests.
3. This fitness app's personalized settings meet my personalized needs.
4. Overall, this fitness app meets my personal exercise needs.
5. This fitness app knows what I want.

Flow. The flow construct was assessed with five items from Chang & Zhu (2012) and Wu (2019). The specific items used for measuring flow can be seen in Table 9.

Table 9

Measures of Flow

Items
1. I feel in total control of the exercise I am doing.
2. My attention is focused entirely on the exercise I am doing.
3. I enjoy the feeling of that performance and want to capture it again.
4. I cannot think about anything else during exercise through this fitness app.
5. Most of the time exercising through this fitness app, I feel that I am in “flow”.

Psychological well-being. Five items from the study by Kim, M. & Kim, H (2021) and Chen & Chang (2019) were used to measure the structure of psychological well-being. These items can be found in Table 10.

Table 10

Measures of Psychological Well-being

Items
1. Exercising through this fitness app satisfies my overall needs.
2. Exercising through this fitness app plays an important role in my social well-being.
3. Exercising through this fitness app plays an important role in my leisure well-being.
4. Exercising through this fitness app makes me feel positive.
5. Exercising through this fitness app can lead a purposeful and meaningful life.

Continuance intention. The measurement of continuance intention utilized five items from the studies of Roca & Gagné (2008) and Chang & Zhu (2012). The items can be found in Table 11.

Table 11

Measures of Continuance Intention

Items
1. I intend to continue using this fitness app for the purpose of exercise.
2. I intend to continue using this fitness app for exercise rather than discontinuing its use.
3. My intention is to continue using this fitness app for exercise than using other similar apps.
4. I would like to recommend this fitness app for exercise to my friends and family.
5. In general, I intend to continue using this fitness app for exercise.

Chapter 5. Results

Demographic Characteristic Analysis

With SPSS 26.0, Demographic analysis was conducted (Table 12). In terms of gender, among the 445 respondents, the proportion of male and female is relatively balanced, with 237 (53.26%) males and 208 (46.74%) females. In terms of age, among the 445 sampled data, the highest number of respondents were in their 20s, with 303 (68.09%) people, followed by respondents in their 30s with 110 (24.72%) people. The number of respondents aged 10s is 13 (2.92%), followed by those aged 40s, with 12 (2.70%) people, and the least number of respondents were aged 50s or above, with 7 (1.57%) people.

Table 12*Demographic Characteristic Analysis*

Variables(N=445)	Characteristics	Frequency	Percent (%)
Gender	Male	237	53.26
	Female	208	46.74
Age	10s	13	2.92
	20s	303	68.09
	30s	110	24.72
	40s	12	2.70
	50s or above	7	1.57
Education	Under high school	22	4.94
	High school	92	20.67
	Bachelor	248	55.73
	Master or above	83	18.65
Occupation	Student	187	42.02
	Out of work	44	9.89
	Employed	211	47.42
	Retired	3	.67

Confirmatory Factor Analysis

A confirmatory factor analysis (CFA) was also performed. Structured validity analysis, convergence validity analysis, and discriminative validity analysis are the three basic divisions of confirmatory factor analysis. The acquired data was subjected to a CFA analysis using Amos 26.0 (Figure 3).

Model fit of CFA

Structural validity can show the relationship of the measured model and the theoretical model. The results are often expressed by χ^2 , df , χ^2/df , TLI, CFI, RMSEA, SRMR, etc.

The results are shown as that the χ^2/df value is 2.42, and it is generally believed that when the χ^2/df value is in the range of 1-3, the model fits well. The value of RMSEA is 0.06, and it is generally believed that when $RMSEA \leq 0.08$. And SRMR is 0.04. It is generally believed that when $SRMR \leq 0.05$, the model fit is ideal. And TFI and CFI are both greater than 0.9. The study CFA have a ideal measurement model fit (i.e., $\chi^2/df=2.42$; $RMSEA=0.06$; $SRMR=0.04$; $TLI=0.91$; $CFI=0.91$) (Table 13).

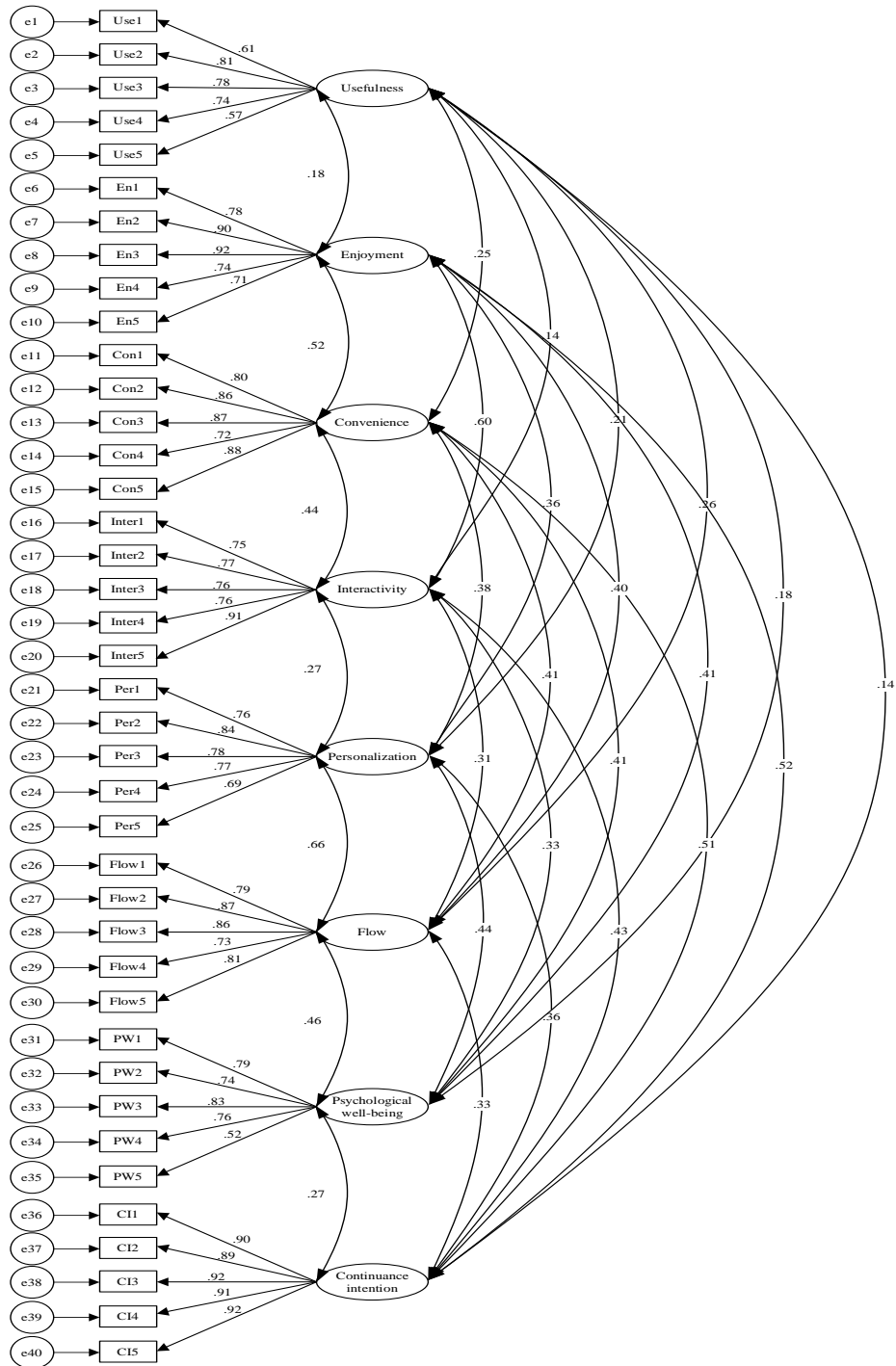
Table 13

Model Fit of CFA

Chi-square (χ^2)	<i>df</i>	χ^2/df	TLI	CFI	RMSEA	SRMR
1721.95	712	2.42	.91	.92	.06	.04

Figure 3

Confirmatory Factor Analysis



Convergence Validity

Convergent validity refers to the factor load coefficient of the corresponding variable reflected by each item, which is mostly calculated through AVE and CR. AVE is the square variance extraction, which reflects the interpretation degree of the variable and the observed variable; CR is the combination reliability, which reflects the consistency degree of the variable and the corresponding item. It is generally believed that in confirmatory factor analysis, when standardized factor loading $>.5$, AVE $>.5$, CR $>.7$, it indicates that the research data convergent validity is ideal (Table 14).

The standardized factor load coefficients of Usefulness, Enjoyment, Convenience, Interactivity, Personalization, Flow, Psychological Well-being, and Continuance intention are all greater than 0.5. Additionally, the values of AVE are also greater than 0.5 and as can be seen the values of CR are greater than 0.8. Therefore, the research data demonstrates great convergence validity.

Table 14*Convergence Validity*

Path	Estimate	AVE	CR
Use1<---Usefulness	.61		
Use2<---Usefulness	.81		
Use3<---Usefulness	.78	.50	.83
Use4<---Usefulness	.74		
Use5<---Usefulness	.57		
En1<---Enjoyment	.78		
En2<---Enjoyment	.90		
En3<---Enjoyment	.93	.67	.91
En4<---Enjoyment	.74		
En5<---Enjoyment	.71		
Con1<---Convenience	.80		
Con2<---Convenience	.87		
Con3<---Convenience	.88	.70	.92
Con4<---Convenience	.72		
Con5<---Convenience	.88		
Inter1<---Interactive	.75		
Inter2<---Interactive	.77		
Inter3<---Interactive	.76	.63	.89
Inter4<---Interactive	.76		
Inter5<---Interactive	.91		
PER1<---Personalization	.76		
PER2<---Personalization	.84		
PER3<---Personalization	.78	.59	.88
PER4<---Personalization	.77		
PER5<---Personalization	.69		

Path	Estimate	AVE	CR
Flow1<---Flow	.79		
Flow2<---Flow	.87		
Flow3<---Flow	.86	.66	.91
Flow4<---Flow	.73		
Flow5<---Flow	.81		
PW1<---Psychological Well-being	.79		
PW2<---Psychological Well-being	.74		
PW3<---Psychological Well-being	.83	.54	.85
PW4<---Psychological Well-being	.76		
PW5<---Psychological Well-being	.52		
CI1<---Continuance intention	.90		
CI2<---Continuance intention	.89		
CI3<---Continuance intention	.92	.83	.96
CI4<---Continuance intention	.92		
CI5<---Continuance intention	.92		

Note. Use=usefulness; En=enjoyment; Con=convenience; Inter=interactivity;

Per=personalization; PW=psychological well-being; CI=continuance intention.

Discriminant Validity

Discriminant validity examines differences between variables. The results (Table 15) showed a significant correlation between variables ($p < .05$), but the correlation coefficients were all less than 0.5 and smaller than the corresponding AVE square roots, indicating both correlation and differentiation between the variables. Therefore, the research data demonstrated strong discriminant validity.

Table 15*Discriminant Validity*

	Use	En	Con	Inter	Per	Flow	PW	CI
Use	.50							
En	.18**	.67						
Con	.25***	.49***	.69					
Inter	.14*	.50***	.44***	.63				
Per	.21***	.36***	.38***	.27***	.59			
Flow	.26***	.40***	.41***	.31***	.59***	.66		
PW	.18**	.41***	.41***	.33***	.44***	.46***	.54	
CI	.14**	.52***	.48***	.43***	.36***	.33***	.27***	.83

Note. *** $p < .001$, ** $p < .01$, * $p < .05$. Use=usefulness; En=enjoyment; Con=convenience;

Inter=interactivity; Per=personalization; PW=psychological well-being; CI=continuance intention.

Correlation Analysis

A correlation analysis was conducted by SPSS 26.0 (Table 16).

As observed, there was a significant positive correlation between usefulness, enjoyment, convenience, interactivity, personalization, flow, psychological well-being, and continuance intention ($p<.05$).

Table 16

Correlation Analysis

	Use	En	Con	Inter	Per	Flow	PW	CI
Use	1							
En	.17**	1						
Con	.21**	.48**	1					
Inter	.12*	.59**	.41**	1				
Per	.20**	.33**	.34**	.24**	1			
Flow	.24**	.37**	.38**	.29**	.58**	1		
PW	.16**	.37**	.39**	.31**	.43**	.50**	1	
CI	.13*	.50**	.48**	.41**	.34**	.31**	.27**	1

Note. *** $p<.001$, ** $p<.01$, * $p<.05$. Use=usefulness; En=enjoyment; Con=convenience;

Inter=interactivity; Per=personalization; PW=psychological well-being; CI=continuance intention.

Structural Equation Model

In this paper, I used Amos 26.0 to construct a structural equation model to prove the relationship between usefulness, enjoyment, convenience, interactivity, personalization, flow, psychological well-being, and continuance intention. Eight variables are established in the model: Use represents usefulness, En represents enjoyment, Con represents convenience, Inter represents interactivity, Per represents personalization, Flow represents flow, PW represents psychological well-being, and CI represents continuance intention. I established 40 observation variables and 43 residual variables (namely e1-e43) (Figure 4).

Model Fit of SEM

The degree of model fit is often used to assess the level of agreement between a hypothesis and research data. In table 17, all indicators have met the fitting standards (i.e., $\chi^2/df=2.58 < 3$; RMSEA=.06 < .08; TLI=.91 > .9; IFI=.90 > .9; CFI=.91 > .9).

Table 17

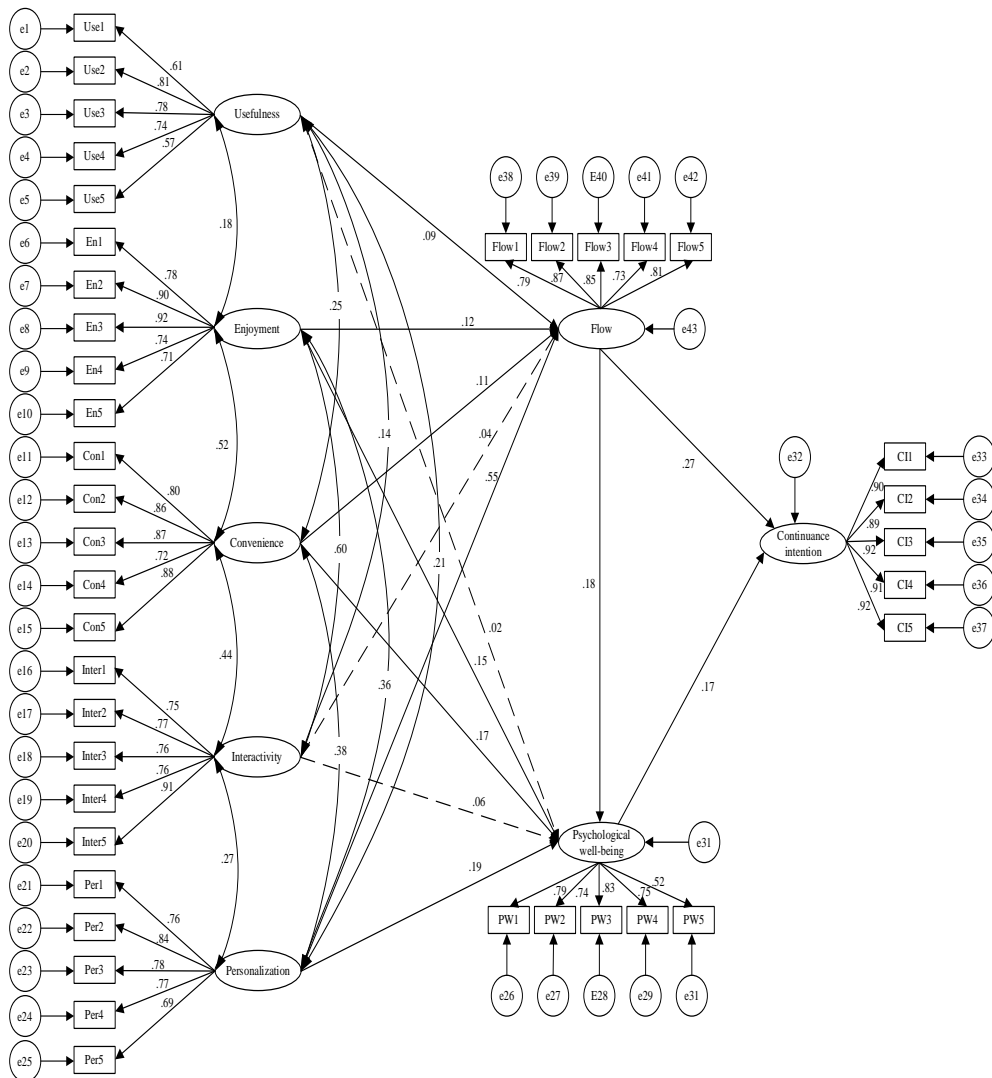
Model Fit of SEM

Chi-square (χ^2)	df	χ^2/df	TLI	CFI	RMSEA	SRMR
1847.44	717	2.58	.90	.91	.91	.06

Note. *** $p < .001$

Figure 4

Structural Equation Model Analysis



Path Analysis

The research data underwent path analysis using the revised model (Table 18). C.R. value exceeding 0.7 indicates a significant path coefficient at the 0.05 level. The path analysis results provide insights into the relationships among the variables in the research data.

H1a, b, c, d, and e hypothesized that users' perceptions of usefulness, enjoyment, convenience, interactivity, and personalization would lead to a flow state during exercise through the fitness app. The results showed that flow was positively affected by usefulness (Standardized coefficient=.09, critical ratio=1.95, $p<.05$), enjoyment (Standardized coefficient=.12, critical ratio=.19, $p<.05$), convenience (Standardized coefficient=.11, critical ratio=2.19, $p<.05$), and personalization (Standardized coefficient=.55, critical ratio=9.68, $p<.001$), supporting H1a, b, c, and e.

H2a, b, c, d, e posited that users' perceptions of usefulness, enjoyment, convenience, interactivity, and personalization would positively affect psychological well-being. From the results, as can be seen, the psychological well-being can be positively influenced by enjoyment (Standardized coefficient=.15, critical ratio=2.27, $p<.05$); convenience (Standardized coefficient=.17, critical ratio=2.80, $p<.01$); personalization (Standardized coefficient=.19, critical ratio=2.68, $p<.01$); supporting H2b, c, and e.

H3a, b hypothesized that users' flow experience while exercising through the fitness app would have a positive effect on the psychological well-being and

continuance intention. The results supported these hypotheses, revealing a positive effect of flow experience on both psychological well-being (Standardized coefficient=.18, critical ratio=2.42, $p<.05$) and continuance intention (Standardized coefficient=.27, critical ratio=4.86, $p<.001$), thus providing support for H3a and b).

H4 proposed that psychological well-being would positively affect continue intention. The empirical results supported H4, showing a significant effect of psychological well-being on continuance intention (Standardized coefficient=.17, critical ratio=2.94, $p<.01$).

Table 18*Path Analysis*

	Structure	Path	Standardized coefficient	S.E.	<i>p</i> - value	Hypothesis testing
H1a	Flow	← Use	.09	.11	*	Supported
H1b	Flow	← En	.12	.09	*	Supported
H1c	Flow	← Con	.11	.05	*	Supported
H1d	Flow	← Inter	.04	.07	.49	Rejected
H1e	Flow	← Per	.55	.10	***	Supported
H2a	PW	← Use	.02	.08	.76	Rejected
H2b	PW	← En	.15	.06	*	Supported
H2c	PW	← Con	.17	.04	**	Supported
H2d	PW	← Inter	.06	.05	.29	Rejected
H2e	PW	← Per	.19	.07	**	Supported
H3a	PW	← Flow	.18	.05	*	Supported
H3b	CI	← Flow	.27	.05	***	Supported
H4	CI	← PW	.17	.09	**	Supported

Note. *** $p < .001$, ** $p < .01$, * $p < .05$. Use=usefulness; En=enjoyment; Con=convenience;

Inter=interactivity; Per=personalization; PW=psychological well-being; CI=continuance intention.

Chapter 6. Discussion

The study have found the relationship between fitness app users' flow experience during exercise, their psychological well being, and their behavioral intentions. And from the standpoint of user experience defined five fitness app features (usefulness, enjoyment, convenience, interactivity, and personalization) by merging fitness app characteristics and established 13 hypotheses through investigation and synthesis of prior literature. This research selects the ‘Keep’ app to explore the research question after looking into the fitness app market in China. This paper created a questionnaire with 40 questions and distributed it on the Chinese “Keep” and “WeChat” platforms based on the examination of prior pertinent literature, which included questions about demographic information. 489 replies were ultimately gathered. The authors utilized SPSS26.0 and Amos26.0 to analyze the collected information, excluding 44 invalid responses.

The empirical results indicate that the characteristics that can favorably impact user flow experience are usefulness, enjoyment, convenience, and personalization. Users' psychological well-being can be beneficially affected by enjoyment, convenience, and personalization; flow and psychological well-being are the emotional aspects that influence continuance intention. At the same time, consumers' psychological health may benefit from flow experiences.

This study primarily enriched the body of knowledge on fitness qualities and cognitive appraisal theories, and it offered researchers a theoretical framework for comprehending how consumers behave as they utilize fitness apps.

Summary of Findings

Unlike conventional training techniques, fitness apps allow users to work out whenever and wherever they decide, have swift access to knowledge and information about fitness, as well as interact and communicate with other fitness aficionados. Fitness applications' UX attributes are becoming more varied and fascinating as technology advances, and they are capable of offering consumers services that are better tailored to their individual needs. Hence, understanding consumer psychology is essential for forecasting consumer behavior in every aspect of marketing.

Results demonstrate that usefulness, enjoyment, convenience, and personalization are able to positively affect the flow of fitness app users. In comparison with other fitness app UX attributes (usefulness, enjoyment, convenience) personalization exhibits the strongest impact on flow ($\beta=.55$, $p<.001$), followed by enjoyment ($\beta=.12$, $p<.05$) and convenience ($\beta=.11$, $p<.05$), and finally usefulness ($\beta=.09$, $p<.05$).

This indicates that users can reach the flow state during exercise with greater ease the more useful, enjoyable, convenient, and personalized fitness apps

are. This is so that users' exercise skills can help to achieve their balance between skills and challenges (Kim, 2021). Fitness information and training courses offered by fitness apps can also help users' exercise skills. In addition, the enjoyment users derive from using fitness applications may encourage them to exercise harder (Huang et al., 2020). Fitness applications make it convenient for users to work out without being constrained by time or place, allowing them to be more active, enjoy their workouts, and get the flow (Weibel et al., 2014). While personalization may render a user's workout method more appropriate for their own physical state, allowing them to devote themselves more throughout the exercise (Hoffman, 1996; Skadberg & Kimmel, 2004). Due to the likelihood that frequent conversation during exercise may hinder the user's concentration (Kim, M. & Kim, H., 2022).

In addition, enjoyment, convenience, and personalization can positively affect the psychological well-being of users. Compared with other fitness app UX attributes (enjoyment and convenience) personalization exhibited the strongest impact on psychological well-being ($\beta=.19, p<.01$), followed by convenience ($\beta=.17, p<.01$) and enjoyment ($\beta=.15, p<.05$).

This implies that the stronger the enjoyment, convenience, and personalization of fitness apps, the easier it is for users to achieve better psychological well-being. Users' enjoyment of fitness apps might lead them to experience excellent emotions, and these positive emotions are strongly

correlated with psychological well-being (Kim, 2021). Convenience renders it possible for consumers to exercise anywhere and at any time, which may boost their life satisfaction and mental health. Personalization can assist people to exercise in a way that better suits their tastes, increasing their enjoyment and satisfaction and fostering psychological calmness (Meredith, 2000).

Kim's (2022) research is reinforced by the discovery that interactivity and usefulness have no discernible impact on psychological well-being. It is hypothesized that this is because, although being valuable, a challenging course will frustrate its users. But because using the fitness app to communicate with other users or the platform only allows for online connection and renders it impossible to experience real social interaction, it is unable to have an advantageous impact on the psychological well-being of everyday life.

According to the empirical investigation, flow exerts a favorable effect on continuance intention ($\beta=.27, p<.001$) and psychological well-being ($\beta=.18, p<.05$). When users experience flow, they are more probable to obtain psychological well-being and are more inclined toward continuing to utilize the fitness app to exercise.

And the results further indicate that psychological well-being ($\beta=.17, p<.01$) influences continuance intention in a favorable way. Accordingly, users who experience a high level of psychological well-being are more inclined toward continuing to use the fitness app to exercise. They intend to continue

utilizing the app to exercise and have a pleasant experience since psychological well-being entails maintaining a positive attitude and being satisfied with life (Mannell, 1993).

Implications

Firstly, this research intends to develop a novel research model based on the cognitive evaluation theory for exercising with fitness apps as opposed to at a set time and location like a gym or fitness center. It investigates how users' cognitive assessments of fitness app attributes influence their emotion.

Additionally, it confirmed that users of fitness apps' emotional states can predict their behavioral intentions, or whether they would continue using the app. Users who experience flow and have higher psychological well-being are more likely to utilize fitness apps to stay in shape. In addition, this article demonstrates how the flow of a fitness app's content might enhance users' psychological well-being. As a result, this study offers a technique to construct a thorough model of a fitness app for users to take into consideration the evolution of their emotional states and continuation intention. This offers a theoretical framework for comprehending the psychology and conduct of users of fitness apps.

Secondly, this study reveals that app users' flow experiences can be utilized for simultaneous sports activity contexts and content consumption in digital fitness apps. In other words, people can achieve the flow state while

engaging in physical activity while using electronic information. This empirical study offers a valuable addition to fitness app user behavior.

Thirdly, this study provides a theoretical basis for fitness app marketing as well as the enhancement and upgrading of fitness apps. For instance, raising the course's quality and interest, among other things. Theoretical evidence for encouraging fitness app usage is provided by the observation that people who enter the flow state simultaneously while maintaining a high level are more likely to continue utilizing fitness applications.

Limitations

Firstly, the study has explored the effects of fitness app UX attributes on users' flow experience and psychological well-being during exercise. However, it did not investigate the mediation effects of flow and psychological well-being. This area represents an important avenue for further research to understand the underlying mechanisms influencing users' continued usage of fitness apps. Such insights can aid app developers in designing apps that enhance users' positive emotional experiences and promote long-term engagement.

Secondly, the study has not divided the potential impact of demographic factors into consideration. Future research should account for these variables to gain a more comprehensive understanding of users' psychological well-being, flow state experiences, and continued interest in fitness apps.

Thirdly, while the study used a literature survey method to identify fitness app features, this approach may introduce bias. Future studies could use a mix of techniques, including in-depth interviews, surveys, and experiments, to overcome potential discrepancies in fitness app UX attributes.

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국문 초록

모바일 피트니스 앱에 대한 소비자 경험적 속성이 사용자 몰입, 심리적 안녕감 및 지속적 의도에 미치는 영향

범 여 진

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체육교육과

글로벌스포츠매니지먼트

우리는 삶의 모든 측면에 영향을 미치는 빠른 기술을 통해 살고 있다.

스마트폰 사용의 가속화는 모바일 피트니스 애플리케이션의 빠른 발전이 주도했다. 그러나 조사에서는 피트니스 앱 이용자의 이직률이 45.7%에 달하는 것으로 나타났다. 많은 사용자들이 건강 앱을 처음 사용한 후 얼마 지나지 않아 사용을 중단하며, 심리적 요인이 지속적인 사용 또는 사용 포기를 설명할 수 있다. 지속적 의도에 대한 이전 연구에서는 기술 사용 패턴을 더 잘 설명하기 위해 기술 관련 요소 외에도 심리적 측면을 포함할 것을 제안했다. 이 연구는 인지 평가 이론에 기초하여 피트니스 앱의 소비자 경험적 속성에 대한 사용자의 평가를 분석해 사용자의 몰입 및 심리적 안녕감에 어떻게 영향을 미치는지, 몰입

및 심리적 안녕이 지속 의도에 어떻게 영향을 미치는지, 몰입이 심리적 안녕에 어떻게 영향을 미치는지 탐구하는 것이다. 본 연구는 ‘Keep’ 앱 중국 사용자를 대상으로 설문조사를 실시하였고 SPSS 26.0과 Amos 26.0을 사용하여, 인구통계분석, 확인적 요인분석, 구조방정식 분석을 수행했다. 실증분석 결과는 유용성($\beta=.11, p<.05$), 즐거움($\beta=.12, p<.05$), 편리성($\beta=.11, p<.05$) 및 개인맞춤성($\beta=.55, p<.001$)이 몰입에 정적 영향; 즐거움($\beta=.15, p<.05$), 편리성($\beta=.17, p<.01$) 및 개인맞춤성($\beta=.19, p<.01$)이 심리적 안녕감에 정적 영향; 몰입($\beta=.27, p<.001$) 및 심리적 안녕감($\beta=.17, p<.01$)이 지속적 의도에 정적 영향; 몰입($\beta=.18, p<.05$)은 심리적 안녕감에 정적 영향을 미친다는 것을 파악했다. 이러한 연구 결과를 바탕으로 본 연구는 피트니스 행위와 피트니스 앱 사용에 대해 의미 있는 시사점을 제기한다.

주요어 : 모바일 피트니스 앱, 소비자 경험적 속성, 몰입, 심리적 안녕감, 지속적 의도

학 번 : 2021-26793

Appendix

Questionnaire

筛选问题

您是否使用过‘Keep’进行健身？

(1) 是

(2) 否（作答停止）

第一部分 健身app属性调查

有用性 (请根据以下描述，选出最为相符的选项)

	非常 不同意			一般			非常 同意
Keep可以为 我提供科学 且有效的锻 炼指导	①	②	③	④	⑤	⑥	⑦
Keep可以让 我知道更多 的健康与健 身相关知识	①	②	③	④	⑤	⑥	⑦
使用Keep进 行锻炼可以 提高我锻炼 的表现	①	②	③	④	⑤	⑥	⑦
使用Keep进 行锻炼可以 减少我在无 效运动上花 费的时间	①	②	③	④	⑤	⑥	⑦
Keep可以让 我更快且更 有效地实现 我的锻炼目 标	①	②	③	④	⑤	⑥	⑦

享受性 (请根据以下描述，选出最为相符的选项)

	非常 不同 意			一般			非常 同意
使用Keep进行锻炼带给我愉快的情绪	①	②	③	④	⑤	⑥	⑦
使用Keep进行锻炼使我的生活开心	①	②	③	④	⑤	⑥	⑦
我发现使用Keep进行锻炼是有趣的	①	②	③	④	⑤	⑥	⑦
使用Keep进行锻炼让我开心且放松	①	②	③	④	⑤	⑥	⑦
使用Keep进行锻炼是令人兴奋的	①	②	③	④	⑤	⑥	⑦

便利性 (请根据以下描述，选出最为相符的选项)

	非常 不同意			一般			非常 同意
Keep使我可以 在我想要 的时间进行 锻炼	①	②	③	④	⑤	⑥	⑦
Keep使我可以 在我想要 的地点进行 锻炼	①	②	③	④	⑤	⑥	⑦
Keep可以提 供给我多样 化的服务 (如：拉伸 训练，体型 矫正...)	①	②	③	④	⑤	⑥	⑦
我发现利用K eep进行锻炼 是很方便的	①	②	③	④	⑤	⑥	⑦
Keep使用起 来很方便	①	②	③	④	⑤	⑥	⑦

交互性 (请根据以下描述，选出最为相符的选项)

	非常 不同 意			一般			非常 同意
Keep对于我的特定需求可以快速回应	①	②	③	④	⑤	⑥	⑦
使用keep的过程中我遇到的问题可以得到平台快速反馈	①	②	③	④	⑤	⑥	⑦
我可以在Keep上与其他健身爱好者进行互动	①	②	③	④	⑤	⑥	⑦
Keep提供的交互质量可以很好地满足我的锻炼任务	①	②	③	④	⑤	⑥	⑦
Keep会根据最新的健身资讯，推出相关的健身信息和活动	①	②	③	④	⑤	⑥	⑦

个性化 (请根据以下描述，选出最为相符的选项)

	非常 不同 意			一般			非常 同意
Keep为我选择和 建议的锻炼方法 符合我的身体状态	①	②	③	④	⑤	⑥	⑦
Keep可以根据我的喜 好和个人兴趣为我 提供更多的相关信息	①	②	③	④	⑤	⑥	⑦
Keep的个性化设定可 以满足我的个性化需求	①	②	③	④	⑤	⑥	⑦
总之，Keep可以满足 我的个人锻炼需求	①	②	③	④	⑤	⑥	⑦
Keep知道我想要的是 什么	①	②	③	④	⑤	⑥	⑦

第二部分 沉浸度调查（请根据以下描述，选出最为相符的选项）

	非常不同意			一般			非常同意
当我使用 Keep 进行锻炼时，我感觉可以完全控制我做的运动	①	②	③	④	⑤	⑥	⑦
我的注意力完全集中在我做的运动上	①	②	③	④	⑤	⑥	⑦
我很享受我使用 Keep 进行锻炼的感受并且想再次体验	①	②	③	④	⑤	⑥	⑦
在我使用 Keep 进行锻炼时，我不会想其他的事情	①	②	③	④	⑤	⑥	⑦
使用 Keep 进行锻炼的大部分时间，我处于‘flow’状态	①	②	③	④	⑤	⑥	⑦

第三部分 心理安宁感调查（请根据以下描述，选出最为相符的选项）

	非常不同意			一般			非常同意
使用 Keep 进行锻炼可以满足我的整体需求	①	②	③	④	⑤	⑥	⑦
使用 Keep 进行锻炼在我的社交幸福上起到重要作用	①	②	③	④	⑤	⑥	⑦
使用 Keep 进行锻炼在我的休闲幸福上起到重要作用	①	②	③	④	⑤	⑥	⑦
使用 Keep 进行锻炼让我感到积极向上	①	②	③	④	⑤	⑥	⑦
使用 Keep 进行锻炼可以让我过上有目的、有意义的生活	①	②	③	④	⑤	⑥	⑦

第四部分 持续意图调查（请根据以下描述，选出最为相符的选项）

	非常不同意			一般			非常同意
我打算继续以锻炼为目的使用 Keep	①	②	③	④	⑤	⑥	⑦
我打算继续使用 Keep 进行锻炼而不是不继续使用它	①	②	③	④	⑤	⑥	⑦
我打算继续使用 Keep 进行锻炼而不是使用其他的相似的 app	①	②	③	④	⑤	⑥	⑦
我愿意推荐我的朋友和家人利用 Keep 进行锻炼	①	②	③	④	⑤	⑥	⑦
总体来说，我打算继续使用 Keep 进行锻炼	①	②	③	④	⑤	⑥	⑦

第五部分 基本信息调查

1. 您的性别是？

- (1) 男性
- (2) 女性

2. 您的年纪是？

- (1) 10s
- (2) 20s
- (3) 30s
- (4) 40s
- (5) 50s 及以上

3. 您的最高学历是？

- (1) 高中以下
- (2) 高中
- (3) 本科
- (4) 硕士
- (5) 硕士及以上

4. 您的职业情况是？

- (1) 学生
- (2) 离职
- (3) 在职
- (4) 退休