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DETERMINANTS OF USERS' INTENTION TO ADOPT MOBILE FITNESS APPLICATIONS: AN EXTENDED TECHNOLOGY ACCEPTANCE MODEL APPROACH

by

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DISSERTATION

Submitted in Partial Fulfillment of the
Requirements for the Degree of

Doctor of Philosophy

Physical Education, Sports, & Exercise Sciences

The University of New Mexico
Albuquerque, New Mexico

July, 2014

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DEDICATION

I dedicate this dissertation to my loving wife, Dr. Young Mi Cho. Thank you for your love, support, and sacrifice throughout my doctoral study. Without you, this dissertation and my doctorate would not have been completed.

I also dedicate my dissertation work to my family and friends who have supported me through the process. A special feeling of gratitude goes to my parents, Byoung Yong Kwak and Gwi Ja Son who have provided unconditional love and support through my life and studies.

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ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to my committee co-chairs, Dr. David Scott and Dr. John Barnes, for their wisdom and support. They continually conveyed a spirit of adventure in regard to research and scholarship. Without their guidance and persistent help this dissertation would not have been possible.

I would like to thank my committee member, Dr. Todd Seidler. His support and consideration through my pursuit of a doctoral degree allowed me on track to complete my degree.

I am also grateful to Dr. Fengfeng Ke of Florida State University, who introduced me to technology-enhanced learning and has shown consistent support to my doctoral journey.

Thank you all for everything.

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Determinants of Users' Intention to Adopt Mobile Fitness Applications: an Extended Technology Acceptance Model Approach

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ABSTRACT

The present research was motivated by the recognition that the use of mobile fitness applications (MFA) is increasingly popular among sports and exercise participants in recent years. Using an extended Technology Acceptance Model (TAM) perspective, this study explored potential predictors of behavioral intention toward MFAs such as perceived ease of use, perceived usefulness, personalization, personal innovativeness in information technology (PIIT), perceived enjoyment, mobile application self-efficacy, involvement in sports and exercise participation, and social influences (interpersonal and external influences). A theoretical model was developed and tested against the empirical data collected from 385 collegiate students enrolled in physical activity classes at a large university in the United States. The result of descriptive statistics indicated that the samples are active sports and exercise participants with their weekly exercise and sports participation of 5.41 hours. A measurement model and structural equation model were tested using AMOS 22.0 and confirmed eight out of eleven hypothesized

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relationships. In particular, personalization and PIIT were found to have significant effects on perceived usefulness and perceived ease of use, which in turn, affected behavioral intention toward using MFAs. Interpersonal influence and involvement in sports and exercise participation were also found to have significant effects on intention whereas no significant effects of mobile application self-efficacy, perceived enjoyment, and external influence were observed. The analyses demonstrated that perceived usefulness was the most powerful determinants of behavioral intention followed by interpersonal influence in terms of the path coefficient values. The construct of PIIT and personalization accounted for 43.4% variances in perceived ease of use and 48.9% variances in perceived usefulness variance. All the constructs within the structural model except external influence, perceived enjoyment, and mobile application self-efficacy, collectively explained the 75.1 % variances in intention to use MFAs, suggesting that the examined model has a strong explanatory power regarding MFA users' decision making process.

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Chapter I - Introduction

With the rapid development of mobile technologies and widespread use of wireless Internet, the way people use their mobile phones has been changing. The explosive popularity of advanced mobile devices (i.e. smartphones and tablet PCs.) has compelled people to start to use their mobile devices for a variety of purposes from making a call, searching for information, socially networking with others, and listening to music, among other things. Software easily installable on mobile devices, also known as mobile applications, has rapidly developed and boosted the popularity of advanced mobile devices (Rao & Troshani, 2007). It was believed that people with advanced mobile devices mostly used them for web browsing. However, a market report by the mobile application analytics firm, Flurry found that average smartphone users were spending more time on mobile applications than web browsing. Specifically, average smartphone users now spend 94 minutes every day on applications compared to 72 minutes on web browsing (Flurry Analytics, 2012).

The development of mobile technologies has promoted the introduction and growth of mobile fitness application market. Since there is no academic definition of a mobile fitness application, this study operationally defines a mobile fitness applications (MFA) as software that runs on smartphones and advanced mobile devices and is designed to educate, entertain, or assist people who are interested in fitness in their daily lives (for e.g., Noom, Runkeeper, iFitness, iBody, deftFitness, Fitsync, AbsoluteFitness, etc). According to market research, the MFA market will grow to over $400 million in 2016 – up from $120 million in 2010. Particularly, increasing smartphone adoption

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rates, application downloads, and wearable device usage will positively affect the growth of the MFA market (ABI Research, 2010).

While other popular mobile applications are developed to expand the existing service channels (e.g. Facebook, ESPN, Yelp, etc.), MFAs should be considered a new market because it has added new value and consumption behavior to people interested in fitness by changing the way people set, record, and reach their fitness goals. For example, Runkeeper, one of the best-selling running applications, combines GPS tracking, map integration, music management, tracking running progress and record into a mobile application, and allows runners to observe their pace, locations, and record while listening to music. The mobile device aggregates all mobile application activities which are also accessible through the company's website. Runners can keep their stats for personal review and share them through the integration with social network sites. (Gilbert, 2011, July 15). Another popular MFA, iFitness, helps users to learn various exercises through texts, pictures and video instructions. Just like other popular MFAs, iFitness also accommodates progress tracking service of users' fitness activities (Heussner, 2010, Jan, 14). Although the function of MFAs vary, it is obvious that the number of people using MFAs is rapidly growing.

Prior research has examined various aspects of consumers' adoption of mobile technologies such as mobile coupons (Dickinger & Kleijnen, 2008; Scharl, Dickinger, & Murphy, 2005) , mobile ticketing (Mallat, Rossi, Tuunainen, & Oorni, 2006, 2009), mobile gaming (Ha, Yoon, & Choi, 2007), mobile advertising (Lee & Hsieh, 2009; Tsang, Ho, & Liang, 2004), and mobile banking (Gu, Lee, & Suh, 2009; Luarn & Lin, 2005). These studies presented compelling cases that mobile technologies indeed create

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new business opportunities (e.g. market expansion), helping businesses stay competitive in the marketplace. However, no academic research has been performed regarding how people use and adopt mobile technologies for their physical fitness. As Venkatesh, Ramesh, and Massey (2003) suggested, technology acceptance behavior should be investigated and understood in relation with a specific context such for better understanding of users' decision making process. Therefore, this study aims to investigate user acceptance of MFAs which are specifically designed to enhance the quality of users' fitness-related activities.

MFA users may have a different adoption process compared to other information systems and information technologies. For example, people who are not interested in sports and exercise may not use MFAs. Considering that a MFA is still new software, an individual's traits such as willingness to use new technology may affect their adoption of MFAs. If people think using a MFA is too difficult or useless, they may not use MFAs.

In order to understand MFA users' complex adoption behavior, a well-grounded theoretical model must be developed and tested against empirical data. Based on the Technology Acceptance Model (TAM: Davis, 1989; Davis, Bagozzi & Warshaw, 1989), the Theory of Reasoned Action (TRA: Fishbein & Ajzen, 1975), Innovation Diffusion Theory (IDT: Rogers, 1983, 1995), Involvement theory (Zaichkowsky, 1985), and Self-efficacy theory (Bandura, 1977, 1982) were incorporated into a theoretical model which describes how and why users accept mobile technologies for their physical fitness. Those five theories have been applied in a variety of academic research domains such as consumer behavior, information systems, and education and have offered evidence of

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their validity and reliability. Therefore, by testing a theoretical model, the present study may contribute to a better understanding of the decision-making processes by which users adopt MFAs. Comprehending the essentials of what determines user adoption of MFAs is important because it can provide great management insight into developing future MFAs. As MFAs have great potential to become an educational tool, this study can give the information regarding students' cognitive process to physical education instructors. Physical education teachers and administrators may utilize the findings of this study when using MFAs for instructional tools.

Purpose of the Study

The overall objective of the present study is to contribute to the knowledge of why and how people adopt MFAs. The present study has two main foci. First, this study is designed to develop a valid scale of the MFA acceptance. Second, it aims to test a theoretical model to understand actual adoption and acceptance of MFAs.

Based on the Technology Acceptance Model (TAM: Davis, 1989; Davis, Bagozzi & Warshaw, 1989), several theories — the Theory of Reasoned Action (TRA: Fishbein & Ajzen, 1975, Innovation Diffusion Theory (IDT: Rogers, 1983, 1995), Involvement theory(Zaichkowsky, 1985), and Self-efficacy theory (Bandura, 1977, 1982) — were employed to understand MFA users' adoption behavior.

To identify actual adoption and use of MFAs, several sub-purposes were included. First, a descriptive analysis was conducted to provide the psychometric properties (e.g., mean scores or correlations) of each construct. Second, as the TAM, IDT, and TRA were used for explaining general adoption technology behavior, a sport-

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specific construct (i.e., involvement in sport and exercise participation) was introduced to understand how their value and interest in sports and exercise participation affect their intention to use MFAs. Third, given that people's perception of ease of use and usefulness of MFAs are dependent on one's personal traits and the quality of mobile services (e.g. personalization), investigating how personal innovativeness in IT and perceived personalization affect users' perceptions toward ease of use and usefulness were also examined. Fourth, one's confidence in using mobile technology is another factor of interest. Therefore, mobile application self-efficacy was developed to investigate its impact on adoption behavior. Lastly, considering users' adoption of technology is highly influenced by their significant others and mass media, the effects of both interpersonal and external influences on behavioral intention were investigated.

Significance of the Study

The present study has significant theoretical and practical implications. As the TRA, the TAM, the IDT, involvement theory, and self-efficacy theory were applied to investigate the adoption of MFAs; validation and generalizability of each theory are examined. Therefore, this study provides information about how well these theories explain a type of information technology – a MFA – adoption behavior.

In addition, this study contributes to the sport management academia by providing an empirical example of sport-related technology adoption. To date, only two studies (Hur, Ko, & Claussen, 2012; Kwak & McDaniel, 2011) have been performed regarding sport-related technology adoption behavior in the domain of sport management, and the

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topic is limited to the web-based sports information technologies (e.g., sports web portals and fantasy sports).

Considering that the market of the wearable mobile devices for fitness and health are congruously growing (Nielson, 2014), this study may serve as a guideline for understanding adoption of other mobile health and fitness technologies.

MFAs help fitness training and coaching (Buttussi & Chittaro, 2008). Therefore, this study has the potential to contribute to both distance education and physical education literature by providing an empirical example of informal learning of physical education through mobile technology.

From a practical standpoint, this study provides managerial insights for the developers of MFAs. With a better understanding of factors affecting MFA users' adoption behavior, current MFA companies and potential developers can make better products that meet needs of consumers. In addition, the marketers of MFA firms develop more effective commutation strategy with the findings of this study.

Research Questions

The present research was motivated by the recognition that use of MFAs is increasingly popular among sports and exercise participants. This study attempts to answer the main questions: "Why and how do people use a MFA?" To answer the main questions, the following questions are generated.

1. What are the effects of perceived usefulness and ease of use on intention to use a MFA?
2. What is the effect of perceived enjoyment on intention to use a MFA?

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3. What is the effect of exercise and sport participation involvement on intention to use a MFA?
4. How do perceived personalization and personal innovativeness in IT affect users' perception toward ease of use and usefulness?
5. What are the effects of social influences (i.e., interpersonal and external influence) on intention to use a MFA?
6. How does users' technological self-efficacy (i.e. mobile application self-efficacy) affect their intention to use a MFA?

Hypotheses Development

The Technology Acceptance Model (TAM) as a guiding theoretical framework. As MFA is a type of information technology, the TAM, which has been widely employed to investigate users' adoption of various technologies, was chosen as a guiding theoretical framework. The TAM is an information systems (IS) theory that models how users come to accept and use a technology and has been provided extensive support to its validity through its application in various technology adoption studies. The TAM consists of four constructs including perceived usefulness, perceived ease of use, behavioral intention, and actual use. Technology users' beliefs — perceived usefulness and perceived ease of use — collectively influence users' intention, which in turn affects actual use of technology. In other words, when users are presented with a new technology, users' perceived ease of use and perceived usefulness of the technology determine users' decision about how and when they will use the technology (Davis, 1989). The original TAM was developed to examine how people use and adopt

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computing devices in the workplace. Since its development, the TAM has been applied in different settings and provided rigorous support for its validity and reliability. As the use of mobile technology has become popular in recent years, scholars have applied the TAM for the adoption studies of various mobile-based services such as mobile coupons (Dickinger & Kleijnen, 2008; Sharples, Taylor, & Vavoula, 2005), mobile ticketing (Mallat et al., 2006, 2009), mobile gaming (Ha et al., 2007), mobile advertising (Lee & Hsieh, 2009), and mobile banking (Gu et al., 2009; Luarn & Lin, 2005). These studies also provided evidence that the TAM is an effective theory that explains and predicts users' decision toward mobile technology adoption. Therefore, the first and second hypotheses are established as:

H1. A MFA user's perceived ease of use will positively influence intention to use a MFA.

H2. A MFA user's perceived usefulness will positively influence intention to use a MFA.

Perceived enjoyment with the TAM. Because the original TAM (Davis, 1989) was developed to examine employees' adoption behavior of computing technology in which the use of technology is mandatory, many researchers suggested that the TAM should be extended with additional variables to account for the voluntary use of technology (Ha et al., 2007; Lu, Yao, & Yu, 2005; Schepers & Wetzels, 2007). Davis, Bagozzi, and Warshaw (1992) introduced the construct of perceived of enjoyment to investigate the extent to which the activity of using computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated. In

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contrast to an extrinsic motivation variable, such as perceived usefulness that measures how users' productivity and effectiveness were improved by using the technology, perceived enjoyment is conceived as an intrinsic motivation variable, such as taking part in an activity for satisfaction rather than for some outcome or result (Davis et al., 1992; Ha et al., 2007; Monsuwé, Dellaert, & De Ruyter, 2004; Moon & Kim, 2001). Since the use of mobile technology is dependent on users' discretion, perceived enjoyment has been employed in many mobile technology adoption studies to account for users' hedonic motives and found to have a strong relationship with users' intention (Ha et al., 2007; Moon & Kim, 2001; Nysveen, Pedersen, & Thorbjørnsen, 2005). Some studies have even suggested that perceived enjoyment is more powerful than perceived usefulness and perceived ease of use in predicting users' intention to adopt mobile technologies. For example, the study by Nysveen et al. (2005) provided empirical evidence that perceived enjoyment is the critical factor which determines users' intention. The authors examined how people adopt various mobile services using the structural equation modeling technique and found demonstrated intrinsic motivation (perceived enjoyment) is more powerful than extrinsic motivation (perceived usefulness) in terms of standard path coefficient value. Ha et al. (2007) also examined the role of intrinsic motivation using perceived playfulness in their study of users' adoption of mobile games under mobile broadband wireless access environment. The authors developed the construct of perceived playfulness based on perceived enjoyment and applied it with perceived usefulness and perceived ease of use. Consistent with Nysveen et al. (2005), the result demonstrated that perceived playfulness was shown to be the most powerful predictor of intention to use mobile games. Therefore, this study hypothesizes that:

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H3. A MFA user's perceived enjoyment will positively influence intention to use a MFA.

Involvement in sports and exercise participation and intention to use a MFA. Involvement, which is defined as "a person's perceived relevance of the object based on inherent needs, values, and interests" (Zaichkowsky, 1985, p. 342), has been employed widely across academic domains (i.e., consumer behavior, marketing, and information systems) and proved its significant positive impact on individual's decision-making process. In the domain of information systems, involvement has been studied mostly with its impact on users' technology adoption behavior via various terms, such as job relevance (Venkatesh & Davis, 2000); job-determined importance (Leonard-Barton & Deschamps, 1988) ; involvement (defined by Hartwick and Barki (1994) as personal importance and relevance); task-technology fit(Goodhue & Thompson, 1995); and cognitive fit (Vessey, 1991). Although the term was different, most studies employing involvement suggested that involvement in job or technology plays a critical role in predicting users' adoption of technology. In the domain of sport management, Hur et al. (2012) firstly investigated the relationship between involvement and sport-related technology adoption behavior. The authors measured sport fan's involvement in sports and examined its relationship with intention to use sports websites. Using structural equation modeling, the study revealed that involvement in sports is one of the significant factors that influence sports fans' intention to use sports websites. However, employing the sport involvement is not desirable because users' purpose of using MFA is not for searching sport-related information but more likely for enhancing enhance performance

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and effectiveness in physical fitness-related activities (e.g., calories counters, motion analysis, exercise log and instruction, and running distance tracker using GPS). Therefore, adapted from Zaichkowsky (1985, 1994) and Shank and Beasley (1998), involvement in sports and exercise participation was developed and fourth hypothesis was generated as:

H4. A MFA user's level of involvement in sports and exercise will positively influence intention to use a MFA.

Determinants of perceived ease of use and perceived usefulness. Prior studies have suggested that perceived ease of use and perceived usefulness not only are the independent variables, which influence intention, but also are the dependent variables, which are affected by users' traits (e.g., personal innovativeness in IT) and mobile service quality (e.g., perceived personalization) (Agarwal & Karahanna, 2000; Asif & Krogstie, 2013; Hung, Ku, & Chang, 2003; Lewis, Agarwal, & Sambamurthy, 2003).

Personalization refers to a process that changes the functionality, interface, information content, or distinctiveness of a system to increase its personal relevance to an individual (Blom, 2000). In mobile information and entertainment services, successful personalization means the amount of information sent to users is reduced (Tan & Chou, 2008). A theoretical review by Asif and Krogstie (2013) provided a conceptual model explaining the role of personalization in mobile services and suggested that the users' perceived personalization is the antecedent of perceived usefulness and perceived ease of use, which in turn determine users' intention to use and actual use of the target technology. Therefore, the sixth and seventh hypotheses are:

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H6. Perceived personalization will influence perceived ease of use of a MFA.

H7. Perceived personalization will influence perceived usefulness of a MFA.

Personal innovativeness in information technology (PIIT), which is defined as the "willingness of an individual to try out any new IT" (Agarwal & Prasad, 1998), is another factor of interest. Agarwal and Prasad (1998) developed the construct of PIIT to account for differences in individual traits in the context of technology adoption. The authors found that PIIT is significantly related to users' intention to adopt new technology. A number of recent technology acceptance studies incorporated PIIT into their technology adoption models. These studies supported that PIIT is an important factor influencing intention via perceived ease of use (Agarwal & Karahanna, 2000; Hung et al., 2003; Lewis et al., 2003; Lu et al., 2005; Rouibah & Abbas, 2010; Yi, Jackson, Park, & Probst, 2006) and perceived usefulness (Agarwal & Karahanna, 2000; Lewis et al., 2003; Lu et al., 2005; Rouibah & Abbas, 2010; Yi et al., 2006). Therefore, it is hypothesized that:

H7. Personal innovativeness in IT will positively influence perceived usefulness of a MFA.

H8. Personal innovativeness in IT will positively influence perceived ease of use of a MFA.

Mobile application self-efficacy. Self-efficacy, which is defined as one's belief in one's ability to succeed in specific situations, is another factor that has been found to be a significant factor influencing one's adoption and use of technology (Agarwal,

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Sambamurthy, & Stair, 2000; Chau, 2001; Compeau & Higgins, 1995; Lee & Hsieh, 2009; McDonald & Siegall, 1992; Wang & Wang, 2008). Since Bandura and Watts (1996) argued that self-efficacy measures should be tailored to the targeted domain context for accurate explanation and prediction, various technological self-efficacy measures have been developed to investigate how one's belief in one's ability to successfully perform various technologically sophisticated new tasks". (McDonald & Siegall, 1992). Particularly in the context of mobile technology adoption, the measures of mobile self-efficacy, mobile healthcare system self-efficacy, and palm-sized device self-efficacy were developed and found to be valid in predicting users' intention to adopt mobile advertising (Lee & Hsieh, 2009), mobile health care system (Wu, Wang, & Lin, 2007), and mobile internet (Wang & Wang, 2010), respectively. Unlike other mobile-based services such as mobile advertisement and wireless internet, the nature of MFA is more similar to computer software because it provides benefits by running on mobile devices just as computer software does through computers. Agarwal et al. who defined software self-efficacy as ''individual's feeling of self-efficacy relative to a specific software package'' found that software self-efficacy is a direct and positive factor which determines users' intention to use computer software (Agarwal et al., 2000). Accordingly, this study defines mobile application self-efficacy as "an individual's feeling of self-efficacy relative to a specific mobile application" and investigates its influence on users' adoption of MFA. Therefore, the ninth hypothesis is developed as:

H9. Mobile application self-efficacy will influence intention to use a MFA.

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Social influence. In the Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB), subjective norm (social influence) directly affects behavioral intention (Ajzen, 1991; Fishbein & Ajzen, 1975). Previous studies on technology acceptance behavior also examined how subjective norms affects an individual's adoption of technology (Lu et al., 2005) While some studies only took interpersonal influence (normative belief) as a determinant of subjective norm (Taylor & Todd, 1995b), recent studies took both personal and external environmental influence as determinants of subjective norm. For example, Karahanna, Straub, and Chervany (1999) classified social influence into informational and normative influence. Bhattacherjee (2000) also classified social influence into two different ways, namely external influence and interpersonal influence. External influence refers to mass media reports, expert opinions, and other non-personal information whereas interpersonal influence includes word-of-mouth influence by friends, colleagues, and superiors. External influence is similar to informational influence whereas interpersonal influence is similar to normative influence. A MFA user's intention to use a MFA may be influenced by significant others (e.g., friends or family members) or mass media reports (e.g., the best applications of the year by the New York Times). To consider both social influences in the research model, the following hypotheses were developed:

H10. Interpersonal influence will have a positive effect on intention to use a MFA.

H11. External influence will have a positive effect on intention to use a MFA.

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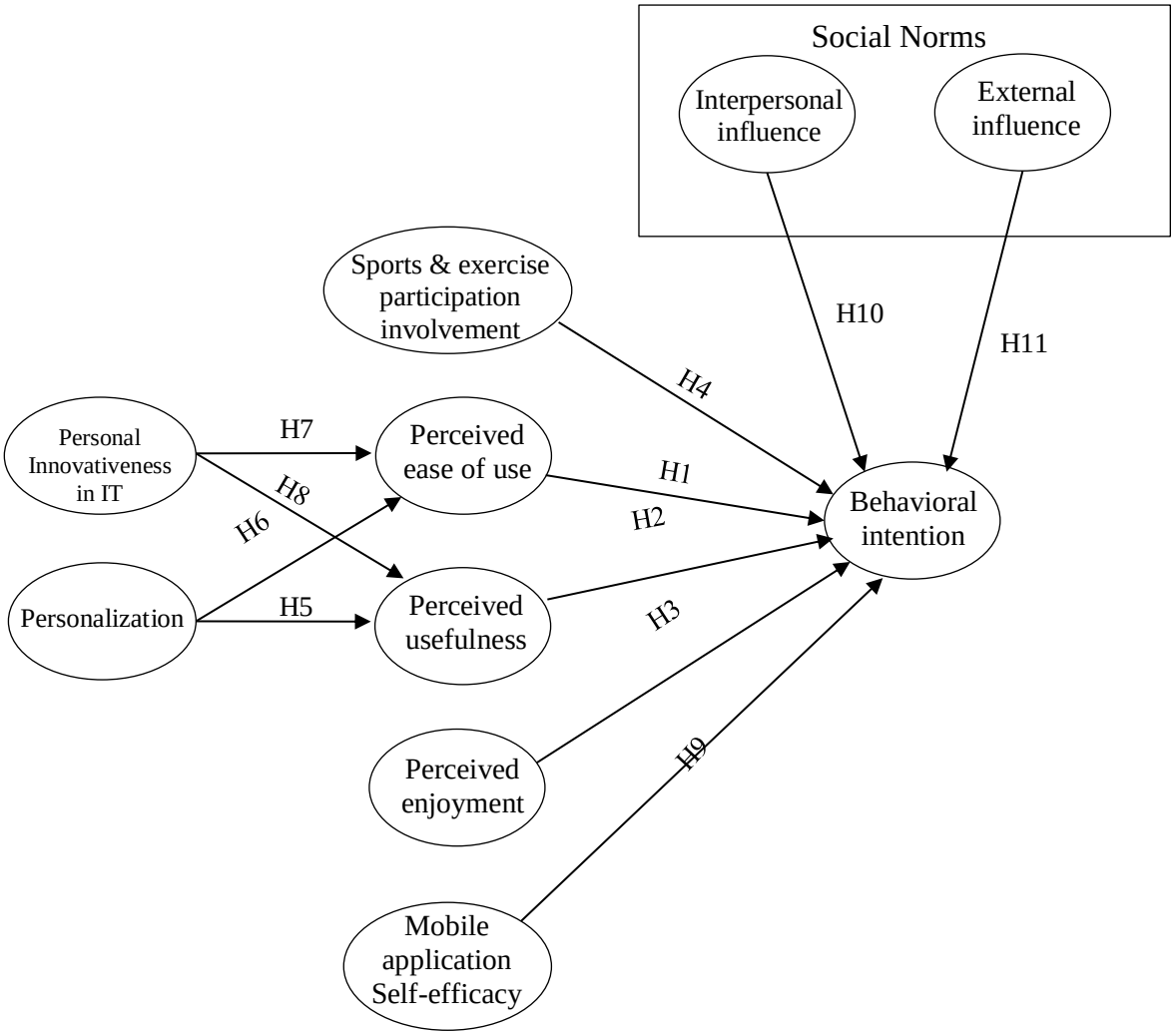

Figure 1. A theoretical model for mobile fitness application acceptance

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Limitations

The research aims to examine users' overall decision-making process about MFAs but does not target a specific MFA. Although this study provides a holistic perspective regarding use of MFAs, careful interpretation is recommended when applying the scale to understand users' behavior of a specific MFA because of difference in application functions, users' purpose of use, and other environmental factors.

Second, the subjects for this study were predominantly college students in New Mexico. Therefore, replication with different populations will be necessary to examine the generalizability of the model.

Third, beyond involvement in sports and exercise participation, other fitness-related constructs (e.g. personal value of physical well-being and motivation to maintain or enhance fitness level) may influence users' acceptance of MFAs. This study, however, included only involvement in sports and exercise participation because involvement is the widely employed belief that has been found to have the significant effect on intention to behave and actual behavior (Amoako-Gyampah, 2007; Hur, Ko, & Claussen, 2011).

Fourth, the price of MFAs, which is also one of the critical factors that affect consumer decision-making process, is excluded in order to create a parsimonious model.

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Assumptions

1. It is assumed that an individual's beliefs and intention are measurable.
2. It is assumed that responses to the survey questionnaires are truthful.
3. It is assumed that participants can read and understand the questions that are given to them.
4. It is assumed that mobile fitness users do not take a heuristic approach in adopting MFAs.
5. Since a proposed model has strong behavioral elements, it is assumed that when respondents intend to use a MFA, they are free to act without limit. In practice, constraints such as limited ability, time, environmental or organizational limits, and unconscious habits limit the freedom to act (Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003)

Definition of Terms

Smartphone : a mobile phone built on a mobile operating system, with built-in applications and wireless Internet access.

Tablet PC: a mobile computer, usually larger than a smartphone or personal digital assistant, integrated into a flat touch screen and primarily operated by touching the screen rather than using a physical keyboard.

Mobile fitness application (MFA): a mobile application that is specifically designed to educate, entertain, or assist people interested in physical fitness.

TRA: Theory of Reasoned Action (Fishbein & Ajzen, 1975)

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TAM: Technology Acceptance Model (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989)

IDT: Innovation Diffusion Theory (Rogers, 1983, 1995)

Involvement in Sport and Exercise Participation: a person's perceived relevance of sport and exercise participation based on inherent needs, values and interests (adapted from Zaichkowsky, 1985)

Perceived Usefulness (PU): the degree to which a person believes that using a particular system would enhance his or her job performance (Davis, 1989)

Perceived Ease of Use (PEU): the degree to which a person believes that using a particular system would be free from effort (Davis, 1989).

Personal Innovativeness in Information Technology (PIIT): the willingness of an individual to try out any new information technology (Agarwal & Prasad, 1998)

Subjective norm: individual perceptions of social pressure regarding whether or not to use a mobile fitness application (Ajzen & Fishbein, 1980)

Interpersonal Influence (II): word-of-mouth influence by one's reference group (Hung et al., 2003; Pedersen, 2005; Rogers, 1995)

External Influence (EI): informational influence by mass media report and experts (Bhattacherjee, 2000)

Mobile Application Self-Efficacy (MASE): an individual's feeling of self-efficacy relative to a specific mobile software package (adapted from Agarwal et al., 2000)

Perceived Enjoyment (PE): the extent to which the activity of using technology is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated (Davis et al., 1992; Moon & Kim, 2001)

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Personalization (P): a process that changes the functionality, interface, information content, or distinctiveness of a MFA to increase its personal relevance to a user (Mardia, 1970).

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Chapter II - Literature Review

In this chapter, firstly, the growth of the mobile fitness application market was described. Secondly, behavioral theories applied for building a conceptual model and were reviewed. Thirdly, sport management literatures utilizing the TAM approach were reviewed. Lastly, technology applied in sports was discussed.

The Growth of the Mobile Fitness Application Market

A mobile fitness application (MFA) is a type of mobile software that is specifically designed to educate, entertain, or assist people interested in fitness. With a phenomenal adoption rate smartphones and tablet computers, the use of MFAs has also become popular among people interested in sports and fitness

The research on smartphone ownership reported that 83 percent of US adults have a cell phone of some kind, and that 42 percent of them own a smartphone (Smith, 2011). A recent market report, which covered the three-months of research period ending January 2012, revealed that 101.3 million people in the United States use smartphones among 234 revealed people using a mobile phone of some kind (comScore Inc., 2012). This report also indicated that a number of smartphone users increased by 13 percent during the study period October 2011 to January 2012. This adoption rate is phenomenal and a lot faster than other major technologies such as television, computer, mobile phone, and the Internet (Scott, 2012). Although the market has not yet fully matured, the adoption rate of tablet computers -another mobile computing devices- in which MFAs run, also showed the phenomenal adoption rate and even faster than the

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adoption rate of smartphones (Scott, 2012). Researchers pointed out that the rapid adoption of advanced mobile devices is attributed to mobile applications which deliver various services enhancing flexibility, mobility, and efficiency for users within business and life domain (Rao & Troshani, 2007).

As the use of advanced mobile devices has become popular, the number of people using mobile technologies for sports and exercise is also rapidly increasing. For example, one of the most popular MFAs, RunKeeper, has more than 12 million users as of 2012 (Alspach, 2012, Sep, 21). Overall value of the MFA market is also rapidly growing and estimated to grow over $400 million in sales in 2016 – up from $120 million in 2010. Particularly, increasing smartphone adoption rates, application downloads, and wearable device usage will positively affect the growth of the MFA market (ABI Research, 2010).

Although the number of MFA users and value of MFA market have been continuously growing, the academic efforts regarding mobile fitness applications are still sparse. To date, most studies regarding mobile fitness and health technologies have been conducted by scholars in computer science and medical informatics. (e.g., Buttussi & Chittaro, 2008; Buttussi, Chittaro, & Nadalutti, 2006; Eastin & LaRose, 2000; Knight et al., 2005). For example, with the perspective of MFA developers, Buttussi et al. (2006) initially presented the study on MFAs. However, the study only described about a new mobile fitness application, the Mobile Fitness Trainer (MOPET), which was developed by the authors. The authors categorized technology-enhanced sports and fitness products into three types that are computer-supported physical games, virtual trainers, and mobile applications and devices for physical activities. In particular, the

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authors argued that the third category to which mobile applications and devices for physical applications belonged are the most promising area because MFAs allow users to be assisted anytime anywhere. This study, however, like most research on mobile fitness technologies in computer science, did not provide sufficient information about how and why users adopt the mobile fitness application but rather focused on the applied technologies, function and design of the MFA, and other factors that may enhance the quality of user experience.

Although there have been many studies conducted with a perspective of developers, no studies have addressed users' cognitive decision making process about MFAs. In order to develop better MFAs which meet users' needs, it is critical to understand why and how people use and adopt a mobile fitness technology. Therefore, this study was designed to fill the research gap in the existing MFA literature.

Theory of Reasoned Action (TRA)

Fishbein and Azjen's (1975) theory of reasoned action (TRA) is a well-accepted model that has proven to be successful in predicting and explaining an individual's decision making process. Derived from previous social psychology research that started out as the theory of attitude, which led to the study of attitude and behavior, the TRA was "born largely out of frustration with traditional attitude–behavior research, much of which found weak correlations between attitude measures and performance of volitional behaviors"(Hale, Householder, & Greene, 2002, p. 259). The key constructs of the TRA are behavioral intention (BI), attitude (A), and subjective norm (SN). As shown in figure 2, behavioral intention measures a person's relative strength of intention

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to perform a behavior. Attitude consists of beliefs about the consequences of performing the behavior (behavioral belief) multiplied by his or her evaluation of these consequences (outcome evaluation) (Fishbein & Ajzen, 1975). Subjective norm is seen as a combination of perceived expectations from relevant individuals or groups (normative belief) along with intentions to comply with these expectations (motivation to comply). In other words, "the person's perception that most people who are important to him or her think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975). The TRA suggested that a person's behavioral intention depends on the person's attitude about the behavior and subjective norms (BI =A+SN).

Based on the TRA, marketers can predict consumers' intention and behaviors, and diagnose where and how to target consumers' switching behavior (Sheppard, Hartwick, & Warshaw, 1988).

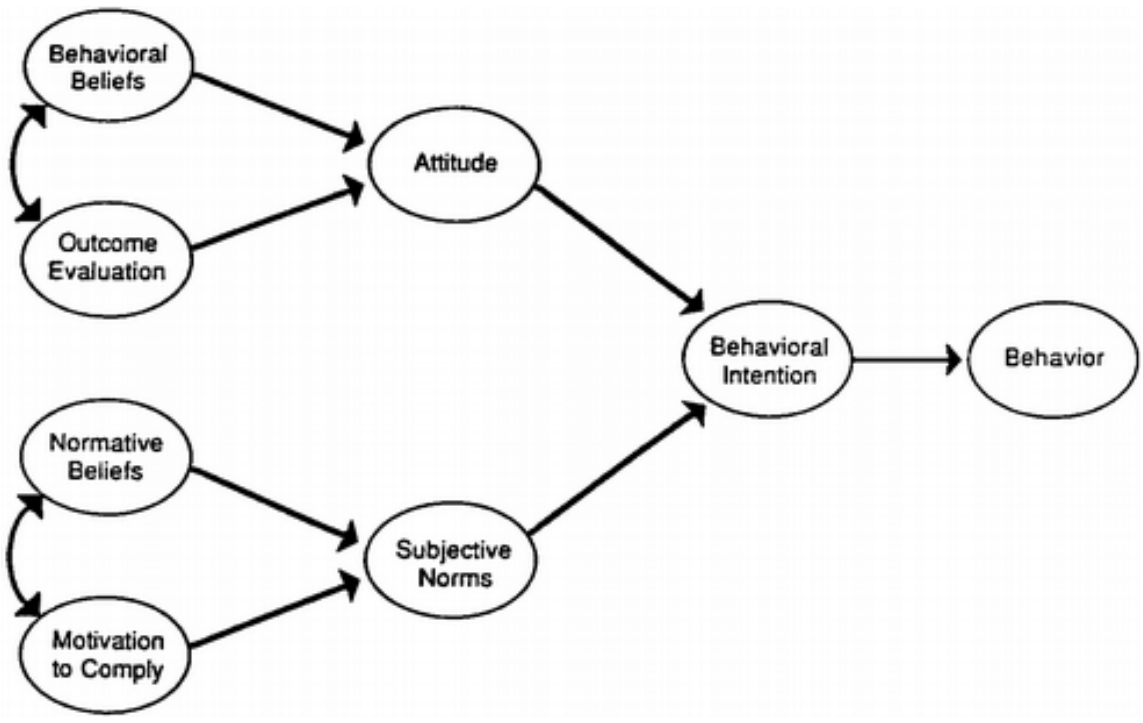

Figure 2. Theory of Reasoned Action (TRA, Fishbein & Ajzen, 1975)

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Beliefs. In the TRA, attitude and subjective norm are influenced by behavioral and normative beliefs. Beliefs refer to "the information he has about the object," and people may have different belief strength (Fishbein & Ajzen, 1975, p.12). The object of a belief may include a person, an event, or a quality. Behavioral beliefs are related to an individual's beliefs about the consequences of a given behavior, whereas normative beliefs are a person's beliefs about the perceived expectations of specific referent individuals or groups for his/her behaviors (e.g., family, friends, supervisors, and peers).

Attitude. Fishbein and Ajzen (1975) argued the nature of attitude as follows: "attitude is learned, it predisposes action, and such actions are consistently favorable or unfavorable toward the object" (p.11). Therefore, attitude is defined as "a person's favorable or unfavorable evaluation of an object" (Fishbein & Ajzen, 1975, p.12). To distinguish attitude from belief, the authors compared three constructs- affect, cognition, and conation. Affect is the essential part of attitude and refers to a person's feelings toward and evaluation of some object, person, issue, or event; cognition denotes his knowledge, opinions, beliefs, and conation refers to his behavioral intention and his actions with respect to or in the presence of the object (Fishbein & Ajzen, 1975). However, many studies regarding technology acceptance behavior excluded attitude in their technology adoption studies because other beliefs such as perceived ease of use and perceived usefulness, replace many attributes toward attitude and attitude was not significant in some studies of technology acceptance. (Taylor & Todd, 1995b; Venkatesh, Morris, et al., 2003).

Subjective norm (social influence). Social influence represents "perceived external pressures to use (or not use) the system" (Liker & Sindi, 1997, p. 152). With

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the rapid development of the Internet and social media, the effect of social influence on an individual's behavior has become more important.

In the TRA model, Fishebein and Ajzen (1975) called these social influence "subjective norms" and presented that these norms, along with personally held attitudes, could be used to consumer predict behavior. Subjective norm is defined by as "a person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975, p. 302). Subjective norms directly determine behavioral intentions because a person may perform a behavior in order to comply with his important referents regardless of his own attitude toward the behavior. In the TRA, the definition of subjective norms refers to a person's normative beliefs that reflect interpersonal pressures. However, in the Theory of Planned behavior(TPB), Ajzen and Fishbein (1980) added the construct of motivation to comply that refer to individual perceptions of social pressure regarding whether or not to perform a particular behavior (Ajzen & Fishbein, 1980).

Subjective norm was included in the Theory of Reasoned Action (TRA) but was excluded in the TAM developed by Davis (1989). The justification for not having the TRA's subjective norm within the TAM was that business settings sometimes require mandatory usage of technology (Davis et al., 1989). However, as the use of technology become a part of our daily lives, many scholars extended the TAM with subjective norms to account for the voluntary use of technology (Hung et al., 2003; Moore & Benbasat, 1991; Venkatesh & Davis, 2000; Venkatesh, Morris, et al., 2003; Wang & Wang, 2010). Since using MFAs is completely voluntary, the present study also included subjective norms as potential predictors of intention to use MFAs. To examine the application of

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the TRA model to information technology acceptance, some studies only took interpersonal influence (normative belief) as subjective norm (e.g.Taylor & Todd, 1995a). However, many other studies included two types of social influences to identify the effective communication channel. For example, Karahanna et al. (1999) noted that social influence can be classified into informational and normative influence. Informational influence is described as individuals accepting information as evidence of reality, while normative influence is described as individuals complying with the expectations of various significant others. Bhattacherjee (2000) also classified social influence into two types, namely external and interpersonal influence. External influence resembles informational influence, whereas interpersonal influence resembles normative influence. The study noted that external influence includes mass media reports, expert opinions and other non-personal information while interpersonal influence includes word-of-mouth influence by friends, colleagues, and superiors. Furthermore, the author found that both interpersonal and external influences significantly affect intention to use e-commerce service. Applying two types of social influence is helpful to identify effective communication channels. Hung et al. (2003) applied both interpersonal and external influences in the context of wireless Internet and found that only interpersonal influence had a significant impact on behavioral intention to use wireless application protocol whereas external influence (e.g., mass media reports, and experts opinions) was not significant in shaping intention.

Behavioral intention. Behavioral intention refers to "a person's intention to perform various behaviors" and the strength of an intention is explained by "the person's subjective probability that he/she will perform the behavior in question" (Fishbein &

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Ajzen, 1975, p.12). Intention refers to "a psychological construct distinct from attitude, which represents the person's motivation in the sense of his or her conscious plan to exert effort" (Eagly & Chaiken, 1993, p. 168). Behavioral intention within the TRA has been considered to be a conative component of attitude, and is determined by attitude and subjective norms. In the context of MFA adoption, behavioral intention is defined as MFA user's intention to adopt MFAs.

Behavior. Behavior refers to "observable acts" (Fishbein & Ajzen, 1975, p.12). The user of MFAs may form a number of beliefs about MFA by various inference processes or from direct observation or information received from outside sources. In the context of MFA, behavior can be measured by actual MFA usage including frequency or duration.

Technology Acceptance Model (TAM)

Derived from the TRA (Fishbein & Ajzen, 1975), the technology acceptance model (TAM) was developed by Davis (1989) in order to improve an understanding of system user acceptance of technology, specifically computer usage behavior. The main objective of the TAM was to theoretically explain the antecedents of users' computer acceptance and their behavior (Davis, 1989; Davis et al., 1989). Since its development, the TAM has received extensive empirical support via validation, applications and replications, and proven to be a robust, powerful, and parsimonious model (Rao & Troshani, 2007; Taylor & Todd, 1995a, 1995b; Venkatesh, Morris, et al., 2003).

In order to make the TAM a psychometrically and theoretically rigorous model of user acceptance of technology, Davis and his colleagues have re-validated the TAM by

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applying it to different technology uses by testing different scale formats. As a result, Davis (1989) and Davis et al. (1989) found the two key theoretical differences between the TRA and the TAM. Whereas under the TRA salient beliefs are explanatory only for a specific context, in the TAM beliefs (i.e., perceived usefulness and perceived ease of use) can be generalized to user acceptance of general technology. Additionally, under the TRA a belief is considered a single construct which is then multiplied by all beliefs and in turn affects attitude toward behavior. In contrast, under the TAM beliefs consist of two distinct constructs (i.e., perceived usefulness and perceived ease of use). The original TAM developed by Davis et al. (1989) did not include the TRA's subject norm. The reason for not including the TRA's subjective norm within the TAM was that business settings sometimes require mandatory usage of computer based technology (Davis et al., 1989). However, as the TAM has been applied to examine voluntary usage of various technologies, many researchers suggested that TAM needed to include subjective norms to provide an even stronger model (e.g., Lu et al., 2005; Schepers & Wetzels, 2007)

The original TAM had five constructs, namely perceived ease of use (PEU), perceived usefulness (PU), attitude towards use (ATU), behavioral intention to use (BI) and actual behavior on use (AU). PU and PEU are the two most important determinants for system use. ATU directly predicts users' BI which in turn determines AU. However, the model has been simplified by removing the ATU construct because PEU and PU replace many attributes toward attitude, and attitude is not significant in some cases (Taylor & Todd, 1995b; Venkatesh, Morris, Davis, & Davis, 2003).

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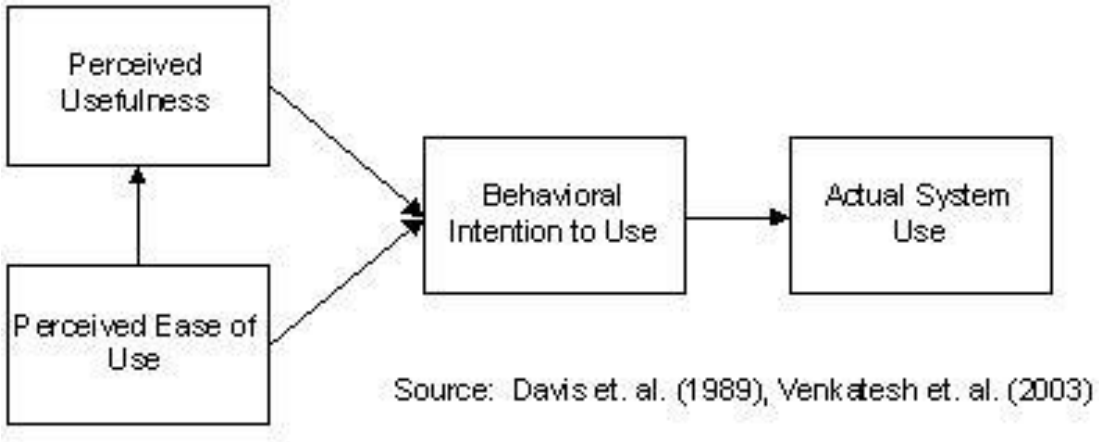

Figure 3. The simplified technology acceptance model (TAM)

Perceived usefulness. Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p.320). A MFA is perceived as useful if it enhances users' fitness-related activities such as skill acquisition and exercise management. In other words, a MFA user makes a judgment about perceived usefulness as he or she cognitively compares the overall fitness-related activities with a MFA to the fitness-related activities without a MFA. Therefore, perceived usefulness is conceived as the variable which explains users' extrinsic motivation. Perceived usefulness in the present study is defined as the degree to which an individual perceive that using a MFA would help his/her fitness-related activities.

Perceived ease of use. Perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p.320). In the present study, perceived ease of use is defined as the degree to which an individual believes that using a MFA would be free of effort. "Free of effort" includes

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ease to navigate, ease to find what/she wants to look at, ease to operate tasks, and ease to interact with a MFA.

Perceived Enjoyment

Compared to extrinsic motivational factors such as perceived usefulness, Davis et al. (1992) argued that perceived enjoyment is another important factor that explains intrinsic motives of users' adoption of information technology. Perceived enjoyment is defined as "the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated" (Davis et al., 1992, p. 113). Perceived enjoyment, along with other beliefs in TAM such as perceived usefulness and perceived ease of use, has been employed in different settings and found to be a powerful determinant of the behavioral intention in the context of voluntary use of technology (e.g., Davis et al., 1992; Ha et al., 2007; Moon & Kim, 2001).

For example, in order to examine the role of intrinsic motivation with the TAM, Moon and Kim (2001) developed the measure of perceived playfulness adapted from perceived enjoyment of Davis et al. (1992). The authors viewed perceived playfulness as an intrinsic source of motivation, referring to the performance of an activity for no apparent reason other than the process of performance itself. Their research demonstrated that perceived playfulness had a significant and positive impact on attitude and behavioral intention to use the World Wide Web. Chen, Gillenson, and Sherrell (2002), in their study of online shopping, also found that perceived playfulness is a critical factor that intrinsically motivate consumers to use and stay on a virtual store.

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As the number of people using mobile technology for fun and pleasure grows(Fang, Chan, Brzezinski, & Xu, 2006), perceived enjoyment become more important in predicting and explaining mobile technology adoption behavior. In the context of mobile services, upon adoption, users are more likely to use the mobile services that offer enjoyment more extensively than those which do not (Fang et al., 2006). Many empirical studies have evidenced that perceived enjoyment is the most important determinant of mobile technology adoption. Nysveen et al. (2005) examined user acceptance of mobile Internet Service and found that perceived playfulness, has the strongest explanatory power about behavioral intention in terms of the path coefficient value while perceived playfulness, perceived ease of use, and perceived usefulness jointly influence on behavior intention to use mobile Internet service. Ha et al. (2007) also found that perceived playfulness plays a critical role in acceptance of mobile gaming services. The authors further argued that adopters of mobile games use an innovation for the pleasure or enjoyment its adoption might bring and, therefore serve as an end unto itself.

Innovation Diffusion Theory (IDT)

The Innovation Diffusion Theory (IDT), proposed by Rogers (1983) is another important theory that explains the different adoption rate by users. With the TAM, the IDT has been widely used for relevant IT and IS studies (Karahanna et al., 1999; Premkumar, Ramamurthy, & Nilakanta, 1994). The IDT describes how innovations spread and consists of two closely related processes: the diffusion process and the adoption process (Rogers, 1995). Diffusion is a macro process concerned with the

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spread of an innovation from its source to the public whereas the adoption process is a micro process that is focused on the stages individuals go through when deciding to accept or reject an innovation. The aggregate adoption process is subsequently an S-shaped function of time (see Figure 4).

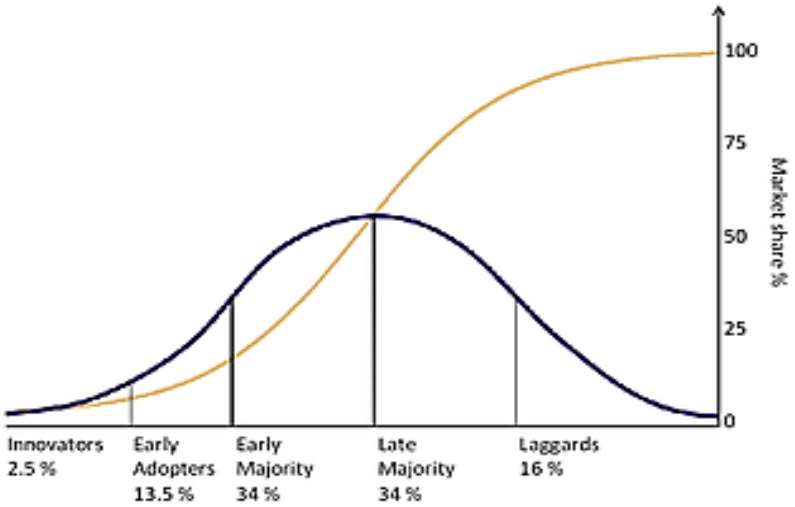

Figure 4. Diffusion of innovation (Rogers,1995)

The central concept of innovation diffusion is "the process in which an innovation is communicated through certain channels, over time, among the members of a social system." (Rogers, 1995, p.12). The IDT states that potential adopters judge an innovation based on their perceptions in regard to five attributes of the innovation. These attributes are: Trialability; Observability; Relative Advantage; Complexity; and Compatibility. The theory holds that an innovation will experience an increased rate of diffusion if potential adopters perceive that the innovation: 1) can be tried on a limited basis before adoption; 2) offers observable results; 3) has an advantage relative to other innovations ; 4) is not overly complex; and 5) is compatible with existing practices and values. Although the IDT initially included five innovation characteristics, only the

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relative advantage, compatibility, and complexity have proven to be significant (Agarwal & Prasad, 1998; Tornatzky & Klein, 1982). Since relative advantage and complexity are similar to perceived usefulness and perceived ease of use respectively, the present study only includes the construct that is compatible with MFA users' existing practice and value – involvement in exercise and sports participation.

Compatibility and Involvement

Compatibility is the degree to which the innovation is perceived to be consistent with the potential users' existing values, previous experiences, and needs (Agarwal & Prasad, 1998; Chen et al., 2002; Rogers, 1995; Sonnenwald, Whitton, & Maglaughlin, 2003). Compatibility has been widely applied in the previous studies in IS. For example, Chen et al. (2002) integrated the compatibility into the TAM to investigate the consumers' intention to use on-line shopping. In their extended TAM model, the authors demonstrated that compatibility, along with perceived ease of use and perceived ease of usefulness, positively affect behavioral intention to use virtual stores via attitude. Compatibility has been studied in the context of mobile technology adoption as well. Wu et al. (2007) examined how healthcare practitioners use and accept advanced mobile computing devices in healthcare industry. Using structural equation modeling technique, the authors found that compatibility has a significant effect on healthcare practitioners' self-efficacy in mobile healthcare system, perceived ease of use, perceived usefulness, and behavioral intention. Furthermore, Wu and Wang (2005) provided empirical evidence that compatibility has both direct and indirect effects on intention in the context of mobile services. In their study of the determinants of behavioral intention

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to use mobile commerce, the authors employed compatibility as the antecedent of perceived usefulness which reflects the overall evaluation of the technology while examining the direct effect of compatibility on intention. As expected, compatibility positively affected both perceived usefulness and intention, indicating that not only compatibility affects intention indirectly via perceived usefulness but also it directly affects perceived usefulness. In their research model, moreover, compatibility has the strongest power in explaining and predicting behavioral intention compared to other predicting variables such as perceived risk and perceived usefulness (Wu & Wang, 2005)

Considering that compatibility concerns technology users' existing values, previous experiences and needs, the construct of compatibility seems to be almost identical to the construct of involvement, which is one of the most widely studied constructs in consumer behavior.

Several leading scholars in consumer behavior have provided definitions of involvement. Laurent and Kapferer (1985) defined involvement as "an unobservable state of motivation, arousal, or interest". Another widely used definition of involvement is "a person's perceived relevance of the object based on inherent needs, values and interests" (Zaichkowsky, 1985, p. 342). According to Mano and Oliver (1993) involvement reflects "the inherent need fulfillment, value expression, or interest the consumer has in the product" (p. 452). Perceived personal relevance is considered an essential element of involvement (Celsi & Olson, 1988), which means that a consumer's involvement level in a product is determined by the degree to which the product is personally relevant to him/her. Such personal relevance of a product is associated with the consumer's needs, goals, values, and knowledge about the product (Celsi & Olson,

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1988). Although the definitions of involvement are somewhat different by scholars, involvement seems to be a similar construct to compatibility in the IDT because as it reflects an individual' interests and values.

Involvement has been considered as one of the important factor that determines a consumer's purchase decision (Celsi & Olson, 1988). Examining consumers' involvement has provided knowledge of how and why consumers build particular attachments with a certain product (Michaelidou & Dibb, 2006; Richins & Bloch, 1986; Zaichkowsky, 1985). Scholars in consumer behavior have debated the dimensionality of involvement. Laurent and Kapferer (1985) argued that indicators of the involvement level need to be examined with multi-faceted constructs in order to accurately examine the involvement level relative to a product category. Some scholars (Bloch, 1981; Rothschild, 1979; Shimp & Sharma, 1983) supported Laurent and Kapferer's argument that involvement should be examined with multi-dimensional constructs, whereas Zaichkowsky (1985) stated that a single construct can explain the nature of involvement. However, Zaichkowsky's personal involvement scale (PII) also has two dimensions: cognitive and affective involvement.

Previous research found that involvement directly affected consumers' satisfaction (Richins & Bloch, 1991), indirectly influenced intention through satisfaction (Tsiotsou, 2006),and was a mediating variable between mood and intention to shop for a product (Swinyard, 1993). Moreover, different levels of consumer involvement lead to different levels of satisfaction (Oliver & Bearden, 1983).

The involvement concept has been applied to sports-related studies and found to be valid in predicting sports and fitness-related behaviors and other relevant

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psychological constructs (e.g., Funk, Ridinger, & Moorman, 2004; Hur et al., 2012; Iwasaki & Havitz, 1998, 2004; Kerstetter & Koovich, 1997; Kyle, Absher, Hammitt, & Cavin, 2006; Lascu, Giese, Toolan, Guehring, & Mercer, 1995; Park, 1996; Shank & Beasley, 1998). As Laurent and Kapferer (1985) argued, a consumer may utilize different decision-making processes based on their involvement. Therefore, identifying individual involvement level in sports and exercise participation is critical to understand users' decision making process toward using MFAs. MFA users may show more favorable adoption behaviors if using MFA is compatible with their values, previous experiences and needs.

The present study developed the construct of involvement in sports and exercise participation adapted from Personal Involvement Inventory (PII; Zaichkowsky, 1985, 1994, Shank and Beasley, 1998). The PII was utilized in golf event by Lascu et al. (1995) to examine individual involvement with golf. In Lascu et al.'s study, sport involvement was examined as an individual difference factor that influences spectator behaviors and general commitment to a sport. Sport involvement was identified as an important predictor for analysis of market segments. Shank and Beasley (1998) developed a sport involvement scale based on the studies of Lascu et al. (1995) and Zaichkowsky (1985) in order to explore the relationship between sport involvement and sport-related behaviors (e.g., participation in sports, attendance at sports events, sport-related television viewing, and sport-related newspaper and magazine readership). Shank and Beasley (1998) also investigated sport fans' media habits, exercise habits, and demographic profiles, as well as the relationships between sport involvement and these habits and demographics. Because the nature of involvement is primarily about the

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perceived importance of the stimulus (Mittal, 1995), Shank and Beasley (1998) utilized sport as the stimulus of interest, and defined the psychological concept of sports involvement as "the perceived interest in and personal importance of sports to an individual" (p. 436). However, the use of MFA is more likely associated to participation in sports and exercise rather than affective feeling to sports, applying sport involvement developed by Shank and Beasley (1998) into the study of MFA adoption seems inappropriate. Therefore, based on Zaichkowsky (1985) and Shank and Beasley, the present study developed involvement in sports and exercise participation to identify the perceived interested in and personal importance of sports and exercise participation to an individual.

Personal Innovativeness in Information Technology

In general innovation diffusion research, it has long been recognized that highly innovative individuals are active information seekers of new ideas. They are able to cope with high levels of uncertainty and develop more positive intentions toward acceptance (Rogers, 1983, 1995). The initial attempt to measure this personal trait dealing with new information technology was made by Agarwal and Prasad (1998). They called this personality trait as Personal Innovativeness in Informational technology (PIIT) and defined it as "the willingness of an individual to try out any new information technology". This definition is derived from research on consumer innovativeness found within the marketing literature (cf. Flynn & Goldsmith, 1993; Midgley & Dowling, 1978). Agarwal and Prasad (1999) theorized that individuals with higher levels of PIIT would have more positive intentions toward the use of a new IT or system. A sample

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item for the PIIT measure is "I like to experiment with new information technologies". Agarwal and Prasad (1999) validated the scale by examining Internet use among a sample of business professionals enrolled in a part-time MBA program. They performed exploratory and then confirmatory factor analyses on the PIIT scale. Cronbach's alpha for the study was .84, and data suggested good convergent and discriminant validities. Since then, many other researchers have employed PIIT to account for an individual's differences in the adoption rate of new technology (Jones, Sundaram, & Chin, 2002; Lewis et al., 2003; Lu et al., 2005). Jones et al. (2002) studied the relationship between PIIT and use of a new sales force automation system among a sample of salespeople working for a Fortune 500 insurance company (N=164 at T1, 85 at T2). Survey data revealed that PIIT (measured pre-implementation) was significantly related to use of the new system and perceived ease of use, measured 6 months post implementation. Lewis et al. (2003) studied the adoption of Internet teaching strategies among faculty at a large, public university. They used Agarwal and Prasad's (1998) measure of PIIT ($\alpha = .90$) and found it to be significantly related to perceived usefulness and perceived ease of use of the web technology. Lu et al. (2005) also adopted PIIT to investigate college students' intention to adopt wireless Internet technology services, and also found that the measure of PIIT ($\alpha = 0.82$) is strongly related to perceived usefulness and perceived ease of use.

Personalization

Personalization is defined as a process that changes the functionality, interface, information content, or distinctiveness of a system to increase its personal relevance to an

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individual (Blom, 2000). Personalization has been widely examined on the study of websites (Komiak & Benbasat, 2006). With personalization, the amount of messages sent to the customers can be reduced and the users will no longer receive irrelevant messages. With less effort, the users can view the information needed, and hence select the information of interest more easily. Amazon, the world's leading web-based shopping mall, is the prototypical example of websites utilizing personalization. Based on a recommendation algorithm, the website provides *context*-specific and *situation*-specific contents to online shoppers (Pavlou, 2003)

In the web context, personalized services refers to the ability to customize the user interface, the information channels, and the services provided according to the individual user's needs, personal interests, and preferences (Hyldegaard & Seiden, 2004; Reamy, 2001). In this way the user is given the opportunity to construct a personal information space with relevant information sources and services and interact with the user interface in a personal manner. Alternatively, personalization is the process whereby a system uses an individual's information to deliver a targeted solution based on that user's personal preferences. This feature is considered one of the most compelling features of future mobile communication systems (Asif & Krogstie, 2013)

Since the mobile phone itself is a highly personalized device and most mobile applications support personalized functions (e.g. GPS tracking and tracking workout progress and record), personalization, along with perceived usefulness perceived enjoyment, is the key factor that determines users' perceived quality of mobile services (Tan & Chou, 2008). As an empirical example study regarding the effect of personalization on mobile technology adoption, Komiak and Benbasat (2006) found that

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perceived personalization significantly affect behavioral intentions to adopt new informational technology. More specifically, when personalized information is given from the mobile recommendation agent, people intend to use and adopt the information based on their evaluation of information accuracy. Pedersen and Ling (2003) stressed that personalization is the most critical factor that promotes adoption of mobile data services which include time, and place. Scholars in mobile learning also argued that personalization is the key feature that enables and promotes mobile learning (Motiwalla, 2007; Sharples et al., 2005). In sum, understanding and implementing personalization is critical when providing services in Ubiquitous environment (Tan & Chou, 2008).

Yelp, one of the most popular applications, has loyal users of their services utilizing personalization effectively. The information searching application helps users to find exactly what they are looking for via a set of filters they developed and to reduce the process by narrowing their search terms by category, distance, and ratings by other users (Newman, 2013). Considering that popular MFAs provide fitness-related information (e.g., calories burned, distance run, customized exercise and diet plans based on users' physical level) based on users' context, MFAs should be deemed information technology utilizing personalization. A theoretical review by Asif and Krogstie (2013) provided a conceptual model explaining the role of personalization in mobile services and suggested that the users' perceived personalization is the antecedent of perceived usefulness and perceived ease of use, which in turn determine users' intention to use and actual use of the target technology.

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Self-efficacy and Mobile Application Self-Efficacy

Self-efficacy was defined by Bandura (1977) as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses"(Bandura, 1977). As noted by Schunk, Pintrich, and Meece (2008), "Self-efficacy affects choice of activities, effort, and persistence. People holding low self-efficacy for accomplishing a task may avoid it; those who believe they are capable are likely to participate" (p. 139). Bandura (1997) considered self-efficacy a powerful cognitive force that is not necessarily directly tied to learners' abilities, but rather their beliefs about their individual skills and abilities, which heavily influence their behavior (p. 391). Self-efficacy has been empirically studied and found to be a consistently significant factor toward learning and performance (e.g.,Campbell & Hackett, 1986; Wood & Locke, 1987). However, when applied in behavioral studies, self-efficacy measures should be tailored to the targeted domain context to for the accurate explanation and prediction (Bandura, 1977, 1982; Bandura & Watts, 1996). Therefore, different technological self-efficacy (TSE) was developed and applied in the context of technology adoption. TSE is "the belief in one's ability to successfully perform a technologically sophisticated new task" (McDonald & Siegall, 1992). Computer self-efficacy is one of most widely employed TSE measures in the studies of web-based learning, and job performance. A number of studies have employed computer self-efficacy and supported the contention that it is a significant construct in determining individuals' behavior toward future use of computer technology (Agarwal et al., 2000; Chau, 2001; Compeau & Higgins, 1995; Rogers & Shoemaker,

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1983). For example, Compeau and Higgins (1995) developed and validated an instrument that measures computer self-efficacy based on individual expectations of computer use, outcomes and emotional responses from using computers. In web-based learning, Volery and Lord (2000) demonstrated that computer self-efficacy, along with instructor characteristics, is the crucial factor which determines the academic success of computer mediated education.

In the context of mobile technology adoption, many scholars have developed different mobile self-efficacy measures. Wang and Wang (2008) argued that the use of mobile devices is unlike generic technology or the Internet, and therefore should be studied independently. The authors developed the scale of mobile computing self-efficacy(MCSE) and pointed out that "traditional measures of computer self-efficacy and Internet-related self-efficacy are perceived as being incapable in the context of mobile computing and commerce because they are targeted primarily toward either desktop computer or wire-based technologies" (p. 407). Further, Wang and Wang (2008) stated, "a comprehensive mobile device self-efficacy instrument can provide a more accurate diagnostic tool to assess an individual's mobile computing self-efficacy than a simple adaptation of computer self-efficacy or Internet self-efficacy scale" (p. 407). Lee and Hsieh (2009) also developed their original measure of mobile self-efficacy to investigate its effect on attitude towards mobile advertising. The author found that mobile self-efficacy, along with informativeness, entertainment, and credibility of information, has a positive effect on consumers' attitude towards mobile advertising.

Wang and Wang (2010) also developed the new self-efficacy measure in the mobile context which is called palm-sized computer self-efficacy and employed it to investigate

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how one's self-efficacy in palm-sized computing device (e.g. smartphone and PDA) affect one's adoption of mobile internet. Applying the multi-group structural equation modeling technique, the authors further found that gender moderates the effect of palm-sized computer self-efficacy on behavioral intention to use mobile internet. In other words, palm-sized computer self-efficacy has shown be a significant factor on intention with responses from men whereas no significant effects of palm-sized self-efficacy on intention was observed with responses from women

Another notable self-efficacy measure is mobile healthcare system self-efficacy. Wu et al. (2007) developed the mobile healthcare system self-efficacy and integrated it to other technology acceptance related constructs such as compatibility, technical support and training, perceived usefulness and perceived ease of use. Using a structural equation modeling, the author found that mobile healthcare system self-efficacy indirectly affects the behavioral intention through perceived ease of use and perceived usefulness. The authors also argued that self-efficacy is especially significant in the early adoption stage of innovations (Wu et al., 2007).

People may hesitate to adopt a new MFA due to their low mobile device literacy or lack of confidence in using mobile technology. Mobile device owners with little confidence in their capability to adopt mobile software may reluctant to use MFAs.

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TAM in Sport Management Literature

Although the use of technology for sports and exercise are common, only a few studies have studied how people use and adopt technology in relation to sports. To date, only two studies were conducted using the TAM in the studies of sport-related technology adoption and usage (Hur et al., 2012; Kwak & McDaniel, 2011). For example, using an extended TAM approach, Hur et al. (2012) built a conceptual model and tested it against data collected from collegiate sports to explain sports fans' decision-making processes in using sports websites. Incorporating two sports-specific constructs such as sport involvement and psychological commitment into the TAM, the author revealed that sport involvement indirectly affect intention to use sports websites via psychological commitment. Interestingly, one of the core TAM constructs -perceived usefulness had no significant effect on intention. Consistent with web based service adoption behavior literatures, the authors also employed trustworthiness and perceived enjoyment and found the strong and significant impact of perceived enjoyment on sports fans' adoption behavior. Kwak and McDaniel (2011) also applied the TAM in exploring sports fans' fantasy sports league websites adoption behavior. As suggested by previous scholars (Ha et al., 2007; Moon & Kim, 2001; Venkatesh & Davis, 2000; Venkatesh, Morris, et al., 2003), this study extended the original TAM with additional psychological variables (e.g. subjective norm) and demographic variables (e.g. gender). Kwak & McDaniel (2011) found multiple significant relationships among variables which explain the complex fantasy sports fans' websites adoption process. More specifically, applying a set of moderated multiple regression and hierarchical regression analyses, the study found that attitude toward televised American professional football,

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perceived ease of using fantasy sport websites, perceived knowledge of the sport, and subjective norm all affect fantasy league users' behavioral intention towards playing fantasy football.

Technology in Sports

Although empirical research regarding MFAs is still sparse, there have been abundant academic efforts to examine how different technologies have been employed in our health and fitness-related activities.

A pedometer is one of examples that has been employed in physical education and sports for measuring physical activities. A pedometer is a device, usually portable and electronic or electromechanical, that counts each step a person takes by detecting the motion of the person's hip movement. Students wore a pedometer and received immediate, continuous feedback regarding their activity level (Beighle, Pangrazi, & Vincent, 2001). Numerous studies have shown pedometers to be reliable tool for measuring physical activities with both adults and children (Bassett Jr et al., 1996; Gretebeck & Montoye, 1992). Pedometers not only demonstrate to the public that students are achieving levels of physical activity but also give parents and instructors a way of discussing how active students should be, including setting goals for activity (Beighle et al., 2001).

Heart rate monitors are another example for incorporating technology into physical education. Heart rate monitors provide immediate feedback about runners' pace (Bian, Partridge, King, Anton, & Boyer, 2007). The use of heart rate monitors helps the learning more user-centered, as heart rate is based completely on the user's ability and current level of fitness. As fitness levels increase, users can see that

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cardiovascular benefits are being achieved. Regardless of running speed and distance, individuals with greater cardiovascular endurance must work harder to achieve desired heart rates, giving users an individualized goal to work towards. Heart rate monitors also provide users real-time data that allow them to see how exercises and activities affect heart rates. Traditionally, a heart rate were measured by counting pulse rates in the neck or wrist for a set period of time, using a heart rate monitor allows users to recognize their heart rates more conveniently (Kirkwood & Mahon, 2002). Charts of maximum heart rates can be made for each user, and subsequent physical activities can be the source for more measurements of heart rate. These measurements can be graphed, looked-at as proportions, provide ranges of "more" and "less," (Kirkwood & Mahon, 2002).

The development of video technology has also promoted sports and exercise participants' skill acquisition. An application that can enhance virtually every area of the physical education curriculum, both in research and in teaching, is the motion analysis system. The use of digital video cameras and smartphones has simplified the collection of data. The collected data using digital devices are imported to interactive multimedia presentations to provide students with a better understanding of the importance of breaking skills into components and the consequences of subtle variations in technique (Ladda, Keating, Adams, & Toscano, 2004). Video technology helps teachers monitor student progress toward motor skill goals, provides opportunities to give feedback, and create ideal situations for assessment of student learning (Finkenberg, Fiorentino, & Castelli, 2005).

Computer-based fitness software is another valuable tool that has been employed in physical education and health education. Subject-specific software such for anatomy,

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body composition, and assorted sports skill acquisition were developed and has been actively applied in physical education (Mohnsen, 2001).

In recent years, exergames have attracted considerable attention from scholars in exercise science and education. Digital games combining exercise with game play, known as exergames, promote students' health status and provide social and academic benefits (Staiano & Calvert, 2011). Exergames were initially developed with technological advancements to make video games more enjoyable (Parker-Pope, 2005 Oct 4). Exergames track full-body movements in three dimensions, accurately measure reaction time and acceleration, and capture the speed and power of a player's movement. Motion sensor technology using foot-operated pads, a camera interface or controller device transfers a player's image or movement to a screen (Staiano & Calvert, 2011). .

Previous studies revealed that playing exergames creates moderate energy expenditure similar to walking, skipping, and jogging. Preadolescent and adolescent youth (n = 21) increased their energy expenditure from 129% to 400% while playing Sony EyeToy games (Maddison et al., 2007). Similarly, 12 college-aged students who played *Wii* Sports games spent energy comparable with walking at 3.0 miles per hour (Bausch, Beran, Cahanes, & Krug, 2008).

Frequent exergame also play contributes to fitness and weight loss over time. Playing *Wii Active* cooperatively with peers over a 7-month period resulted in weight loss for overweight and obese youth when compared with a control condition (Staiano & Calvert, 2011). Regular *EyeToy* play also increased 20 children's total physical activity in sports and exercise and contributes their behavioral changes(Mhurchu et al., 2008).

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Along with physical benefits from playing exergames, Psychosocial and cognitive impacts of exergame play may include increased self-esteem, social interaction, motivation, attention, and visual–spatial skills. The skills that youth acquire during exergame play can transfer to other activities, thereby benefiting physical, social, and cognitive development (Staiano & Calvert, 2011)

As technology has become an important part of physical education, National Association for Sport and Physical Education (2009) produced position statement titled "Appropriate use of instructional technology in physical education", which outlined four key guidelines for appropriate use of technology in physical education. The first guideline states that the use of instructional technology in physical education is designed to provide a tool for increasing instructional effectiveness. The second guideline states that the use of instructional technology in physical education is designed to supplement, not substitute for, effective instruction. Teachers should never use the technology tool to replace instruction completely. The third guideline states that the use of instructional technology in physical education should provide opportunities for all students, versus opportunities for a few. The fourth guideline states that the use of instructional technology in physical education can prove to be an effective tool for maintaining student data related to standards-based curriculum outcomes.

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Table 1. Empirical studies of the TAM

Authors	Main Variables	External/ Moderating Variables	Subjects	Major Findings
Chen, Gillenson, & Sherrell (2002)	o PU, PEU o Compatibility		253 registered users of a non-profit organization	o Both compatibility and PEU influence PU of virtual store o Significant Effects of Compatibility, PEU and PU on Behavioral Intention to use virtual stores
Ha, Yoon, & Choi (2007)	o PU, PEU o Perceived Playfulness o Perceived Attractiveness o Flow Experience o Perceived lower Sacrifices	o Gender o Age o Prior Experience	1011 respondents	o Significant effect of perceived enjoyment on behavioral Intention to play mobile games o Significant gender difference in perception of perceived enjoyment
Tan & Chou (2008)	o PU, PEU o Personalization o Experimentation o Content o Variety o Feedback	o Compatibility o Perceived Playfulness	146 students in IS and Business classes at a New Zealand University	o Mobile Service Quality(MSQ) is determined by PU, PEU, Personalization, Experimentation, Contents, Variety, Feedback o Significant direct effect of MSQ on Perceived Playfulness o Mediating role of Compatibility between MSQ and Perceived Playfulness
Wang & Wang (2010)	o PU, PEU o Social Influence o Perceived playfulness o Perceived Value o Palm-size Computer Self-efficacy	o Gender	342 students in Taiwan	o Significant positive effect of PU, PEU, social influence, perceived value, and palm-sized computer self-efficacy on behavioral intention to use m-Internet o Significant gender differences in terms of the determinants on behavioral intention
Cheng, Sheen, & Lou (2006)	o PU, PEU o Perceived playfulness o Perceived risk	-	A total of 447 students	o Significant effect of PEU and perceived playfulness on PU o Significant effect of PU on attitude and intention o No significant effect of perceived risk on attitude and PU

Note: PU (perceived usefulness), PEU (perceived ease of use)

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Table 1. Empirical studies of the TAM (continued)

Authors	Main Variables	External/ Moderating Variables	Subjects	Major Findings
Lu, Liu, Yu & Wang (2008)	o PU, PEU o PIIT o Social Influence o Mobile Trust o Condition o Mobile Internet		A total 1432 students and practitioners	o Significant effect of PIIT on PEU and Intention to accept ***wireless mobile data service*** o Significant effects of social influence on Intention
Davis & Venkatesh (1996)	o PU, PEU	-	708 – 3 experiments and 2 systems	o No significant effect of item grouping vs. item intermixing on reliability and validity of the TAM scales o The original format (grouping) found to be better to predict and explain user acceptance
Davis (1989)	o PU, PEU	-	152 system users	o More significant effect of PU than PEU on usage o Significant effect of PEU on PU
Davis (1993)	o PU, PEU	o System design features	112 employees of a large North American corporation	o Significant effect of system characteristics on usage entirely through attitude, PU and PEU o More significant effect (50 % more) of PU than PEU on usage
Davis, Bagozzi, & Warshaw (1989)	o PU, PEU o Subjective norm	-	107 users	o Strong, significant effect of PU on intention o Small but significant effect of PEU on intention o Partial mediating effect of attitude on intention o No significant effect of subjective norm on intention
Davis, Bagozzi, & Warshaw (1992)	o PU (extrinsic motivation), PEU o Enjoyment (intrinsic motivation)		200 MBA students	o Significant effect of PU and enjoyment on intention
Wu, Wang & Lin (2007)	o PU, PEU o MHS self-efficacy o Technical Support and Training o Compatibility		137 physicians, nurses, medical technicians in Taiwan	o Significant effect of compatibility on PU, PEU, and Behavioral Intention o Significant effect of MHS self-efficacy on PEU and PU o Strong Significant effect of technical Support(60%) on MHS self-efficacy

Note: PU (perceived usefulness), PEU (perceived ease of use)

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Table 1. Empirical studies of the TAM (continued)

Authors	Main Variables	External/ Moderating Variables	Subjects	Major Findings
Bhattacherjee(2000)	o PU,PEU o Interpersonal Influence o External Influence o Self-efficacy o Facilitating Control		172 electronic brokerage adopter	o Significant effect of both Interpersonal and external influences on intention to use E-brokerage o Significant effect of Self-efficacy on Intention via behavioral control
Hung, Ku, and Chang (2003)	o PU, PEU o Peer Influence o External Influence o Self-efficacy o Perceived Control		267 respondents in Taiwan	o Significant effect of PIIT on attitude o Not significant effect of External Influence on behavioral Intention to use Wireless Application protocol (WAP) o Significant effect of Peer influence on intention to use WAP o Significant indirect effect of Self-efficacy via perceived control
Lai & Li (2005)	o PU, PEU	-	247 graduate students	o The TAM found to be invariant across gender, age, and IT competence
Moon & Kim (2001)	o PU, PEU o Perceived playfulness	-	152 graduate students	o Significant effect of perceived playfulness on attitude and intention o For the entertainment purpose group, a more significant effect of perceived playfulness on intention than PU
Page-Thomas (2006)	o PU (4 sub-dimensions) o PEU (4 sub-dimensions)	-	2077 web users	o Significant effect of how easy to use and how useful for purchasing on frequency of usage
Sánchez-Franco & Roldán (2005)	o PU, PEU o Flow	-	340 users	o Significant moderating effect of experiential and goal directed behaviors between the key relationships in the model
Schepers & Wetzels (2007)	o PU, PEU o Subjective norm	-	63 studies – Meta analysis	o Significant effects of subjective norm on PU and intention

Note: PU (perceived usefulness), PEU (perceived ease of use)

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Table 1. Empirical studies of the TAM (continued)

Authors	Main Variables	External/ Moderating Variables	Subjects	Major Findings
Shih (2004)	o PU, PEU	o Relevance of information need	203 Taiwanese office workers	o Significant effect of relevance of information needs on PU, PEU, and attitudes toward Internet use as well as individual performance
Venkatesh & Davis (1996)	o PU, PEU	o Computer self-efficacy o Usability of a specific system	108 – 3 experiments and 6 systems	o Significant effect of computer self-efficacy on PEU both before and after hands-on use o Significant effect of objective usability on PEU only after direct experience with a system
Yi, Wu, & Tung (2005/2006)	o PU, PEU	o Gender and Age o Personal Innovativeness o Computer Experience	88 students	o Potential direct or indirect effect of individual differences on usage

Note: PU (perceived usefulness), PEU (perceived ease of use)

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Chapter III - Methodology

Because this study required the use of human subjects, the research protocol, the instrument, informed consent, and departmental approval were submitted to the Institutional Review Board (IRB) of the University of New Mexico, and approval was granted.

Selection of Subjects

In order to generalize the findings of quantitative study, random sampling methods such as stratified random sampling, systematic random sampling, cluster random sampling, and multi-stage sampling are desired. However, since strict statistical sampling was not practicable for this study, the researcher employed a purposive sampling method suggested by Cook and Campbell (1976). They argued that when statistical sampling is not feasible, some degree of representativeness could be achieved by sampling only the most prevalent type of individual in the target population. Calder, Phillips, and Tybout (1981) also recommended the use of purposive sampling in consumer behavior research. Specifically, the authors argued that sampling from a homogenous group is effective in theory-testing studies because homogeneous respondents permit more exact theoretical predications and decrease the chance of arriving at false conclusions about whether covariations exist between the variables under study (Calder et al., 1981).

Based on three standards of judgment, the study subjects were carefully selected:

- The samples must have an understanding of MFA and experience in using at least one MFA.

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- The samples must consist of users of multiple MFAs instead of users of a specific MFA.
- The sample must be selected from a homogenous group which represents characteristics of *active* MFA users.

To meet the first standard of judgment (a clear understanding of MFA and experience in using a MFA), along with the definition and three representative images of MFAs, a binary question (*Have you ever used any MFAs?*) was employed in the survey questionnaire. Only the study participants with experience in using a MFA were included in the data analyses of this study.

For the second standard (a homogenous group of active MFA users), data were collected from collegiate students who enrolled in physical activity classes at a large university because 1) the most frequent users of mobile services are people between 18 and 29 years (Smith, 2011) and 2) collegiate students enrolled in physical activity classes represent a homogeneous group based on age, occupation, and interest.

Using collegiate samples was also appropriate because samples consist of users of multiple MFAs. Therefore, the third standard (users of multiple MFAs instead of users of a specific MFA) was also satisfied.

Data Collection Procedures

The researcher employed a purposive sampling method and administered the web-based survey instrument to students who were enrolled during Spring and Summer semesters at a large university in the Southwestern region from July 8 through July 22,

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2013. In addition to the measures of the ten constructs within the research model, several other questions (e.g., a favorite MFA, age, and gender) were added to the main survey (see Appendix B). The e-mailed invitation included the purpose of study, explanation of study procedures, confidentiality of individual responses, raffle information, and a web-link to the online survey tool (Opinio) where the survey questionnaire was uploaded. A raffle to win a small gift was employed to maximize the response rate. One week after the initial e-mail, a followed-up e-mail was sent to individuals who had not yet responded to the survey questionnaire.

A total of 4,276 students who enrolled in physical activity education program were invited to participate in the web-based survey. However, 11 emails were returned as not delivered. Of the 4,265 survey invitations sent, 440 were returned completed. The response rate of the survey was 9.7%. Among the 440 survey responses, 50 of them indicated that that they have not used any MFAs. As this study required subjects' experience in using MFAs, those 50 responses were excluded from the data analyses. A total of 385 responses were used for the data analyses after excluding five additional incomplete questionnaires.

More details about study subjects are presented in chapter Four.

Formulation of Survey

The survey instrument consisted of eight parts: (i) demographics, and two questions related to sports and exercise participation; (ii) involvement in sports and exercise participation; (iii) definition and representative images of MFA, and a question regarding respondents' experience of using a MFA; (iv) questions regarding MFA usage;

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(v) questions regarding beliefs about MFA including perceived ease of use, perceived usefulness, perceived enjoyment, and personalization; (vi) questions regarding personal innovativeness in IT, mobile self-efficacy, and two types of social influences (interpersonal and external influence); (vii) two questions regarding intention to use a MFA; and (viii) respondent's e-mail address for the raffle winner notification.

Section (i) of the survey consisted of three questions regarding demographics information (gender, ethnicity, and age) and two questions regarding sports and exercise participation (frequency and duration of sports and exercise participation per week).

Section (ii) of the survey contained the Sports and Exercise Participation Involvement (SEPI) scale, which was adapted from the Personal Involvement Inventory (PII) (Zaichkowsky, 1985, 1994). The PII consisted of ten items concerning two dimensions: affective and cognitive. The affective dimension consisted of five items including a) interesting, b) appealing, c) fascinating, d) exciting, and e) involving. The cognitive dimension included a) important, b) relevant, 3) valuable, 4) means a lot to me, and 5) needed. In accordance with the PII, the SEPI also included 10 items and uses a seven-point semantic differential scale. The semantic differential scale is a type of rating scale designed to measure the connotative meaning of objects, events, and concepts. The connotations were used to derive the attitude towards the given object, event, or concept (Rosenthal & Rosnow, 1991). In this study, respondents were given a single statement (*To me, Sports or Physical Fitness Activity I participate in is:*) and asked to mark the corresponding answer in a semantic differential scale. In accordance with the original scale (Zaichkowsky, 1995), the SEPI also alternated the order of negative and

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positive answers (see Appendix B). There are two advantages of alternating the order; reducing the acquiescent bias and extreme response bias (Hague, 2002).

Section (iii) contained a single question regarding the MFA experience, along with the definition of a MFA and representative images of three different MFAs. Considering that MFAs are a new technology, the definition and three representative images of MFAs were given to the respondents to identify the target technology. A question (*Have you ever used any MFAs?)* was given to screen out the respondents with no experience with a MFA. The study participants with no experience in using a MFA were directed to the last section of the survey without answering the remaining questions. Only the respondents with experience in using a MFA were given the remaining questions in section, (iv), (v), (vi), and (vii)

Section (iv) contained questions about respondents' MFA usage (the number of MFAs used, the name of the MFA smost frequently used, the frequency of the MFA use). The question regarding most frequently used MFA was given to designate the referential MFA which was used by the respondent to answer the questions about their perceptions toward the MFA.

Section (v) contained users' perceptions (perceived ease of use, perceived usefulness, perceived enjoyment, and perceived personalization) toward their most frequently used MFA. All measures were 6-point scales with anchors ranging from 1) strongly disagree to 6) strongly agree.

Perceived ease of use and perceived usefulness are the core constructs in the TAM. In the original model (Davis, 1989), perceived ease of use and perceived usefulness were measured with 28 items (14 for each; Davis, 1989). However, the scale

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was purified with four items per each constructs by Davis et al. (1989) and has been validated by several scholars (Amoako-Gyampah, 2007; Davis, 1989; Ha et al., 2007). The present study also employed the purified scales which had four items per each construct. Perceived ease of use was assessed using four items, including: "*the MFA is easy to use."* Perceived usefulness was assessed using items including: *"Using the MFA enables me to accomplish my fitness goal more quickly."*

Perceived enjoyment was derived from Davis et al. (1992) and Moon and Kim (2001) to account for intrinsic motivation of technology users. Personal enjoyment was assessed by the four statements including: *"When using the MFA, I have fun*."

Perceived personalization was assessed using four items derived from Ng-Krülle, Swatman, Hampe, and Rebne (2004) and Venkatesh and Ramesh (2002). Statements such as "*When I use the MFA; I feel the information/service is specific to my context (e.g., diet, calories, exercise)"* were used to measure perceived personalization.

Section (vi) contained the sixteen statements that measure two types of social influences, personal innovativeness in IT, and mobile application self-efficacy. All measures were 6-point scales with anchors ranging from 1) strongly disagree to 6) strongly agree.

Two types of social influences – Interpersonal and external influences – were derived from Bhattacherjee (2000). Those two types of social influence were employed in several technology adoption contexts (e.g. software, internet web-sites) and shown to be predictive factors of intention to use the target technology (Bhattacherjee, 2000; Hsu & Chiu, 2004; Hung et al., 2003). Eight statements were employed to measure social influences. Five statements, including "*My friends think that I should use a MFA for the*

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management of health and physical fitness.", were employed to assess interpersonal influence while three statements, including "*Mass media reports influenced me to try out a MFA."*, were employed to measure external influence.

Personal Innovativeness in IT developed by Agarwal and Prasad (1998) was employed to examine how individual differences affect the adoption of the technology. Agrawal and Prasad developed the questionnaires based on Rogers (1995)'s Innovation Diffusion Theory (IDT) and argued that technology end users' difference in their desire to use and adopt technology is a critical factor that determines rate of technology adoption.

Mobile application-specific self-efficacy is adapted from computer software specific self-efficacy (SSE) (Agarwal et al., 2000) and web-specific self-efficacy (WSE) (Hsu & Chiu, 2004). SSE refers to "an individual's feeling of self-efficacy relative to a specific software package", whereas WSE refers to "an individual's perception of efficacy in using a specific WWW application (service) within the domain of general Internet computing". Since the nature of mobile applications is similar to computer software and websites, mobile application self-efficacy, which is defined as an individual's perception of self-efficacy in using a specific MFA, was developed for the purpose of this study. Mobile application self-efficacy was assessed using items including "*I am able to use a MFA without the help of others".*

Section (vii) included two questions asking respondents' intention to use a MFA. These questions were derived from Davis (1989). Behavioral intention was employed as the dependent variable in this study because the actual use (frequency and duration of MFA use) varied by the application functions.

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Section (viii) contained the raffle information. If respondents were willing to participate in the raffle for a small gift, they were asked to click the link to the raffle page. Only their e-mail addresses were collected for the raffle winner notification.

Survey Instrument Development Procedures

For the purpose of the study, a scale was developed utilizing three steps: 1) item generation, 2) field test, and 3) confirmation of the survey instrument through structural equation modeling analysis.

Item generation. The first step in the survey instrument development process was the generation of a list of items for each construct. Based on the literature review, multiple measures were derived from the existing scales and modified in relation with MFAs: involvement (Zaichkowsky, 1985, 1994); the TAM constructs (Davis, 1989; Venkatesh, Morris, et al., 2003); perceived enjoyment (Davis et al., 1992; Moon & Kim, 2001), mobile application self-efficacy (Agarwal & Karahanna, 2000; Hsu & Chiu, 2004); personal innovativeness in IT (Agarwal & Karahanna, 2000; Lu et al., 2005); interpersonal and external influences (Bhattacherjee, 2000; Hung et al., 2003); and personalization (Ng-Krülle et al., 2004; Tan & Chou, 2008; Venkatesh & Ramesh, 2002).

Content validity was established through careful selection and adaptation of items from previously validated instruments. Table 2 presents the employed constructs and sources of scales.

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Table 2. The constructs employed in the survey instrument

Variables	Source
Perceived usefulness	Davis (1989)
Perceived ease of Use	Davis (1989)
Perceived enjoyment	Davis et al.(1992); Moon and Kim (2001)
Mobile application Self-efficacy	Agarwal and Karahanna (2000); Hsu and Chiu (2004)
Interpersonal influence	Bhattacherjee (2000); Hung et al. (2003)
External influence	Bhattacherjee (2000); Hung et al. (2003)
Personal innovativeness in IT	Agarwal and Karahanna (2000); Lu et al. (2005)
Personalization	Ng-Krülle et al. (2004); Tan and Chou (2008); Venkatesh and Ramesh (2002)
Behavioral Intention to use	Davis (1989)
Involvement in sports & exercise participation	Zaichkowsky (1985; 1994)

Field test. In order to purify the instrument, along with the definition of each construct, a questionnaire including all constructs was given to a panel of experts including four professors with expertise in survey research and six MFA developers and asked to assess logical consistencies, ease of understanding, sequence of items, and task relevance. A number of suggestions were provided with respect to the wording of several items and the overall structure of the questionnaire.

Data analysis procedures. Data were analyzed using the Statistical Package for Social Science (SPSS) 22.0 and Analysis of Moment Structures (AMOS) 22.0.

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Firstly, descriptive statistics were conducted using SPSS 22.0. They provided simple summaries of the sample characteristics.

The second step of data analysis was a confirmatory factor analysis using a full measurement model (see Figure 5). The results of the measurement model test determine how well the indicators capture their related constructs (Bollen, 1998; Hair, Anderson, Tatham, & William, 1998). The measurement model's overall goodness-of-fit was assessed based on two criteria: absolute fit measures and incremental fit measures. Absolute fit measures such as normed chi-square, RMSEA, and SRMR test the degree of how the overall model predicts the observed covariance or correlation matrix, while incremental fit measures such as NFI, NNFI, and CFI compare the proposed model to the null model.

Reliability and validity of the survey instrument were tested with the measurement model. Reliability analysis is a test of the internal consistency of indicators for a construct (Hair et al., 1998). The purpose of reliability analysis is to determine how well a set of items falls into some common sources of variance (Viswanathan, 2005) and is frequently measured with Cronbach's coefficient alpha. Cronbach's coefficient alpha is "the ratio of the sum of the covariances among the components of the linear combination (items), which estimates true variance, to the sum of all elements in the variance-covariance matrix of measures, which equals the observed variance" (Nunnally & Bernstein, 1994, p. 212). The minimum acceptable level of Cronbach's alpha coefficient was suggested as 0.70 (Hair et al., 1998). The reliability of a scale can be also measured by composite reliability. Composite reliability is different from Cronbach's alpha coefficient because it does not assume that the indicators have

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equal weights (Chin, 1998). Composite reliability can be calculated as follows: (square of the summation of the factor loading)/[(square of the summation of factor loading)+(summation of error variance)]. The recommended value of composite reliability is greater than 0.70. Another reliability analysis is the average variance extracted (AVE). This analysis provides "the overall amount of variance in the indicators accounted for by the latent construct" (Hair et al., 1998, p. 612). The AVE value is recommended to exceed 0.50 for a construct; exceeding 0.50 indicates that more than 50% of the variance of the indicators is explained by the latent construct.

In order to establish construct validity, the researcher examined: (a) the relationship between the observable items and their latent constructs (i.e., perceived ease of use, perceived usefulness, perceived enjoyment, personalization, personal innovativeness in IT, involvement in sports & exercise participation, mobile application self-efficacy, interpersonal influence, external influences, and intention to use a MFA); (b) the critical ratio (C.R.) in each item; and (c) correlations between the ten constructs. The C.R. is obtained by dividing the covariance estimate by its standard error. At a significance level of 0.05, any critical ratio greater than 1.96 in magnitude for a two-tail test is statistically significant (Arbuckle & Wothke, 1998).

The last step of data analysis was to test the theoretical model against the empirical data collected using structural equation modeling (see Figure 6). The structural equation modeling technique is an effective tool for identifying causal relationships between several constructs and is one in which separate multiple regression equations are estimated simultaneously (Hair et al., 1998). The researcher examined the structural model with these criteria; a) the overall goodness-of-model fit, b) individual

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casual paths in terms of standardized path coefficients, c) the indirect effects of variables within the structural model, and d) explanatory power of the structural model with R^2 values.

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Chapter IV - Results

The following chapter describes the findings of the present study and consists of three sections. The first section discusses study participants' descriptive statistics summary. The second section provides the analysis results of the measurement model. The last section discusses the results of structural equation model tests.

Study Participants' Descriptive Statistics

The purpose of this study was to investigate how and why sports and exercise participants use MFAs. The researcher employed a purposive sampling method and administered a web-based survey instrument to students who were enrolled during Spring and Summer semesters at a large university in the Southwestern region from July 8 through July 22, 2013. In addition to the measures of ten constructs within the theoretical model, several other questions (e.g., a favorite MFA, age, and gender) were added to the main survey (see Appendix B).

A total of 4,276 students who enrolled in physical activity education programs were invited to participate in the survey via the e-mail. However, 11 students were not able to receive the e-mailed invitation. Of the 4,265 survey invitations sent, 440 were returned and completed. The response rate of the survey was 9.7%. Among the 440 responses, 50 survey participants responded that they have not used any MFAs. As this study requires subjects' experience in using MFAs, those 50 subjects were excluded from the data analysis. Five additional incomplete questionnaires were also excluded and resulted in 385 usable responses.

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Table 3. Description of survey participants who have experience in using a MFA (N= 385)

Variables	Description	Frequency	Percent
Gender	Male	115	29.9
	Female	270	70.1
Ethnicity	Black or African American	12	3.1
	Asian	7	1.8
	White or Caucasian American	207	53.8
	Hispanic American	108	28.1
	American Indian or Native American	35	9.1
	Others	16	4.2
Exercise frequency	None	10	2.6
	1 time per week	78	20.3
	2 or 3 times per week	187	48.6
	4 or 5 times per week	92	23.9
	6 or 7 times per week	15	3.9
	more than 7 times per week	3	0.8
The number of apps used	1	60	15.6
	2	130	33.8
	3	74	19.2
	4	71	18.4
	More than 4 applications	50	13.0
App usage	less than once a week	30	7.8
	about once a week	55	14.3
	2 or 3 times a week	227	59.0
	4 or 5 times a week	57	14.8
	6 or 7 times a week	8	2.1
	more than 7 times a week	8	2.1

Average age of subjects: 22.29 yrs.

Weekly Exercise and Physical Activity participation: 5.41 hours

The average number of MFA used: 2.79 ea

A total of 22 MFA were used most frequently by subjects

Table 3 shows the summary of characteristics of subject who have experience with a MFA. The sample consists of 115 (29.9%) males and 270 (70.1%) females. The average age of subjects was 22.29 years and the average time per week spent on sports and exercise was 5.41 hours. With the 5.45 mean value of involvement in sports and exercise participation, the result indicated that study subjects are highly involved with

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sports and exercise participation. The majority of survey participants (87%) have used less than five MFAs and the average number of MFAs the subjects used was 2.79. Considering that more than hundreds of MFAs are on the market at the study point, this result suggests that this study was conducted at with the early adopters and early majority of MFA users.

Regarding the actual usage of MFAs, the frequency and duration of MFA use per week were asked. The majority of subjects (59%) answered that they had used a MFA 2 or 3 times per week while only 8 (2.1%) respondents used a MFA more than 7 times per week. The duration of using MFAs varied from the minimum of 0.5 hours to the maximum of 40 hours. The wide range of time spent on using MFAs seemed to have 22 MFAs with different functions.

Measurement Model

A measurement model for the ten constructs was assessed by a confirmatory factor analysis using AMOS 22.0 (Figure 5). As one of the items (perceived enjoyment 1: PE1) within the measurement model 1 (M1) failed to load the suggested value of 0.7, a modified measurement model (M2) without an item with low factoring loading (PE1) was developed. Measurement models were compared using overall goodness-of-fit and the result yielded that measurement M1 is the better model (see Table 4).

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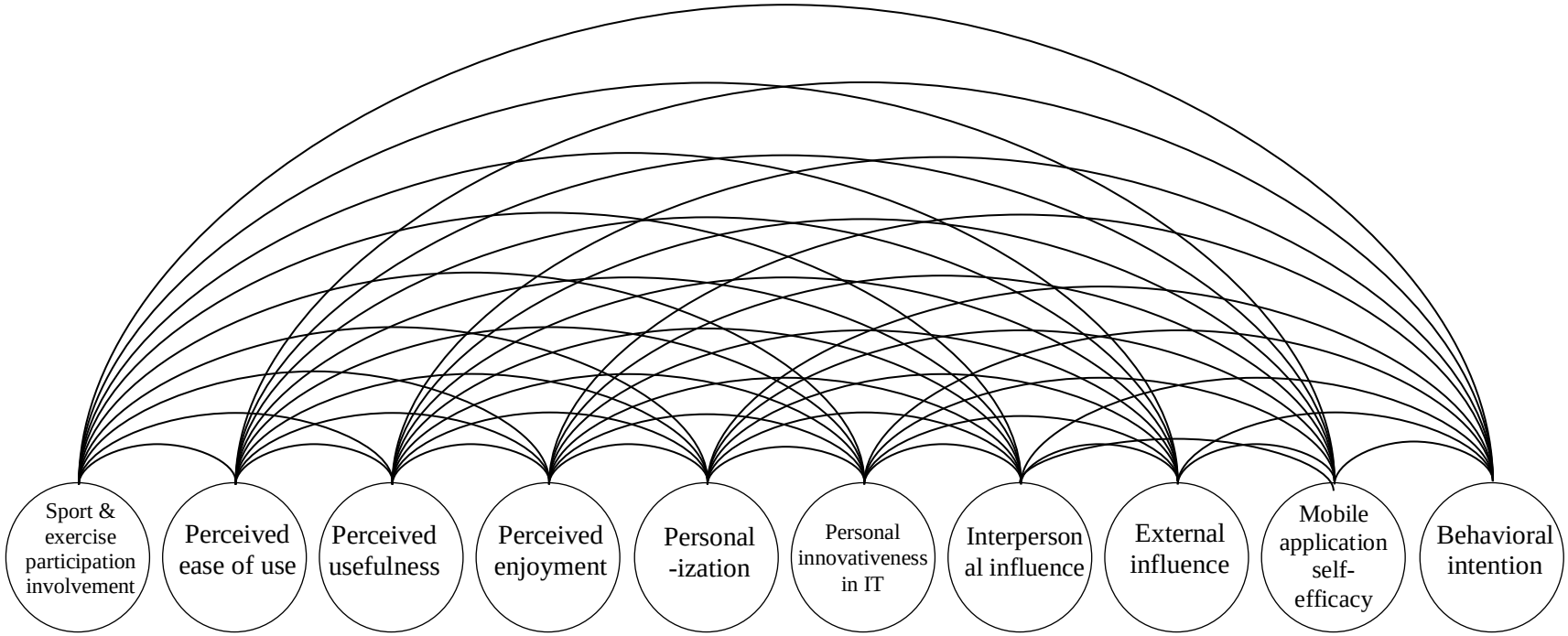

Figure 5. Measurement Model

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Absolute fit of the measurement model was tested using normed chi-square (chi-square divided by degree of freedom), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR).

A chi-square test was performed to test the model fit. The higher the probability level (p-value) associated with the chi-square, the better the fit. M1, which included all items, showed 1614.367 of chi-square value with 857 degree of freedom at the significant level of $p < 0.001$ while M2, which excluded PE1, showed 1568.414 of chi-square value with 815 degree of freedom at a significant level of $p < 0.001$. Chi-square tests are especially sensitive to sample sizes and the probability of rejecting a model increases with increasing sample sizes, even when the model is minimally false (Bentler & Bonett, 1980, pp. 588-606). Consequently, in very large samples, virtually all models are rejected as statistically untenable. Hence, Bentler (1989) recommended using the normed chi-square–chi-square divided by degree of freedom–as a more appropriate measure of model fit. This ratio should not exceed 5 for models and the smaller normed chi-square value indicates the better fit with observed data. The normed chi-square values for the M1 and the M2 were 1.884 (1614.367/857) and 1.926 (1568.414/815), respectively, indicating both measurement models are acceptable and the M1 has the slightly better fit.

The RMSEA provides a mechanism for adjusting of sample size where chi-square statistics are used (Kline, 2005). The RMSEA values are classified into four categories: close fit (0.00-0.05), fair fit (0.05-0.08), mediocre fit (0.08-0.10), and poor fit (over 0.10) (Hu & Bentler, 1999). The RMSEAs for the M1 and the M2 were 0.048 and 0.049 respectively, indicating both models closely fit into data.

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The SRMR is defined as the standardized difference between the observed correlation and the predicted correlation. Values for the SRMR range from zero to 1.0. Well-fitting models obtain values less than 0.05 and values as high as 0.08 are deemed acceptable (Byrne, 1989; Diamantopoulos & Siguaw, 2000; Hu & Bentler, 1999). Both the M1 and M2 were found to be good with 0.043 value of SRMR.

Normed fit index (NFI), the non-normed fit index (NNFI), and the comparative fit index (CFI) were used to test the incremental fit. Incremental fit indices are the measures of the proportionate improvement in fit by comparing a target model with a more restricted, nested baseline model. Incremental fit indices are relatively insensitive to sample size.

The NFI is a relative comparison of the proposed model to the null model. A NFI value above 0.95 is good, between 0.90 and 0.95 acceptable, and below 0.90 indicates a need to respecify the model (Hair et al., 1998). The result of the measurement model tests indicated that both the M1and the M2 were acceptable with the value 0.908 and 0.91, respectively. The NNFI is another incremental fit index. Hu and Bentler (1998, 1999) recommended the use of the NNFI since that the NNFI is a) relatively sensitive to model misspecification; b) insensitive to sample size; c) relatively insensitive to violations of assumptions of multivariate normality; and d) relatively insensitive to estimation method . A NNFI close to 1.00 indicates a good fit and the greater than or equal to 0.90 indicates acceptable model fit while below 0.90 indicate a need to respecify the model. The measurement model test showed both the M1 and M2 had good fits with 0.95 and 0.949 of NNFI values, respectively. The CFI examines the relative improvement in fit of the proposed model compared with the null model and a

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value of 0.95 or higher is a good fit (Kline, 2005). Both M1 and the M2 were found to be good with the identical CFI value of 0.954.

Although both M1 and M2 seemed to closely fit to data in term of the six model fit measures mentioned above, the results of model comparison yielded that the M1, which included the PE1, was slightly better than M2 in term of values in normed chi-square, NNFI, SRMR, and RMSEA. Therefore, PE1 was included in further analyses of data.

Table 4. Goodness-of-fit indexes of measurement models

	χ^2/df ratio	NFI	NNFI	CFI	SRMR	RMSEA
Measurement model 1	1.884 (1614.367/857)	0.908	0.950	0.954	0.0427	0.048 (0.044-0.052)
Measurement model 2	1.926 (1568.414/815)	0.910	0.949	0.954	0.0429	0.049 (0.045-0.053)

Note: The measurement model 2 excluded indicators of PE1

To investigate whether the scales are reliable, the measurement model was estimated using confirmatory factor analysis including Cronbach's alpha coefficient, composite reliability, and average variance extracted (AVE) measures.

Cronbach's alpha coefficients for constructs ranged from 0.826 (perceived enjoyment) to 0.965 (perceived usefulness). Composite reliability scores of latent constructs ranged from 0.830 (perceived enjoyment) to 0.954 (perceived ease of use). Both reliability measures exceeded the recommended value of 0.7 for social science research (Fornell & Larcker, 1981). The AVE values of the measurement ranged from 0.555 (perceived enjoyment) to 0.879 (behavioral intention), suggesting that all latent constructs exceeded the threshold AVE value of 0.5 (Fornell & Larcker, 1981).

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Table 5 shows that all reliability measures exceeded the recommended levels.

Table 5. Reliability of the scales

Construct	Cronbach's α	Composite Reliability	Average Variance Extracted	Number of Items
Sport &exercise Participation involvement	0.946	0.948	0.645	10
Perceived ease of use	0.953	0.954	0.840	4
Perceived usefulness	0.965	0.945	0.821	4
Perceived enjoyment	0.826	0.830	0.555	4
Personalization	0.944	0.945	0.811	4
Personal innovativeness in IT	0.951	0.951	0.831	4
Interpersonal influence	0.950	0.950	0.792	5
External influence	0.923	0.926	0.806	3
Mobile application self-efficacy	0.930	0.930	0.768	4
Behavioral intention	0.932	0.935	0.879	2

Validity refers to how well a test measures what it is purported to measure (Viswanathan, 2005). Content and face validity were established through the item generation phase and field test. Construct validity was evaluated by convergent and discriminant validity.

Convergent validity refers to the degree to which a measure correlates or converges with another measure of the same construct (Viswanathan, 2005). Convergent validity is assessed by factor loading and the average variance extracted (AVE). Convergent validity established when 1) reliability is 0.7 or higher to indicate adequate convergence or internal consistency, and 2) constructs have an AVE value of at

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least 0.5 (Netemeyer, Bearden, & Sharma, 2003). Table 5 presents evidence of reliability above 0.7 and the AVE above 0.5

Discriminant validity is defined as "the degree to which two conceptually similar concepts are distinct" (Hair et al., 1998, p. 118). Discriminant validity is established when 1) when the estimated correlations between the constructs, whether positive or negative, are close to zero and not excessively high (less than 0.85; Kline, 2005, p. 73), and 2) when the AVE from the construct is greater than the variance shared between the construct and other constructs in the model. Each squared correlation should be smaller than the AVE (Fornell & Larcker, 1981).

In the present study, the correlations between constructs ranged from -0.043 (sports and exercise involvement and external influence) and 0.728 (interpersonal influence and behavioral intention), indicating that the estimated correlations between the constructs are not excessively high (less than 0.85). In addition, all AVE estimates were greater than the squared correlations (see Table 6). Therefore, it is concluded that the latent constructs are distinct from each other.

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Table 6. Correlations and squared correlations between constructs

Construct	INV	PEU	PU	PE	PER	PIIT	Internal	External	MAE	BI
Sport &exercise participation involvement	0.645	0.228	0.033	0.015	0.040	0.091	0.232	0.002	0.323	0.234
Perceived ease of use	0.477	0.840	0.219	0.093	0.194	0.362	0.367	0.011	0.160	0.521
Perceived usefulness	0.181	0.468	0.821	0.175	0.462	0.123	0.194	0.007	0.026	0.480
Perceived enjoyment	0.123	0.305	0.418	0.555	0.188	0.089	0.092	0.001	0.001	0.168
Personalization	0.201	0.440	0.680	0.434	0.811	0.135	0.152	0.005	0.022	0.372
Personal innovativeness in IT	0.301	0.602	0.350	0.299	0.367	0.831	0.149	0.010	0.084	0.222
Interpersonal influence	0.482	0.606	0.440	0.303	0.390	0.386	0.792	0.005	0.176	0.530
External influence	-0.043	-0.103	-0.085	-0.029	-0.068	-0.101	-0.074	0.806	0.002	0.014
Mobile application self-efficacy	0.568	0.400	0.162	0.024	0.148	0.290	0.420	0.048	0.768	0.150
Behavioral intention	0.484	0.722	0.693	0.410	0.610	0.471	0.728	-0.118	0.387	0.879

Note: The figures underlined represent AVE; Figures below the AVE line are the correlations between the constructs; Figures above the AVE line represent squared correlations between the constructs.
INV (Sport & exercise participation involvement); PEU (perceived ease of use); PU (perceived usefulness); PE (perceived enjoyment); PER (personalization); PIIT (Personal innovativeness in IT); PE (perceived enjoyment); PER (personalization); MAE (Mobile application self-efficacy); BI (behavioral intention)

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Table 7. Means, Standard deviations, factor loadings, and critical ratios of the measure items

Items	Mean	Standard Deviation	Loadings	Critical Ratio (p<0.05)
INV1. Important-----Unimportant	5.64	1.174	0.785	-
INV2. Boring-----Interesting	5.34	1.309	0.825	18.208*
INV3. Relevant-----Irrelevant	5.61	1.256	0.747	16.025*
INV4. Exciting-----Unexciting	5.60	1.314	0.883	19.962*
INV5. Means nothing-----Means a lot to me	5.98	1.232	0.791	17.243*
INV6. Appealing-----Unappealing	4.13	1.461	0.737	15.771*
INV7. Fascinating-----Mundane	5.46	1.410	0.751	16.130*
INV8. Worthless-----Valuable	5.60	1.283	0.867	19.485*
INV9. Involving-----Uninvolving	5.65	1.297	0.856	19.129*
INV10. Not needed-----needed	5.55	1.272	0.771	16.681*
PEU1. The mobile fitness application is easy to use.	4.45	1.205	0.904	-
PEU2. Learning to operate the mobile fitness application is easy.	4.70	1.357	0.908	28.701*
PEU3. My interaction with the mobile fitness application is clear and understandable.	4.60	1.311	0.946	32.167*
PEU4. It is easy to interact with the mobile fitness application.	4.60	1.375	0.907	28.611*

Note: INV (Sport & exercise participation involvement); PEU (perceived ease of use); * significant at $p < 0.05$
INV1, INV3, INV4, INV6, INV7, INV9 (Reverse coded)

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Table 7. Means, Standard deviations, factor loadings, and critical ratios of the measure items (continued)

Items	Mean	Standard Deviation	Loadings	Critical Ratio (p<0.05)
PU1. Using the mobile fitness application enables me to accomplish tasks more effectively.	4.90	0.951	0.841	-
PU2. Using the mobile fitness application improves my exercise performance.	4.83	1.020	0.893	23.329*
PU3. Using the mobile fitness application improves productivity of my fitness-related activities.	4.88	0.892	0.938	25.608*
PU4. Overall, I found the mobile fitness application useful.	4.87	0.904	0.949	26.184*
PE1. Using the mobile fitness application enhances the effectiveness on managing fitness.	2.83	1.123	0.547	-
PE2. Interacting with the mobile fitness application lead to exploration.	3.71	1.349	0.806	10.431*
PE3. When using the mobile fitness application, I have fun.	3.24	1.186	0.771	10.226*
PE4. Interacting with the mobile fitness application is enjoyable.	3.30	1.250	0.822	10.514*
PER1. When using the mobile fitness application, I feel the information I received is specific to my context (e.g., calories, distance, nutrition)	4.34	1.157	0.870	-
PER2. The information provided by the mobile fitness application is customized for my needs (e.g., calories, distance, nutrition)	4.43	1.118	0.916	26.269*
PER3. The information that I received reflects my context (e.g., location, exercise, nutritional information)	4.59	1.064	0.937	27.589*
PER4. Overall, the mobile fitness application understands my needs.	4.58	1.092	0.877	24.027*

Note: PU (perceived usefulness); PE (perceived enjoyment), PER (personalization); * significant at $p < 0.05$

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Table 7. Means, Standard deviations, factor loadings, and critical ratios of the measure items (continued)

Items	Mean	Standard Deviation	Loadings	Critical Ratio (p<0.05)
PIIT1. If I heard about new technology, I would look for ways to experiment with it.	4.23	1.450	0.924	-
PIIT2. Among my peers, I am usually the first to explore new information technologies.	4.11	1.536	0.918	31.289*
PIIT3. I like to experiment with new information technologies.	4.19	1.514	0.934	32.982*
PIIT4. In general, I am hesitant to try out new information technologies.	4.26	1.512	0.868	26.741*
Internal1. My peers/colleagues/friends think that I should use a mobile fitness.	5.48	0.960	0.907	-
Internal2. People around me think that using a mobile fitness application is a good idea.	5.34	1.049	0.920	29.882*
Internal3. People I know influence me to try out a mobile fitness application.	5.38	1.016	0.912	29.127*
Internal4. People close to me think that using a mobile fitness application is a way to manage my fitness.	5.39	1.047	0.856	24.884*
Internal5. In general, people who are important to me think that I should use a mobile fitness application.	5.39	1.002	0.851	24.553*
External1. I read/saw reports that using a mobile fitness application is a good way of managing my physical fitness.	4.54	1.143	0.878	-
External2. Mass media reports influenced me to try out a mobile fitness application.	4.70	1.247	0.943	26.322*
External3. The popular press depicted positive statements about using a mobile fitness application.	4.94	1.198	0.871	23.559*

Note: PIIT (Personal innovativeness in IT); Internal (interpersonal influence), External (external influence), * significant at $p < 0.05$
PIIT4 (Reversed coded)

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Table 7. Means, Standard deviations, factor loadings, and critical ratios of the measure items (continued)

Items	Mean	Standard Deviation	Loadings	Critical Ratio (p<0.05)
MAE1. I am able to use a mobile fitness application without the help of others.	4.72	1.282	0.875	-
MAE2. I have the knowledge and skills required to use a mobile fitness application.	4.69	1.198	0.872	23.371*
MAE3. I am able to use a mobile fitness application reasonably well on my own.	4.51	1.236	0.864	22.943*
MAE4. Overall, I am confident in using a mobile fitness application by myself.	4.71	1.217	0.895	24.579*
BI1. I intend to use a mobile fitness application in the near future.	4.67	1.207	0.883	-
BI2. I will use a mobile fitness application on a regular basis.	4.79	1.009	0.989	31.128*

Note: MAE (Mobile application self-efficacy); BI (behavioral intention) * significant at $p < 0.05$

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Structural Model

The test of structural model was performed using AMOS 22.0 statistical software. The result of measurement model test yielded that the measurement model 1, which included with the PE1 (0.54 value of item loading), fits better to the data in terms of goodness-of-model fit indices. Therefore, the structural model also included the PE1. The tests of structural model included 1) estimating the goodness-of-fit indices, 2) estimating of the path coefficients, which indicate the strength of the relationships between the independent and dependent variables, 3) estimating of the indirect effect of variables within the structural model, and 4) the R^2 value, which represents the amount of variance explained by independent variables.

Goodness-of-model fit test. Goodness of model fits were estimated using normed chi-square (χ^2/df), SRMR, NFI, NNFI, CFI, and RMSEA. The values of model fit indices for the structural model are presented in Figure 6.

Normed chi-square, which should be less than 5.0 for acceptable fit (Kline, 1998), was 2.012 (χ^2=1750.6, df=870). The SRMR, which should be less than 0.08 for the acceptable fit, was 0.075 (Byrne, 1989; Diamantopoulos & Siguaw, 2000; Hu & Bentler, 1999). The RMSEA, was 0.051, which was below the threshold of 0.08 for acceptable fit (Hu & Bentler, 1999).

The incremental fit indices of the structural model (0.900 for the NFI, 0.942 for the NNFI, and 0.947 for the CFI) were above the recommended value of 0.9, thus indicating an acceptable fit between model and data.

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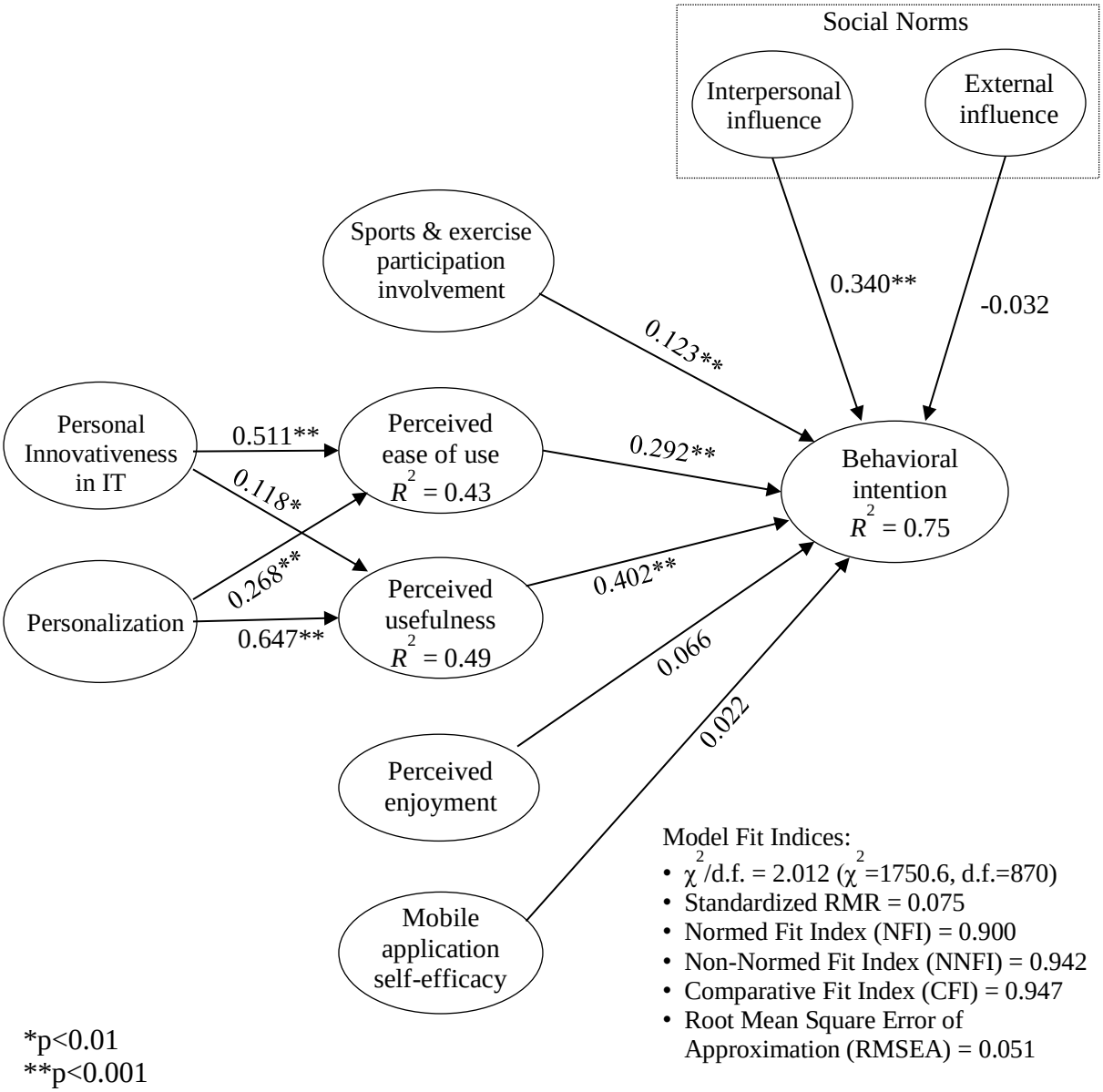

Figure 6. The results of structural model test

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Hypothesis tests. The hypotheses were tested using structural equation modeling analysis. The strengths of path relationship are presented with standardized path coefficients, which are the same as the beta weight in a multiple regression. The standardized path coefficients between the constructs were presented in Figure 6. Of eleven hypothesized causal paths, seven were statistically significant at a 0.001 level and one was significant at a 0.01 level.

The first hypothesis *(H1. Perceived ease of use will positively influence intention to use a mobile fitness application.)* was supported with a 0.292 path coefficient value (critical ratio of 8.608) at the significant level of 0.001, indicating that users' perceived ease of use positively influence their behavioral intention to use a MFA.

The second hypothesis *(H2. Perceived usefulness will positively influence intention to use a mobile fitness application.)* was also supported. A strong and significant effect of perceived usefulness on intention was found in terms of the standard path coefficient value of 0.402 ($p<0.001$). The result also indicated that of seven significant predicting variables, perceived usefulness had the highest direct effect on intention in terms of the path coefficient value.

The third hypothesis *(H3. Perceived enjoyment will positively influence intention to use the mobile fitness application.)* was not supported with a 1.935 value for the critical ratio (C.R.), suggesting that the effect of perceived enjoyment on intention was significant, but can be said as on the margin of statistical significance ($p=0.053$).

The fourth hypothesis was generated to examine the positive effect of sports and exercise specific belief on intention (*H4. A mobile fitness application users' involvement level in sports and exercise participation will positively influence intention to use a*

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MFA.). A significant path coefficient (0.123) was found between sports and exercise participation involvement and intention. The result suggests that an individual who has a high involvement in sports and exercise participation is more likely to use a MFA.

The fifth and sixth hypotheses tests were regarding the positive effects of personalization on a sports and exercise participant's perceived usefulness and ease of use. *(H5: Personalization will positively influence perceived ease of use; H6: Personalization will positively influence perceived usefulness.)* A 0.268 value of standardized path coefficient was found between personalization and perceived ease of use, indicating that personalization has a positive effect on perceived ease of use. In addition, a strong and positive effect of personalization on perceived usefulness was found with a path coefficient value of 0.647. These results indicated that personalization is significant and positive predictor of users' perception toward the technology. In other words, when users perceive that service and information is personalized to their context, they are more likely to perceive that MFAs are easy to use and useful. Thus, fifth and sixth hypotheses were supported.

The seventh and eighth hypotheses were developed to examine the relationships between individual traits, such as personal innovativeness in information technology and perceived usefulness and perceived ease of use. (*H7: A MFA users' personal innovativeness in IT will positively influence perceived usefulness; H8: A MFA users' personal innovativeness in IT will positively influence perceived ease of use.).* As presented in Figure 6, an individual's personal innovativeness in IT positively influenced perceived usefulness (path coefficient=0.118, $p<0.01$) and perceived ease of use (path

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coefficient=0.511, p<0.001) in terms of the path coefficients, respectively. Therefore, H7 and H8 were supported.

The ninth hypothesis investigated the effect of mobile application self-efficacy on intention (*H9: Mobile application self-efficacy will positively influence intention to use a MFA.*). No significant path coefficient was found (critical ratio of 0.588), indicating that a MFA user's judgment of his/her capability to use a mobile software technology is not directly related to his or her intention to use the MFA.

The tenth and eleventh hypotheses were developed to investigate the potential effect of social influences on intention to use MFAs. For more accurate evaluation of influential sources, social influence was measured with two constructs such as interpersonal and external influence (*H10. Interpersonal influence will positively affect a sports and exercise participant's intention to use a MFA; H11. External influence will positively affect a sports and exercise participant's intention to use a MFA*). The analyses showed that interpersonal influence is significant and a powerful predictor (a standardized path coefficient of 0.34) of intention whereas external influence had no significant effect on intention. The result indicated that a MFA user's decision making process is highly influenced by his or her peers and friends, not by mass media. The tenth hypothesis was supported while the eleventh was rejected.

Indirect effects. The indirect effects of personal innovativeness and personalization on intention were examined using the structural equation modeling technique (Table 8). The analysis results indicated that both personal innovativeness in

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IT and personalization have significant indirect effects on intention through perceived use and perceived usefulness.

Table 8. Indirect effects within the structural equation model

Indirect effect relationship					Standardized indirect effect
Independent variable		Mediating variable		Dependent variable	
Personalization	→	Perceived Usefulness	→	Intention	0.212 (p<0.01)
Personalization	→	Perceived Ease of Use	→	Intention	0.085 (p<0.01)
Personal Innovativeness in IT	→	Perceived Usefulness	→	Intention	0.096 (p<0.01)
Personal Innovativeness in IT	→	Perceived Ease of Use	→	Intention	0. 118 (p<0.01)

R squared value (R^2). The explanatory power of the research model was examined with the proportion of variance explained in each dependent variable. Squared multiple correlations (R^2) for the endogenous construct indicates the percentage of variance explained in the construct. The R^2 values are shown in Figure 6.

The construct of personal innovativeness in IT and personalization accounted for 43.4% variances in perceived ease of use and 48.9% variances in perceived usefulness variance. All the constructs within the structural model except external influence, perceived enjoyment, and mobile application self-efficacy, jointly explained the 75.1 % variances in intention to use the MFA.

Summary of Results

Chapter 4 provided the findings of data analysis including 1) descriptive statistics for the study subjects, 2) the goodness-of fit indices of the measurement model, and the

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reliability and validity of the survey instrument, and 3) hypotheses testing through the structural equation modeling, the model fit of the structural model and the explanatory power of the research model.

Survey respondents' characteristics were investigated with descriptive statistics. The samples consist of 115 (29.9%) males and 270 (70.1%) females. The gender proportion of the samples was reasonably similar to that of the previous study which examined the usage behavior of mobile health and fitness applications using data collected from 80 countries (Holmes, August 29, 2013). Average age of subjects was 22.29 years and average time they spent for the sports and exercise was 5.41 hours.

The overall goodness-of-fit was examined using the following common model fit measures: Normed chi-square, CFI, NFI, NNFI, SRMR, and RMSEA. The measurement model was found to be good as the values of overall goodness-of-fit indices were greater than each suggested value. The reliability of the measurement instrument was tested by examining Cronbach's alpha, composite reliability, and average variance extracted. The results indicated these three values were greater than suggested for each threshold. The evidence of the validity of the measurement model was provided by testing convergent and discriminant validity.

Hypotheses were tested using the structural equation modeling. Of eleven hypotheses, eight hypotheses were supported. Compared to other predicting variables within the model, perceived usefulness exhibited the strongest effect on intention to use a MFA in terms of the standardized path coefficient. Interpersonal influence was the second most powerful factor in predicting intention while external influence, mobile application self-efficacy, and perceived enjoyment were not significant. Indirect

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significant effects of personal innovativeness in IT and personalization on intention were also observed through their influences on perceived usefulness and perceived ease of use.

The construct of personal innovativeness and personalization accounted for 43.4% variances in perceived ease of use and 48.9% variances in perceived usefulness variance. All the constructs within the structural model except external influence, perceived enjoyment, and mobile application self-efficacy, jointly explained the 75.1 % variances in intention to use MFAs.

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Chapter V - Discussion

This chapter includes a study overview, discussion of the results, practical and academic implications, limitations, and recommendations for future research.

A Study Overview

The overall purpose of this study was to contribute to the knowledge of MFA adoption behavior. The sub-purposes of this study were: (a) to provide a reliable scale of MFA (MFA) acceptance; (b) to develop and propose a theoretical model to describe sports and exercise participants' use of MFAs; and (c) to empirically test the theoretical model with the data and evaluate the validity of the theoretical model and the scale.

Based on the technology acceptance model (Davis, 1989), several other constructs were incorporated into the theoretical model: involvement in sports and exercise participation (Shank & Beasley, 1998; Zaichkowsky, 1985, 1994), perceived enjoyment (Davis et al., 1992; Moon & Kim, 2001), mobile application self-efficacy (Agrawal & Prasad, 1999; Hsu & Chiu, 2004), interpersonal and external influences (Hung et al., 2003; Lu et al., 2005), personal innovativeness in IT (Agarwal & Karahanna, 2000; Lu et al., 2005), and personalization (Ng-Krüle et al., 2004; Tan & Chou, 2008; Venkatesh & Ramesh, 2002).

A theoretical model was developed to describe the causal relationships between ten latent constructs: sports and exercise involvement, sports and exercise participants' beliefs toward MFAs (i.e., perceived usefulness, perceived ease of use, perceived enjoyment, and perceived personalization), users' socio-psychological characteristics

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(personal innovativeness in IT, mobile application self-efficacy, and their desires to conform with peers and society; interpersonal influence and external influence), and intention to use MFAs. Since this study was conducted with users of 22 different MFAs, the duration of MFA use varied by the applications a minimum of 0.5 hours and a maximum of 40 hours. Therefore, instead of actual use, behavioral intention to use MFAs was employed as the ultimate dependable variable.

Discussion of Results

The present research was motivated by the recognition that the use of MFAs is increasingly popular among sports and exercise participants and MFA developers and researchers alike need to better understand what drives an individual's behavior toward MFAs. Concerning that an individual's adoption and usage decision is not simple, but rather complex, the researcher sought to offer a holistic perspective on the factors that constitute behavioral intention to use MFAs. Based on the literature review, a theoretical model was developed and empirically tested against data using the structural equation modeling technique. Eight out of eleven hypotheses were supported. The total variance explained in intention to use a MFA (75.5%) was comparable to that in prior research in the mobile health system context (63% in Wu, Li, & Fu [2011] , and 70 % in Wu, Wang, & Lin [2007]) . The result of each hypothesis test is summarized in Table 9.

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Table 9. Summary of hypothesis test

Hypothesis	Result	Comments
H1. Perceived ease of use will positively influence intention to use a MFA.	Supported	This result is consistent with findings of most TAM related studies.
H2. Perceived usefulness will positively influence intention to use a MFA.	Supported	This result is consistent with findings of most TAM related studies.
H3. Perceived enjoyment will positively influence intention to use a MFA.	Not Supported	This result is consistent with utilitarian technology adoption behavior studies; conflicts with studies on hedonic mobile technologies (Ha et al., 2007; Hur et al., 2012; Moon & Kim,2001; Nysveen et al., 2005)
H4.Involvement in sports and exercise participation will influence intention to use a MFA.	Supported	This result is consistent with findings of most TAM studies and consumer behavior studies examining the relationships between involvement and an individual's behavior.
H5. Personalization will positively influence perceived ease of use.	Supported	This result supports the theoretical model (Asif & Krogsite, 2013)
H6. Personalization will positively influence perceived usefulness.	Supported	This result is consistent with Chau and Lai (2003).
H7. Personal Innovativeness in IT will positively influence perceived usefulness.	Supported	This result supports the findings of Agarwal and Karahanna (2000), Lu et al. (2005), Lewis et al. (2003), and Lu, Liu, Yu, and Wang (2008).
H8. Personal Innovativeness in IT will positively influence perceived ease of use.	Supported	This result supports the findings of Agarwal and Karahanna (2000), Lu et al. (2005), and Lewis et al. (2003).
H9. Mobile application self-efficacy will positively influence intention to use a MFA.	Not Supported	This result conflicts with findings of software and web-specific self-efficacy. (Agarwal et al., 2000; Hsu & Chiu, 2004)
H10. Interpersonal influence will have a positive effect on intention to use a MFA.	Supported	This result is consistent with the previous studies employing two types of social influences (Bhattacherjee, 2000; Hung et al., 2003).
H11. External influence will have a positive effect on intention to use a MFA.	Not Supported	This result is consistent with the Hung et al. (2003)

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Core constructs in the TAM. The first and second hypotheses tested the effect of the core constructs in the TAM– perceived ease of use and perceived usefulness–on behavior intention. The analysis results showed that both perceived ease and perceived usefulness had positive effects on intention to use a MFA ($p<0.001$). Consistent with most mobile technology adoption studies (e.g., Davis, 1989; Dickinger & Kleijnen, 2008; Lee & Hsieh, 2009; Lu, Liu, Yu, & Wang, 2008; Luarn & Lin, 2005; Nysveen et al., 2005; Wu & Wang, 2005), this study provided evidence that the perceived ease of use and perceived usefulness are significant constructs in shaping behavioral intention to use mobile technology.

While both perceived usefulness and ease of use had significant effects on intention to use a MFA, the analysis result revealed that the predictive power of perceived usefulness on intention (0.402) was stronger than that of perceived ease of use on intention (0.292) in terms of the path coefficient value. This finding was in line with a number of previous TAM studies (e.g. Davis, 1989; Davis et al., 1989; Lu et al., 2005; Wang & Wang, 2010). An explanation may be that the study subjects put more emphasis on the *outcome* of the MFA experience than the *process* leading to the final outcome in evaluating MFAs for adoption.

Perceived enjoyment and intention. The causal path from perceived enjoyment to intention (H3) was not significant at $p<0.05$. This result was not consistent with the previous studies that found a positive effect of perceived enjoyment on intention (Davis et al., 1992; Ha et al., 2007; Hur et al., 2012; Nysveen et al., 2005). Along with the powerful and significant effect of perceived usefulness on intention, this

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finding suggested that the use of MFAs is mostly influenced by an individual's utilitarian motive (perceived usefulness) than hedonic motive (perceived enjoyment). Although some advanced MFAs actively utilize entertaining features (e.g., game-based learning feature, fitness competition function with friends through social media, celebrity-endorsed exercise instruction feature, and highly interactive user interface) to provide positive experience to MFA users, hedonic features are still not major issues when MFA users make a decision to use a MFA. However, given that the p value (0.053) of this relationship was just above the significant level of 0.05 and this study included 22 MFAs to investigate general MFA adoption behavior, it would be hard to conclude that perceived enjoyment is not an important factor when potential users make a decision about usage of MFA. The role of hedonic features in MFA should be further investigated with a specific MFA.

Sport and exercise participation involvement and intention. As expected, the positive direct influence of involvement in sports and exercise participation on intention to use a MFA (H4) was found. This result was consistent with previous studies that found a positive effect of involvement on an individual's technology adoption behavior (Goodhue & Thompson, 1995; Hartwick & Barki, 1994; Hur et al., 2012; Leonard-Barton & Deschamps, 1988; Venkatesh & Davis, 2000; Vessey, 1991). Additionally, this finding also supported that sport involvement is a significant factor that initiates various sport consumption behaviors such as the use of sport websites (Hur et al., 2012), participation in sports, sport-related television viewing, sport-related media readership

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(Shank & Beasley, 1998), and sport spectatorship (Bennett, Ferreira, Lee, & Polite, 2009).

Personalization on perceived ease of use and usefulness. As suggested by Asif and Krogstie (2013), significant and positive effects of personalization on perceived ease of use (H5) and perceived usefulness (H6) were found in the present study. In particular, the effect of personalization on perceived usefulness (path coefficient=0.647, $p<0.001$) was much stronger than its effect on perceived ease of use (path coefficient=0.266, $p<0.001$). This finding was consistent with the studies that emphasized the critical role of personalization in evaluating usefulness of mobile services such as mobile banking (Chau & Lai, 2003) and mobile shopping (Lee & Park, 2006).

Personal innovativeness with IT (PIIT) on perceived ease of use and usefulness. PIIT exhibited strong effects on the posited consequences of perceived ease of use (H7) and perceived usefulness (H8). These findings confirmed the positive relationships postulated by Agarwal and Prasad (1998). Agarwal and Prasad argued that individuals with higher PIIT could be expected to develop more positive perceptions about the target innovation. The finding of this study was also consistent with the Lu et al. (2005) which showed that PIIT had the positive effect on both perceived ease of use and perceived usefulness, and the stronger effect was on perceived usefulness. The finding of this study, along with Lu et al. (2005) which examined the role of PIIT in the context of mobile Internet, suggested that PIIT is a critical determinant of perceived ease of use and perceived usefulness in the mobile technology context.

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Mobile application self-efficacy and intention. Contrary to prior studies suggesting that task-specific self-efficacy is an important determinant of behavioral intention (Agarwal et al., 2000; Eastin & LaRose, 2000; Hsu & Chiu, 2004), the ninth hypothesis which examined the causal path from mobile application self-efficacy to intention was rejected. Based on software-specific self-efficacy (SSE) and web-specific self-efficacy (WSE), the researcher developed the construct of mobile application-specific self-efficacy to examine the role of task-specific self-efficacy in the context of MFA. Although SSE and WSE were found to be strong and positive factors influencing behavioral intention to use computer software and websites, respectively, it appeared for these samples that the individual's feeling of self-efficacy relative to a specific mobile application was not significant factor in shaping intention to use MFAs. A possible explanation for this unexpected finding is that the respondents of this study were young adults (average age of 22.29 years) who are the most heavy users of a variety of mobile services, suggesting their experience with other mobile services moderates the relationships between mobile application-specific self-efficacy and intention to use an MFA. Several studies have suggested that an individual's level of experience with the focal technology can influence the strength of relationship in the TAM model (Davis et al., 1989; Taylor & Todd, 1995a). Another possible explanation is that MFAs, the target technology in this study, is perceived to be inherently easy to use, thereby diminishing the direct effect of mobile application-specific self-efficacy on intention. Given that the mean value for perceived ease of use and mobile application-specific self-efficacy were higher than the mid-point of the scale (4.8 for ease of use, and 4.7 for mobile application self-efficacy), this explanation is supported by the data.

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Social influence and external influence. The tenth and eleventh hypotheses examined the direct effects of interpersonal and external influence on behavioral intention to use MFAs. Interpersonal influence has shown to be a strong and significant predictor of intention with a path coefficient of 0.34 at $p<0.001$, whereas no significant effect was found between external influence and intention. It means users' decision in MFA usage was not influenced by mass media (external influence), but important referents (interpersonal influence). The strong and positive effect of interpersonal influence is consistent with previous studies arguing interpersonal influence was significant in shaping intention to use new technology (Hung et al., 2003; Moore & Benbasat, 1991; Venkatesh & Davis, 2000; Wang & Wang, 2010). This suggested once MFA users become familiar with a MFA, they may begin to persuade their friends and colleagues to adopt it. This explains why leading MFAs (e.g. Runkeeper and Nike+) actively utilize the social networking service in their marketing and communication campaigns.

An explanation regarding insignificant effect of external influence (mass media) is consistent with the study on Wireless Application Protocol (WAP) service adoption (Hung et al., 2003). The authors applied both external and internal influence in predicting WAP service adoption behavior. Consistent with the findings of the present study, the authors only found significant causal relationship from interpersonal influence to intention whereas no significant effect of external influence was observed. The author explained the insignificant effect of external influence with the fact that both positive and negative information regarding WAP service were reported by mass media. This explanation seems to be also applicable in the context of MFA, suggesting that both

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positive and negative mass media reports regarding MFAs resulted in the insignificant effect of external influence on users' decision about MFA use.

In particular, among all causal paths predicting intention, the path from perceived usefulness to intention had shown to have the strongest explanatory power with a path coefficient of 0.402 at $p<0.001$. This result supported the founding of Tan and Chou (2008) that perceived usefulness is the most important factor that determines mobile service quality.

Conclusions

This study represented an initial attempt to extend our understanding of the utilization of technology for sports and exercise to the case of MFAs. This was done by synthesizing relevant elements derived from multiple behavioral theories such as the theory of reasoned action, technology acceptance model, innovation diffusion theory, involvement theory, and social cognitive theory. In addition this study conceptualized the integrated framework within the context of MFA acceptance, and investigated the nomological relationships among perceived ease of use, perceived usefulness, perceived enjoyment, involvement, personal innovativeness in IT (PIIT), mobile application self-efficacy, and intention to adopt a specific information system– MFA. The following conclusions are drawn from the research findings.

- Individual perceptions of ease of use and usefulness toward MFAs are significantly attributed to perceived personalization. This conclusion reveals the critical role of personalization in mobile services. Successful adoption and use of MFAs to a certain degree rely on utilization of context-aware and personalized information.

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- Individual perceptions of ease of use and usefulness toward MFAs are significantly attributed to internal motivations to try a new technology. PIIT is an important internal stimulus influencing perceptions of MFAs. While PIIT influences both perceived usefulness and perceived ease of use significantly, the impact on usefulness is stronger.
- Both personalization and PIIT indirectly influence intention through perceived ease of use and perceived usefulness. These two antecedents collectively explain 43 % of variance in perceived ease of use and 49% of perceived usefulness.
- Involvement in sport and exercise participation is a significant factor which directly influences intention to use a MFA. This study confirms the relationship between involvement in sport and sport consumption behavior.
- Perceived enjoyment should be further investigated with a specific MFA in future research . At least in this study on the general adoption of MFAs, perceived enjoyment is not a direct factor determining intention to use MFA at the significant level of 0.5.
- For adoption of MFAs, behavioral beliefs such as perceived usefulness and perceived ease of use are critical factors influencing users' intention to adopt MFAs. The confirmed positive paths from perceived usefulness to intention and from the perceived ease of use to intention once more affirmed the theoretical value of the TAM in explaining technology adoption. The strongest effect of perceived usefulness on intention within the model is particularly important for MFA adoption as it explains users' extrinsic motivation is the key factor in a decision about MFA use.

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- At least for the samples of this study, mobile application self-efficacy is not a significant factor that directly affects behavioral intention to use a MFA, suggesting further research should be necessary to validate this construct.
- Among two types of social influences, only interpersonal influence is significant in shaping behavioral intention to use MFA. Particularly, social influence is the second important factor behind perceived usefulness in determining intention to use a MFA.

Overall, findings of this study suggest that the posited structural model is generally applicable for explaining MFA initial adoption as 75.5% of variance in intention to use a MFA is explained by the specified explanatory constructs.

Implications

Theoretical implications. Theoretically, the findings of this study help our understanding of nomological network among individual differences (involvement in sports and exercise participation, PIIT, mobile application self-efficacy), social influences (interpersonal and external influences), perceptual beliefs (perceived usefulness, perceived ease of use, perceived enjoyment, and perceived enjoyment), and intention to use MFA. First and foremost, this study has provided evidence that the extended TAM with involvement in sport and exercise participation is a valid model in explaining mobile technology use for fitness-related activities. In addition, this study has revealed the significant effects of personalization on both perceived ease of use and perceived usefulness. Unlike other relationships posited in this study, the simultaneous effects of personalization on perceived usefulness and perceived ease of use have not been examined specifically in any of the previous TAM studies. Therefore, it can be

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considered a unique contribution to the technology adoption studies. As stated in conclusion, this study also confirms a number of important findings in the latest TAM studies.

Practical implications. From the standpoint of the practitioner, multiple important implications follow. First, the results point out the importance of utilitarian features in MFA. This particular finding is hardly groundbreaking but, nonetheless, tells MFA developers that certain basic threshold levels of usefulness must be present for all MFAs–regardless of their objective–in order for consumers to create intention to use the MFA. Implementing more customized functions in the MFA will definitely lead to positive perception toward ease of use and usefulness. Given that the effect of perceived enjoyment on intention shows a considerable trend toward significance ($p=0.053$), industry players should also pay close attention to aspects of enjoyment–as excitement and fun–when developing a MFA.

Second, the findings of this study also provide an understating of the characteristics of current and potential users of MFAs. People with higher involvement in sports and exercise participation and higher willingness to try a new information technology are more likely to use an MFA. Therefore, marketers should concentrate on sports and exercise participants with high personal innovativeness. In addition, this study clearly demonstrated interpersonal influence (e.g. word of mouth) is much more important than external influence (e.g. mass media and expert opinions). Therefore, for market penetration, an emphasis on viral effects such as incorporating social networking

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tool (e.g. Facebook, twitter) into the MFA is more recommended than relying on product endorsement by famous athletes.

Third, the effect of ease of use will be diminished at a later point in time. As Taylor and Todd (1995a) suggested, experience moderates the general perception and intention toward technology. Although MFAs are still considered new technology, users' experience in other prevalent mobile technologies has already seemed to diminish the effect of perceived ease of use and mobile application self-efficacy for early adopters and early majority of MFA. This finding also implies when mobile technology becomes more common in our daily lives, ease of use–process–will not be a considerable factor when people make a decision about the use of MFAs. In other words, mobile literacy will diminish the effect of perceived ease of use, thus the effect of other variables such as perceived usefulness, perceived enjoyment, PIIT, involvement in sports and exercise, or peer influence may become more important. With a better understanding of technology life cycle and its impact on users' perception and intention, developers and marketers can develop a better MFA which meets needs of consumers.

Limitation and Recommendations for Future studies

This study examined the posited model within the context of a research site. Testing the robustness of these relationships using different samples would be a fruitful area for research. For instance, the non-significance of mobile application self-efficacy was attributed to the characteristics of the samples who are technologically savvy and the most active users of mobile services. However, individual differences in task-specific self-efficacy might be significant when testing the model with different samples.

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Although the measures used in this study exhibited adequate psychometric properties, conceptually there are some overlaps between personalization and perceived usefulness. Therefore, it would be useful in future study to develop the measures of perceived personalization that more accurately discern between usefulness and personalization.

Researchers may also consider postulating and empirically testing the existence of potential casual relationships among these constructs. For instance, one could ask whether perceived enjoyment operate through perceived usefulness, rather than directly.

Some research (e.g., Taylor and Todd 1995) has suggested that experience moderates the relationships embedded in technology acceptance models such as TAM and TPB. As the descriptive statistics suggested, data were collected at a fairly early stage of the life cycle of mobile technology for exercise and sports, and the findings therefore apply to early adopters rather than majority or laggards. An interesting question to examine next would be the extent to which experience moderates the effects of the posited belief antecedents.

Beyond involvement in sports and exercise participation, other sports-related constructs (e.g. personal value of physical well-being, and personal motivation to enhance physical fitness) may influence users' acceptance of MFAs. This study, however, included only involvement in sports and exercise participation because involvement is the fundamental belief which directly determines intention to behave and actual behavior. Considering that participation in sports and physical activities is a behavioral antecedent of the use of MFAs, applying the level of commitment on sports

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and exercise (e.g., the frequency and duration of sport and physical activity participation) as another predictor may also provide a better understanding of MFA acceptance.

Previous studies on mobile communication and mobile commerce suggested that others variables such as trust including security, privacy protection, and system reliability (Lu, Yu, Liu, & Ku, 2004; Siau, Sheng, Nah, & Davis, 2004); satisfaction, loyalty, and cost (Lin & Wang, 2006) have to be addressed to enable a successful adoption of mobile services. Expanding the model with these variables may provide more valuable information for MFA adoption.

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REFERENCES

ABI Research. (2010). *Wireless Healthcare and Fitness Market Data*. ABI research Retrieved from http://www.abiresearch.com/research/1004313.

Agarwal, R., & Karahanna, E. (2000). Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage. *Mis Quarterly*, *24*(4).

Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information systems research*, *9*(2), 204-215.

Agarwal, R., & Prasad, J. (1999). Are individual differences germane to the acceptance of new technologies? *Decision Sciences*, *30*(2), 361-391.

Agarwal, R., Sambamurthy, V., & Stair, R. M. (2000). Research report: the evolving relationship between general and specific computer self-efficacy—an empirical assessment. *Information systems research*, *11*(4), 418-430.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior* (Vol. 278). Englewood Cliffs, NJ: Prentice-Hall.

Alspach, K. (2012, Sep, 21). RunKeeper hires former Zipcar exec as engineering VP. *Boston Business Journal*. Retrieved from http://www.bizjournals.com/boston/blog/startups/2012/09/runkeeper-hires-former-zipcar-exec-as.html

Amoako-Gyampah, K. (2007). Perceived usefulness, user involvement and behavioral intention: an empirical study of ERP implementation. *Computers in Human Behavior*, *23*(3), 1232-1248.

Arbuckle, J. L., & Wothke, W. (1998). Amos 4.0 User's Guide.

Asif, M., & Krogstie, J. (2013). *Role of Personalization in Mobile Services Adoption.* Paper presented at the Proceedings of the International Conference on Multimedia and Human Computer Interaction. International ASET.

www.manaraa.com

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review, 84*(2), 191.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American psychologist, 37*(2), 122.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York: W.H. Freeman.

Bandura, A., & Watts, R. E. (1996). Self-Efficacy in Changing Societies. *Journal of Cognitive Psychotherapy, 10*(4), 313-315.

Bassett Jr, D. R., Ainsworth, B. E., Leggett, S. R., Mathien, C. A., Main, J. A., Hunter, D. C., & Duncan, G. E. (1996). Accuracy of five electronic pedometers for measuring distance walked. *Medicine and Science in Sports and Exercise, 28*(8), 1071-1077.

Bausch, L., Beran, J., Cahanes, S., & Krug, L. (2008). Physiological responses while playing Nintendo Wii sports. *Journal of Undergraduate Kinesiology Research, 3*(2), 19-25.

Beighle, A., Pangrazi, R. P., & Vincent, S. D. (2001). Pedometers, physical activity, and accountability. *Journal of Physical Education, Recreation & Dance, 72*(9), 16-19.

Bennett, G., Ferreira, M., Lee, J., & Polite, F. (2009). The role of involvement in sports and sport spectatorship in sponsor's brand use: The case of Mountain Dew and action sports sponsorship. *Sport Marketing Quarterly, 18*(1), 14-24.

Bentler, P. M. (1989). EQS 6 structural equations program manual. *Los Angeles: BMDP Statistic Software*, 86-102.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological bulletin, 88*(3), 588.

Bhattacherjee, A. (2000). Acceptance of e-commerce services: the case of electronic brokerages. *Systems, Man and Cybernetics, Part A: Systems and Humans, IEEE Transactions on, 30*(4), 411-420.

www.manaraa.com

Bian, Partridge, King, Anton, & Boyer. (2007). Impact of technology-enhanced curriculum on high school students' physical activity participation.(PEDAGOGY). *Research Quarterly for Exercise and Sport, 78*(1), A-50(51).

Bloch, P. H. (1981). An exploration into the scaling of consumer's involvement with a product class. *Advances in consumer research, 8*(1), 61-65.

Blom, J. (2000). *Personalization: a taxonomy.* Paper presented at the CHI '00 Extended Abstracts on Human Factors in Computing Systems, The Hague, The Netherlands.

Bollen, K. A. (1998). *Structural equation models*: Wiley Online Library.

Buttussi, F., & Chittaro, L. (2008). MOPET: A context-aware and user-adaptive wearable system for fitness training. *Artificial Intelligence in Medicine, 42*(2), 153-163.

Buttussi, F., Chittaro, L., & Nadalutti, D. (2006, September). *Bringing mobile guides and fitness activities together: a solution based on an embodied virtual trainer.* Paper presented at the MobileHCI 2006: 8th International Conference on Human-Computer Interaction with Mobile Devices and Services.

Byrne, B. M. (1989). *A primer of LISREL*: Springer.

Calder, B. J., Phillips, L. W., & Tybout, A. M. (1981). Designing research for application. *Journal of consumer research*, 197-207.

Campbell, N. K., & Hackett, G. (1986). The effects of mathematics task performance on math self-efficacy and task interest. *Journal of Vocational Behavior, 28*(2), 149-162.

Celsi, R. L., & Olson, J. C. (1988). The role of involvement in attention and comprehension processes. *Journal of consumer research, 15*(2), 210-224.

Chau, P. Y. (2001). Influence of computer attitude and self-efficacy on IT usage behavior. *Journal of Organizational and End User Computing (JOEUC), 13*(1), 26-33.

www.manaraa.com

Chau, P. Y., & Lai, V. S. (2003). An empirical investigation of the determinants of user acceptance of internet banking. *Journal of Organizational Computing and Electronic Commerce, 13*(2), 123-145.

Chen, L., Gillenson, M. L., & Sherrell, D. L. (2002). Enticing online consumers: an extended technology acceptance perspective. *Information & Management, 39*(8), 705-719.

Chin, W. W. (1998). Commentary: Issues and opinion on structural equation modeling. *Mis Quarterly, 22*(1), vii-xvi.

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *Mis Quarterly, 19*(2), 189-211.

comScore Inc. (2012). 2012 US Mobile Subscriber Market Share. Retrieved June 5 2012, from comScore Inc http://www.comscore.com/Press_Events/Press_Releases/2012/3/comScore_Reports_January_2012_U.S._Mobile_Subscriber_Market_Share

Cook, T. D., & Campbell, D. T. (1976). The design and conduct of quasi-experiments and true experiments in field settings. *Handbook of industrial and organizational psychology, 223*, 336.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Mis Quarterly, 13*(3), 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management science, 35*(8), 982-1003.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and Intrinsic Motivation to Use Computers in the Workplace. *Journal of Applied Social Psychology, 22*(14), 1111-1132.

Diamantopoulos, A., & Siguaw, J. A. (2000). *Introducing LISREL: A guide for the uninitiated*: Sage.

www.manaraa.com

Dickinger, A., & Kleijnen, M. (2008). Coupons going wireless: Determinants of consumer intentions to redeem mobile coupons. *Journal of Interactive Marketing, 22*(3), 23-39.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich College Publishers.

Eastin, M. S., & LaRose, R. (2000). Internet self-efficacy and the psychology of the digital divide. *Journal of Computer-Mediated Communication, 6*(1), 0-0.

Fang, X., Chan, S., Brzezinski, J., & Xu, S. (2006). Moderating effects of task type on wireless technology acceptance. *Journal of Management Information Systems, 22*(3), 123-157.

Finkenberg, M. E., Fiorentino, L. H., & Castelli, D. (2005). Creating a virtual gymnasium. *Journal of Physical Education, Recreation & Dance, 76*(4), 16-18.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behaviour: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Flurry Analytics. (2012). Mobile App Usage Further Dominates Web, Spurred by Facebook. Retrieved 2012, Jan 15, from Flurry Analytics http://blog.flurry.com/bid/80241/Mobile-App-Usage-Further-Dominates-Web-Spurred-by-Facebook

Flynn, L. R., & Goldsmith, R. E. (1993). A validation of the Goldsmith and Hofacker innovativeness scale. *Educational and Psychological Measurement, 53*(4), 1105-1116.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research (JMR), 18*(1).

Funk, D. C., Ridinger, L. L., & Moorman, A. M. (2004). Exploring origins of involvement: Understanding the relationship between consumer motives and involvement with professional sport teams. *Leisure Sciences, 26*(1), 35-61.

Gilbert, J. (2011, July 15). The Fitness App RunKeeper: Reviewed For Lazy People, By A Lazy Person *Huffington Post*. Retrieved from

www.manaraa.com

http://www.huffingtonpost.com/2011/07/15/runkeeper-a-fitness-app-review_n_899855.html

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *Mis Quarterly*, 213-236.

Gretebeck, R. J., & Montoye, H. J. (1992). Variability of some objective measures of physical activity. *Medicine and Science in Sports and Exercise, 24*(10), 1167-1172.

Gu, J. C., Lee, S. C., & Suh, Y. H. (2009). Determinants of behavioral intention to mobile banking. *Expert Systems with Applications, 36*(9), 11605-11616.

Ha, I., Yoon, Y., & Choi, M. (2007). Determinants of adoption of mobile games under mobile broadband wireless access environment. *Information & Management, 44*(3), 276-286. doi: 10.1016/j.im.2007.01.001

Hague, P. N. (2002). *Market research: a guide to planning, methodology & evaluation*: Kogan Page Publishers.

Hair, J. F., Anderson, R. E., Tatham, R. L., & William, C. (1998). Multivariate data analysis: Upper Saddle River, NJ: Prentice Hall.

Hale, J. L., Householder, B. J., & Greene, K. L. (2002). *The theory of reasoned action. In J. Dillard, & M. Pfau (Eds.), The persuasion handbook: Developments in theory and practice (pp. 259-287). .* Thousand Oaks, CA: SAGE Publications, Inc.

Hartwick, J., & Barki, H. (1994). Explaining the role of user participation in information system use. *Management science, 40*(4), 440-465.

Heussner, K., Potter, N, & Berkowitz, L. (2010, Jan, 14). Have You Been Defriended? iPhone App Will Tell You. *ABC news*. Retrieved from http://abcnews.go.com/Technology/AheadoftheCurve/defriended-iphone-app/story?id=9561431&page=5#.UGLww42PVdA

Holmes, L. (August 29, 2013). Analyst Pulse: The Growing Use of Mobile Health and Fitness Apps. *Euromonitor International*. Retrieved from http://blog.euromonitor.com/2013/08/analyst-pulse-the-growing-use-of-mobile-health-and-fitness-apps.html

www.manaraa.com

Hsu, M.-H., & Chiu, C.-M. (2004). Internet self-efficacy and electronic service acceptance. *Decision support systems, 38*(3), 369-381.

Hu, L.-t., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological methods, 3*(4), 424.

Hu, L.-t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55.

Hung, S. Y., Ku, C. Y., & Chang, C. M. (2003). Critical factors of WAP services adoption: an empirical study. *Electronic Commerce Research and Applications, 2*(1), 42-60.

Hur, Y., Ko, Y., & Claussen, C. (2011). Acceptance of sport websites: a conceptual model. *International Journal of Sports Marketing and Sponsorship, 12*(3), 209-224.

Hur, Y., Ko, Y. J., & Claussen, C. L. (2012). Determinants of using sports web portals: an empirical examination of the Sport Website Acceptance Model. *International Journal of Sports Marketing & Sponsorship, 13*(3), 169-188.

Hyldegaard, J., & Seiden, P. (2004). My e-journal-exploring the usefulness of personalized access to scholarly articles and services. *Information Research. An International Electronic Journal, 9*(3).

Iwasaki, Y., & Havitz, M. E. (1998). A path analytic model of the relationships between involvement, psychological commitment, and loyalty. *Journal of leisure research, 30*(2), 256-280.

Iwasaki, Y., & Havitz, M. E. (2004). Examining relationships between leisure involvement, psychological commitment and loyalty to a recreation agency. *Journal of leisure research, 36*(1), 45-72.

Jones, E., Sundaram, S., & Chin, W. (2002). Factors leading to sales force automation use: A longitudinal analysis. *The Journal of Personal Selling and Sales Management*, 145-156.

www.manaraa.com

Karahanna, E., Straub, D. W., & Chervany, N. L. (1999). Information technology adoption across time: a cross-sectional comparison of pre-adoption and post-adoption beliefs. *Mis Quarterly*, 183-213.

Kerstetter, D. L., & Koovich, G. M. (1997). An Involvement Profile of Division I Women's Basketball Spectators. *Journal of Sport Management, 11*(3), 234-249.

Kirkwood, J. J., & Mahon, A. (2002). What makes us tick? *Technology & Children, 7*(1), 4-6.

Kline, R. B. (1998). *Principles and practice of structural equation modeling.* . Guilford, New York: Guilford Publication.

Kline, T. (2005). *Psychological testing: A practical approach to design and evaluation*: Sage.

Knight, J. F., Schwirtz, A., Psomadelis, F., Baber, C., Bristow, H. W., & Arvanitis, T. N. (2005). The design of the SensVest. *Personal and ubiquitous computing, 9*(1), 6-19.

Komiak, S. Y. X., & Benbasat, I. (2006). The effects of personalization and familiarity on trust and adoption of recommendation agents. *Mis Quarterly*, *30*(4), 941-960.

Kwak, D. H., & McDaniel, S. R. (2011). Using an extended Technology Acceptance Model in exploring antecedents to adopting fantasy sport league websites. *International Journal of Sports Marketing and Sponsorship, 12*(3), 240-253.

Kyle, G. T., Absher, J. D., Hammitt, W. E., & Cavin, J. (2006). An examination of the motivation—involvement relationship. *Leisure Sciences, 28*(5), 467-485.

Ladda, S., Keating, T., Adams, D., & Toscano, L. (2004). Including technology in instructional programs. *Journal of Physical Education, Recreation & Dance, 75*(4), 12-13.

Lascu, D.-N., Giese, T. D., Toolan, C., Guehring, B., & Mercer, J. (1995). Sport involvement: A relevant individual difference factor in spectator sports. *Sport Marketing Quarterly, 4*, 41-46.

www.manaraa.com

Laurent, G., & Kapferer, J.-N. (1985). Measuring consumer involvement profiles. *Journal of Marketing Research (JMR), 22*(1), 41-53.

Lee, C., & Hsieh, M. (2009, June 30-July 2). *The Influence of Mobile Self-Efficacy on Attitude towards Mobile Advertising.* Paper presented at the New Trends in Information and Service Science, 2009. NISS '09. International Conference on, Beijing, China.

Lee, S., & Park, S. (2006). Improving accessibility and security for mobile phone shopping. *Journal of Computer Information Systems, 46*(3), 124.

Leonard-Barton, D., & Deschamps, I. (1988). Managerial influence in the implementation of new technology. *Management science, 34*(10), 1252-1265.

Lewis, W., Agarwal, R., & Sambamurthy, V. (2003). Sources of influence on beliefs about information technology use: An empirical study of knowledge workers. *Mis Quarterly, 27*(4), 657-678.

Liker, J. K., & Sindi, A. A. (1997). User acceptance of expert systems: a test of the theory of reasoned action. *Journal of Engineering and Technology Management, 14*(2), 147-173.

Lin, H.-H., & Wang, Y.-S. (2006). An examination of the determinants of customer loyalty in mobile commerce contexts. *Information & Management, 43*(3), 271-282.

Lu, Liu, C., Yu, C.-S., & Wang, K. (2008). Determinants of accepting wireless mobile data services in China. *Information & Management, 45*(1), 52-64.

Lu, J., Yao, J. E., & Yu, C. S. (2005). Personal innovativeness, social influences and adoption of wireless Internet services via mobile technology. *The Journal of Strategic Information Systems, 14*(3), 245-268.

Lu, J., Yu, C.-S., Liu, C., & Ku, C. Y.-F. (2004). Wireless trust: conceptual and operational definition. *International Journal of Mobile Communications, 2*(1), 38-50.

Luarn, P., & Lin, H. H. (2005). Toward an understanding of the behavioral intention to use mobile banking. *Computers in Human Behavior, 21*(6), 873-891.

www.manaraa.com

Maddison, R., Ni Mhurchu, C., Jull, A., Jiang, Y., Prapavessis, H., & Rodgers, A. (2007). Energy expended playing video console games: an opportunity to increase children's physical activity? *Pediatric exercise science, 19*(3).

Mallat, N., Rossi, M., Tuunainen, V. K., & Oorni, A. (2006). *The impact of use situation and mobility on the acceptance of mobile ticketing services*.

Mallat, N., Rossi, M., Tuunainen, V. K., & Oorni, A. (2009). The impact of use context on mobile services acceptance: The case of mobile ticketing. *Information & Management, 46*(3), 190-195.

Mano, H., & Oliver, R. L. (1993). Assessing the dimensionality and structure of the consumption experience: evaluation, feeling, and satisfaction. *Journal of consumer research, 20*(3), 451-466.

Mardia, K. V. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika, 57*(3), 519-530. doi: 10.1093/biomet/57.3.519

McDonald, T., & Siegall, M. (1992). The effects of technological self-efficacy and job focus on job performance, attitudes, and withdrawal behaviors. *The Journal of Psychology, 126*(5), 465-475.

Mhurchu, C. N., Maddison, R., Jiang, Y., Jull, A., Prapavessis, H., & Rodgers, A. (2008). Couch potatoes to jumping beans: A pilot study of the effect of active video games on physical activity in children. *International Journal of Behavioral Nutrition and Physical Activity, 5*(1), 8.

Michaelidou, N., & Dibb, S. (2006). Product involvement: an application in clothing. *Journal of Consumer Behaviour, 5*(5), 442-453.

Midgley, D. F., & Dowling, G. R. (1978). Innovativeness: The concept and its measurement. *Journal of consumer research, 4*(4), 229-242.

Mittal, B. (1995). A comparative analysis of four scales of consumer involvement. *Psychology & Marketing, 12*(7), 663-682.

Mohnsen, B. (2001). Using instructional software to meet national physical education standards. *Journal of Physical Education, Recreation & Dance, 72*(3), 19-22.

www.manaraa.com

Monsuwé, T. P., Dellaert, B. G., & De Ruyter, K. (2004). What drives consumers to shop online? A literature review. *International Journal of Service Industry Management, 15*(1), 102-121.

Moon, J. W., & Kim, Y. G. (2001). Extending the TAM for a World-Wide-Web context. *Information & Management, 38*(4), 217-230.

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information systems research, 2*(3), 192-222.

Motiwalla, L. F. (2007). Mobile learning: A framework and evaluation. *Computers & Education, 49*(3), 581-596.

National Association for Sport and Physical Education. (2009). *Appropriate use of instructional technology in physical education*, [Position statement]. Reston, VA: Author.

Netemeyer, R. G., Bearden, W. O., & Sharma, S. (2003). *Scaling procedures: Issues and applications*. Thousand Oaks, CA: SAGE Publications, Inc.

Newman, J. (2013). 50 Best Android Apps for 2013. Must-have Android apps for newbies and enthusiasts alike. *Time*. Retrieved from http://techland.time.com/2013/07/01/50-best-android-apps-for-2013/

Ng-Krülle, G., Swatman, P., Hampe, F., & Rebne, D. (2004). *End-user perspectives on the adoption of wireless applications: Price of convenience and a model for contextual analysis*.

Nielson. (2014, 04.16.2014). HACKING HEALTH: HOW CONSUMERS USE SMARTPHONES AND WEARABLE TECH TO TRACK THEIR HEALTH.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory*. New York: McGraw-Hill.

Nysveen, H., Pedersen, P. E., & Thorbjørnsen, H. (2005). Intentions to use mobile services: antecedents and cross-service comparisons. *Journal of the Academy of Marketing Science, 33*(3), 330-346.

www.manaraa.com

Oliver, R. L., & Bearden, W. O. (1983). The role of involvement in satisfaction processes. *Advances in consumer research, 10*(1), 250-255.

Park, S. (1996). Relationships between involvement and attitudinal loyalty constructs in adult fitness programmes. *Journal of leisure research, 28*(4), 233-250.

Parker-Pope, T. (2005 Oct 4). The PlayStation workout: Videogames that get kids to jump, kick and sweat. *Wall Street Journal*.

Pavlou, P. A. (2003). Consumer acceptance of electronic commerce: integrating trust and risk with the technology acceptance model. *International Journal of Electronic Commerce, 7*(3), 101-134.

Pedersen, P. E. (2005). Adoption of Mobile Internet Services: An Exploratory Study of Mobile Commerce Early Adopters. *Journal of Organizational Computing and Electronic Commerce, 15*(3), 203-222. doi: 10.1207/s15327744joce1503_2

Pedersen, P. E., & Ling, R. (2003). *Modifying adoption research for mobile Internet service adoption: Cross-disciplinary interactions.* Paper presented at the System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on.

Premkumar, G., Ramamurthy, K., & Nilakanta, S. (1994). Implementation of electronic data interchange: an innovation diffusion perspective. *Journal of Management Information Systems*, 157-186.

Rao, S., & Troshani, I. (2007). A conceptual framework and propositions for the acceptance of mobile services. *Journal of Theoretical and Applied Electronic Commerce Research, 2*(2), 61-73.

Reamy, T. (2001). From information architecture to knowledge architecture. *Intranet Professional, 4*(5), 5-6.

Richins, M. L., & Bloch, P. H. (1986). After the new wears off: the temporal context of product involvement. *Journal of consumer research, 13*(2), 280-285.

Richins, M. L., & Bloch, P. H. (1991). Post-purchase product satisfaction: incorporating the effects of involvement and time. *Journal of Business Research, 23*(2), 145-158.

www.manaraa.com

Rogers, E. M. (1983). *Diffusion of innovations*. New York: The Free Press.

Rogers, E. M. (1995). *Diffusion of innovations*. New York: The Free Press.

Rogers, E. M., & Shoemaker, F. (1983). Diffusion of innovation: A cross-cultural approach. *New York*.

Rosenthal, R., & Rosnow, R. L. (1991). *Essentials of behavioral research: Methods and data analysis* (Vol. 2): McGraw-Hill New York.

Rothschild, M. L. (1979). Marketing communications in nonbusiness situations or why it's so hard to sell brotherhood like soap. *Journal of Marketing, 43*(2), 11-20.

Rouibah, K., & Abbas, H. A. (2010). Effect of personal innovativeness, attachment motivation and social norms on the acceptance of camera mobile phones: An empirical study in an Arab country. *International Journal of Handheld Computing Research (IJHCR), 1*(4), 41-62.

Scharl, A., Dickinger, A., & Murphy, J. (2005). Diffusion and success factors of mobile marketing. *Electronic Commerce Research and Applications, 4*(2), 159-173.

Schepers, J., & Wetzels, M. (2007). A meta-analysis of the technology acceptance model: Investigating subjective norm and moderation effects. *Information & Management, 44*(1), 90-103.

Schunk, D. H., Pintrich, P. R., & Meece, J. L. (2008). *Motivation in Education: Theory, Research, and Applications*. Upper Saddle River, N.J: Pearson/Merrill Prentice Hall.

Scott, H. (2012). U.S. smartphone adoption is faster than any other major technology shift. Retrieved from phoneArena.com website: http://www.phonearena.com/news/U.S.-smartphone-adoption-is-faster-than-any-other-major-technology-shift_id30062/

Shank, M. D., & Beasley, F. M. (1998). Fan or fanatic: Refining a measure of sports involvement. *Journal of Sport Behavior, 21*(4), 435-443.

www.manaraa.com

Sharples, M., Taylor, J., & Vavoula, G. (2005). *Towards a theory of mobile learning.* Paper presented at the Proceedings of mLearn 2005.

Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of consumer research*, 325-343.

Shimp, T. A., & Sharma, S. (1983). *The dimensionality of involvement: A test of the automobile involvement scale.* Paper presented at the American Marketing Association winter educator's conference: Research Methods and Causal Modeling in Marketing, eds, WR Darden, KB Monroe and WR Dillon Chicago.

Siau, K., Sheng, H., Nah, F., & Davis, S. (2004). A qualitative investigation on consumer trust in mobile commerce. *International Journal of Electronic Business, 2*(3), 283-300.

Smith, A. (2011). 35% of American adults own a smartphone. *Pew Research Center Study*. from http://www.pewinternet.org/2011/07/11/smartphone-adoption-and-usage/

Sonnenwald, D. H., Whitton, M. C., & Maglaughlin, K. L. (2003). Evaluating a scientific collaboratory: Results of a controlled experiment. *ACM Transactions on Computer-Human Interaction (TOCHI), 10*(2), 150-176.

Staiano, A. E., & Calvert, S. L. (2011). Exergames for physical education courses: Physical, social, and cognitive benefits. *Child development perspectives, 5*(2), 93-98.

Swinyard, W. R. (1993). The effects of mood, involvement, and quality of store experience on shopping intentions. *Journal of consumer research, 20*(2), 271-280.

Tan, F. B., & Chou, J. P. C. (2008). The relationship between mobile service quality, perceived technology compatibility, and users' perceived playfulness in the context of mobile information and entertainment services. *Intl. Journal of Human–Computer Interaction, 24*(7), 649-671.

Taylor, S., & Todd, P. (1995a). Assessing IT usage: The role of prior experience. *Mis Quarterly*, 561-570.

www.manaraa.com

Taylor, S., & Todd, P. (1995b). Understanding information technology usage: A test of competing models. *Information systems research, 6*(2), 144-176.

Tornatzky, L. G., & Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on engineering management, 29*(1), 28-45.

Tsang, M. M., Ho, S. C., & Liang, T. P. (2004). Consumer attitudes toward mobile advertising: An empirical study. *International Journal of Electronic Commerce, 8*(3), 65-78.

Tsiotsou, R. (2006). The role of perceived product quality and overall satisfaction on purchase intentions. *International Journal of Consumer Studies, 30*(2), 207-217.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science, 46*(2), 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *Mis Quarterly, 27*(3), 425-478.

Venkatesh, V., & Ramesh, V. (2002). Usability of web and wireless sites: Extending the applicability of the Microsoft usability guidelines instrument. TR134-1. *Information Systems Technical Reports and Working Paper*. www.kelley.iu.edu/ardennis/wp/

Venkatesh, V., Ramesh, V., & Massey, A. P. (2003). Understanding usability in mobile commerce. *Communications of the ACM, 46*(12), 53-56.

Vessey, I. (1991). Cognitive Fit: A Theory-Based Analysis of the Graphs Versus Tables Literature*. *Decision Sciences, 22*(2), 219-240.

Viswanathan, M. (2005). *Measurement error and research design*. Thousand Oaks, CA: Sage Publications, Inc.

Volery, T., & Lord, D. (2000). Critical success factors in online education. *International Journal of Educational Management, 14*(5), 216-223.

www.manaraa.com

Wang, H. Y., & Wang, S. H. (2010). User acceptance of mobile internet based on the Unified Theory of Acceptance and Use of Technology: Investigating the determinants and gender differences. *Social Behavior and Personality: an international journal, 38*(3), 415-426.

Wang, Y. S., & Wang, H. Y. (2008). Developing and validating an instrument for measuring mobile computing self-efficacy. *CyberPsychology & Behavior, 11*(4), 405-413.

Wood, R. E., & Locke, E. A. (1987). The relation of self-efficacy and grade goals to academic performance. *Educational and Psychological Measurement, 47*(4), 1013-1024.

Wu, Wang, & Lin. (2007). Mobile computing acceptance factors in the healthcare industry: A structural equation model. *International journal of medical informatics, 76*(1), 66-77.

Wu, I.-L., Li, J.-Y., & Fu, C.-Y. (2011). The adoption of mobile healthcare by hospital's professionals: An integrative perspective. *Decision support systems, 51*(3), 587-596.

Wu, J. H., & Wang, S. C. (2005). What drives mobile commerce?: An empirical evaluation of the revised technology acceptance model. *Information & Management, 42*(5), 719-729.

Yi, M. Y., Jackson, J. D., Park, J. S., & Probst, J. C. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view. *Information & Management, 43*(3), 350-363.

Zaichkowsky, J. L. (1985). Measuring the involvement construct. *Journal of consumer research, 12*(3), 341-352.

Zaichkowsky, J. L. (1994). The personal involvement inventory: Reduction, revision, and application to advertising. *Journal of advertising, 23*(4), 59-70.

Zaichkowsky, J. L. (1995). *Defending your brand against imitation: consumer behavior, marketing strategies, and legal issues*: Quorum Books Westport, CT.

www.manaraa.com