Constructing a Technology Readiness Scale for Sports Center RFID Door Security System Users

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ABSTRACT

This study was based on the technology readiness (TR) theory proposed by Parasuraman & Colby (1997) and the modified scale of willingness to use mobile services proposed by Sun (2010). It involves reviewing confirmatory factory analysis (CFA) to construct a technology readiness scale for sports center RFID door security system users. The research participants consisted of students from Feng Chia University's sports teams from whom a total of 280 valid questionnaires were collected. The study results show that the proposed scale possesses adequate convergent validity, discriminate validity, and composite reliability. Therefore, the proposed scale is a multi-factorial first-order model with four factors: optimism, innovativeness, discomfort, and insecurity.

Keywords: *Technology Readiness, RFID Door Security System*

INTRODUCTION

The 2008 Beijing Olympic Games, the accession to the World Trade Organization (WTO), and the rise of the knowledge economy and globalization have greatly influenced the development of the domestic sports industry. The impact of the trend towards having fewer children and changes in the university's educational environment have also forced schools to adjust management practices, make progressive reforms, and institute innovative programs to establish their own unique characteristics to distinguish themselves from other academic institutions. Furthermore, the provision of well-equipped sports facilities and healthy activities is an important consideration for students when choosing a university. Feng Chia University is a famous school in central Taiwan. In consideration of the demands of the students and local residents, the school has invested a considerable sum of money to construct a state-of-the-art sports center with the latest software and hardware. With a total of 9,158 pings (30,221 square meters), the center has an international standard swimming pool, three multi-functional indoor courts, a semi-outdoor court, two dance rooms, two squash courts, two gyms, two audio visual rooms, a multi-functional conference room, a restaurant, two parking lots, a management center, an administration center, 24 research rooms for P. E. teachers, a meeting room, an equipment room, shower rooms, locker rooms, restrooms, comprehensive audio video facilities, wireless internet access, and other types of leisure facilities. In addition, the center also offers physical education courses, sports leisure facilities, training courses, sports arenas, an assembly hall, and conference rooms (Feng Chia University Sports Center, 2012). It's highly expected that this sports center will be an ideal place for students and residents in the neighboring communities to exercise and spend their leisure time.

Radio Frequency Identification (RFID) is proven technology that has been used to improve management efficiency while lowering management costs in a variety of industries. It was first used in

the logistics management industry. Wal-Mart, a famous American multinational retail corporation, has been using RFID to save on logistics costs for many years. The latest available assessment shows that its use in inventory and personnel management has saved Wal-Mart up to 8.4 billion US dollars (Cheng, 2005). In addition, RFID has also been successfully used in fields such as public transportation (e.g. the Taipei MRT Easy Card System), car maintenance, library science, health, restaurant, and hotel, to name just a few (Hong, 2006). Providing a safe and comfortable sports environment for students and local residents so that they can attend P. E. classes and participate in sports is the main goal of the school sports center, and many researchers also think that it's a good place to use RFID. Wang, Chen, Tseng & Ye (2008) proposed that RFID has the following advantages for the school sports center. First, it can enable users to become familiar with the regulations or related affairs of the center. Second, it can offer personalized options for its members. Third, it can facilitate an Internet-based course reservation system. Fourth, it can provide management with a convenient roll call system for class attendance. Because of the hardware and software involved, the technological readiness of the school sports center users also plays an important role. Parasuraman & Colby (1997) defined Technology Readiness (TR) as "people's propensity to embrace and use new technologies at home and at the workplace." They also provided four general distinct TR dimensions: optimism, innovativeness, discomfort, and insecurity. Furthermore, Parasuraman & Colby (2003) pointed out in their following research that what TR reflects is a belief in technology, not an ability index of technology. They also proposed that TR can quickly and accurately predict the "levels of technology implementation" and "technology adoption" of daily customers. Part of TR's multiple characteristics include incentives, and the other part involves obstacles. Therefore, the researcher organized the related studies of both domestic and foreign scholars, referred to the TR theory of Parasuraman & Colby (1997), modified a scale used to determine willingness to use mobile services proposed by Sun (2010), and then analyzed the acquired information with confirmatory factory analysis (CFA) to construct a technology readiness scale for Feng Chia University Sports Center users and to see if the model works in a real-world environment.

METHODOLOGY

This study provided questionnaire surveys to students in Feng Chia University's sports teams and used SPSS 20.0 for data input. The collected questionnaires were checked, and invalid questionnaires were excluded. Fig. 1 shows the path diagram for the confirmatory factor analysis structured according to the research design. AMOS 20.0 was used for the research model tests, parameter estimation and structural modeling.

Method

The technology readiness scale used in this study was modified from a "scale of willingness to use mobile services" by Sun (2010). It has a 7-point Likert scale, and is divided into seven categories: "strongly agree" (seven points) to strongly disagree" (one point). The scale has 18 questions divided into four dimensions: optimism (Q1 to Q5), innovativeness (Q6 to Q10), discomfort (Q11 to Q14), and insecurity (Q15 to Q18). Before conducting the confirmatory factor analysis, the fitness and co-linearity of every dimension were checked, which resulted in the deletion of Q1 and Q2 in the optimism dimension, Q2 and Q4 in the discomfort dimension, and Q2 in the insecurity dimension because of the co-linearity problem resulting from high modification indices. All of the questions in the innovativeness dimension were kept since it did not have a co-linearity problem.

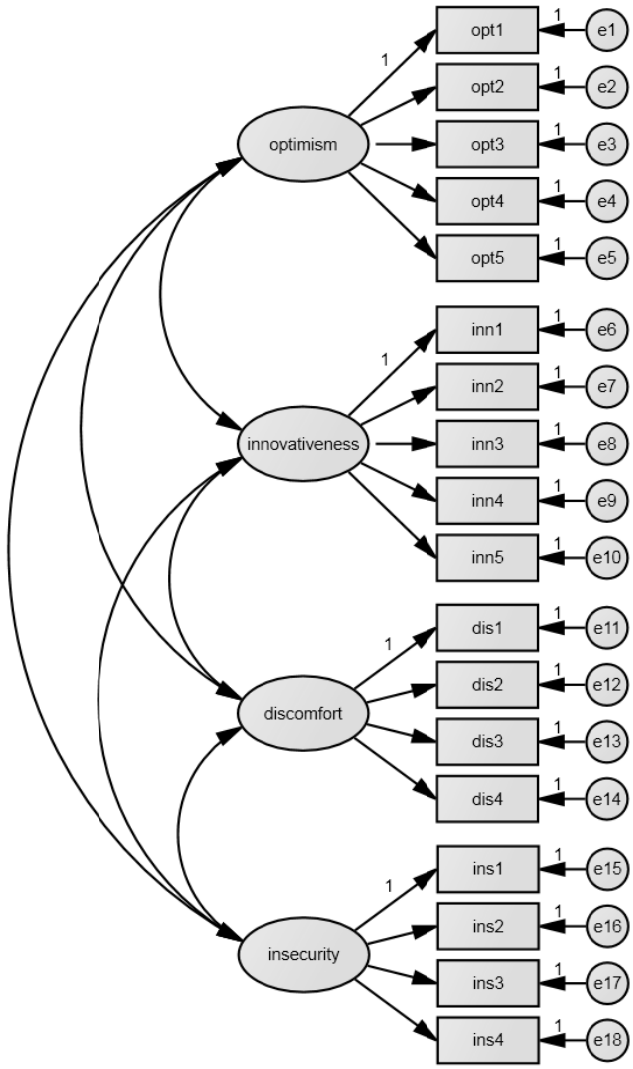

Fig. 1: Path diagram for the confirmatory factor analysis

Research Participants

This research conducted questionnaire surveys on students on Feng Chia University's sports teams using convenience sampling. The surveys were conducted at the Feng Chia University Sports Center from April 1, 2012 to April 30, 2012. Three hundred questionnaires were distributed, all of which were returned, yielding a return rate of 100%. After eliminating invalid questionnaires, there were 280 valid questionnaires, yielding a valid return rate of 93.3%. Table 1 shows the distribution of general information for this sample using descriptive statistics. The size of the valid sample is 280 people. It is composed of 144 males (51.4%) and 136 females (48.6%), indicating the majority of Feng Chia Sports Center users are male. In terms of school years, sophomores comprise the largest group (21.1%), followed by second-year graduate students (20.4%). The smallest group was the seniors (10.0%). This shows that sophomores make up the majority of users at the Sports Center. In terms of colleges, students from the college of business comprise the largest group (26.8%), followed by students from the college of

construction and development (17.9%); the smallest group consists of students from the college of finance (6.4%). This shows that students from the college of business make up the majority of Sports Center users. When asked about the length of time on their respective sports teams, students who have been on their team for four to six months comprise the largest group (32.1%), followed by those for one to three months (19.6%); those who have been on teams for seven to nine months comprise the smallest group (3.9%). When asked if they frequently use or own digital technology products, 189 participants answered "yes" (67.5%), and 91 people answered "no" (32.5%). In terms of frequency of computer use, "once (or more) every day" comprises the largest group (41.4%), followed by "three times (or more) a week" (33.6%); the smallest group is "seldom" (1.1%). In terms of sports habit, "two to three hours every day" is the largest group (57.1%), followed by "0 to one hour every day" (26.8%); the smallest group is "five hours (or more) every day" (1.1%). In terms of frequency of using the Sports Center, the largest group is "three times (or more) a week" (39.6%), followed by "one time (or more) a week" (26.8%); the smallest group is "one time (or more) every day" (6.8%). Asked about if the opening hours of the Sports Center meet their needs, 57.9% of the research participants answered with "agree," followed by "neutral" (29.9%); "strongly agree" makes up the smallest group (5.0%).

Table 1: Descriptive statistics of the sample characteristics

Background Variables	Category	Number	Percentage (%)	Accumulated Percentage (%)
Gender	Male	144	51.4	51.4
	Female	136	48.6	48.6
School Year	First-year	50	17.9	17.9
	Second-year	59	21.1	38.9
	Third-year	51	18.2	57.1
	Fourth-year	28	10.0	67.1
	First-year in Graduate Program	35	12.5	79.6
	Second-year in Graduate Program	57	20.4	100.0
College	College of Engineering	26	9.3	9.3
	College of Business	75	26.8	36.1
	College of Science	25	8.9	45.0
	College of Humanities and Social Sciences	30	10.7	55.7
	College of Information and Electrical Engineering	27	9.6	65.4
	College of Construction and Development	50	17.9	83.2
	College of Management Development	29	10.4	93.6
	College of Finance	18	6.4	100.0
Length on Sports Team	One to three months	55	19.6	19.6
	Four to six months	90	32.1	51.8
	Seven to nine months	11	3.9	55.7
	Ten to twelve months	33	11.8	67.5
	Over one year	41	14.6	82.1
	Over two years	50	17.9	100.0
Whether the participant frequently uses or owns	Yes	189	67.5	67.5
	No	91	32.5	100.0

digital technology product(s)				
	Once (or more) every day	116	41.4	41.4
	Three times (or more) every week	94	33.6	75.0
Frequency of computer use	Once (or more) every week	26	9.3	84.3
	Three times (or more) every month	19	6.8	91.1
	Once (or more) every month	22	7.9	98.9
	Rarely	3	1.1	100.0
	0 to 1 hour every day	75	26.8	26.8
	Two to three hours every day	160	57.1	83.9
Exercise Habits	Four to five hours every day	42	15.0	98.9
	More than five hours every day	3	1.1	100.0
	Once (or more) every day	19	6.8	6.8
	Three times (or more) every week	111	39.6	46.4
Sports Center Use Frequency	Once (or more) every week	75	26.8	73.2
	Three times (or more) every month	22	7.9	81.1
	Once (or more) every month	32	11.4	92.5
	Rarely	21	7.5	100.0
	Strongly agree	14	5.0	5.0
	Agree	162	57.9	62.9
Whether or Not the Opening Hours of the Sports Center Meet the Needs of Users	Neutral	82	29.3	92.1
	Disagree	22	7.9	100.0
	Strongly disagree	0	0	0

Test for Offending Estimates

The test for offending estimates conducted in this study includes error variances and standardized regression coefficients (Tatham & Black, 1998). As shown in Table 2, the estimated error variances of the proposed model in this study are positive values, and the error variances of the model fall between 0.05 and 0.11, yielding no error variance. In addition, standardized regression coefficients fall between 0.76 and 0.95 (all below 0.95), indicating that there are no offending estimates. Therefore, the overall goodness-of-fit test for the proposed model can be conducted.

Table 2: Test for Offending Estimates

Items	Standardized Regression Coefficient	Error Variance
1. I expect to use the most advanced technology.	0.70	0.09
2. Technology allows me to live a more convenient life.	0.68	0.05
3. New technology always excites me.	0.71	0.05
4. Technology allows me to act freely.	0.71	0.06
5. I think that learning how to use technology provides a lot of advantages.	0.70	0.05
6. Other people frequently ask me about new technology.	0.72	0.05
7. I encounter fewer problems than others when using high-tech products.	0.76	0.05
8. I am always the first person to buy the latest technology products among my friends.	0.71	0.07
9. I can learn about new technology products and services by myself.	0.69	0.06
10. I can always follow the latest technological trends and developments in my field of interest.	0.69	0.07
11. I cannot easily fully understand technological terms and technical support jargon.	0.60	0.10
12. I will feel embarrassed if others find out that I made a mistake when using a high-tech product.	0.60	0.11
13. It's not easy to read the manuals for high-tech products or services.	0.58	0.09
14. I'm worried that the suppliers of high-tech products or services will take advantage of me when they offer technical support.	0.68	0.09
15. I don't think that it's safe to provide personal information on the Internet.	0.70	0.06
16. I don't think that the security of online financial institutions is reliable.	0.73	0.06
17. I'm worried that information I send through the Internet will be read by other people.	0.72	0.06
18. I don't think that doing business online is safe.	0.75	0.08

RESULTS

This study conducts confirmatory factor analysis on the proposed technology readiness scale for sports center RFID door security system users. It uses structural equation modeling and employs modification indices to determine whether to eliminate or retain variable parameters (Li, 2006). It is found that the MI of opt1, opt2, dis2, dis4, and ins2 are too high, so these five items are removed, while the other 11 are retained.

Measurement Model Analysis

The measurement model analysis mainly includes tests for convergent validity and discriminant validity. Convergent validity is determined with standardized regression coefficient, average variance extracted, and composite reliability analyses (Bagozzi and Yi, 1988). Discriminant validity is tested by the confidence interval approach.

1. Convergent Validity

Table 3 shows that the standardized path coefficient of the measurement variable falls between 0.65 and 0.77; the composite reliability score falls between 0.66 and 0.84; the value of the average variance extracted falls between 0.50 and 0.53. These results show that the scale possesses adequate convergent validity (Wu, 2007).

Table 3: Observable Variable Reliability, Latent Variable Construct Reliability, and Average Variance Extracted

Latent Variable	Observable Variable	Factor Loadings	Composite Reliability	Average Variance Extracted
Optimism	opt3	0.66	0.75	0.50
	opt4	0.73		
	opt5	0.72		
Innovativeness	inn1	0.71	0.84	0.50
	inn2	0.76		
	inn3	0.71		
	inn4	0.68		
	inn5	0.69		
Discomfort	dis1	0.76	0.66	0.50
	dis3	0.64		
Insecurity	ins1	0.66	0.77	0.53
	ins3	0.75		
	Ins4	0.77		

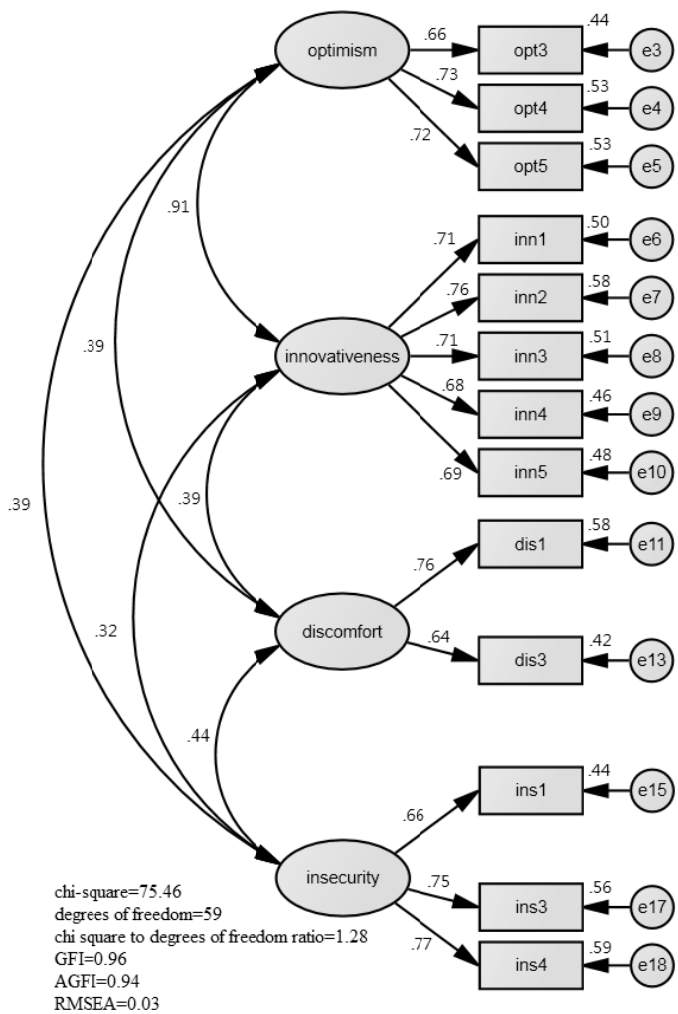

Fig. 2: Path Diagram of the Research Model

2. Discriminant Validity

Table 4 shows that the 95% confidence interval for all dimensions does not include 1, and therefore there is adequate discriminant validity.

Table 4: Bootstrapping the 95% Confidence Interval for Correlation Coefficient

Parameter			Estimated	Bias-corrected		Percentile method	
				Lower	Upper	Lower	Upper
Optimism	< -- >	Innovativeness	0.91	0.83	0.98	0.83	0.98
Optimism	< -- >	Discomfort	0.40	0.18	0.60	0.19	0.60
Optimism	< -- >	Insecurity	0.39	0.23	0.54	0.24	0.54
Innovativeness	< -- >	Discomfort	0.39	0.17	0.60	0.18	0.61
Innovativeness	< -- >	Insecurity	0.32	0.13	0.50	0.13	0.51
Discomfort	< -- >	Insecurity	0.44	0.26	0.59	0.27	0.60

3. Cross Validity

As shown in Table 5, different partitioned subsets are tested to determine the significance between them to decide if the information originated from the same population. Moreover, stability of the model and cross validity was tested. First, the factor loadings of the two subsets are set the same. In this structural model, when a total of nine factor loadings are set the same (DF=9), the CMIN increases by 6.481 and the result shows $p = 0.005$, which does not reach the significance of $p = 0.05$. This indicates that it's acceptable to set the nine factor loadings the same and that they are congruent. In addition to maintaining the limit of the measurement coefficient model, when the 10 extra variances and covariances are also set (DF=19-9=10), the CMIN increases by 10.189 (CMIN=16.670-6.481) and the result shows $p = 0.612$, which does not reach the significance of $p = 0.05$. This indicates that it's acceptable to set the 10 variances and covariances the same. Therefore, these 10 are congruent. The setting above fits the moderate test proposed by Byme (2010), and the results show that the two subsets are homogeneous, so it can be inferred that the two subsets are equal and the model has adequate stability and cross validity.

Table 5: Comparison of invariance of the technology readiness scale for sports center RFID door security system users

Model	Degrees of Freedom	Chi-square	*p* value	NFI Delta-1	IFI Delta-2	RFI rho-1	TLI rho2
Measurement weights	9	6.481	0.691	0.005	0.005	-0.005	-0.006
Structural covariances	19	16.670	0.612	0.012	0.013	-0.007	-0.008
Measurement residuals	32	33.914	0.375	0.024	0.026	-0.007	-0.008

Structural Relations Analysis

As shown in Table 6, the modified chi-square to degrees of freedom ratio is 1.28 (less than 3), the GFI score is 0.96 (exceeding 0.90), the AGFI score is 0.94 (exceeding 0.80), the RMSEA score is 0.03 (less than 0.08), the CFI score is 0.99 (exceeding 0.90), and the PCFI score is 0.75 (exceeding 0.50). The results all conform to the seven evaluation indices proposed by Bagozzi and Yi (1998), Bentler (1992), and Wu (2009). Therefore, the model used in this study is acceptable.

Table 6: Goodness-of-fit analysis of the research model

Fit Indices	Permissible Threshold	Model (Before Modification)	Model (After Modification)	Goodness-of-fit
χ^2 (Chi-square)	As Low as Possible	285.52	75.46	
Chi-square to Degrees of Freedom Ratio	< 3	2.21	1.28	Fit
GFI	>0.90	0.90	0.96	Fit
AGFI	>0.80	0.86	0.94	Fit
RMSEA	<0.08	0.07	0.03	Fit
CFI	>0.90	0.92	0.99	Fit
PCFI	>0.50	0.78	0.75	Fit

RESULTS AND SUGGESTIONS

Results

Parasuraman & Colby (1997) defined technology readiness (TR) as "people's propensity to embrace and use new technologies at home and at the workplace." This can be regarded as an overall mental state whose enablers and inhibitors affect the personal intention to use new technologies. They analyzed positive and negative beliefs about technology. Positive beliefs include optimism and innovativeness, while negative belief includes discomfort and insecurity; furthermore, customers with different levels of technology readiness and attempts to use new technologies will present different intentions to use information services. This study is based on the technology readiness (TR) theory proposed by Parasuraman & Colby (1997), and modified the scale of willingness to use the mobile services proposed by Sun (2010) to construct a technology readiness scale for sports center users. CFA shows that both of the scale's convergent validity and discrimant validity yield satisfactory results. So it can be determined that the proposed scale possesses adequate validity and reliability and is fit for measuring the degrees of technology readiness of the sports center users.

Suggestions

(1) For future studies: This study is primarily based on a scale to measure the technology readiness of sports center users. However, only the users of the Feng Chia University Sports Center are the participants of the study, so until the results of this study can be applied to the users of other sports centers, this is definitely the limit of this research. Therefore, future researchers can focus on the users of other sports centers to test the scale's validity, reliability, and stability.

(2) For future applications: Although the validity and stability of the scale needs to be tested further, the scale is still valid and can be used to measure the technology readiness of the sports center users. The measurement results will allow sports center owners to understand the intention of customer to accept and use new technologies and information services, and will be the basis for the owners' decision regarding ways to improve the quality of their respective sports centers' information technology.

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