

# Assessing Measurement Invariance of Behavioral Tendency Model for College and University Students Participating in In-line Hockey between Male and Female Groups

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## ABSTRACT

*Ajzen's (1985) Theory of Planned Behavior (TPB) was referred to as the architecture by this study, using SEM to construct the behavioral tendency causal model for university students participating in in-line hockey. The university students participating in in-line hockey were taken as the research subjects and Ajzen's (1985) Theory of Planned Behavior was used as the reference. In addition, the modified planned behavior scale of behavior attitude scale for college and university students participating in tennis proposed by Chang and Lai (2005) were adopted as the research tool. The scale was found to feature good convergent validity, discriminate validity and composite reliability. The research results indicate that H1 attitude of university students participating in in-line hockey has a positive impact towards behavioral tendency with a path coefficient of .43 ( $p < .01$ ), and so H1 is supported. H2 subjective norm of university students participating in in-line hockey has a positive impact towards behavioral tendency with a path coefficient of .16 ( $p > .01$ ), and so H2 is not supported. H3 perceived behavioral control of university students participating in in-line hockey has a positive impact towards behavioral tendency with a path coefficient of .54 ( $p < .01$ ), and so H3 is supported. The results have verified that the measurement invariance assessment for college and university students participating in in-line hockey is incongruence between male and female groups.*

**Keywords:** TPB (Theory of Planned Behavior), in-line hockey, measurement invariance.

## INTRODUCTION

### Research Background and Motivation

The university stage is regarded as an extremely important development era in learning career. In this stage, as students are free to control their own spare time, the use of spare time and the arrangement of leisure activities have become a major issue that cannot be ignored (Yao, 2005) for university students in self-career planning. To challenge the 2008 National Development Plan, the Ministry of Education has promoted the "One Person One Movement, One School One Team" campaign, hoping that through the idea of each student to learn at least one sport skill and each school to form at least five sports teams, it is able to allow each student to accumulate at least 30-60 minutes of physical activity time daily, and the school to increase its goal of regular exercise population by 2% each year (Council of Economic Planning, 2002). Leisure activities are able to provide an interpersonal interaction opportunity for university students, allowing them to relieve their stress and to gain growth experience, such as focusing and obtaining feedback from interpersonal interaction in order to understand the selfhood, self-identification and even to experience self-transcendent, thereby gaining self-respect and self-realization (Driver, Brown & Peterson, 1991). The important factors that affect students in choosing their recreational sports vary from person to person; among

them are interests, gender, time, personality, attitudes on recreational sports or sensory perception, etc.

In-line hockey sport was originated from the extension of in-line skates in 1735, being invented by John Joseph Merlin with metal wheels. Not until Chicago Ice Skating Company created the skating shoes in 1966 did we now see the in-line skating or rollerblading sports. The stability and comfort of in-line skates at that time had much to improve, however. In 1979, hockey player Scott Olson and his brother Brennan Olson thought of practicing hockey in the absence of seasonal snow and so made some modification on their hockey shoes, and meanwhile, established the Rollerblade Company. Ever since then, in-line hockey sport has been developing rapidly all over the world, in particularly in the Equator and subtropical countries without snow, claiming that it is even more suitable to develop such sport there. Taiwan started to promote in-line hockey in 1993, and listed it as an official competition event in World Games 2009 in Kaohsiung. As the sport is not restricted by age and playground, not difficult to handle, easy to learn and able to satisfy the youths seeking for excitement and other factors, these have allowed in-line hockey to become one of the sports promoted by ice skating-related associations. In order to increase the awareness on in-line hockey, the majority of clubs formed by community folks, college and university students, and senior high school students are raising the visibility and popularity of the sport by organizing in-line hockey competitions regularly (Chinese Taipei Skating Union, 2003). To date, the promotion has already prompted several colleges and universities to establish related associations.

The Theory of Planned Behavior proposed by Ajzen (1985) is a thesis extended from the Theory of Reasoned Action brought up by Fishbein and Ajzen in 1975. The Theory of Reasoned Action is described as the main controlling factors when an action is subjected to personal attitude and external subjective norm towards such action. From the above theory, Ajzen then extended the Theory of Planned Behavior by adding this theoretical basis with perceived behavioral factor in the original behavior attitude and subjective norm. This factor is affected by personal past experiences and the expected encountering obstacles on such behavior, and these three predicted variables will affect each other. "The Theory of Planned Behavior" is often used to predict and explain the theory of personal behavioral tendency. It serves as the basis to explore personal attitudes, and as the references to group opinions, resource capacity constrains and other factors towards the impact on personal behavioral intention and actual behaviors. Many studies have indicated that this Theory of Planned Behavior has been used effectively on health, fitness (Hausenblas, Carron & Mark, 1997), sports (Chang & Lai 2005), medicines (Frost, Myers & Newman, 2001), recreation (Hrubes & Daigle, 2001), marketing (Kalafatis, Polland, East & Tsogas, 1999) and other fields, and has a good predictive ability in interpreting personal behaviors (Chao, 1999; Wu & Chen, 2006). The Theory of Planned Behavior consists of three key dimensions of "attitude," "subjective norm," and "perceived behavioral control." They are described as follows (Ajzen, 1985):

- (1) Behavioral attitude: It refers to the predisposition of like or dislike by an individual towards a specific target or object. It also refers to the positive or negative assessment adopted by the individual on a particular behavior. If the assessment is regarded as positive, it means that the individual has developed the sense of identity towards such behavior.
- (2) Subjective norm: It refers to the perceived social perception while the individual is using a particular behavior, thereby generating the social pressure to affect the individual willingness from engaging in such behavior. It also refers to the external pressure arising from other people or groups to think whether or not the individual should adopt a particular behavior while the individual is engaging in a certain behavior.
- (3) Perceived behavioral control: It refers to an intention while the individual is expecting to adopt a particular behavior by following his/her own controllable feeling, and based on past experiences or predicted encountering obstacles to affect whether or not to engage in such behavior.

(4) Behavioral tendency: It refers to the action tendency of an individual wanting to adopt a particular behavior, and that the behavioral intention is a mandatory process of any behavior expression.

Li (2009) used the Theory of Planned Behavior to explore the behavioral intention of bicycle riding. The research results indicate that attitude, subjective norm and perceived behavioral control are all able to significantly predict the behavioral intention to engage in cycling activities; and among them, perceived behavioral control shows the greatest impact towards the intention, while subjective norm shows the lowest impact. In addition, Chang, & Weng (2005) used the Theory of Planned Behavior to explore the table tennis changing stages of university students towards the differential performances on behavior attitude, subjective norm, and perceived action control of Theory of Planned Behavior. They discovered that behavior attitude, subjective norm and perceived action control are able to directly and positively affect the intention of college and university students to participate in table tennis sport. Among them, behavioral attitude comes in first priority, followed by perceived action control and subjective norm.

Summarizing the above relevant theories and empirical research, we come to understand the applicability of the Theory of Planned Behavior in behavior research. Ajzen's (1985) Theory of Planned Behavior was referred to as the architecture by this study, taking university students participating in in-line hockey as the subjects and adopting SEM to construct the behavioral tendency causal model for university students participating in in-line hockey in order to construct a more complete behavioral tendency model for university students participating in in-line hockey.

Based on the above concepts, the study is able to derive into three assumptions:

H1: The attitude of university students participating in in-line hockey has a positive impact towards behavioral tendency.

H2: The subjective norm of university students participating in in-line hockey has a positive impact towards behavioral tendency.

H3: The perceived behavioral control of university students participating in in-line hockey has a positive impact towards behavioral tendency.

### **Research Objectives**

(1) To verify the theoretical model of behavioral tendency and to observe the data's adaptive extent of university students participating in in-line hockey.

(2) To construct a theoretical model of behavioral tendency for university students participating in in-line hockey, and further to analyze the behavioral tendency of students participating in in-line hockey, and their causal relationship between these factors.

(3) To verify whether or not the existence of measurement equivalence in theoretical model of behavioral tendency between the two groups of male and female university students participating in in-line hockey.

## **RESEARCH METHODS**

### **Research Subjects**

The college and university student participants in 2010 National In-line Hockey Competition were chosen as the tested samples, using the convenient sampling method to perform a questionnaire investigation within the period of March 16, 2010 and April 6, 2010. The questionnaires were sent via mail by the researchers to the in-line hockey associations of colleges and universities, aiming at students in the country's colleges and universities who engaged in in-line hockey sport. Out of a total of 220 questionnaires sent, 220 copies were collected, with a recovery rate of 100%. After canceling the invalid questionnaires, 200 valid questionnaires were obtained, achieving an effective rate of 90.90%.

## Research Tool

The tool used by this study was the planned behavior scale, consisting of two sections: The first section was the planned behavior, comprising mainly the references of Ajzen's (1985) Theory of Planned Behavior, and the modified version of behavior attitude scale of college and university students participating in tennis sport suggested by Chang and Lai(2005). The seven-point Likert scale was adopted, being divided into seven graded responses of "strongly disagree," "disagree," "slightly disagree," "ordinary," "slightly agree," "agree," and "strongly agree;" in scores of 1 point, 2 points, 3 points, 4 points, 5 points, 6 points and 7 points, respectively. The original scale was divided into four dimensions, namely "behavior attitude," "subjective norm," "perceived behavioral control," and "behavior tendency;" with a total of 24 questions in this section. The second section was basic personal information, including age, gender, place of residence, number of years participating in in-line hockey sport, marital status, and number of hours involved in in-line hockey sport weekly.

## RESULTS

### Data Analysis Methods

The structural equation modeling was adopted by this study, using AMOS 16.0 statistical software version to conduct SEM analysis on the research samples to verify the causal relationship of research variables. While analyzing with SEM, the undetected concepts of latent variables in the model could only be estimated from the observable variables in the model. Among the latent variables in the research model were "attitude," "subjective norm," "perceived behavioral control," etc. While measurement errors were also taken into account by SEM to carry out reliability verification of variables. Li (2006) pointed that the modified indexes of confirmatory factor analysis could also serve to understand the non-adaptation of the model and as the basis whether or not to release or delete the variable parameters. Chen and Huang (2006) also indicated that when MI value was too great, it might be caused by measurement errors among the titles and so needed to adopt the modified indexes to delete the titles. Therefore, the titles of excessive large MI values were deleted by this study. After revising the model, all of them had reached the ideal fit standards.

### Measurement model

#### (1) Reliability test

In term of reliability test, the composite reliability sequence of the four factors was 0.705, 0.937, 0.621 and 0.705. All these values were greater than the acceptable value of 0.6, indicating that four factors have good reliability.

**Table 1: the Reliability of Observed Variables, Construct Reliability of Latent Variables, and Average Variance Extraction Size**

Latent variables	Observed variables	Factor loading	Composite reliability	Average variance extraction
Behavior attitude	A6	.85	0.705	0.878
	A7	.82		
	A8	.85		
Subjective norm	A10	.85	0.737	0.893
	A12	.93		
	A13	.79		
Perceived behavioral control	A14	.93	0.621	0.865
	A15	.89		
	A17	.72		

Behavioral tendency	A18	57	0.705	0.877
	A21	.83		
	A22	.84		
	A24	.85		

(2) Convergent validit

Table 1 indicates that the standardized coefficients of A6 to A24 fell within 0.83 and 0.95. They have reached the significant standard, denoting that these observed variables can be effectively converged into their belonging factors. The average variance extraction values were .634, .623, .627 and .582, respectively; indicating that the internal quality of the model is good and that this scale has a convergent validity.

(3) Discriminant validity

From Table 2, we know that the chi-square value of restricted factor R=1 model increased more than 3.84 than the chi-square value of non-restricted R=1 model, indicating that the correlation between the latent variables can be distinguished, and they are thus supported by discriminant validity.

**Table 2: Discriminant Validity Analysis Table**

Paired factor		Unrestricted model $\chi^2$	DF	Restricted model $\chi^2$	DF	$\Delta\chi^2$
Behavior attitude	Subjective norm	49.7	10	236.7	11	187.0
	behavioral control	87.3	15	256.9	16	169.6
	Behavioral tendency	73.3	10	214.4	11	141.1
Subjective norm	Perceived behavioral control	79.9	15	301.0	16	221.1
	Behavioral tendency	48.5	10	238.8	11	190.3
Perceived behavioral control	Behavioral tendency	61.2	15	177.1	16	115.9

*Structural model analysis*

(1) Overall model fitting extent test

Seven indexes, namely  $\chi^2$  test,  $\chi^2$  and the degree of freedom ratio, GFI, AGFI, root mean square error of approximation (RMSEA) and comparative fit index (CFI) were used by this study to perform the overall model fitting extent test (Bagozzi & Yi, 1988: Benter, 1992: Wu, 2009: Hair et al.1998). In the absolute fit indices, the chi-square test p value=.000 had reached a significant standard, and so the model was rejected. As the chi-square test was easily affected by sampling size to reach a significant level, so Bagozzi and Yi (1988) suggested using  $\chi^2$  and its degree of freedom ratio to test the model fitting extent. In this study,  $\chi^2$  and the degree of freedom ratio were less than 3 (1.965), GFI was greater than .90 to indicate that the model was accepted, AGFI was greater than .80 to indicate that the model was accepted, RMSEA was smaller than .80 to indicate that the model was accepted, CFI was greater than .90 to indicate that the model was accepted, and PCFI was greater than .50 to indicate that the model was accepted. Generally, only RMSEA among the seven indexes of the overall model was good, denoting that this research model was acceptable.

**Table 3: the Fit Analysis of Research Model**

Fit Indices	Permissible standard	Overall sample model	Model fitting judgment
$\chi^2$ ( Chi-square )	The smaller the better	156.0.	
$\chi^2$ and degree of	<3	2.64	Compliance
GFI	>.9	.91	Compliance
AGFI	>.8	.87	Compliance

RMSEA	<.08	.08	Good
CFI	>.9	.96	Compliance
PCFI	>.5	.73	Compliance

(2) Research hypothesis test

From the path coefficients among the structural model in Figure 1, the H1 attitude of university students participating in in-line hockey has a positive impact towards behavioral tendency with a path coefficient of .30 ( $p < .01$ ). So hypothesis H1 is supported. The H2 subjective norm of university students participating in in-line hockey has a positive impact towards behavioral tendency with a path coefficient of .14 ( $p > .01$ ). So H2 is not supported. The H3 perceived behavioral control of university students participating in in-line hockey has a positive impact towards behavioral tendency with a path coefficient of .45 ( $p < .01$ ). So H3 is supported.

**Figure 1 : The behavioral tendency model of university students participating in in-line hockey**

*The measurement invariance assessment of model in male and female groups*

Under the premise that the research model was assumed correct, as shown in Table 4, the subjects were randomly divided into two groups according to gender for comparison. 1. The factor loadings of two groups were first set equality, then all nine loading factors of the structural model had to be set equally (DF=9) and the chi-square value (CMIN) increased to 12.39. The test result of  $P = .19$  did not reach the .05 significant level, indicating that the nine equally set loading factors were accepted. Therefore, all nine loading factors were deemed equal. 2. Besides restricting the test model, three additional structural path

coefficients were set (DF=12-9=3), and the chi-square value (CMIN) increased to 1.33 (CMIN=13.72-12.39=1.33). The test result of P=.32 did not reach the .05 significant level, indicating that the three equally set structural path coefficients were accepted. Therefore, all the three structural path coefficients were deemed equal. 3. Besides restricting the structural coefficient model, six additional variances and covariances were set (DF=18-22=6), and the chi-square value (CMIN) increased to 10.318 (CMIN=35.16-13.72=21.44). The test result of P=.01 had reached a significant level of .05, indicating that the six equally set variances and covariances were not accepted. Therefore, the six variances and covariances were deemed unequal. The above data indicate that with regard to the behavioral tendency model of university students participating in in-line hockey, their measurement invariance assessment of male and female groups did not pass the modest test standards proposed by Kline (2005). When the data were divided into two groups, there was an obvious inhomogeneity of residual similarity. Therefore, the two groups were not equal. There were differences in the behavioral tendency model for male group and female group participating in in-line hockey. They might due to the reasons that men tend to like sports than women, and there are more occurrences of physical contacts and collisions in in-line hockey. Thus, the male and female groups are incongruent.

**Table 4: Invariant Comparison of Male and Female Groups**

Model	DF	CMIN	P	NFI Delta-1	IFI Delta-2	RFI rho-1	TLI rho2
Measurement weights	9	12.39	.19	.00	.01	.00	.00
Structural weights	12	13.72	.32	.01	.01	.00	-.01
Structural covariance	18	35.16	.01	.01	.01	.00	.00
Structural residuals	19	36.19	.01	.01	.02	.00	.00
Measurement residuals	32	57.10	.00	.02	.02	.00	.00

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

A series of stringent analysis procedures was done in this study to verify the reliability of planned behavior scale. The results of confirmatory factor analysis show that the majority of observed variables in the factor loading of latent variables were greater than 0.70, in four respective composite reliabilities of 0.785, 0.918, 0.830 and 0.841, and in respective average variance extractions of 0.634, 0.633, 0.627 and 0.582. They indicate that this scale possesses good composite reliability and convergent validity. In term of overall model fit test indices, the chi-square came in value of 192.528, the chi-square degree of freedom ratio of 1.965, the GFI of 0.924, AGFI of 0.894, RMSEA of 0.058, CFI of .964, and PCFI of 0.788, indicating that the behavioral tendency of university students participating in in-line hockey conforms with basic adaptive standard. Hence, the sample data constructed by this study on the behavioral tendency of university students participating in in-line hockey can be used to explain the actual observed data.

The attitude in research hypothesis 1 was found to have a similar positive impact towards behavioral intention pointed by Hsu (1999), Chao (1999) and Ajzen & Driver (1991) et al. It may due to the reasons that in-line hockey is regarded as an emerging recreational sport with the characteristics of speed and competitiveness. Apart from providing students with exercise and fitness, it is also an interesting leisure activity capable of helping them to relieve stress. Therefore, it allows students to enjoy the fun and attraction in it, and appreciated by them to generate an impact towards behavioral tendency. The subjective norm in research hypothesis 2 was found to have a similar negative impact towards behavioral intention proposed by Atsalakis & Sleaf (1996), Huang (2006b) et al. The possible reasons are university students are still in their youthful

stage, and students in this stage are eager to grant independence from their families and seek personal subjectivity, and to take the opportunity to shake off their dependence habit (cited from Li, 2004, p12). Therefore, the self-action tendency of students in this stage is more vigorous, and so the impact on willingness to participate in the activity is relatively low upon views and opinions given by others. The perceived behavioral control in research hypothesis 3 indicates that there is a consistent positive impact towards behavioral intention. The possible reasons are in-line hockey is regarded as an interesting recreational sport and its requirement on physical fitness is considered not high. For university students who have fully-developed physical structure, they are generally competent in in-line hockey and able to master the basic skills of the sport easily through teacher's guidance and practices. Coupled with the fact that university students have ample leisure activity time, this has generated an impact on perceived behavioral control towards behavioral intention. In term of measurement invariance assessment of male and female groups in behavioral tendency model scale of university students participating in in-line hockey, the study has provided empirical evidence to support the behavioral tendency model scale of university students participating in in-line hockey. It is able to make direct comparison on the scores obtained from behavioral tendency model scale on different groups of male and female university students participating in in-line hockey. In other words, if there is a need to compare whether or not there are significant differences on behavioral tendency of male and female university students participating in in-line hockey, they can be viewed from the angle of gender differences to participate in in-line hockey. Hence, the behavioral tendency model scale of this study on university students participating in in-line hockey has provided a certain degree of generalizable evidence to infer the gender differences.

### **Recommendations**

- (1) The study has discovered that the attitude of college and university students participating in in-line hockey has a positive impact towards the behavioral intention of participants. Therefore, we recommend physical education teachers and association sports instructors to introduce in-line hockey-related sports information to college and university students, allowing them to generate an interest and good feeling through the introduction of relevant skills of in-line hockey, and through experiencing in the sport personally.
- (2) The study has found that the perceived behavioral control of college and university students participating in in-line hockey has a positive impact towards the behavioral intention of participants. We therefore recommend the school to open in-line hockey-related courses in physical education curriculum and establish in-line hockey association, allowing students to have more opportunity to learn and improve the sports-related skills in in-line hockey. The school should also purchase in-line hockey-related sports equipment and provide a playground to satisfy the students' needs.
- (3) For followed up research suggestions, the theoretical model constructed by this study on behavioral tendency of university students participating in in-line hockey can be used in future research to further explore the applicability of this theoretical model in other sports. The theoretical model can also be probed into with the addition of different intervening variables, allowing the overall theoretical model to apply in sports events more completely.

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