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A Study on Lifestyle Attitude Change and Training Continuity of Martial Arts Sports Participants

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Abstract

Today, martial arts have developed into international competitions based on rules and forms, and various competitions are held on the world stage. Judo and Taekwondo have been adopted as Olympic sports, and Kendo, Karate, Wushu, and Sumo are also being held at the international level. The purpose of this study is to investigate the relationship between martial arts mentality, lifestyle attitude changes, and training continuity of martial arts sports participants. In order to achieve this purpose, the research subjects were selected as Chinese college students participating in martial arts sports, and the survey link was shared online and sampled through email. A total of 400 data were sampled, and 50 questionnaires that could not be used for analysis due to insincere responses or missing answers were excluded, and a total of 350 questionnaires were finally used for analysis. The martial arts sports were limited to Wushu, Taekwondo, and Judo. Data processing was performed using the statistical program SPSS 22.0 version to perform statistical processing according to the purpose of analysis. The results obtained through this research process are as follows. First, martial arts mentality was found to partially affect changes in lifestyle attitudes. Second, martial arts mentality was found to partially affect training continuity. Third, changes in lifestyle attitudes were found to partially affect training continuity.

Keywords: Martial Arts Mentality, Lifestyle Attitude Changes, Training Continuity

1. INTRODUCTION

It is said that in human history, martial arts arose naturally in the process of defense or hunting for food for human survival [1, 2]. In this one-dimensional claim, a more high-level view is asserting the origin of martial arts. In other words, martial arts is explained as an anthropological phenomenon that is achieved through the process of training the body, practicing techniques, and tempering the mind to better defend oneself, as a result of artificial efforts and their results [3, 4]. Recently, martial arts have been commercialized as a sport to suit the needs of modern people, and the meaning of martial arts sports has been established. Accordingly, in

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modern society, martial arts are deeply related to the lives of modern people as a part of the social system that reflects diverse and complex social phenomena. Most people participate in martial arts sports in some form, regardless of demographic characteristics such as gender, age, and social class. In addition, there are associations related to dance, such as gyms, in various places in our lives, and dance sports are often familiarized to modern people through the mass media [5, 6]. Then, what is the part of martial arts that modern people are most interested in? Also, what part has the greatest influence? This question arises. The answer can be found in the characteristics of oriental martial arts. In other words, oriental martial arts are not limited to the form of fighting, but are combined with ethical factors such as etiquette, manners, and morality. In addition, they have developed in combination with medical factors for human health other than fighting [7, 8]. Accordingly, it can be seen that there is interest in the educational aspect of solving social problems such as material abundance, materialism, and the extinction of humanity due to the development of science in modern society. This can be said to mean that the health aspect and self-defense aspect are the basic factors of martial arts sports training, and that education on the mental aspect is more preferred and necessary [9]. Therefore, in modern society, martial arts sports are feeling the need for mental strength education such as courtesy, emotion, courage, etc., in addition to the most direct functions of health promotion, self-defense, and physical training, such as changing one's attitude toward life through mental training. This study is necessary to provide basic data for the continuous expansion of martial arts sports by clarifying the influence of the achievement of martial arts mental strength on the changes in attitude toward life and the continuation of training of martial arts sports practitioners.

2. ANALYSIS METHOD AND SURVEY TOOL

2.1 Study Subjects

The research subjects were selected as Chinese college students participating in martial arts sports, and the survey was sampled online through sharing the questionnaire link and email. A total of 400 data were sampled, and 50 questionnaires that could not be used for analysis due to insincere responses or missing answers were excluded, and a total of 350 questionnaires were finally used for analysis. The martial arts sports were limited to Wushu, Taekwondo, and Judo. Table 1 is based on the details of the study subjects.

Table 1. Study Subjects

Variable		N	%
Gender	Male	200	57
	Female	150	43
Martial Arts Sports	Wushu	140	40
	Taekwondo	120	34
	Judo	90	26
Household income (won)	200 ↓	100	29
	200 ↑ -300 ↓	130	37
	300 ↑	120	34

2.2 Research Tool

The survey tool was a questionnaire that was modified and supplemented to fit this study based on a scale that had been verified for validity and reliability in previous studies. Each item was composed of a 5-point Likert scale. In order to measure the martial arts mentality, the items used in previous studies were modified and supplemented to fit this study, and the martial arts mentality consisted of four sub-factors: concentration, patience, courage, and courtesy [10, 11]. In order to measure the change in lifestyle attitude, the items used in previous studies were modified and supplemented to fit this study. The change in lifestyle attitude consisted of three sub-factors: changes in attitude toward home, school, and neighbors [12, 13]. In order to measure the continuity of martial arts training, the items used in previous studies were modified and supplemented to fit this study, and the intention to continue training consisted of two sub-factors: intention to continue training and intention to recommend others [14, 15]. Table 2 is based on the detailed composition of the questions on the test paper.

Table 2. Questionnaire Composition Indicator

Factor	Sub-factor	Number of questions
Demographic characteristics	Gender	1
	Martial Arts Sports	1
	Household income	1
Martial arts mentality	Concentration	5
	Patience	4
	Manners	3
	Courage	3
Life attitude changes	Family	5
	School	5
	Neighbor	4
Training continuity	Training intention	3
	Intention to recommend others	3

3. VALIDITY AND RELIABILITY OF THIS STUDY

3.1 Exploratory Factor Analysis

Table 3 is based on the results of the exploratory factor analysis on the martial arts mentality.

Table 3. Exploratory factor analysis and reliability analysis of Martial arts mentality

Question	Factor 1	Factor 2	Factor 3	Factor 4	
Concentration	Q02	0.799	0.245	0.154	0.212
	Q03	0.693	0.247	0.207	0.141
	Q05	0.634	0.023	0.261	0.256
	Q04	0.608	0.208	0.153	0.345
Patience	Q08	0.356	0.744	0.304	0.130
	Q09	0.291	0.732	0.257	0.140
	Q07	0.109	0.685	0.286	0.247
Manners	Q13	0.246	0.250	0.760	0.181
	Q14	0.301	0.261	0.684	0.051

Courage	Q10	0.190	0.224	0.162	0.609
	Q11	0.080	0.218	0.173	0.435
Characteristic value		2.659	2.405	2.216	1.291
Dispersion %		24.171	21.860	20.145	11.733
Accumulation %		24.171	46.032	66.177	77.910

If we look at this in detail, the four items with high factor loadings(0.608 or higher) in Factor 1 are 2, 3, 5, and 4, all of which are related to concentration. Item 1 was removed because it had a low factor loading value. The three items with high factor loadings(0.685 or higher) in Factor 2 are 8, 9, and 7, all of which are related to perseverance. Item 6 was removed because it had a low factor loading value. The two items with high factor loadings(0.684 or higher) in Factor 3 are 13 and 14, all of which are related to Manners. Item 15 was removed because it had a low factor loading value. The items showing high factor loadings(over 0.435) of factor 4 are items 10 and 11, both of which are related to courage. Item 12 was removed because it had a low factor loading value. And the cumulative ratio explaining the four factors of concentration, patience, manners, and courage of martial arts mentality was 77.910%.

Table 4 is based on the results of the exploratory factor analysis on changes in lifestyle attitudes.

Table 4. Exploratory factor analysis and reliability analysis of life attitude changes

Question		Factor 1	Factor 2	Factor 3
Family	Q01	0.802	0.271	0.228
	Q02	0.768	0.319	0.270
	Q03	0.721	0.278	0.318
	Q04	0.696	0.220	0.217
School	Q10	0.276	0.800	0.109
	Q07	0.249	0.777	0.328
	Q06	0.277	0.705	0.133
	Q08	0.228	0.610	0.216
Neighbor	Q12	0.279	0.088	0.606
	Q14	0.327	0.283	0.562
Characteristic value		3.027	3.054	1.428
Dispersion %		32.074	30.537	14.276
Accumulation %		32.074	62.612	76.888

If we look at this in detail, the four items with high factor loadings(0.696 or higher) in Factor 1 are 1, 2, 3, and 4, all of which are related to family attitudes. Item 5 was removed because it had a low factor loading value. The four items with high factor loadings(0.610 or higher) in Factor 2 are 10, 7, 6, and 8, all of which are related to school attitudes. Item 9 was removed because it had a low factor loading value. The two items with high factor loadings(0.562 or higher) in Factor 3 are 12 and 14, all of which are related to neighbor attitudes. Items 11 and 13 were removed because they had low factor loading values. And the cumulative ratio explaining the three factors of changes in lifestyle attitudes, including family attitudes, school attitudes, and neighbor attitudes, was 76.888%.

Table 5 is based on the results of the exploratory factor analysis on training persistence.

Table 5. Exploratory factor analysis on training continuity

Question		Factor 1	Factor 2
Training intention	Q06	0.865	0.242
	Q04	0.803	0.159

	Q05	0.803	0.249
Intention to recommend others	Q01	0.134	0.789
	Q03	0.291	0.770
	Q02	0.230	0.557
	Characteristic value	3.381	1.438
	Dispersion %	56.346	23.969
	Accumulation %	56.346	80.315

Looking at this in detail, the three items with high factor loadings (0.803 or higher) in factor 1 are 6, 4, and 5, all of which are related to the will to practice. The three items with high loadings (0.557 or higher) in factor 2 are 1, 3, and 2, all of which are related to the willingness to recommend to others. In addition, the cumulative ratio explaining the two factors of training persistence, the willingness to practice and the willingness to recommend to others, was 80.315%.

3.2 Reliability Analysis of This Study

Table 6 is based on the results of the questionnaire reliability analysis in this study.

Table 6. Reliability analysis

Factor	Sub-factor	Cronbach's α
Martial arts mentality	Concentration	0.89
	Patience	0.88
	Manners	0.83
	Courage	0.84
Life attitude changes	Family	0.90
	School	0.89
	Neighbor	0.69
Training continuity	Training intention	0.83
	Intention to recommend others	0.89

The Cronbach's α value of the martial arts mentality was 0.83~0.89, and the Cronbach's α value of the lifestyle attitude change was 0.69~0.90. In addition, the Cronbach's α value of the training continuity was 0.83~0.89. In this study, the Cronbach's α value, which is the reliability coefficient for all factors, was high, so it is considered a reliable item.

4. STATISTICAL ANALYSIS

For the collected data, double-entered and un-entered data were excluded from the analysis, and only valid samples were coded according to coding guidelines. After individually entering the information into the computer, frequency analysis, exploratory factor analysis, reliability analysis, and multiple regression analysis were performed using the statistical program SPSS Windows 20.0 Version. The statistical significance level was set at $p < 0.05$.

5. RESULTS

5.1. The Effect of Martial Arts Mental Strength on Changes in Life Attitude

Table 7 is based on the results of the multiple regression analysis conducted to examine the influence of the martial arts mentality on changes in attitude toward life.

Table 7. Multiple regression analysis of the impact of martial arts mentality on changes in life attitude

Variable	Family		School		Neighbor	
	β	t	β	t	β	t
Constant		12.790		11.020		11.249
Concentration	0.134	1.763	0.327	4.343***	0.193	2.573**
Patience	0.125	1.240	-0.042	-0.422	0.098	0.987
Courage	-0.012	-0.130	-0.022	-0.228	0.073	0.776
Manners	0.253	2.706**	0.244	2.635**	0.171	1.861
R ²	0.219		0.233		0.244	
F	27.616***		30.037***		31.804***	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Looking at Table 7, the final regression equation shows that the martial arts mentality affects the changes in attitude toward life at the 0.1% level in terms of family attitude, school attitude, and neighborhood attitude.

Looking at this in detail, first, the martial arts mentality showed that only manners had a significant effect at the 1% level on the change in family attitude, and the concentration of the martial arts mentality showed a significant effect at the 0.1% level on the change in school attitude, and manners at the 1% level. In addition, the concentration of the martial arts mentality showed a significant effect at the 1% level on the change in neighborhood attitude. Looking at the beta(β) value indicating the relative contribution, the martial arts mentality showed that manners(0.253), concentration(0.134), patience(0.125), and courage(-0.012) had an effect on the change in family attitude in that order, showing an explanatory power of 21.9%. In addition, the spirit of martial arts was found to have an effect on changes in school attitudes in the order of concentration (0.327), manners(0.244), perseverance(-0.042), and courage(-0.022), and had an explanatory power of 23.3%. In addition, the spirit of martial arts was found to have an effect on changes in neighbors' attitudes in the order of concentration(0.193), manners(0.171), perseverance(0.098), and courage(0.073), and had an explanatory power of 24.4%.

In comparison with the results of previous studies, a study targeting judo practitioners reported that the changes in the life attitudes of judo practitioners were closely related to patience, overcoming, patience, and polite behavior acquired during the training process [16]. In addition, a study on Taekwondo practitioners reported that personality education among mental strength education has a positive correlation with attitude toward life [17], and a study on changes in Taekwondo practitioners' attitude toward home life reported that the sense of etiquette formed through Taekwondo training has a positive influence on attitude toward home life [18, 19]. This indirectly supports the results of this study. In comparison with the results of previous studies, sports activities for modern people are not simply health activities, but rather have various purposes such as improving the quality of life, educational aspects, and lifestyle changes. In particular, I think that the purpose of bringing about positive lifestyle changes will be high during childhood and adolescence, when personality,

values, and sociality are formed. In particular, I think that the reason why martial arts sports are activated as the center of children is because the unique mental strength education that Taekwondo has brings about positive attitude changes toward life.

5.2. The effect of martial arts mentality on training continuity

Table 8 is based on the results of the multiple regression analysis conducted to determine the effect of martial arts mentality on training continuity.

Table 8. Multiple regression analysis on the effect of martial arts mentality on training continuity

Variable	Training intention		Intention to recommend others	
	β	t	β	t
Constant		7.543		6.652
Concentration	0.039	0.521	0.010	0.133
Patience	0.354	3.578***	0.235	2.404*
Courage	0.004	0.039	0.141	1.513
Manners	0.125	1.360	0.155	1.710
R ²	0.249		0.262	
F	32.690***		35.120***	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Looking at Table 8, it was found that martial arts mentality had an effect on training continuity and willingness to recommend to others at the 0.1% level in the final regression equation. Looking at this in detail, first, martial arts mentality had a significant effect on training continuity only with patience at the 0.1% level, and willingness to recommend to others only with patience of martial arts mentality had a significant effect at the 5% level. Looking at the beta(β) value indicating the relative contribution, martial arts mentality had an effect on training continuity in the order of patience(0.354), manners(0.125), concentration(0.039), and courage(0.004), showing an explanatory power of 24.9%. In addition, it was found that the spirit of martial arts influenced the willingness to recommend others in the following order: patience(0.235), manners(0.155), courage(0.141), and concentration(0.010), accounting for 26.2% of the explanatory power.

In comparison with the results of previous studies, a study on mentality and training continuity targeting Taekwondo participants reported that the more a practitioner perceives patience and courtesy in achieving martial arts mentality in Taekwondo, the higher the training continuity [20, 21]. This supports the results of the study as it shows the same context as the results of this study. In addition, the variables that significantly affect mentality concentration, patience, courage, and courtesy as a result of the operation of a program centered on Taekwondo mentality are reported to be training period and frequency factors [22]. This indirectly supports the results of the positive correlation between martial arts mentality and intention to continue training in this study. Considering these results in a comprehensive manner, it can be said that the internal desires such as attitudes, motivations, expectations, and values toward the exercise one participates in affect the continuous behavior toward exercise. Accordingly, it is thought that the formation of internal factors such as martial arts mentality of Taekwondo participants affects behavioral determinants such as the intention to continue training.

5.3. The Effect of Changes in Life Attitude on Continuity of Training

Table 9 is based on the results of the multiple regression analysis conducted to determine the effect of changes in life attitude on the continuity of training.

Looking at Table 9, the final regression equation shows that changes in life attitude have a 0.1% effect on the will to continue training and the willingness to recommend others. Looking at this in detail, first, only changes in life attitude have a significant effect on the will to continue training at the 5% level, and only changes in neighbors' attitudes have a significant effect on the willingness to recommend others at the 5% level. Looking at the beta(β) value indicating the relative contribution, changes in life attitude have a significant effect on the will to continue training in the order of school attitude(0.243), family attitude(0.131), and neighbors' attitude(0.057), showing an explanatory power of 17%. In addition, it was found that changes in lifestyle attitudes affected the willingness to recommend others in the following order: neighbor attitude (0.180), family attitude(0.133), and school attitude (0.112), accounting for 16.1% of the explanatory power.

Table 9. Multiple regression analysis on the effect of changes in lifestyle attitude on training continuity

Variable	Training intention		Intention to recommend others	
	β	t	β	t
Constant		7.543		7.229
Family	0.131	1.364	0.133	1.371
School	0.243	2.502*	0.112	1.145
Neighbor	0.057	0.638	0.180	1.997*
R2	0.170		0.161	
F	27.008***		25.320***	

p<0.01, *P < 0.001

Compared to the results of previous studies, a study on middle school Taekwondo players reported that school life factors were closely related to factors that affected exercise continuation and dropout [23, 24]. This supports the results of this study. In addition, a study reported a close correlation between school life factors and exercise continuation factors [25]. On the other hand, a conflicting study reported a negative correlation between college students' academic satisfaction and exercise continuation [26]. Considering this, it can be thought that continuous participation in exercise is influenced by environmental factors such as personal purpose and current position. In other words, participation in Taekwondo in one's personal life is formed by changes in one's current situation and purpose, such as neighbors, school, and family. When these changes in life attitude are positive, training is continued, and when they are negative, training is discontinued.

5. CONCLUSION

The purpose of this study is to investigate the relationship between martial arts spirit, lifestyle attitude changes, and training continuity of martial arts sports participants. The results obtained through the research process to identify this research purpose are as follows.

First, the martial arts mentality was found to partially affect the change in life attitude. That is, the higher the awareness of the courtesy of the martial arts mentality, the higher the change in family attitude. The higher the awareness of concentration and manners, the higher the change in school attitude. Also, the higher the concentration, the higher the change in neighbor attitude.

Second, the martial arts mentality was found to partially affect the persistence of training. That is, the higher the persistence of the martial arts mentality, the higher the intention to persist in training and the intention to recommend to others.

Third, the change in life attitude was found to partially affect the persistence of training. That is, the higher the change in school attitude of the change in life attitude, the higher the intention to persist in training. The higher the change in neighbor attitude, the higher the intention to recommend to others.

REFERENCES

- [1] J.H. Lee, and S. Chang, "The Re-discovery of Educational Meaning on Eastern Martial Arts," *The Journal of Korean Alliance of Martial Arts*, Vol. 11. No. 1, pp. 49-57, 2009.
- [2] J.B. Yang, "Softness and Hardness as a Ground Theory of Martial Arts," *The Korean Journal of Martial Arts*, Vol. 2. No. 1, pp. 43-58, 2000.
- [3] H.Y. Tan, and S.M. Park, "The impact of Wushu Image on Self-Congruity and Loyalty of Chinese College Students," *International Journal of Advanced Culture Technology*, Vol. 12. No. 2, pp. 438-447, 2024. DOI: <https://doi.org/10.17703/IJACT.2024.12.2.43>
- [4] H.Y. Li, "Influence of Chinese university taekwondo participants on martial arts mentality, lifestyle changes, and intention to continue training according to the type of leader," Ph.D. Honam University Graduate School of Sports Science, Gwangju, Korea, 2024.
- [5] H.S. Song, *New Theory of Taekwondo*, Imun Publishing, pp. 75, 2008.
- [6] J.H. Lee, "The Philosophical Discourse on Eastern Martial Art and Western Sports," *The Journal of Korean Alliance of Martial Arts*, Vol. 10. No. 2, pp. 37-46, 2008.
- [7] S.M. Park and H.Y. Li, "The Effects of Physical Education Class Participation and Perception on Stress and School Life Adaptation," *International Journal of Advanced Culture Technology*, Vol. 11. No. 2, pp. 256-266, 2023.
- [8] H.S. Kim, "A study on the effect of Wushu stadium environment factor on spectators' characteristics, immersion, and continuous participation intention," Master. Dong-Shin University Graduate School of physical education, Naju, Korea, 2020.
- [9] G.Z. Yang, "A Study on the International Cultural Exchange of Wushu in China through the History of the Development of Taekwondo in Korea," Ph.D. Woosuk University Graduate School of Sport & Taekwondo, Jeonju, Korea, 2020.
- [10] K.P. Kim, "The Relationship Between Taekwondo Training Experience of Children and Mental Achievement of Martial art," Master. Chonnan National University Graduate School of Physical Education, Gwangju, Korea, 1999.
- [11] J.C. Park, "Effect of the planned character education program of Taekwondo: focusing on honesty and perseverance," Master, Yong-In University Graduate School of Physical Education, Yong-In, Korea, 2016.
- [12] O.T. Kong, "The Effects of Hapkido Training on Elementary School Children's Living Attitude," Master, Myongji University Graduate School of Physical Education, Seoul, Korea, 2005.
- [13] C.B. Shin, "Effect of Taekwondo Training on Human's Development," Master, Myongji University Graduate School of Physical Education, Seoul, Korea, 2006.
- [14] B.H. Kim, "The Study of the relationship among motivation of participation of Taekwon Gymnastic, Perception of Pleasure, and Training Continue Intention of Elementary School Student," Master,

- Kyungwon University Graduate School of Sports and Leisure Studies, Gyeonggi, Korea, 2012.
- [15] H.J. In, “*Effects of Taekwondo aerobic program on the willingness to continue to be trained,*” Master, Yong-In University Graduate School of Physical Education, Yong-In, Korea, 2009.
- [16] D.I. Kim, “*The Effects of Judo Training Activities on Sociality Development and School Adjustments in the Elementary School,*” Master, Kwandong University Graduate School of Physical Education, Gangneung, Korea, 2012.
- [17] S.J. Lim, and S. H. You, “The influence of character education for Taekwondo trainee on the life attitude,” *Journal of Martial Arts*, Vol. 4. No. 2, pp. 77-93, 2010.
- [18] G.H. Hong, “*The effects of Taekwondo training on the change of home life attitude and propriety,*” Master, Yong-In University Graduate School of Physical Education, Yong-In, Korea, 2008.
- [19] W. Zhong, and S.M. Park, “Effect of SNS Sports Community Participants Perception of Sports Value on Perception of Fun and Sports Activities,” *International Journal of Advanced Culture Technology*, Vol. 12. No. 2, pp. 416-426, 2024. DOI: <https://doi.org/10.17703/IJACT.2024.12.2.416>
- [20] B.I. Jeong, “*The Effect of Taekwondo Spirit and Toughness on The Training Sustainability of Elementary Students,*” Master. Korea National University Graduate School of Physical Education, Seoul, Korea, 2015.
- [21] S.Y. Sun, “*The Relations Between Taekwondo Training Programs and Mental Strength of Elementary School Students,*” Ph.D. Chosum University Graduate School of Physical Education, Gwangju, Korea, 2004.
- [22] N.W. Yoo, “*The Effect of Middle School Taekwondo Athletes' Class Participation on School Life Adaptation, Exercise Adherence, and Dropout,*” Master. Dankook University Graduate School of Physical Education, Gyeonggi-do, Korea, 2018.
- [23] E.J. Tak, and H.A. Jung, “A Study on Sports Media Interest in Sports Values and Sports Activities,” *International Journal of Advanced Culture Technology*, Vol. 9, No. 4, pp. 154-161, 2021. DOI: <https://doi.org/10.17703/IJACT.2021.9.4.154>.
- [24] E.K. OH, “*A study on factors influencing dropout of adult participants in life dance,*” Master. Chung-Ang University Graduate School of Dance Education, Gyeonggi-do, Korea, 2007.
- [25] Y.R. Lee, “*The Effects of Participation in Sports Activities on Self-concept and School Life Satisfaction of College Students,*” Master. Gangneung-Wonju National University Graduate School of Physical Education, Gyeonggi-do, Korea, 2007.
- [26] Y.G. Chung and S.M. Park, “A Study on the Relationship Between Health Club Users' Perception of Service Quality and Use Satisfaction and Loyalty,” *International Journal of Advanced Culture Technology*, Vol. 9. No. 4, pp. 145-153, 2021. DOI: <https://doi.org/10.17703/IJACT.2021.9.4.145>