Abstract

**Purpose:** Martial arts can be related to the scientificization of the sporting process in the case of the body and the scientificization of the mind in the case of the mind, considering the two major flows of training the body and mind.

**Method:** Scientificization related to physical training can promote future-oriented sports science with activation of convergence based on existing sports science, and cultivation of the mind can suggest scientificization to pursue new areas of philosophical thinking and the spiritual world. Therefore, based on the holistic training for the training of body and mind, it is made up of an academic approach for comprehensive scientificization. In the course of attempts for academic development and social contribution, various fields of science are promoting field-oriented basic guidelines, systematic review, high-level technology and qualitative evaluation, along with efforts to find evidence-based principles.

**Results:** Martial arts activities are carried out in the form of sports activities, promoting optimization and maximization of physical fitness and technical factors, and are based on related physiology, nutrition, epidemiology, psychology, sociology, motor control and learning. In addition, the academic approach of sports science, including the physical conditioning and training theory of athletes, and industrial and environmental engineering related to efficient facilities, equipment, implement, and environment, will be the main content.

**Conclusion:** The scientific approach for the future-oriented activation of martial arts requires the establishment of an intensive scientific support system for concrete scientificization in terms of the practical value and utilization of martial arts activities based on the establishment of academic identity. In addition, for the science of martial arts, it is necessary to promote advanced convergence science, globalization centered on trends and popularity in Korea, systematic nurturing of research personnel related to martial arts sports, establishment of a cluster of martial arts sports-related infrastructure, and popularization and industrialization of martial arts sports.

**Keywords** Martial Arts, Scientific Development, Academic Development, Body, Mind

1. Introduction

The dictionary meaning of martial arts is 'a systematic training method for training the mind and body'. Of course, it is closer to us as it has been transformed into a fighting sport by emphasizing the competitive part, but it can emphasize the importance of the fundamental meaning and value that puts greater weight on the discipline of the body and mind. The reason why martial arts are emphasized as a physical training or sport is because the original form can be found in the mixed martial arts of the ancient Greek 'Pankration' and the ancient Korean 'Subagdo'. Meanwhile, as religious and philosophical ideas are included, the importance of spiritual discipline is emphasized together.
According to the historical evidence of Korean martial arts, the martial arts of the Three Kingdoms period is mainly described as a training event for the warriors, and in the Chosun Dynasty period, it is described as a martial art form as a sport. In addition, even in those days, it is possible to find a part related to the spiritual cultivation of martial arts while being linked to the religious part. Taekwondo, which plays a key role in modern martial arts, has been called by various names such as 'Taekkyeon', 'Subag', 'Taekseom', and 'Takgyeon' since ancient times. It has been widely practiced as the basis of martial arts training.

After the liberation, it was systematically established and unified under the name 'Taekwondo' in 1954. The Korea Taekwondo Association was founded in 1961, an official sport from the 44th Jeonju National Sports Festival in 1963, and designated as the national flag of Korea in 1971. It is developing into a global sport, including the adoption of an Olympic sport.

Martial arts have been regarded as an attack and defense technique for the survival of the state and individuals in its historical background, as well as a technique for cultivating the mind and body. It can be seen that the development of martial arts in modern society has been led by the process of competition through sports shoes such as karate, taekwondo, muay thai, and wushu. The main content related to the science of martial arts can flow into fragmentary parts related to martial arts as a game while being related to sports science. Therefore, for the science of martial arts, establishing the identity of martial arts must be preceded as an important part.

In the case of Taekwondo, in relation to the essential purpose of martial arts training, it is regarded as realizing humanity through self-reflection through poomsae, practice of sparring with etiquette, and defeat through concrete experiences of the interrelationship between skill and spirit. The importance has been emphasized. However, it is almost impossible to dare to discuss the identity of martial arts in this paper.

Although it is fragmentary in relation to the identity of martial arts, considering the two major flows of training the body and mind, the body is progressed through scientificization focusing on the phenomena that appeared in the process of sports shoes, and the scientificization of the mind is related to mental cultivation can be described.

Based on the existing sports science, training of the body can promote future-oriented sports science with activation of convergence, and cultivation of the mind can suggest philosophical thinking and scientificization to pursue new areas of the spiritual world.

2. Basic Approach to Scientific Martial Arts

If you look at martial arts from an academic point of view, it has the characteristics of not allowing only a fragmentary approach while having organic relevance to the form of comprehensive studies built on various academic foundations. Of course, these arguments are also remarkably insufficient to be regarded as arguments based on objective arguments. Shim Seung-goo (2007) asserts that more and more people are learning traditional martial arts for mind and body training, but academic systematization is still far away, and 'Korean Martial Arts Collection' is very important as the first work to compile traditional martial arts materials did. The definition of martial arts is being tried from various perspectives, and if we look at the main contents, it has goals such as fighting skills, spiritual experience of religious mystery through spiritual aspects, and development of moral character including personality. In addition, it can be seen as a training process, which has the main characteristics of morality of struggle and restoration of humanity by physical fitness and technology, and a method of training the mind-control through body self-discipline can be defined as.
Intensively, martial arts can be regarded as a holistic training for the body and mind, and it consists of the flow of human history based on comprehensive science. Therefore, the scientification of martial arts can be largely accomplished through an academic approach to the two factors of body and mind. The science of martial arts should be considered in terms of human-centered characteristics, and should be approached within the scope so that the essence of martial arts is not distorted. Regarding the importance of the development of martial arts, Ahn Jung-deok and Song Kang-young (2008)[1] argued that Taekwondo is the most globalized cultural heritage of Korea with a clear identity as a traditional martial art, and that a new paradigm should be established to build the identity as a global martial arts sport. Here, we can suggest three important directions for the development of martial arts: identity establishment, globalization promotion, and construction of a new paradigm. Martial arts require a comprehensive analysis rather than a simple interpretation, including complex and diverse structures and functions based on physical activity, and requires subdivision and fusion of disciplines. In addition, generalization and popularization cannot be overlooked as the basic properties of martial arts science, but continuous challenges for innovation and change are required because science requires a challenge to uncertainty. The essential properties of martial arts have limitations and difficulties in scientific and systematic approaches, but as the most important approach to overcome them, the subdivision and systematization of theoretical and academic grounds is necessary to prove the essential mechanism of martial arts performance for its effects and values. Topics include improvement of physical characteristics centered on the body, which constitutes the core system of martial arts, strengthening the functions of martial arts factors, disease prevention and treatment for health improvement, and positive change in the mental world through mental training[11][12].

In the course of most recent attempts for academic development and social contribution, various fields of science are promoting field-oriented basic guidelines, systematic review, high-level technology and qualitative evaluation, as well as efforts to find evidence-based principles. In order to develop the importance of the role and value of sports science, which has recently been expanded in its scope, an active approach that can present detailed academic grounds and mechanisms is required[13]. In addition to the attempts to systematize and diversify the evidence-based science of human health promotion and physical training, which martial arts pursue, questions and answers related to changes in body and mind are collected in the process of martial arts activities. In addition to the analysis and evaluation of the validity and applicability of the evidence, it should proceed as a process of grafting changes in actual martial arts activities[13].

The importance of effort to present the academic basis of martial arts can also be found in the column of Lee Seung-heon (2017)[14], who pioneered brain science research while inventing the 'Five Laws of the Brain Operating System'. He said ‘I started doing it, and I especially concentrated on martial arts such as Taekwondo and Hapkido. The first effort to control various thoughts and emotions that occur in the brain and live as the master of the brain started with training to focus on the body and train the body.’ 'Sports science' refers to all research related to physical education, and when the term 'science' is used in the sense of a rational method, it can include all modern scientific research methods regardless of divisions in the humanities, society, and nature[15]. Therefore, all these fields can be considered holistically in the process of trying to make martial arts scientific. Jeon Hyunjoo (2017)[15] secured the status of its existence by pursuing a form developed on the identity of physical education in relation to the concept of sports science, and, like all studies, the reality of a unique and specific domain through rationality. She said that it can exist as a science only by securing realism. There is a need to receive support from active academic research activities centered on martial arts in the process of attempting to scientifically develop martial arts. The content of the course available to martial arts can be achieved through scientification and specialization in the same context as sports science.
The most basic attempt in the scientific approach for the development of martial arts requires constant academic research. What is particularly emphasized in this process is the establishment of the identity of the martial arts, the study of the history and philosophy of the martial arts, the cross-cultural study of the country, and the study of the demands and changes of society. In addition, integrated research on martial arts movements, techniques, inner training center, educational functions, health martial arts, artistry, and modern science should be continued [16]. As described above, the scientific approach of martial arts must be premised on an attempt to establish an academic identity, and must develop the characteristics of a comprehensive science integrated with the adjacent disciplines along with the humanities, social sciences, and natural sciences )[16].

The basic direction for the approach for scientification of martial arts is the process of making changes and development of martial arts from a systematic, empirical, future-oriented point of view. What is emphasized in this process is the need to clarify identity and roots based on an ideological basis. The most common approach of scientification to establish identity is to deeply explore and consider the historical and philosophical foundations, and a procedure to clearly confirm historicity and identity will be required. A good example of an attempt to analyze historicity is a method of systematically organizing contributions to the development and change of related fields based on the research results of major scholars, or a qualitative study[17]. In particular, this attempt will help to secure the historicity by examining how the detailed major field of sports science has contributed to the development of practical martial arts. In order to establish a rational methodological foundation for the scientification of martial arts, the process of development and verification of analysis methods such as body shape, motion, and technology performed in martial arts activities through measurement, evaluation and analysis will be required, and now it is also required a big data analysis technique )[15].

Accurate analysis for the improvement of technical factors of martial arts activities, analysis and correction of causes of motion errors, attempts of biomechanical analysis including presentation of excellent models, application of feedback by biomarkers for skill mastery, and efficient technique learning methods The use of learning theories is included. The biomechanical approach is recently converging with bioengineering, and the role of new products related to martial arts sports in the design, injury prevention and rehabilitation process is growing.

The biomechanical approach plays an important role in the process of analyzing the motion of most martial arts activities, the mechanism of body damage, the development of new equipment, and the application of wearable techniques and convergence fields such as virtual reality. In particular, detailed analysis of the physical movements that are the basis of martial arts activities became possible. For example, using a high-speed camera, a three-dimensional motion capture system, a ground reaction force, and an electromyography, the force exerted by the muscles, the angle and speed of the joint, the quantitative and qualitative comparison of motion performance, and the inefficiency of the motion can be analyzed. In addition, analysis of fast motions that cannot be seen with the naked eye and three-dimensional motions can be analyzed. Based on this, development of new technology, correction of motion, and analysis of overall motion were made possible. Martial arts activities have a high possibility of injury in the course of performing them, so scientific analysis in this field is required, and the importance of various experts is emphasized.

Recently, the problems raised by the electronic protect tools of Taekwondo are representative examples that suggest the need for biomechanical research. The psychological approach, considering the importance of values related to the mental training effect of martial arts activities, is based on accurate analysis of personality, anxiety level, concentration, self-confidence, attitude, cognitive function, etc. In addition, psychological training and counseling
were promoted to achieve psychological stability and to overcome stress[18]. Looking at practical examples of scientific approaches to increase the value related to the effectiveness of martial arts activities, the first example is Attention Deficit Hyperactivity Disorder (ADHD), which is recently considered as one of the serious diseases of the youth, and its prevalence is significantly increasing. Martial arts activities can suggest their value as an alternative to drug treatment and psychotherapy, but the relevant evidence is still insufficient.

In addition, the value of martial arts activities can be presented in the process of developing programs for preventing muscle and nervous system damage or diseases or for rehabilitation.

3. Advanced Fusion, Promotion of Complex Scientificization

Based on the development of a muscular nervous system training protocol using martial arts activities and big data collection through wearable sensors, detailed factor analysis of martial arts activities on the muscular nervous system will be possible. In order to make such an attempt possible, it suggests the importance of a scientific approach to martial arts activities, and at the same time, it can increase the possibility of realization through active convergence with various surrounding disciplines centered on sports science.

Figure 1. Martial arts and various academic fusions.

Figure 2. Periodic wave of academic development.
For the science of martial arts, it is necessary to promote advanced convergence science, globalization centered on trends and popularity in Korea, systematic nurturing of research personnel related to martial arts sports, establishment of a cluster of martial arts sports-related infrastructure, and popularization and industrialization of martial arts sports. ICT convergence and complex scientifization comprehensively promote cutting-edge science centered on martial arts and a new health industry. In addition to the overall nurturing of martial arts sports-related professionals, globalization of martial arts sports, the fusion of sports industry and culture, and infrastructure for martial arts sports, global talent discovery and scientific talent training, expansion of the base of martial arts sports, and promotion of projects to revitalize and popularize martial arts clubs. Innovative tasks for the science of martial arts sports include sports science that approaches policy and system, convergence of cultural industries, realization of a healthy life through sports activation, ICT innovation capability and use of IT and software, and affinity for the increasing aging population, building a global sports network, and strengthening the competitiveness of the tourism industry. Based on the recent convergence of sports with culture, construction, technology, service, and media, etc., using the part that broadens the spectrum as a domestic core nurturing science and technology, through the convergence of sports with industrialization technology and marketing know-how, the need to foster global competitiveness is emphasized. In particular, as the main flow of the 4th industrial revolution, the activation of convergence with new fields that are inducing innovation in society as a whole should be included as an essential task in the scientific approach of martial arts.

In order to increase the value of overall health promotion as well as the positive value of mental health promotion, martial arts activities must be organized and diversified based on academic evidence, as well as questions and answers from the field are collected and the validity of the collected evidence. It is necessary to promote scientifization to increase the possibility of use and utilization [13]. The science of martial arts activities for health promotion requires active use of big data [19] and artificial intelligence, which have been predicted for a long time with the advent of the 4th industrial revolution. Of course, there will be conflicts with claims that emphasize the importance of human-centeredness. As the robot industry, the internet of things, virtual reality, genetics, and big data are used, and machine learning and deep learning are combined with the science of martial arts, their role will be further expanded, and a new form of science for health promotion is required [13].

4. Promotion of Globalization of Martial Arts Activities

Efforts for global information, which are important parts for the development of martial arts, should be further emphasized. As in other fields, the importance of globalization has been emphasized for a long time in the martial arts field. In this regard, the establishment of a global system with the core of international advancement and exchange of excellent human resources is emphasized. Efforts to perform the international hub function of martial arts sports should be actively promoted. Promotion of MOUs and joint projects with world-class research institutes in related fields centered on martial arts sports, exchange of researchers, and holding joint symposiums should also be actively promoted. Organization and human resources for discovering outstanding talents, training and training for professional leaders, research in related fields, and promoting international projects, and build an international cooperation system through a global network. The important tasks to be dealt with for the promotion of international research are the grounds for receiving national support and support from various sponsors, a plan to raise financial resources for continuous and developmental operation, and the preparation of a more efficient and practical organizational structure and operation plan.
5. Nurturing Research Manpower for the Science of Martial Arts and Establishment of Related Infrastructure

One example is the training of professional research personnel for the science of martial arts. In particular, it is necessary to develop various educational programs to develop the qualifications of leaders and to improve their coaching ability, and qualification test and re-education programs that can directly improve the practical skills of leaders will be needed. Based on this, training abroad to produce excellent leaders, qualitatively and quantitatively developed education is required through the recruitment of excellent overseas coaching programs and leaders. In particular, training professional leaders through systematic programs including dream leaders is an important task for the science of martial arts. In the process of nurturing professionals, international exchanges should be paralleled, and domestic leaders should be dispatched overseas together with the invitation of excellent foreign leaders. Considering the revitalization of the 4th industry, attention should be paid to nurturing relevant professional manpower in order to promote science for ICT convergence, which has emerged as a new field. A new infrastructure for the scientific development of the martial arts field is required. In relation to the institutional or systemic infrastructure, a future-oriented linkage system must be established together with a specialized institution or a new system that can exclusively promote and promote martial arts. In addition to the hardware approach centered on infrastructure, development of new martial arts programs and educational programs for various martial arts instruction, changes in the environment and culture related to martial arts, and development of university education programs for nurturing new talents to promote martial arts science development, etc. In particular, this is required for the software change that promotes the science of martial arts, segmentation, systematization, and diversification centered on the academic evidence that is the basis for it should be promoted. It is difficult to manage and nurture talents related to martial arts sports due to the lack of a professional scientific research support system for martial arts sports. There is a need to establish a system for scientifically and systematically attracting, managing, and nurturing competitive martial arts-related talents scattered in each region. It is said that mid- to long-term measures should be prepared for this, and a more systematic and scientific human resource nurturing system is urgently needed, and a more active science support system is required.

6. Popularization and Industrialization of Martial Arts Sports

Based on the increased awareness of the importance of public health after Corona 19 pandemic, it will be possible to create a new opportunity for revitalizing martial arts sports while emphasizing the mental and physical training effect of martial arts sports.

The policy direction for popularization of martial arts sports can include the development of sports clubs, the systematic training of leaders, and the recommendation of martial arts sports activities in the family unit. Considering the seriousness of the recent health status of adolescents, it is necessary to suggest new values and roles for the physical and mental cultivation of martial artists and to foster them as a martial arts education program. Considering the reality that the normalization of school sports for young people is highly emphasized, from a policy point of view, it can be suggested to actively utilize martial arts sports to revive school sports. Active use of martial arts sports for revitalization of school physical education is the most effective for strengthening the physical fitness of children and adolescents in the growing age. In order to improve youth health and strengthen physical fitness[20][21][22][23][24], where the important value of martial arts sports activities is presented, the introduction of a youth physical fitness certification system to promote youth physical activity opportunities and induce physical fitness improvement, to promote the vitalization of club activities for each school[25][26][27].
In order to systematically foster club sports through martial arts sports, it is necessary to promote the systematic development of life sports such as the linkage between adult club sports and school club sports, various martial arts sports classes, and martial arts sports classes for club members. Strategic nurturing of martial arts sports clubs should be promoted, and popularization programs such as sports classes, camps with athletes and friends, and commercialized clinic programs for health improvement through the prevention and treatment of specific diseases should be developed.

Considering the basic development model of popularization, it is expected that it will greatly contribute to the improvement of public health through the popularization of martial arts if appropriate clustering is established by regionalization by district or region. By inducing a close relationship between martial arts sports and the event business and tourism industry, it can help revitalize the economy through the brand value of martial arts sports. We will promote the construction of a comprehensive leisure culture town where culture, art and leisure coexist, centering on martial arts and sports-related shopping malls. In addition, the establishment of an information network considering the big data of martial arts sports, establishment of a certification system for martial arts sports equipment, and promotion of linking and convergence between martial arts sports and local tourism will be promoted.

7. Conclusion

Since the physical activity of martial arts is the basis, it is expected that the literal translation will be further expanded when considering the two characteristics for training the body and mind, including very complex and diverse structures and functions. In addition, scientificization based on comprehensive analysis rather than simple interpretation is required, and the subdivision and convergence of independent disciplines coexist or repeat periodically. The scientificization of martial arts can be largely accomplished through an academic approach to the two factors of body and mind[28][29][30].

Considering martial arts as a form of sport and applying an academic approach related to human body structure and function analysis, parts related to the optimization of the structure and function of human beings who are the subject of martial arts activities will be included. Martial arts activities consist of a process of optimizing and maximizing physical and technical factors. Therefore, the academic approach of a wide range of sports science such as conditioning and training theory based on physiology, nutrition, epidemiology, psychology, sociology, motor control and learning, and industrial and environmental engineering related to the creation of efficient training conditions is the main contents. The scientific approach for the future-oriented activation of martial arts is basically a physiological approach centered on the body based on the establishment of academic identity, a kinematic approach to human movement based on a mechanistic worldview, and a psychological approach for an analysis of the value and importance of the spiritual realm, etc.

In order to analyze and develop martial arts activities based on an academic approach, an attempt to make more specific science is required in terms of the practical value and utilization of martial arts activities. Future-oriented promotion of science support projects for specialized martial arts sports, including the establishment of an intensive science support system in the long term, is urgently needed. In particular, for the science of martial arts, it is necessary to promote advanced convergence science, globalization centered on trends and popularity in Korea, systematic nurturing of research personnel related to martial arts sports, establishment of a cluster of martial arts sports-related infrastructure, and popularization and industrialization of martial arts sports.
8. References

8.1. Journal articles


8.2. Thesis degree

(1997).

8.3. Books


8.4. Additional references


9. Appendix

9.1. Authors contribution

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9.2. Funding agency

This paper is a revised version of the topic presented at the 2021 WMC International Conference (October 29, 2021).