Purpose: Taekwondo is gaining global popularity as a sport through gyeorugi, poomsae, and demonstrations. As a proposal for the better development of Taekwondo, I would like to emphasize the importance of scientification.

Methods: There is a need for systematic efforts to create a new Taekwondo for sports science that integrates with artificial intelligence, virtual reality, the robot industry, big data, and biological chemistry. Above all, we must not forget the essence of human-centered Taekwondo. The development of contents as an educational program centered on the moral value of Taekwondo and the development of Taekwondo in fusion with culture must be emphasized continuously.

Results: As a specific project, scientific research on Taekwondo to present evidence for health promotion and academic research for cutting-edge science in competition sports are representative. In order to establish itself as a sport and improve performance, more intensive efforts on the use of cutting-edge science are emphasized to solve the abundance of problems such as stadium specifications, game time, scoring type, judgment method, and electronic tooling of sportswear and shoes. The development of a taekwondo program as a rehabilitation sport for the recovery of human inner and physical function can be a new attempt in consideration of changes in the times including low birthrate and aging.

Conclusion: Taekwondo should play a role in protecting human body shape in excellent form while converging with more diverse disciplines to promote health and improve athletic performance. Just as many changes in human science have been accompanied by culture and religion, efforts to find human-centered Taekwondo science should also be attempted.

Keywords: Taekwondo, Scientification, Health Promotion, Performance, Humanity

1. Introduction

The origins of sports can be traced to various traces of ancient physical education in BC or in the history of BC in China. Sports have important and diverse values that are indispensable in the history of human change, but the most core values are human health promotion and performance improvement. An important factor in the process to further increase these values is more active scientification. The scientification of sports has been progressed through the process of subdividing various fields and convergence with various surrounding disciplines. This scientification has led to the development of sports and the creation of new genres in modern society through the help of advanced science. Taekwondo is a modern creative martial art representing Korea, and since advancing to the Olympics as a sporting event, Taekwondo has been playing a role as a global sport beyond the scope of martial arts. Beginning with the origin of the Three Kingdoms period, Taekwondo has 209 member countries around the world, and it has been established the central position of global sport through the process
of an official national sporting event in 1963, the designation of the Korean flag in 1971, the establishment of Kukkiwon in 1972, a pilot event for the 88 Seoul Olympics, and an official event for the Sydney Olympics. In addition, it has established itself as a global sport that produced 100 million Taekwondo people.

Taekwondo has been popularized around the world, and has a shape as a sport through gyeorugi, poomsae, and demonstrations. In addition, it has already occupied the position of a global sport, and scientification has also played an important role in the development of Taekwondo through continuous efforts. Despite the remarkable development so far, it has not been able to clearly solve many problems such as renovating the face of the suspicion country, internal factions, misjudgment of the gyeorugi event, game manipulation, foot fencing and improvement of electronic guards to overcome tedious game management, and new changes in game rules. In addition, in preparation for the 4.0 era, which emerged as a new engine of industrialization, in order to advance to a new Taekwondo, along with the existing difficulties such as the scientification of the newly emerged sport, poomsae, and the promotion of Korean culture in relation to internationalization of Taekwondo. I would like to further emphasize the importance.

2. Main Contents

2.1. Academic change of taekwondo

The academic development of Taekwondo has been active with active academic research since the establishment of the university's Taekwondo department in 1982. In particular, scientific studies have been conducted in various fields of Taekwondo, and qualitative and quantitative studies on values, history, spirit, and problems as well as gyeorugi, poomsae, and demonstrations are being activated. The characteristics of Taekwondo include men and women of all generation, no difficulty in places, growth and development, social enhancement and physical fitness improvement, and Taekwondo's martial arts philosophy is summarized as 'Strong but not reckless, prudent but not passive'.

Looking at the results related to marshall art's academic efforts, it can be seen that the most research results related to Taekwondo were made. Full-scale academic research for the scientification of Taekwondo has continued to develop through the process of establishing the Taekwondo department in the university in 1982, the founding of the Korean Martial Arts Association in 1999, and the establishment of the Kukkiwon Taekwondo Research Center in 2006. In fact, the first publication of taekwondo-related research papers can be seen around 1974. Until the 1990s, it was somewhat insufficient, but after 2000, Taekwondo students began to increase rapidly as they entered graduate school[1][2]. Looking at the analysis results for each research subject before and after the 2000s until 2009, research topics for improving athletic performance showed a decreasing trend of 58.2% before 2000 and 29.6% after 2000, but the most researches were conducted overall. As of the 2000’s year, attitudes, perceptions, facilities, systems, and administrative sectors, as well as usefulness and popularization, show a remarkable increase[1][3]. In particular, looking at the publication status of 'The Journal of Korean Martial Arts' and 'Kukkiwon Taekwondo Research', which have been the main focus of research papers related to Taekwondo since 2010, as shown in <Figure 1>, 19.4% of thesis on the institutional development and management of Taekwondo indicating that interest in efforts for economic development, including institutional change for new development and the operation of a studio, is increasing. In addition, the research on the educational application plan centering on moral values also showed a high ratio of 17.4%, indicating the importance of the value of character education through Taekwondo. It is believed that the developmental future of Taekwondo is being pioneered as researches in various fields including scientification have been widely conducted. However, it seems that the attempt to respond widely to the changes of the new era is somewhat insufficient.
2.2. The 4th industrial revolution and the scientification of taekwondo

The opinions of various business scholars are divided around 2015, but it is generally evaluated that the 4.0 era, which is the era of the 4th industrial revolution, has been reached worldwide. In the era of the 3rd industrial revolution driven by computers and the internet, each field is making rapid progress with millennials such as ICT, IOT, robots, AI and 3D printers. Taekwondo is required to establish itself as a new and important discipline for the general public as well as athletes and leaders, and various convergence and evolution with advanced science are required. In the flow of sports science, the convergence of the cultural industry, the realization of healthy life through sports activation, ICT innovation capabilities and the use of IT and software, the increasing affinity of the elderly population, the establishment of a global sports network, sports science to strengthen the competitiveness of the tourism industry and development of realistic virtual sports services are being emphasized as important fields[4]. In particular, sports science is expanding to a diverse spectrum based on the convergence of culture, construction, technology, services, and media, and the national growth with high value-added sports industry fostering and global competitiveness through the convergence of industrialization technology and marketing know-how and sports. The need for intensive nurturing as a driving force is being emphasized. Therefore, Taekwondo is required to build a system to be able to maintain an equal position like this, and it is required to discover various fields based on Taekwondo. For the better development of Taekwondo, which is the most scientifically advanced among marshall arts, research to seek convergence with advanced science including ICT in research fields and competition management methods is needed. Based on this, other marshall arts fields are also 2.0 Apart from the times, active progress toward the 4.0 era is required along with benchmarking centered on Taekwondo.

2.3. Scientification of taekwondo for health promotion

The traces of the use of exercise as a means of disease treatment around 1800 BC can be said to be the origin of exercise is medicine[5], first proposed by ACSM in 2007. Recently, the role of sports has come to play a very important role in relation to the importance of human life. It is necessary to be able to present evidence related to the value of sports as a condition required to satisfy this trend. In order to further revitalize the role and evolution of ‘Exercise is Medicine’, it is necessary to be able to provide a detailed basis for the level and range of the exercise and physical activity performed according to the type and the most effective. The personality program with philosophical values and moral perspective is close to the roots of Taekwondo, and is emphasized as a field of high value as a way to solve the ill factors of modern society. However, the limitations and difficulties of scientific and systematic approaches can be regarded as due to their own properties, but they have a weakness in that the subdivision and systematization of the basis is inferior[6]. For example, it is thought that there is a desperate need for an evidence-based academic study on how the training of Taekwondo can
show the difference in effect at the cellular level of our body according to more subdivided factors and types. After emphasizing the evidence-based principle in clinical decision-making focusing on treatment in the past, medicine has applied it as a clinical practice guideline, systematic review, medical technology and qualitative evaluation, and has made efforts to more actively realize and expand this[7]. In the course of attempting evidence-based sports science for the scientification of Taekwondo, questions about the approach to field use are drawn and answers are collected, and the validity of the collected evidence and the possibility of field use are analyzed and evaluated. It should be conducted as a process that combines training or stadium experience. In addition, since Taekwondo requires field use more than any other field, it should be possible to find ways to further improve the process of integrating evidence-based information and field experience.

With the advent of the 4th industrial revolution in Taekwondo, there will be a need for active use of big data[8] and artificial intelligence, which have been expected for a long time. Of course, there will be conflicts with arguments emphasizing the importance of human-centeredness, but more advanced Taekwondo will enter a new stage of convergence with virtual reality and robot sports. If machine learning and deep learning are applied to sports science along with the use of big data, the role of sports science will be further expanded, and a new aspect of Taekwondo science will be required to improve health and exercise performance[9]. The main role of the use of big data is to predict the future through correlations, and the value of using future-oriented big data to solve the question of Taekwondo until now can be presented as 'why'.

2.4. Scientification of taekwondo to improve performance

In relation to sports science, it is possible to propose the science of Taekwondo centering on gyeorugi and poomsae. Sports science has been widely attempted to make scientific efforts through training grounds and stadium facilities, development of new training methods[10], nutritional approach and changes in sports equipment in relation to the improvement of athletic performance[11]. In particular, the development of equipment for measuring and analyzing human capabilities have been the core of science. Taking these perspectives into account, Taekwondo gyeorugi has been tried various changes. For example, we are constantly trying to change and develop through the standardization of the stadium, the game time, the match score type, the method of judging, and the electronic tooling of the game clothes and shoes. In the process, the scientific approach has played an important role. In this process, a more systematic approach is required on how to use and converge artificial intelligence, virtual reality, robot industry, big data, and biological industry, which are the main factors of the 4th industrial revolution in Taekwondo as summarized in <Figure 2>.

Cybathlon, created on the basis of bionics, which combines biotechnology and electronics, is a representative example of Taekwondo in the future. Cybathlon, in which robots and human rehabilitation in virtual reality, may be a new look of Taekwondo. Sports science is required to produce new knowledge and values through various convergence with surrounding disciplines including ICT, and to evolve into sports science with a new system through active academic consolidation.
The main achievements of the 'Sports Science Convergence Research Project' recently made in Korea were the development of new technologies, precise control of various sports environments, and the development of sports events that combine the ultra-lightweight Internet of Things (IoT) platform. In the case of Taekwondo, it is also required to develop a new sport that is fused with these technologies\[12\]. For example, we can suggest the development of the gyeorugi relative tactic analysis program, the simulation program for the development of Taekwondo technology through the modernization of the electronic protector, the development of a platform that integrates analysis and feedback of physiological, biochemical, and physical human effects by poomsae type, and the development of a Taekwondo training program for poomsae that combines artificial intelligence and biotechnology\[13\][14][15].

2.5. Humanity and science

There are also stages in sports science. It has been through stages that have focused on improving athletes' performance, promoting human health, and activating human welfare and economy. In the process of experiencing this stage, sports science has made efforts to overcome difficult problems while experiencing changes and development centered on elite sports. Excessive sports science, such as political abuse, drug doping, distortion of the essence of sports and loss of humanity, has been denied the value of existence of sports. The problem arising from the focused on elite sports is that it may lead to serious drug contamination, the development of full body swimsuit and advanced equipment as it flows to sports science focused on excessive victory, while on the one hand, it may lead to a revival period of sports science and on the other hand, perhaps a dark period in sports. However, this step would be an inevitable step if sports science exists alongside the human environment and evolving science. In the case of Taekwondo, it is also going through these stages. Taekwondo's concern on how to change these stages should be emphasized. In order to develop Taekwondo as an essential sport of character training and physical reinforcement, above all, it must be human-centered.

With the increase of the elderly population and the increase of the sports active population, the incidence of sports injuries has also rapidly increased, and the importance of scientific rehabilitation training related to this is being emphasized, and the role of sports science in rehabilitation medicine is also increasing. In particular, sports damage is emphasized as the most important limiting factor in the process of exercising athletes' performance, and prevention and rehabilitation of sports damage are very important to improve the quality of life of the general public. Since all human functions decrease from the twenties, even if they are not damaged, effective rehabilitation is an inevitable program, and the need for a rehabilitation program based on sports science is required. All human beings must perform sports science evidence-based exercise programs for lifelong rehabilitation. Taekwondo is a martial arts sport in the training process and is evaluated as a core sport for human function rehabilitation. Considering the new role of rehabilitation sports, Taekwondo is expected to occupy a pivotal position.

The complex promotion of elite sports, sports health industry, ICT convergence science, and sports culture through sports science research will be activated\[16\]. Sports science in the f-
uture will require more diverse academic approaches and harmony, and will require the use of advanced science, diversified information, and sharing with surrounding sciences\cite{17}\cite{18}\cite{19}. The emphasis is on promoting active linkages between sports science and sports culture and industry. By encouraging the sports and tourism industries to have a close relationship, it can further enhance the brand value of sports and help revitalize the economy. Considering the importance of cultural content that can be fused with Taekwondo, comparing with other martial arts sports in previous studies\cite{20}, as shown in <Figure 3>, it is related to cultural contents compared to karate and judo.

3. Conclusion

Considering the role and social flow of Taekwondo, it is predicted that the scientification of Taekwondo will further expand its literal role in terms of economic, social and cultural as well as academic status. From this point of view, fusion and complex scientific research is required to achieve integration with various academic fields and social flows. In this process, it is necessary to establish an effective cluster system with advanced science and industry along with systematic and future-oriented activation for health promotion and athletic performance improvement. What should be considered important in the advanced science of Taekwondo is the restoration of humanity. Changes in human form and body shape require efforts to regain human-centeredness while harmonizing with culture. Through various changes, the human body has a nice and beautiful appearance, but there is also the worry of getting deformed. Taekwondo should play a role in protecting human body shape in excellent form while converging with various disciplines along with scientification of health promotion and performance improvement. In addition, just as many changes in human science have been accompanied by culture and religion, efforts to seek human-centered taekwondo science should also be attempted.

Figure 3. Comparison of martial arts content on google\cite{8}.

4. References

4.1. Journal articles

5. Appendix

5.1. Authors contribution

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