Better human functions, movements, and social interactions through physical activity and sport: A synergistic interdisciplinary approach

(Subject: Physical Activity & Sport)

2020. 3. 27.

Project Manager
Yukyoum Kim

Affiliation
Department of Physical Education
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PART A.  Executive Summary

People are losing physical human functions, movements and person-to-person-interactions, due to ever-stronger emphasis on the non-physical technologies such as artificial intelligence, virtual reality, and various informational technologies. It is our aspiration and goal to rise above the challenge.

Vision

- The Department of Physical Education will be the world’s best academic program in the field of physical activity and sport, preeminent in research and discovery, teaching and engagement beyond institutional, disciplinary, and geographical boundary.

Objectives & Competence

- Rise into Top 3 program in the QS World Rankings by 2026.
- Improve impact and value of faculty scholarship by 1) increasing scholarly publications by 25% in the year 2026; and 2) increase average h-index of the department faculty by 2 in the year 2026.
- Enhance and enable access to world-class infrastructure and resource by generating external funding from both public and private sources, aiming the total amount to $2.5 million (40% increase) for the next 5 years.
- Build online and offline platforms for translational research.
- Our strengths will enable us to achieve these objectives:
  1. Superb academic reputation in sports-related fields (No.7 QS rankings in 2017).
  2. Future-oriented research areas & expertise.

Project Details & Management

- The proposed project will mainly focus on three research themes:
  1. Sports medicine & physiology pillar pursues to understand the mechanism how the exercise mitigate mood disorder and to develop evidence-based antidepressant exercise programs.
  2. Health promotion & sports participation pillar seeks to identify hurdles impeding participation in physical activities and to resolve the hurdles by effective policies.
  3. Movement science & sports engineering pillar aims to quantify motor performance precisely and develop practical technologies to improve human motor function and promote sports participation.
- We expect that this unique combination of the three distinct research areas, tied under the common theme of physical activities and sports, will not only enhance the scientific knowledge of human movement, but also contribute to filling the long-standing lack of the necessary dialogue among social science, kinesiology, and engineering.
- All the faculty members in the department will be responsible to participate in this project. Project Leadership Committee (PLC), which consists of Dr. Yukyoum Kim (Project Manager), Dr. Jooeun Ahn, Dr. Hyoyoul Moon, and Dr. Chung Gun Lee, will monitor and manage the progress of the proposed project.
1. Competency Analysis

Our department has essential competencies on which to build the top sport-related academic program in the world.

- **Strengths**

  (1) *Future-oriented research areas and expertise of the faculty.* Technology has been distancing people from bodily experiences and physical interactions. Children no longer need to go to playground to have fun. So many children are addicted to their smartphones or to video gaming. Online community, which lacks the face-to-face and physical interaction, has been replacing the offline one. Technological development and intelligence explosion of artificial intelligence (AI) might even eliminate the necessity of physical presence and contact. However, we, humans have bodies. People cannot live happily without bodily experience and face-to-face social interaction. Losing touch with the physical elements of life makes people feel disoriented, alienated, and irrelevant. This ironic discrepancy between functional necessity and the basic human needs make the platform and infrastructure for physical experiences and interaction with the environment all the more important. Our faculty is world-renowned and considered the trusted authority in the essential areas of physical activity and sport, addressing the gaps above.

  (2) *Superb academic reputation in sport-related disciplines worldwide.* Our faculty, students, and alumni have been recognized nationally and internationally for its excellence in research, teaching, and service. The recent QS World University Rankings reflects the department’s place among the top higher education institutions for sport-related subjects. The department were ranked 7th best sport-related program in 2017, which is the highest rank ever attained by any department in Seoul National University (SNU). Our department has held the highest rank in SNU in the QS ranking for the last three consecutive years; 10th in 2018 and 12th in 2019.

  (3) *Extensive experience and capability for large grant projects.* It is noteworthy that significant external grant funding is rare in sport-related areas in most parts of the world including South Korea. Despite the constraints, our department has successfully raised a large amount of external funding to support the university and the program. For the recent 5 years, 155 grants have been funded in the total amount of $17.8 million.

  The strength of the department also lies in (4) *Dynamic, young, and growing core group of faculty;* (5) *Interdisciplinary structure of the department;* (6) *Global research network and collaboration;* and (7) *Tight-knit and supportive academic community of faculty and students.* In conjunction with the high quantity and high quality research output, significant research funding, and high QS ranking, these strengths are recently confirmed by the External Review Committee (ERC). The ERC, which consisted of three most esteemed scholars in their respective fields (Dr. Mark Latash, the Pennsylvania State University; Dr. Michael Sagas, University of Florida; and Dr. Myung-Whan Kim, Seoul National University), visited the department on November 18-20, 2019 and provided constructive feedbacks.
# Opportunities

The department sees several opportunities to grow into the top academic program in the world. These opportunities, some of which come disguised as challenges, include:

(1) **Strong future demand and relevance in the world of increasing scarcity of bodily experience and physical interaction.** Technological development and intelligence explosion of artificial intelligence (AI) quickly reduce the functional needs of physical presence and contact. For example, convenience of online education comes at the cost of the diminishing offline education. In the near future, physical attendance in the classroom might be no longer required for education. However, in order to flourish, people still need to ground themselves into the physical worlds. The gaps between decreasing physical lives and the basic human needs present the most critical opportunities for our department to improve the quality of life.

(2) **Growing societal need for sense of community and belonging.** Information technology and online social network contributed to building a global human community. Unfortunately, however, offline and intimate community has been disintegrated for the last decade and people feel lonelier and more alienated. Due to our evolutionary development, online communities cannot match the depth that offline communities offer. People really need physical stages and platforms such as sport to reconnect themselves to others in the real world and share their physical experiences.

(3) **Paradigm shift in the meaning of human health and wellbeing.** Health is no longer just the absence of disease. With twin revolutions in infotech and biotech, human might be able to conquer most devastating diseases including cancer in the not too distant future. Taking the disease out of equation, the health means achieving physical, spiritual, and emotional harmony. Therefore, sport and physical activity will play more important and powerful role for the health and wellbeing as the paradigm evolves.

(4) **Widening exercise and health inequalities.** Due to the societal changes discussed above, the exercise is no longer optional but rather a necessity for all human beings. Thus, growing gaps in the level of physical activity between the have and have-nots should not be viewed as matter of personal choice. The physical activity should be considered as basic human right, which calls for immediate actions to narrow the inequalities in physical activity and sport participation. This societal imperative should provide the department with more opportunities to grow further through overcoming the challenges.

# Areas for improvement

While the department boast many strengths, no program is perfect. We recognize a few weaknesses that might prevent the department from evolving to the next level. The ERC suggested our faculty seem to be overcommitted, given the very large number of graduate students (which was, by itself, viewed as a strength of the program as well). The current number of faculty seems insufficient to provide the highest-level instruction and training at both undergraduate and graduate levels. Many faculty mentors advise over 10 graduate students in addition to their relatively high teaching load and administrative duties. As a result,
time is scarce and faculty face challenges finding enough time for the high-quality research and teaching. Another disadvantage of the department is the outdated experimental equipment. In contrast with the excellence of the students and the faculty members, the current level of infrastructure and equipment of the department is substantially below the standard of other universities with comparable world rankings. In addition, it would be beneficial to add international faculty member to improve the diversity and global reach for the department.

**Threats**

The department is also facing some challenges to overcome. First, there still exists social and academic prejudice against the subject area and the discipline. Both inside and outside the university communities, sport-related subjects are not considered legitimate topics for serious and scientific research. This old stigmatization lingers and has some negative consequences including the devaluation of the quality of the research and expertise of the faculty and students. Moreover, partly due to the underappreciation of the academic value of sport related research, governmental support for the area is limited. The outdated models and policies for sport and physical activity is a limiting environmental factor.

**2. Main Strategy**

**Overall Goals and Objectives**

- Establish the reputation and credibility of the department as the world best academic program in the sport related field by becoming ranked in the top 3 programs in the QS World University Rankings in 2026.
- Improve the impact and value of faculty scholarship by
  - Increasing scholarly publications by 25% in the year 2026, and
  - Increase average h-index of the department faculty by 2 in the year 2026.
- Enhance and enable access to world-class infrastructure and resources by generating external funding from both public and private sources, aiming the total amount to $2.5million (40% increase from the past 5 years) for the next 5 years.
- Develop world-class research culture that recognizes, values and nurtures excellence, scholarship, creativity, enterprise and innovation.
- Strengthen the quality of graduate program and enhance research-training environment.
- Participate in and lead major collaborative events, professional networks, exhibitions and performances.
Action plan for phase 1

All the faculty members in the department will actively participate in this project. Moreover, Project Leadership Committee (PLC) will be formed to address the implementation of the following action plans:

- Recognize and reward outstanding research,
- Encourage publication in high impact journals,
- Identify funding sources and provide seed funds,
- Help develop partnership with leading researchers and institutions in and outside campus, and Design and implement a research development program.

Action plan for phase 2

- Establish high-quality, focused research concentrations in areas of established and emerging strengths. The areas of focus include:
  - Prevention and treatment of depression,
  - Inclusion in sport and physical activity,
  - Improvement of motor function, and
  - Sense of community and social integration.
- Develop proposals attract internal and external funding for improving research equipment, facility, and space that are necessary to support the strong, high quality research initiatives and collaborations.
- Build online and offline platforms for translational research to facilitate interdisciplinary integration of basic, practice, population and policy-based research on physical activity and health.
- Anchor the changes of values, expectations, and standards into the departmental processes, systems, and culture for goal setting, performance evaluation, rewards, recruit, collaboration, and development.

3. Objectives and Goals

Overall objective of this project is to expand and strengthen the various pillars of research and expertise of the department, including kinesiology & exercise science, sport management, sport pedagogy, and sport studies cluster. The success of the proposed research projects will promote active participation of more population in sports activities, leading to healthier and happier life of individuals and eventually to healthier society.

We also expect that the proposed research will enhance the scientific knowledge of human movement and contribute to filling the long-standing lack of the dialogue among social science, kinesiology, and engineering. This project will focus on three research themes that represent the areas of the department’s existing strength and emerging opportunities.
Physical activity to beat mood disorder

The objectives of this line of inquiry are 1) to understand and explain the mechanism behind the beneficial effect of exercise on mood disorder; 2) to identify novel antidepressant target and biomarkers for depression from body fluid; and 3) to develop and optimize evidence-based antidepressant exercise programs.

Inclusion in sport and physical activity for people with disabilities

The aims of this research project are 1) to identify causes and mechanisms related to physical activities and sport participation of people with disabilities; 2) to develop a theoretical framework and practical programs; 3) to address barriers impeding physical activity and sport participation among people with a disability; and 4) to establish a platform to facilitate interdisciplinary integration of basic, practice, population and policy-based research on the topic of inclusion in sport and physical activity.

Quantification and augmentation of human movement

This program of research aims to develop more various practical technologies 1) to precisely quantify the motor performance; and 2) to improve human motor function of the elderly, patients, athletes, and others.

4. Project Details

Physical activity to beat mood disorder

Patients with major depressive disorder are at increased risk for numerous physical health problems. Depressive disorder is a mental nervous system disease that requires active treatment. In particular, the level of depression among Korean students was very high, and the most common cause of death among adolescents aged 9 to 24 in 2014 was intentional self-injury (including suicide), which proves that proper depression management is required (Korea National Statistical Office 2016). According to statistics from Seoul National University Health Clinic, six of the twelve students who committed suicide from 2006 to 2010 were suffering from depression (Seoul University News, 2011). Serotonin-based antidepressants (SSRI) are widely used for the treatment of depressive disorders, but it takes several weeks SSRI to produce noticeable results, if any. Moreover, SSRI have serious side effects, and even many patients remain unresponsive to the drugs. Serious depressive patients require a pathologically objective judgment because of its treatments types and causes (sometimes, beyond just emotional issues). In addition to psychosocial findings, biological disorders such as hypothyroidism, diabetes, myocardial infarction, and various cancers have a high correlation with depression. Most psychiatry and counseling centers provide psychological tests and counseling in the form of questions and answers such as comprehensive psychological tests or depression scale tests. In case of severe depression, biological tests such as blood, liver function, kidneys, diabetes, electrolytes, heart, hepatitis, CT, MRI, brain SPECT scans, and brain wave tests are accompanied. Nevertheless, no clear physiological or biochemical marker that represents depression has been found. Previous studies showed that exercise and intermittent fasting are not only major modulators of energy.
metabolism but also cause enormous physiological, biochemical, and structural changes of neurotransmitters systems and brain. Some psychological drugs for severe anxiety, stress, depression, insomnia and mental illness are available. However, as there is still debate about the safety of the antipsychotic drugs being used, it is urgent to find a new target or a biomarker for safe depression treatment through exercise. For the success of detailed projects, imaging related tools such as cryostat are needed.

So far, research related to antidepressant effect of exercise has focused mainly on the identification of depression-inducing factors in neurons in the brain. However, previous studies revealed that the interaction between brain and peripheral tissues is important. Therefore, it is essential to expand the scope of research on the intercellular communication mechanisms in exercise induced anti-depressive behavior. Professor Hyo Youl Moon who has continued research on intercellular signaling will conduct the research on the antidepressant mechanism of exercise. In addition, researches on the factors that influence intercellular signal communication with body fluids and the changes in intracellular signal transduction processes enhance the understanding of depression and anti-depressive action of exercise. Depressed individuals stand to gain physical and mental health benefits from participation in regular physical activity. However, depressed individuals tend to have low rates of physical activity and poor adherence to exercise interventions relative to non-depressed groups. Evidence-based programs can motivate exercise-participation and will be useful for monitoring their improvement. The use of novel biomarkers may provide an easy and objective measure of depression and provide a platform for research on new approaches to treatment of mood disorder. The concepts and techniques presented in this study will lead to derive excellent academic and industrial effects. For the development of an optimized antidepressant-exercise program, Professor Yeonsoo Kim, who is an expert in translational research in sports medicine and Professor Chung Gun Lee, majoring sports participation, will participate help in integrating essential factors for this program.

**Inclusion in sport and physical activity for people with disabilities**

Among people with disabilities, participation in sport, exercise, and other forms of leisure time physical activity has been shown to yield numerous health benefits. Nevertheless, the vast majority of people living with a disability do not participate in sufficient physical activity to achieve health benefits. Of further concern, when people with disabilities do try to become physically active, their attempts are often thwarted, as evidenced by high dropout rates among those trying to initiate or maintain an active lifestyle. Taken together, the low physical activity participation rates and high dropout rates suggest that people with disabilities face tremendous barriers to becoming, and staying physically active.

Dozens of descriptive studies and review articles have been published, identifying both barriers and facilitators to physical activity and sport participation among persons with disabilities. Yet, while these data are informative, if the ultimate goal is to increase physical activity, then scientists must do more than simply generate lists of factors related to participation. Rather, such information needs to be used as a basis for selecting, designing, testing, and implementing physical activity-enhancing strategies. A significant challenge to using this information, however, is that there has been little effort to synthesize it in a manner
that is accessible and useful to the various sectors that are responsible for physical activity promotion among people with physical disabilities.

Some researchers have tried to synthesize this literature within the World Health Organization’s International Classification of Functioning, Disability and Health model (ICF). The ICF is a framework for describing and classifying information on health conditions that takes into account interactions between the condition/disorder/disease, components of functioning (Body Functions and Structures, Activities, and Participation), and contextual factors (Environmental Factors and Personal Factors). In a review of factors related to sport and exercise among people with spinal cord injury, authors concluded that most, but not all (e.g., depression, independence) factors, could be classified within the ICF, by applying published ICF-linking procedures and rules. The ICF’s inability to incorporate all of the factors is an important limitation. Another limitation is that the ICF was designed as a descriptive, rather than a predictive model. It lacks temporal and causal ordering of constructs, providing little guidance for hypothesis testing, regarding the effects of specific factors and interventions on physical activity and sport. It has also been noted that while the ICF can be useful for guiding the development of exercise rehabilitation programs, its complexity (e.g., need for linking procedures and rules) and abstract organization limit its value for non-health-care professionals working in sectors that would benefit from an understanding of factors related to physical activity and sport participation.

Indeed, experts have argued that multi-sector approaches are needed to promote physical activity. That is, approaches that engage various sectors to change environments and policies (e.g., recreation, transportation, city planning), engage health professionals and behavioral scientists to educate and motivate individuals, and foster social environments conducive to physical activity. Within the disability context in particular, a call has been made for greater collaboration between the medical/rehabilitation and community sectors to facilitate and promote life-long physical activity and sport participation. Given that many barriers are not resolvable from disciplinary silos, there could be tremendous benefit if scientists from different disciplines collaborated to address research questions aimed at solving the problem of low physical activity and sport participation and adherence rates. In our department, four faculty members can collaborate to develop, evaluate, and establish efficient programs and policies for promoting physical activity and sport participation of people with disabilities. Professor Chung Gun Lee’s major research area is utilizing health behavior theories and models to find out the mechanisms by which physical activity, sport participation, and sedentary behavior are influenced by multiple determinants. He also develops evidence-based, efficient, and effective programs for promoting sport participation and physical activity among various population and performs process and outcome evaluation of already developed programs. Since professor Chung Gun Lee’s target population was used to be healthy adolescents and adults, he will collaborate with Professor Yongho Lee who mainly studies about the role of recreation and physical activity for individuals with disabilities and program development for population with special needs. Professor Hyoyoul Moon who studies about the effect of exercise on brain function and depression and Professor Jooeun Ahn who studies about sports engineering, biomechanics, motor control, and robotics can help develop programs for promoting sport participation among people with intellectual and physical disabilities, respectively. In year 1, we will invest considerable effort in compiling lists of factors related to physical activity and sport participation of people
with disabilities. In year 2 and 3, we will organize and conceptualize these factors within a theoretical framework and apply it to practice. Finally, we will establish inter-professional communication channels and work collaboratively to address barriers impeding physical activity and sport participation among people with a disability.

**Quantification and augmentation of human movement**

Another important factor in promoting participation in physical activities is improvement of motor function. The elderly and the impaired population desperately want to recover their motor ability to participate in physical activities. The general public and amateur athletes also want to enjoy playing sports better with the assistance of useful technologies. For professional athletes and coaching staffs, enhancing motor performance is one of their top priorities. Thus, we additionally aim to develop more various practical technologies to improve the motor function of the elderly, patients, athletes, and others. Development of such technologies through iterative design fundamentally requires precise quantification of human movement. Therefore, we also aim to devise methods for precise assessment of human motor performance.

The Sports Engineering Laboratory, directed by Professor Jooeun Ahn, has been dedicated to developing effective technology to enhance human movement through deep understanding of kinesiology and accurate quantification of human motor performance. Professor Ahn proposed a novel approach of robotic therapy, and developed a novel method to quantify the stability of rhythmic human movement without a bias. He also devised a new method to accurately estimate the learning rate during training. More recently, the Sports Engineering Laboratory discovered a sudden step-like change in motor ability structure due to aging, and addressed the mechanical cause of the noticeable difference between treadmill and over ground locomotion. The research team is currently devising special shoes that mitigate declines in balance after fatigue, and enhance the jump height.

Necessary conditions for the practical use of the technology in actual sports and exercise include compact implementation; the complexity or the size of the necessary equipment has hindered practical use of many technologies outside laboratory or gym environment. We are to devise compact technologies that can increase human motor function without a cumbersome process. **In particular, we pay attention to the significant effect of tactile sensory input on the motor performance.** The effect of the sensory input on the motor output of mammals has been widely reported (F. Matyas, V. Sreenivasan, F. Marbach, et al. 2010; J. P. Donoghue, S. P. Wise, 1982; J. Coulter, E. Jones, 1977; J. A. Rathelot, P. L. Strick2006, W. Welker, R. M. Benjamin, R. C. Miles, C. N. Woolsey, 1957). In particular, a study of the mouse whisker system revealed a direct pathway for cortical motor control driven by the somatosensory cortex. Overlapping sensory and motor representations of rodent hind limb is also observed. For human movement, previous studies reported the critical role of cutaneous feedback on maximum voluntary finger force (J. K. Shim, S. Karol, Y. S. Kim, et al, 2012; N. J. Seo, J. K. Shim, A. K. Engel, L. R. Enders, 2011). **Inspired by these findings, we will develop smart wearable devices that provide optimal stimulus to enhance human motor performance.** Various types of textile, vibration, and functional electrical stimulation (FES) can be combined to deliver advantageous effects on motor output with compact implementation.
During the first two years of the project, we will conduct basic research to find effective stimuli. Textile and clothing pressure of the wearable device, and vibration to the skin can affect the motor performance. FES can also affect human motor function. Finding the optimal parameters of these stimuli requires systematic experiments and multiple iterations. One Masters student (Hyunji Kim) and three Ph.D. students (Jeongin Moon, Prabhat Pathak, and Sudeok Kim) in the Sports Engineering Lab will conduct these experiments under Professor Ahn’s direction. Considering that we are to find subtle changes in motor output owing to proper tactile input rather than additional power from a wearable robot, precise quantification of motor function with fine resolution is absolutely necessary. However, as explained in the “Competency Analysis”, the current equipment of the department is outdated. In particular, quantification of over-ground walking with precise kinetic data is not possible in the current facility. Therefore, we are planning to purchase two high resolution force platforms to quantify the ground reaction force and design the tactile stimuli accordingly. Considering the minimum length of walkways, the force platforms will be installed in Room 301 of Building 71-1 of SNU, and will be managed by the Sports Engineering Laboratory. This additional equipment will enable the success of the proposed research, and contribute to making the level of infrastructure of our department closer to that of our competitors in the same field.

During the 3rd year, we will develop compact garments that can practically enhance human motor performance of the elderly, the patients, and athletes based on the results obtained during the first two years. The schematic of an example garment that applies vibration to human skin via piezoelectric actuators is illustrated in Figure 1. The same research staffs (Hyunji Kim, Jeongin Moon, Prabhat Pathak, Sudeok Kim, and Professor Ahn) will participate in this subproject during the 3rd year.

![Figure 1: The schematic of the smart compression wear. Various stimulations including vibration through light mechanisms like piezoelectric actuators can be applied to human skin to enhance motor function.](image)
5. Project Management

Evaluation Criteria

Research outcomes: 8 SCIE papers ranked as Q1 and 2 provisional patents. Success of the proposed project requires synergy of interdisciplinary research subjects involving instrumentation, experiment with human subjects, motor-neuroscience, physiology, data analysis, and statistics. We aim to publish at least two SCIE journal papers which are ranked as Q1 (top 25%) in each of four distinct fields (Sports Management, Sports Participation, Physiology, and Sports Engineering) during the first three years. In addition, we aim to create at least two provisional patents by the 3rd year of the project.

Training of students: Annual presentations of 2 Master’s and 8 Ph.D. students. A large portion of the proposed budget needs to be assigned to the training of students in the various fields. During the first three years, the project will partly support 2 Master’s and 8 Ph. D. students annually. The students are also expected to develop their communication skills and present their research progress at least once per year in renowned international conferences.

Contribution to society: One antidepressant exercise program. The outcomes of the proposed project should go beyond academic achievements like presentations and papers; we are to contribute to making healthy society practically. Thus, based on what we will find through the proposed research project, we will produce an antidepressant exercise program for the general public in the 3rd year of the project. The program will be provided in various forms like applications, booklets and videos.

Reputation of the department: Academic Reputation and H-index of 88 and 75. The average values of the Academic Reputation and H-index of the department over the last three years are 85.6 and 71.8, respectively. We aim to increase these indices to 88 and 75 by the 3rd year of the project. Outbound trips to leading universities and foreign research institutes will provide more opportunities to strengthen international cooperation and enhance the reputation of the department by showing the excellence of our studies and projects. We will also continue to build relationships with many institutes in developing countries that can implement our achievements.

Management Plan

All the faculty members in the department will actively participate in this project. In addition, the progress of the proposed project will be monitored and managed by the Project Leadership Committee (PLC). The PLC will consist of Prof. Yukyoum Kim (Program Manager), Prof. Jooeun Ahn, Prof. Hyoyoul Moon, and Prof. Chung Gun Lee. The PLC will hold monthly meetings to check the actual progress in each field and compare the achievement with the evaluation criteria suggested above. PLC will also prioritize the items that the limited budget should be spent on. For example, regarding the budget for travel expenses, the students who will present their research in an international conference will have priority over the faculty. In addition to this internal evaluation and management plan, PLC will invite External Review Committee (ERC) again to receive objective feedback from esteemed scholars in the 3rd year of the project. Since the department has already invited ERC in November 2019, this planned external review will focus on the assessment of any improvement that the department will make during the 3 years of the proposed project.
PART C. Biographical Sketch

Project Manager

Yukyoum Kim, Ph. D. Professor of Physical Education at the Seoul National University. He earned his Ph.D. from the University of Florida in 2008. Same year, he started as an assistant professor at the Florida State University, where he became a tenured professor in 2013.

Professional Standing. Dr. Kim is a world leader in the field of sport management and sport-related areas. Dr. Kim is the youngest-ever scholar to be named a Research Fellow of the North American Society of Sport Management, an honor that has only been bestowed to 50 scholars in the history of the field. Dr. Kim presently serves on the editorial boards for the top three journals in the field, Journal of Sport Management, Sport Management Review, and Sport Marketing Quarterly. He is on the editorial board for many of the better journals in the field, including Journal of Global Academy of Marketing Science, and Journal of Tourism Studies, International Journal of Human Movement Science and Journal of Global Sport management (as Associate Editor). He has been invited to speak at several prestigious institutions in South Korea and abroad. He has served on a number of research and policy development committee of the Korean government agencies and professional sport organizations.

Scholarly Achievement. Dr. Kim has worked on questions of psychological health and wellbeing through bodily experience, including vicarious achievement, gratitude, relationship quality, constraints and motivation. Since assuming the role of assistant professor at the Florida State University in Fall 2008, he has authored or coauthored more than 100 peer-reviewed articles, reviews, proceedings, and books, leading to an h-index of 26, an i-10 index of 39, and over 2,000 total citations. He has published his work in the most elite journals in the field, including Journal of Sport Management, Sport Management Review, Sport Marketing Quarterly, and European Sport Management Quarterly. The acceptance rate of these journals is around 10-15%. He also has 123 refereed conference presentations. Overall, Dr. Kim’s research productivity places him the top 1% of all sport management faculty worldwide.

External Funding Since arriving at Seoul National University in 2014, Dr. Kim has generated external funding in excess of $1.2 million. He also has collaborated as a co-principal investigator on several successful grant projects of over $10 million in the just last 7 years. His research has been funded by both government agencies and sport business enterprises such as Ministry of Culture, Sport, and Tourism, Ministry of Trade, Industry, & Energy, Seoul Metropolitan Government, Korea Institute for Sport Science, Korea Sport Promotion Foundation, Korea Professional Sport Association, Korea Sport Safety Foundation, and Korean Basketball Association.

Others Dr. Kim has also attained a considerable reputation beyond academic circles. He regularly writes for leading newspapers and business journals such as Dong-A Business Review, Dong-A Ilbo, Chosun Ilbo, and Maeil Business News.
## Annual Budget (Year 1):

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<tr>
<th>Item</th>
<th>Budget</th>
<th>Description</th>
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<tr>
<td>Physical activity to beat mood disorder</td>
<td>58,100,000</td>
<td><strong>Equipment</strong>&lt;sup&gt;1)&lt;/sup&gt;&lt;br&gt;Cryostat (40,000,000) × 1 = 40,000,000&lt;br&gt;(Example model: Thermo Fisher Scientific)&lt;br&gt;<strong>Labor expenses</strong>&lt;br&gt;Ph.D student (33% participation rate) × 1 = 10,000,000&lt;br&gt;Ph.D student (13.3% participation rate) × 1 = 4,000,000&lt;br&gt;<strong>Research activities</strong>&lt;sup&gt;2)&lt;/sup&gt;&lt;br&gt;International conference registration for faculty members: 790,000 (per person) × 2 = 1,580,000&lt;br&gt;International conference registration for students: 630,000 (per person) × 4 = 2,520,000</td>
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<td>Inclusion in sport and physical activity for people with disabilities</td>
<td>28,100,000</td>
<td><strong>Labor expenses</strong>&lt;br&gt;Ph.D student (33% participation rate) × 2 = 20,000,000&lt;br&gt;Ph.D student (13.3% participation rate) × 1 = 4,000,000&lt;br&gt;<strong>Research activities</strong>&lt;sup&gt;2)&lt;/sup&gt;&lt;br&gt;International conference registration for faculty members: 790,000 (per person) × 2 = 1,580,000&lt;br&gt;International conference registration for students: 630,000 (per person) × 4 = 2,520,000</td>
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<tr>
<td>Quantification and augmentation of human movement</td>
<td>86,100,000</td>
<td><strong>Equipment</strong>&lt;sup&gt;1)&lt;/sup&gt;&lt;br&gt;Force platform (30,000,000) × 2 = 60,000,000&lt;br&gt;<strong>Labor expenses</strong>&lt;br&gt;Ph.D student (11% participation rate each) × 3 = 10,000,000&lt;br&gt;Master’s student (27.8% participation rate) × 2 = 12,000,000&lt;br&gt;<strong>Research activities</strong>&lt;sup&gt;2)&lt;/sup&gt;&lt;br&gt;International conference registration for faculty members: 790,000 (per person) × 2 = 1,580,000&lt;br&gt;International conference registration for students: 630,000 (per person) × 4 = 2,520,000</td>
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<td>Project leadership committee</td>
<td>141,900,000</td>
<td>Hosting an international conference&lt;sup&gt;3)&lt;/sup&gt;: 19,000,000&lt;br&gt;Seminar invitation: 10,750,000 (per person) × 2 = 21,500,000&lt;br&gt;Program management meetings: 24,000,000&lt;br&gt;400,000 (per meeting) × 10 (labs) × 6 (counts per lab)&lt;br&gt;Operational costs: 700,000 (per month) × 12 = 8,400,000&lt;br&gt;Travel for international conferences and meetings&lt;sup&gt;3)&lt;/sup&gt;: 2,300,000 (per person) × 30 = 69,000,000</td>
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<td><strong>Total</strong></td>
<td><strong>314,200,000 (KRW)</strong></td>
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1) Explained in B. 4. Project Details

2) Based on the registration and travel costs for ISBS non-members and the currency on Jan 13, 2020

3) Based on the budget spent for 2019 Global Sports Science Conference
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<th>Item</th>
<th>Budget</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity to beat mood disorder</td>
<td>42,200,000</td>
<td><strong>Labor expenses</strong>&lt;br&gt;Ph.D student (33% participation rate) × 1 = 10,000,000&lt;br&gt;Ph.D student (13.3% participation rate) × 1 = 4,000,000&lt;br&gt;&lt;strong&gt;Research activities&lt;/strong&gt;¹&lt;br&gt;International conference registration for faculty members: 790,000 (per person) × 4 = 3,160,000&lt;br&gt;International conference registration for students: 630,000 (per person) × 8 = 5,040,000&lt;br&gt;Body fluids collection and analyses (outsourcing): 10,000,000&lt;br&gt;Exercise prescription platform development: 10,000,000</td>
</tr>
<tr>
<td>Inclusion in sport and physical activity for people with disabilities</td>
<td>72,200,000</td>
<td><strong>Labor expenses</strong>&lt;br&gt;Ph.D student (33% participation rate) × 2 = 20,000,000&lt;br&gt;Ph.D student (13.3% participation rate) × 1 = 4,000,000&lt;br&gt;&lt;strong&gt;Research activities&lt;/strong&gt;¹&lt;br&gt;International conference registration for faculty members: 790,000 (per person) × 4 = 3,160,000&lt;br&gt;International conference registration for students: 630,000 (per person) × 8 = 5,040,000&lt;br&gt;Market research and development: 40,000,000</td>
</tr>
<tr>
<td>Quantification and augmentation of human movement</td>
<td>26,100,000</td>
<td><strong>Labor expenses</strong>&lt;br&gt;Ph.D student (11% participation rate each) × 3 = 10,000,000&lt;br&gt;Master’s student (27.8% participation rate) × 2 = 12,000,000&lt;br&gt;&lt;strong&gt;Research activities&lt;/strong&gt;¹&lt;br&gt;International conference registration for faculty members: 790,000 (per person) × 2 = 1,580,000&lt;br&gt;International conference registration for students: 630,000 (per person) × 4 = 2,520,000</td>
</tr>
<tr>
<td>Project leadership committee</td>
<td>172,600,000</td>
<td>Hosting an international conference²: 19,000,000&lt;br&gt;Seminar invitation: 10,750,000 (per person) × 4 = 43,000,000&lt;br&gt;Program management meetings: 32,000,000&lt;br&gt;400,000 (per meeting) × 10 (labs) × 8 (counts per lab)&lt;br&gt;Operational costs: 800,000 (per month) × 12 = 9,600,000&lt;br&gt;Travel for international conferences and meetings¹ :&lt;br&gt;2,300,000 (per person) × 30 = 69,000,000</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>313,100,000 (KRW)</strong></td>
<td></td>
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¹ Based on the registration and travel costs for ISBS non-members and the currency on Jan 13, 2020

² Based on the budget spent for 2019 Global Sports Science Conference
### Annual Budget (Year 3):

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<tr>
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</table>
| **Physical activity to beat mood disorder** | 22,200,000 | **Labor expenses**  
Ph.D student (33% participation rate) × 1 = 10,000,000  
Ph.D student (13.3% participation rate) × 1 = 4,000,000  
**Research activities**  
International conference registration for faculty members: 790,000 (per person) × 4 = 3,160,000  
International conference registration for students: 630,000 (per person) × 8 = 5,040,000 |
| **Inclusion in sport and physical activity for people with disabilities** | 62,200,000 | **Labor expenses**  
Ph.D student (33% participation rate) × 2 = 20,000,000  
Ph.D student (13.3% participation rate) × 1 = 4,000,000  
**Research activities**  
International conference registration for faculty members: 790,000 (per person) × 4 = 3,160,000  
International conference registration for students: 630,000 (per person) × 8 = 5,040,000  
Market research and development: 30,000,000 |
| **Quantification and augmentation of human movement** | 26,100,000 | **Labor expenses**  
Ph.D student (11% participation rate each) × 3 = 10,000,000  
Master’s student (27.8% participation rate) × 2 = 12,000,000  
**Research activities**  
International conference registration for faculty members: 790,000 (per person) × 2 = 1,580,000  
International conference registration for students: 630,000 (per person) × 4 = 2,520,000 |
| **Project leadership committee**          | 192,500,000 | Hosting an international conference: 19,000,000  
Seminar invitation: 10,750,000 (per person) × 2 = 21,500,000  
Program management meetings: 36,000,000  
400,000 (per meeting) × 10 (labs) × 9 (counts per lab)  
Operational costs: 1,000,000 (per month) × 12 = 12,000,000  
Travel for international conferences and meetings: 2,300,000 (per person) × 30 = 69,000,000  
External review committee invitation: 35,000,000 |
| **Total**                                 | 303,000,000 | **KRW**                                                                                                                                 |

1) Based on the registration and travel costs for ISBS non-members and the currency on Jan 13, 2020  
2) Based on the budget spent for 2019 Global Sports Science Conference  
3) Based on the budget spent for the external review performed for the Department of Physical Education in November 2019
1. Project Manager Curriculum Vitae

[Click here to visit Dr. Kim’s homepage for his CV and more information](#)

2. QS World University Rankings by Subject(Sport-Related)


3. Global Outreach and collaborations

[http://dtm.snu.ac.kr/](http://dtm.snu.ac.kr/)


4. List of project committee members

<table>
<thead>
<tr>
<th>Name</th>
<th>Click here to visit Dr. Name’s homepage for biographical sketch and more information</th>
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<tr>
<td>Dr. Euichang Choi</td>
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