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MESSAGE FROM THE INTERNATIONAL TABLE TENNIS FEDERATION

ITTF President's Message

As a prelude to the individual World Table Tennis Championships, a tradition has developed of holding a gathering of sport scientists interested in table tennis. This time, Budapest has the honour of hosting such sports scientists from across the world.

More than 100 table tennis scientists from around the world shall converge in Budapest to anticipate trends and exchange the latest knowledge. Against this strong scientific background, we are hoping for important results which will help table tennis move forward appropriately and allow us to look towards a bright future.

The ITTF counts on you to be guides on the way to a healthy and safe future for our sport while maintaining the athletic and technical performance of our athletes. I also ask you to work closely with coaches and players to establish new trends to enhance our beloved sport.

On behalf of the ITTF, I welcome you all to the 16th ITTF Sport Science Congress being held on 19 and 20 April. I hope the over 100 abstracts submitted by contributors from 29 countries and 4 continents will ensure interesting discussions and be thought-provoking for all participants.

I am very grateful to the event organisers, the WTTC Organising Committee, the University of Pecs, the Hungarian Table Tennis Association and members of the ITTF Sports Science and Medical Committee. I hope you enjoy the Congress and make some new friends while reviving some old ones. In addition, after the congress, I hope that all of you take the chance to watch the exciting matches of the World Table Tennis Championships in the historical city of Budapest.

Thomas Weikert
President ITTF

MESSAGE FROM ORGANIZING COMMITTEE

Organizing Committee Message

Dear Participants and Guests of the Congress,

I am pleased to welcome you to the 16th ITTF Sport Science Congress in Budapest.

It is a great honour for the University of Pécs, Faculty of Health Sciences to organize this outstanding scientific event together with the Hungarian Table Tennis Association and the ITTF Sport Science and Medical Committee.
Our faculty has been cooperating with the Hungarian Table Tennis Association for a long time, which has been so far the subject of joint educational programs and research activities, especially there is going on now a curriculum development for table tennis coaching on university-level. That is the reason I think the organization of this scientific congress is a new level of cooperation.

Such a broad-spectrum scientific congress – covering both fields of physiology, biomechanics, and psychology, pedagogy, training theory, sports analytics and management - can not only bring new impulses and knowledge for the scientific community, but also for people who are practicing it every day. It is not a secret intention of us, inviting and involving in this international cycle the lecturers and researchers from our faculty and the Hungarian sports science society as effectively as possible. Due to the profile of our faculty, we would like to contribute to the professionalism of this Congress with our experience in the fields of recreational sport, health sport and sport tourism.
I think it is not only a great honour, but also a great responsibility to host the world's most prominent sports scientists. That's why our colleagues have made every effort over the past few months to give you new experiences here, which can take our reputation all over the world. I believe that the venue of the Congress and the atmosphere and attractions of Budapest, moreover, the World

Table Tennis Championship will be able to make a big contribution in this.
I wish for all of you deep discussions, new impulses, successful networking and memorable experiences!

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Dean, Faculty of Health Sciences
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Dr. habil Pongrác ÁCS
Table tennis sport coach
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CLASSIFICATION, IMPAIRMENTS, AND RESEARCH IN PARA TABLE TENNIS: PAST, CURRENT, AND FUTURE

Abstract
Classification is the most important and complicated issue in disability sports. Currently, table tennis (TT) players with physical impairments (PI) and intellectual impairments (II) have been included at the Paralympic Games. There are ten classes for TT players with PI (five classes for wheelchair and five classes for standing players) and one class for players with II. TT-specific classification systems for PI players are physical and functional approaches and for II players are functional and cognitive approaches. 3S (speed, spin, and spot) principles are used to classify players with PI, and 3S and 3C (control, consistency, and change) principles are used to classify players with II. Para-TT classification systems are based on evidence and physical and functional evaluations. Medical and technical competent classifiers need to work together to make fair classifications for players. Recently, countries focused on winning medals at the major Championships and started to include elite able-bodied players with very mild impairments in Para-TT. The objective minimal impairment criteria (MIC) are urgently required by ITTF-PTT to maintain fairness of competition and protect actual disabled players. Therefore, evidence-based research is helpful to revise the TT classification system scientifically. In the presentation, the related evidence and information will be provided to identify and tackle the main issues and the future directions for Para-TT classification and research will be offered to include more scientists and classifiers.

Key words: *para table tennis, physical impairment, intellectual impairment, evidence-based classification*

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HOW SHOULD WE TEST AGILITY COMPONENTS IN RACKET SPORTS, INCLUDING TABLE TENNIS?

Abstract
It is generally accepted that non-planned and pre-planned agility should not be observed as unique capacity. However, it is still not clear are the different forms of agility unique capacity when performed with and without racket among racket-sport athletes? Indeed, a limited number of studies examined agility components in racket-sport athletes, while to the best of our knowledge no investigation specifically examined pre-planned and non-planned agility with or without a racket in table tennis. This paper overview several important topics which should be highlighted in studies where investigators will observe agility performance in racket sports, including table tennis. Basically, it explains the necessity of the simultaneous evaluation of agility components: (i) with and without a racket, but also (ii) throughout non-planned and pre-planned scenarios. Also, the importance of specific movement templates which mimic real game performance is discussed. Finally, the importance of the standardized measurement environment is explained from the perspective of the applicability of test results.

Key words: *agility, racket sports, movement, measurement*

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ECONOMIC IMPACTS OF INTERNATIONAL SPORT EVENTS ORGANIZED IN HUNGARY

Abstract
Among others Budapest hosted 2016 ITTF European Championships several ITTF World Tour events and Junior Circuit events and Budapest hosts 2019. ITTF World Championships and will host 2019 European Veteran Championships.
Our primary research focused on attitudes of participants and spectators about the given international sport events and their related expenditures with the analysis of the budget of the events as well. We surveyed the 2018 ITTF World Tour Hungarian Open, the 2018 U13 Table Tennis International Hungarian Open, the 2018 European Shooting Championships and the Badminton International Junior Championships (N=863).
The four events realized 11,400 guest nights with 133 thousand EUR revenues, 56.7 thousand EUR GDP contribution, 38.5 thousand EUR budget income (VAT and other taxes) per competition day.
The average daily spending of the domestic spectators were 43 EUR, the foreign spectators spent daily 84 EUR on average and the foreign participants spent daily 86 EUR on average. Altogether the Hungarian budget realized 543 thousand EUR tax income from these event with spending only 529 thousand EUR on support of these events.
Our results show that smaller scale international sport events realize significant economic impact with other diplomatic, social, sport related, technological and environmental impact as well for the organizers, the municipality and the state as well.

Key words: *sport tourism, economic impact of international sport events, economic multiplier*

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IN THE BEGINNING WAS THE HALF-VOLLEY: THE HISTORY OF DEFENCE IN TABLE TENNIS–REVISED

Abstract
The term "defensive play" is known in many different sports. In the field of racket sports, however, the word defensive player is quite distinct to table tennis. While technically relying to a great extent on backspin defence, defensive players in table tennis are also called "choppers". This article on the technical development of table tennis shows that defensive play in this sport is as old as competitive table tennis itself. Nevertheless, it becomes evident that playing a long-range defence while standing rather far away from the table, as it is commonly known, was originated not earlier than around 1930; this was about three decades after the start of competitive table tennis. It is said that choppers were dominating the early era. Beginning in the 1950s, various alterations in table tennis turned to a decline of backspin defence. Inventions such as rubbers based on sponge and sticky surfaces, the modern topspin stroke (loop drive), the fresh-gluing of rubbers, and the so-called two-colour rule favoured offensive play. In this article it is described how defensive players continuously reacted and adapted by finding effective remedies to ensure that defensive play can be a still existing specific style in the world of table tennis.

Key words: *stroke technique, racket covering, match strategy, variation, adaptation*

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DISCUSSION OF TABLE TENNIS RACKET PROPERTIES 2019

Abstract
In the first part, this paper contains the theoretical connection between table tennis rubber properties, table tennis blade, and the characteristics of the complete racket, which make up a large part of the hitherto not physically described feeling of a table tennis racket. Furthermore, we draw attention to insufficient physical description of table tennis rubbers and table tennis blades. Thus, sizes such as the speed of a table tennis racket are not only arbitrarily scaled, but also published with arbitrarily chosen units and unknown measuring methods.
In the second part of this paper some negatibve cosequences in the table tennis sport due to the explained problem are demonstrated. Moreover an outlook is declared what first measurements are necessary to get a step closer to the exact and repeatable physical description of a table tennis racket.

Key words: *table tennis rubber, table tennis blade, speed, spin, control, table tennis*

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THE BIOMECHANICAL EFFECTS OF TWO PERFORMANCE LEVELS DURING TABLE TENNIS CROSS STEP

Abstract
The agile footwork is a basic but important skill in table tennis, how to efficiently grasp and improve its performance has always interested coaches and athletes, beginners particularly. The purpose of this study was to investigate the differences in kinetics and kinematics of the cross step between professional players and beginners using the Oxford Foot Model (OFM). 22 male participants (professional player, 11; beginner, 11) with dominant right feet attended in the table tennis cross step test. A Vicon motion analysis system and a Novel Pedar insole plantar pressure measurement system were used to record kinematic and kinetic data, respectively. Professional athletes showed significant larger forefoot inversion and adduction, but significant smaller forefoot dorsiflexion. In addition, they also showed significant larger hind foot dorsiflexion and internal rotation as well as significant larger hallux dorsiflexion than beginners. In this study, compared with beginners, professional athletes demonstrated apparently faster angle change rate, but smaller range of motion. Professional athletes showed significantly greater relative load on the other toes, lateral forefoot and rear foot. Professional athletes possessed greater foot drive technique. The findings on internal mechanisms of the cross step could help coaches and beginners to in-depth understand the mechanical efficiency and improve the performance.

Key words: *Oxford foot model, footwork, kinematic chain*

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EFECT RESEARCH OF THE CONNECTION TECHNIQUE ON THE TACTICAL CAPABILITY OF HIGH-LEVEL TABLE TENNIS PLAYERS

Abstract
With the "connection technique" as the theoretical basis, this paper analyses the factors affecting the tactics in the traditional table tennis tradition, and discusses the effect of connection technique on the tactical capability of high-level table tennis players. The research believes that the consecutive two grips of the connection technique have certain internal relation. The first grip focuses on the connection technique, enabling to predict the line of incoming ball of the opposite side, and the second grip focuses on the tactics to fight against the opposite side. Therefore the connection technique is also a tactic, there being a dispensable relationship between them. However, the connection technique hasn't ever been well explored, mined and perfected, so that the athletes cannot be systematically trained, which also affects the mastery of tactical capability of the athletes. In addition, there has always been the problem with separation of technique and tactical training in ~~the~~ traditional training, which also an important factor affecting the athletes' tactical capacity. With the "connection technique" theory as the training means, the solution is to dispense with tradition and introduce the connection technique and connection tactics to athletes when they come into contact with table tennis as children, allowing them to have simultaneous training of technique and tactics and receive a one-step and balanced development.

Key words: *competition and training, table tennis, high-level athletes, connection technique, superposition tactics*

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PATHOGENESIS AND BASIC HANDLING PRINCIPLES OF COMMON INJURIES CAUSED BY FOREHAND SPIN IN TABLE TENNIS

Abstract
Forehand spin still plays a major role in current table tennis as a mainstream technique. Its fundamental movements include preparation, backswing, strike, and return, etc., in which players must judge where the ball comes from and strike it in a short amount of time. Such is a technique with high explosiveness. In the long run, players may suffer from injuries caused by excessive training, insufficient warm-up, incorrect movement, and insufficient strength.
According to literatures, common injuries caused by forehand spin include meniscus injury, patella tendonitis, ankle sprain, deltoid muscle strain, shoulder impingement syndrome, and low back pain. Based on such factors, this article will explain the causes of injuries from forehand spin from the perspective of anatomy and motion analysis, and briefly describe the basic handling principles for the injuries, which can be an important reference for players and coaches on training and teaching to decrease the occurrence of sport injuries.

Key words: *forehand spin, ankle sprain, shoulder impingement syndrome*

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STUDY ON THE EFFECT OF PHYSICAL FUNCTION TRAINING ON COLLEGE STUDENTS' TABLE TENNIS SPORTS INJURY

Abstract
Based on the characteristics of table tennis itself, the scientific training methods of body function training is helpful to formulate effective intervention methods for preventing college students' table tennis injury. Thirty students were divided into 15 in the experimental group and 15 in the control group for 15 weeks. The experimental group received physical function training twice a week, 30 minutes each time. The training contents included: fascia carding, flexibility of joint muscles, trunk and spine strength, shoulder joint strength, knee joint strength. Test indicators include Serum creatine kinase, lactate, interleukin-6 and tumor necrosis factor TNF-alpha. Functional Motion Screening (FMS) indicators before and after the intervention were analysed with SPSS22.0. After intervention training, in the experimental group CK level decreased significantly ($P < 0.01$), LA, IL-6, TNF-alpha level decreased significantly ($P < 0.05$), and total FMS score increased significantly ($P < 0.05$). There was no significant difference in CK, LA, IL-6 and TNF-alpha levels before and after intervention in the control group. Intervention methods of physical function training prevent muscle injury in training, improve table tennis players' technical and tactical skills, physical fitness and strengthen the learning of flexibility and coordination in table tennis practice.

Key words: *physical function training, table tennis sports injury, study*

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STUDY ON THE INTERESTING TABLE TENNIS TEACHING METHOD OF "ONE PLAYER, ONE TABLE AND ONE BALL"

Abstract
The interesting teaching method of "One Player, One Table and One Ball" breaks the traditional learning modes. Using a patented product - Singles table, and under the principle of step-by-step teaching, learners complete the learning of table tennis skills. According to the pattern of time sequence and interesting teaching method, learners practice for 30-40 minutes every day to complete initial stage, intermediate stage, advanced stage and super-advanced stage for learning of small table. The training program was compiled according to the mode of logical thinking analysis. In six months learners learn to serve, catch and attack forehand and backhand (40-70/minute). It stimulates students' interest in learning table tennis, evokes students' motivation to learn table tennis technology, and improves the utilization rate of sports venues and learning efficiency. "One Player, One Table and One Ball" interesting teaching method is designed reasonably, positioned accurately, and learning means are advanced. It promotes the reform of table tennis teaching and contributes to the lifelong learning of physical education (table tennis) for all. The interesting teaching method makes students learn faster and teachers teach more easily. The difficulty of learning table tennis technology is reduced, the interest is increased and training cycle is shortened.

Key words: *table tennis, interesting teaching method, study*

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ANALYSIS ON SPORT COMPETITION TRAIT ANXIETY OF CHINESE ELITE FEMALE JUNIOR TABLE TENNIS PLAYERS

Abstract
As a common psychological factor, trait anxiety in sports competitions will invisibly affect the competitive level of athletes in competitions. This paper analyses the level of trait anxiety of elite young female table tennis players in China by means of questionnaires and compares it with the norm of Chinese athletes, so as to provide reference for coaches to control the psychological state of high-level table tennis players of different age groups, formulate training plans and arrange competition techniques and tactics. The results show that: (1) Compared with other sports, young women athletes in table tennis have higher competitive trait anxiety. Because the higher athletes' competition trait anxiety is likely to cause higher competition state anxiety, so we can take certain measures for elite young women table tennis players to carry out relevant psychological training, so as to prevent and alleviate pre-competition anxiety. (2) The difference of trait anxiety level between the Youth female's Team and the norm is different in different age groups. The reason may be related to the athletes' self-orientation and goal of struggle in different age groups.

Key words: *juniors, table tennis players, competition trait anxiety*

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THE KINEMATICS ANALYSIS OF STRIDE STEP OF ELITE TABLE TENNIS PLAYER

Abstract
The variably, accurately foot step in table tennis is not only influencing the completement of stroke movement but also one of the determinate factors deciding results of competitive match. However, few studies explore the lower-limb and foot biomechanical variations in table tennis athlete. Therefore, the purpose of this study is to explore lower-limb kinematics characteristics of stride step in elite table-tennis players. Ten male table tennis players with pen-hold grip performed towards-left stride step in biomechanical laboratory. Vicon motion capture system was used to collect three-dimension bilateral lower-limb joint kinematics. Independent sample t-test was performed to determine any significant differences between bilateral lower limbs. Kinematics parameters indicated that 1) right leg (RL) prior to left leg (LL) both take-off and landing phases when player performed stride step; 2) no significant time difference of bilateral lower limb was found in take-off and flight phases, but RL used significantly more time to cushion than LL in landing phase; 3) the range of motion (ROM) of RL joints were all smaller than LL in take-off phase, only hip significant big ROM and knee small ROM in flex-extension were found in landing phase. Conclusion: RL of elite table tennis player takes role of producing power and LL plays role of maintain stability, which needs more power output on RL and more muscular endurance on LL during take-off phase. In landing, RL mainly depends on hip flex-extension to cushion and LL depends on ankle flex-extension to cushion, which need practitioner to notice in training.

Key words: *table tennis, stride step, kinematics, elite athlete*

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TABLE TENNIS LOOP-DRIVE TRAINING: A NEUROMOTOR EXERCISE MODALITY FOR THE ADULT POPULATION

Abstract
By practicing table tennis, the adult population can meet the American College of Sports Medicine's recommendations for neuromotor exercising. In this study, thirteen recreational players (46.2 ± 18.3 yr., 8 males) trained for improved spin rate (SR) and hitting speed (HS) of their forehand loop-drives (FLD). The eight-week program followed ACSM's guidelines for developing balance, agility, and proprioceptive abilities. Two practices per week were conducted which included a 20-min FLD training against consistent backspin balls served by a table tennis robot. In addition, participants studied instructional materials and utilized self-regulated peer feedback. Biweekly tests assessed average SR, HS, and ball contact location on the paddle (CL) from five consecutive FLDs. SR increased from 41.6 rs^{-1} to 60.7 rs^{-1}, while HS from 8.57 ms^{-1} to 9.71 ms^{-1} by the end of the program (both $p<0.05$). While SR increased consistently throughout the program, HS reached its peak after four weeks of training, then remained at that increased level. CL moved from 21 mm below the paddle's longitudinal axis (the paddle was usually in horizontal position at contact) to 35 mm below the axis. This study contributed to the knowledge base of training type, intensity, and methods for neuromotor exercising of adult population.

Key words: *adult table tennis, neuromotor exercise, forehand topspin, spin rate*

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SYSTEMATIC DEVELOPMENT OF TABLE TENNIS SPORT SCIENCE PROJECT IN TAIWAN: TALENT SELECTION, MEASUREMENT OF PRESSURE, SPORT INJURY, TECHNOLOGICAL RACKETS, AND INTELLECTUAL TACTICAL SYSTEM

Abstract
The purpose of this presentation is to share the research and practical experience in table tennis (TT) sport science (SS) in Taiwan. We develop five science modules including talent selection, measurement of pressure, sport injury, technological rackets and intellectual tactical system in competitive TT from 2018 to 2022. The integrated TT project includes (a) development of talent selection and analysis system; (b) objective measurement of pressure and release in players; (c) development and analysis of sport injury in players; (d) development of technological rackets and intelligent computing; and (e) development and analysis of tactics and skills. Each sub-project has its theoretical and practical components which related to TT. The project focuses on competitive TT and SS and technology through multi-perspectives and experts in several academic and practical fields in order to enhance elite TT and its related development and application in Taiwan and then may have further applications in the world. Thus, this project may be useful for elite TT players to improve their performances and related skills and tactics. Through these serious processes and systematic research, we expect to develop positive outcomes and also apply related methods and results nationally and internationally in order to assist the International Table Tennis Federation (ITTF) to promote the combination of competitive TT and SS. There are a few presentation papers related to sub-projects in the ITTF conference to explain the detailed information.

Key words: *sport science, talent selection, measurement of pressure, sport injury, technological rackets and intellectual tactical system*

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COMPARING THE KINEMATIC CHARACTERISTIC BETWEEN DIAGONAL AND STRAIGHT SHOT IN FOREHAND LOOP FROM WORLD-CLASS TABLE TENNIS ATHLETE

Abstract
Diagonal forehand loop (DFL) and straight forehand loop (SFL) are the most commonly techniques of table tennis. However, there are few researchers have been studied and compared these kinematics character of lower-limbs, therefore, the aim of this study was to investigate the differences in lower-limbs kinematics between the DFL and SFL. One male world-class Chinese table tennis participant performed a DFL and SFL in random order. Three-dimensional kinematic data was captured using eight-camera Vicon motion analysis system (Oxford Metrics Ltd., Oxford, UK) with a frequency of 200 HZ. Key findings from the study was that in the backward-end (BE) phase, Significant differences in joint angles between DFL and SFL were found in the sagittal and transverse planes. Compared with DFL, SFL showed significantly larger knee external rotation (Mean (SD)=24.2(1.5)) with larger ankle external rotation (Mean(SD)=16.3(1.6)) and larger ankle adduction (Mean(SD)=4.9(0.4)). In the forward-end (FE) phase, SFL show significantly larger knee adduction (Mean (SD)=16.9(1.2) compared with DFL (Mean(SD)=7.1(1)). SFL show larger ankle abduction (Mean (SD)=10(1.5)) and internal rotation (Mean(SD)=28.9 (3.2)) compared with DFL (ankle abduction (Mean (SD)=6.1(0.3)); internal rotation (Mean(SD)=18.1 (0.8))). SFL show significantly larger knee internal rotation (Mean (SD)=42.5(4)) compared with DFL(Mean(SD)=29.8 (1.5)). The results demonstrated that the SFL requires a higher lower limb drive than a DFL. These biomechanical findings may be beneficial for table tennis athletes and coaches as a method of optimizing performance characteristics for both competition and training.

Key words: *table tennis, kinematic compare, lower limb, angular changing rate*

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INVESTIGATION OF THE LOYALTY OF PROFESSIONAL AND AMATEUR ATHLETE OF TABLE TENNIS PLAYERS TO SPECIFIC BRANDS IN THIS FIELD OF SPORT

Abstract
The purpose of this study was to assess the level of loyalty of professional and amateur athlete of table tennis players to specific brands in this field of sport. A total of 392 people aged in12-64 years, voluntarily completed the revised questionnaire on brand loyalty evaluation. The questionnaire assessed eleven factors naming: the brand name, product quality, price, product style, store environment, advertising, quality of service delivery, impact on others, social classes, lifestyle and volume of sales. The data were analysed by SPSS software version 19 using Kolmogorov-Smirnov, Chi-square, U man -Whitney and Friedman tests (all tests were performed at ≥ 0.05). The results of this study showed that there is a significant difference in the ranking of male and female athletes for different brands in priority of products. Also, there was a significant difference between the components of brand loyalty evaluation between male and female athletes and between athletes aged in 18 and under 18, but there was no significant difference between amateur and professional athletes in this component. Therefore, it seems that professional and beginner players are loyal to sports products and products in a similar ways .In addition, those who use and buy sport products with a famous brand, they are more influenced by the people around them in the case of the quality and style of the product they choose. As a result, the influence of people around them is an important factor in creating customer loyalty; which it means that brand names, which include high quality and high style, can create a high level of loyalty in customers. Since the loyalty factor directly affects the value of a brand name, it can have an important effect on the increase of profit owners.

Key words: *loyalty, brand, marketing*

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HISTORY AND ANALYSIS OF THE BACKHAND STROKE IN TABLE – TENNIS SPORT, FROM HUNGARY TO THE WORLD, WITH EMPHASIS ON NEW STYLES

Abstract
It is universally acknowledged that the implementation of the backhand stroke, as a primary and even decisive weapon, in TT top-world- level tournaments, was first clearly demonstrated by the Hungarian golden players: the legendry trio Barna, Laszlo and Gergely, over an incredible 50 years era, from the 1930^{s} to early 1980^{s}.
Though awaken at the pen hold-style deadly backhand weakness, the Chinese kept their faith high for the traditional- heritage school with only few top players have switched to shake hand style. It was not until late 1980s, after the historic 5set-zero win for Sweden against China, which invoked a dramatic migration of the majority of Chinese athletes to Shake-hand system. Really it was a tremendous display for the victorious backhand topspin technique over the Pen hold style.
The last 3 decades witnessed remarkable development for table tennis techniques in terms of power, spin and speed, including those for the backhand stroke. The poster should try demonstrating these developments, with emphasis on the latest innovated "3rd style" [next to Pen hold & Shake hand styles], named the "MG – Ship" style.

Key words: *Barna, Laszlo, Gergely, shake hand, pen hold, MG-Ship*

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BIOLOGICAL MATURITY AND THE RELATIVE AGE EFFECT IN DUTCH ELITE YOUTH TABLE TENNIS PLAYERS

Abstract
The relative age effect (RAE) in sports refers to the inhomogeneous distribution of the players' birth dates in one age category and its consecutive effects. It appears that in many sports the children who are born early after the reference date are more likely to experience success and to sustain participation. This can lead to an unfair environment regarding training and competition. This study investigated the birth distribution of Dutch elite youth table tennis in the age categories U11, U13, U15 and U18. It was also studied whether the players from different birth semesters differ regarding biological maturity. Data of 159 Dutch elite youth players (9-18 years, ♂83, ♀76) were included: birth semester (first or second after the reference date), birth cohort, sex and the predicted age to peak height velocity (pAPHV). Based on the results of this study is can be concluded that 1.) elite youth table tennis in the Netherlands is at risk for a RAE at certain age categories and specifically the younger birth cohorts within an age category and 2.) that the relatively younger elite players of the second semester have a significantly lower pAPHV (i.e. are more mature) than their older peers, which seems to beneficial to survive at the elite level in this context.

Key words: *racquet sports, youth sport, age to peak height velocity, birth-date*

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RELATIVE AGE EFFECTS IN ELITE TABLE TENNIS IN INTERNATIONAL AND NATIONAL CONTEXTS

Abstract
Although relative age effects in sports have been studied worldwide, the underlying mechanisms are still under debate. This study adds to the existing knowledge by providing a further exploration of the within-year and between-year effects and their possible interaction in an individual skill/technique based sport: table tennis. Data of male and female elite players across ages (U15, U18, U21 and senior) were collected from the ranking lists in international (world and Europe) and national contexts (France and the Netherlands). A multi-way frequency analysis per subsample revealed 1.) no interaction effects; 2.) significant within-year and between-year effects for the U15 players in the international context and male French players; 3.) a significant within-year effect in the French U18 category; 4.) a significant within-year effect in female European U21; and 5.) no within-year effects in the senior category. Table tennis seems to be at risk for within-year and between-year effects specifically within the context of high competitive level for younger players (U15, males and females), but not for interactions between these effects. Future research should reveal the development of the RAEs over time in a longitudinal study, evaluate influencing constraints and innovative prevention solutions in a more comprehensive way.

Key words: *racquet sports, relative age, effect, table tennis, youth*

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IS TABLE STARS @SCHOOL OF ADDED VALUE AS PART OF THE PHYSICAL EDUCATION PROGRAM IN PRIMARY SCHOOLS? – A PILOT INTERVENTION STUDY

Abstract
The Table Stars @school program was lautnched in 2010 to serve as a first introduction to table tennis in primary school children. The main aims of this study were to 1.) evaluate the effect of Table Stars @school on the perceptuo-motor skills and selective attention in primary school children in comparison to regular physical education and 2.) to find out how many and which children benefited more from Table Stars @school than regular physical education. A pilot intervention study was carried out including 177 children between 6 to 12 years from two regular primary schools. All children were tested by means of four perceptuo-motor tests (static balance, walking backwards, speed while dribbling, eye hand coordination) and a selective attention task (map mission). Both schools were exposed to both the Table Stars @school program and regular physical education in a different order. The results revealed no differences between the regular physical education classes and the Table Stars @school program on group level. Moreover, it was revealed that both interventions showed different responders. Consequently, Table Stars @school seems to fit in as it meets the level of improvement of regular physical education classes and it can be of added value by addressing other children to improve perceptuo-motor skills and selective attention.

Key words: *table stars, physical education and training, child, psychomotor performance, racquet sports*

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THE RELATIONSHIP BETWEEN BIORHYTHM AND SPORT PERFORMANCE IN TABLE TENNIS ATHLETES

Abstract
The aim of present study was to investigate the relationship between Biorhythm and sport performance in table tennis athletes. Seventy-eight male table tennis athletes (age=21.2±2.6 years and Competition experience=10±2 years) participated in this descriptive-correlated research voluntarily. The data were collected through sport performance questionnaire filled after athletes' competition of knockout round. The results of biorhythm were delineated by biorhythm software in which the exact athletes' born dates were employed. The statistical chi-square and three- way analysis of variance tests were used in SPSS ver22 Software. The results of chi-square test showed a significant difference between the match and situations of physical, emotional, and intellectual cycles ($p<0.01$).Also, the results of three-way analysis of variance showed significant differences between variant types of physical cycle and athletes' performance ($p=0.008$, $F=5.3$), and emotional cycle and athletes' performance ($p=0.038$, $F=3.468$), but no significant differences were observed between variant type intellectual cycle and athletes' performance($p=0.008$, $F=5.3$).It seems that variant phase of biorhythm cycles can affect the performance of table tennis athletes. Therefore, Table tennis coaches are advised to select the athletes for matches based on the appropriate biorhythm cycle phase.

Key words: *biorhythm, performance, table tennis, descriptive-correlated research*

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"MATCH ANALYSIS" USING NOTATIONAL ANALYSIS IN TABLE TENNIS

Abstract
China dominates World Table Tennis, moreover, Japan also has risen from past a decade!!
Withal technical, physical, mental training in place, one crucial aspect they work on is "Specificities"!
With more and more science and technology permeating sports, Notational Analysis is an empirical method that collects objective data, analyses player's performance and helps coaches to work on specificities. Franks and Millers, during research (in 1986, 1991), stated that post a match, coaches can recollect only 30% of the key factors that determine performance. Thus, capturing objective data and analysing a match plays a pivotal role in determining an athlete's performance.
The aim of this paper is to explain how advance data analytics is applied to notation analysis for creating "in-depth match analysis" solution and "athlete profiling". The in-depth "match analysis" solution, delves into every minuscule aspect of an athlete's performance, be it technical or tactical. Many matches have been analysed for amateur and professional athletes from India, Junior & youth primarily during this study. The results from this match analysis were remarkable and the feedback from coaches was very encouraging. Further, a collection of the large set of athlete's data converges to "athlete profiling" that asserts trends, track patterns, errors and progress. This helps coaches in understanding the profound mistakes and anomalies of the players and planning a very specific training program accordingly. Additionally, player's reviews were also captured post their matches to substantiate discrepancies, if any. It is not strange but interesting that 80% of the players had presumptions about their performance that don't conform with match analysis. Such disparities clearly depict a strong role of in-depth match analysis and athlete profiling in redressing player's presumptions and apprehensions.

Key words: *notational analysis, match analysis, table tennis analysis, racket sports analytics, athlete profiling*

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THE RELATIONSHIP BETWEEN REACTION TIME, EYE-HAND COORDINATION WITH VISUAL FIELD IN ELITE TABLE TENNIS PLAYERS

Abstract
The aim of this study was to investigate the relationship between simple reaction time, choice reaction time and eye-hand coordination with visual field; peripheral and central vision in elite female adult and teenager in table tennis players. 10 female players with a range of 19.7± 5.964, were member of Islamic Republic of Iran's national table tennis for participate in the 18th Asian Games 2018 Jakarta, were selected as convenience. Visual field measured with Humphrey perimeter (2011) and performed in Basir Eye Center specialist clinic. Choice and simple reaction time were measured with Deary-Liewald test (2011) and eye-hand coordination were measured with throw the ball to wall test (1997). The data were analysed by Pearson correlation.
The results show that there is no significant relationship between the simple reaction time with the peripheral vision of both eyes, and also, there is no significant relationship between choice reaction time with peripheral vision of both eyes. There is a significant relationship between simple reaction time with the central vision of left eye ($p \leq 0.05$), but there is no significant relationship between simple reaction time with central vision of right eye. According to data analysis, there is no significant relationship between choice reaction time and the central vision of both eyes. There is no significant relationship between eye - hand coordination and visual field.
According to research conducted, this study is one of the first studies to investigate the relationship between the simple and choice reaction time and eye – hand coordination with visual field in elite table tennis players. Therefore, this study is suggested table tennis exercises increased variable related to peripheral and central vision. This finding need to investigate the larger sample size and also compare with novice players or different level of skills in Racket Sports.

Key words: *eye-hand coordination, peripheral and central vision, simple and choice reaction time, table tennis*

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VISUALIZATION ANALYSIS OF RESEARCH FRONTIERS AND HOT SPOTS IN TABLE TENNIS

Abstract
This research selected 477 articles indexed by the Web of Science using the table tennis as the key word. The CiteSpaceIII software was used to visualize the research status of table tennis with keyword co-occurrence analysis and burst term analysis. This research explored the frontier and hot spot topics of table tennis research from 1996 to 2019. This research found out that the key words that showed high frequency in the publications concerning table tennis were mainly distributed in the fields of table tennis, sport, players, exercise and expertise. In the future, table tennis, table tennis players and performance will become the forefronts in table tennis research. The findings of this research may have some implications for researchers in this field.

Key words: *table tennis, visualization, frontier and hot spot*

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ANALYSIS AND PREDICTIVE CLASSIFICATION MODEL OF ATHLETES' BRAINWAVE BASED ON MACHINE LEARNING - A CASE STUDY OF TABLE TENNIS ATHLETES IN TAIWAN

Abstract
The psychological states of athletes will influence the performance of competition. Different levels of concentration and mental representations of each sport will reflect on brainwaves. The related brainwave researches of sports' field are applying scientific analysis to provide quantitative data, which provide researchers, coaches, and players to understand the psychological states of athletes during sports. Obviously, the performance of certain sports is related to the α frequency of brainwave, the psychological states of players in different sports can be analysed with other frequencies. The proposed method in this study can be used as a prototype of high potential players' selection system in the future or can be used as adjusting the mental state for active athletes to improve training efficiency and performance.
This study aims to establish classification model of sports by analysing electroencephalogram (EEG) of athletes with data mining techniques. In data collection, collects the EEG with pressure of the athletes with filling out the questionnaires in limited time. In data analysis, applies the Butterworth low-pass filter to remove noise before converts the EEG to power spectral density by Fast Fourier Transform, then extracts 24 features according to frequency bands and statistical methods as the basis of the classification model. Last but not least, constructs the classification model by machine learning algorithms such as C4.5 and CART and compares the accuracy of different classifiers.
By means of proposed sports classification model coordinated with other biotechnologies such as electrocardiogram and electromyogram, which can help athletes and prospective athletes to well understand psychological conditions and choose more appropriate sports.

Key words: *athletes, players' selection system, electroencephalogram, Butterworth low-pass filter, Fast Fourier Transform, C4.5*

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AFFECTIVE EXPERIENCES AND BENEFITS OF TABLE TENNIS FOR YOUTH AND ADULTS: A REVIEW OF LITERATURE

Abstract
In recent years, mental health issues have led to an increased attention to the affective benefits of participation in sport. The question that concerns the present study was 'can table tennis contribute to the affective development for health?' The purpose of the study was to explore how the empirical research has reported on their affective experiences and benefits in both competitive and recreational settings. A literature search was conducted through EBSCO databases and Physical Education Index with the search term 'table tennis'. Peer-reviewed studies published in English until December 2018 that examined concepts and achievements related to the affective domain in table tennis will be included. A total of 10 studies were identified that satisfied the inclusion criteria. The review found that three main themes of the affective experiences and benefits could be recognised: motivation, stress coping, and emotional process during competition. In addition, this review highlighted that motivation is associated with recovering from stress and negative emotions among table tennis players. This review concludes by suggesting that the empirical research shows evidence that table tennis participation can be beneficial to the affective domain. Nevertheless, little has been reported on the interaction of teaching and outcomes in order to understand how and why the affective development occurs.

Key words: *mental health, motivation, stress coping, emotional process*

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TABLE TENNIS UMPIRE TRAINING VIDEO DESIGN BASED ON VIRTUAL REALITY TECHNOLOGY

Abstract
The umpires are the keepers of order in the game, and so are the umpires in table tennis. Table tennis associations in various regions need to spend a certain amount of manpower and material resources for the training of referees every year. In order to improve the efficiency of table tennis umpire training, enhance the experience of trainees in the training process, reduce the consumption of resources. This paper adopted the methods of literature review, expert interview and experiment. Used the virtual reality technology to design table tennis umpire training video. The training video included the whole process of the umpire's on-the-spot work and the handling of some unconventional problems. The video simulated the actual scene of table tennis competition through virtual reality technology, and designed human-computer interaction steps at key nodes, and requiring students to make correct responses in the corresponding parts to continue the subsequent learning. If students made mistakes in the process of interaction, the computer would automatically identify and feedback the correct way to guide students to complete. The content of training video was comprehensive, and systematic, and it was easy to use and promote. And it could also save huge manpower and material resources for the table tennis associations in various regions. Meanwhile, it could train more and more excellent referees for ITTF.

Key words: *virtual reality technology, table tennis, umpire, training*

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PERCEIVED ANGER PROFILES IN TABLE TENNIS PLAYERS: BURNOUT AND COPING

Abstract
The aims of the study were to identify anger profiles in table tennis players and examine whether participants from distinct profiles significantly differed on burnout and coping. A sample of 180 Spanish table tennis players (M_{age} = 33.87; *SD* = 16.64) participated in the study and completed the following questionnaires: The State-Trait Anger Expression inventory (STAXI-II), The Coping Inventory for Competitive Sport (CICS), the Athlete Burnout Questionnaire (ABQ) and the Oviedo Scale of Infrequency Response (INF-OV). Cluster analyses revealed two anger profiles: (a) profile 1 with low scores in: temperament, external anger expression, internal expression and reaction; and high values in external control and internal control; (b) profile 2 with high: temperament, reaction, external expression, internal expression and low levels of external control and internal control. Results of MANOVAS revealed significant differences across profiles on emotional/physical exhaustion, reduce feeling of accomplishment, sport devaluation, resignation, distancing and venting emotions. Concerning these results, it is important to point out that profile 2 was the profile with the higher punctuation in all significant variables. As conclusions, it is important to remark that there are two different anger profiles in table tennis players with different management of anger. Furthermore, cluster analysis has shown to be a good approach to understand anger emotion from a person-centred perspective in table tennis.

Key words: *emotion, sport, management, dropout*

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SPANISH TABLE TENNIS PLAYERS EMOTIONAL PROFILES: RELATIONSHIP WITH BURNOUT AND COPING SKILLS

Abstract
The wide variety of emotions that can occur in table tennis competition could be a difficult issue to be handled by table tennis players. Concerning this issue, the goals of the present work were to: (a) identify the dispositional emotion profiles in table tennis competition; and (b) examine if table-tennis players from different emotion profiles significantly differed on burnout and coping. A sample of 180 Spanish table tennis players involved in clubs with coaches (M_{age} = 33.87; *SD* = 16.64), completed the following questionnaires: The Sports Emotion Questionnaire, the Coping Inventory for Competitive Sport, the Athlete Burnout Questionnaire (ABQ) and the Oviedo Scale of Infrequency Response (INF-OV). The Cluster analyses revealed two dispositional emotional profiles: (a) High unpleasant emotions and moderate pleasant emotions (HUE); and (b) high pleasant emotions and moderate unpleasant emotions (HPE). Results of MANOVAs showed significant differences across emotional profiles on burnout and coping. In particular, athletes from the HUE reported significantly higher scores of emotional/physical exhaustion, reduced accomplishment, sport devaluation, resignation, distancing, venting emotions and mental distraction in comparison to athletes from the HPE. As a whole, athletes from the HUE profile could be particularly at risk developing dysfunctional coping strategies and experiencing burnout symptoms. Thus, it would be interesting to develop empirically proven interventions designed to help athletes modify maladaptive emotion profile (HUE) and/or stabilize adaptive one (HPE) in order to maximize their psychological adjustment to table-tennis competition.

Key words: *burnout, cluster analysis, coping, emotion profiles, table tennis competition*

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EXPLORATION ABOUT THE COMPETITIVE PERFORMANCE AND WINNING RULES OF TABLE TENNIS BASED ON BOARD CHARACTERISTICS IN THE CONTEXT OF THE NEW BALL ERA

Abstract
In order to exploration the competitive performance and winning rules of table tennis in the context of the new ball era, this paper adopted the methods of documentary, video observation and mathematical statistics, to summarize and analyse the characteristics of the boards in the men's World Cup from 2014 to 2018. The result showed that, there would be a stalemate with a large number of boards occasionally, but generally not more than 13 boards, mainly concentrated in a round of 2-6 boards, and the average number of boards in each round is about 5 boards. The scoring rate and the frequency of scoring were very high in the first boards. There was a close correlation between the receiving score and the other main boards, and there was no correlation between the fifth board scoring and the sixth board losing and the other boards. In addition, there was a significant difference between the data of two or three boards in one round in 2018 and that of previous years. Draw the following conclusions: Under the new ball era, the first three boards was still an important part to establish the advantage of the game, and the core position of the game has been replaced by the receiving; The fifth board and the sixth board were the key points of the attack and defence conversion, which could reverse the situation to a certain extent; The best way to curb the mighty receiving was to increase the proportion of long balls when service.

Key words: *table tennis, the new ball era, boards, competitive performance, winning rule*

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RELATIONSHIPS BETWEEN PERCEIVED COACHING LEADERSHIP, COPING AND EMOTIONS AMONG TABLE TENNIS PLAYERS

Abstract
The influence of coach leadership in sport context has been widely investigated by research community, due to its salient impact on a variety of sport outcomes such as performance, satisfaction, motivation, or dropout. Therefore, the aim of this study was to examine if coach leadership predict athletes' coping which in turn predict emotional outcomes in competition. A sample of 180 table tennis players (M_{age} = 33.87; *SD* = 16.64; 149 men and 31 women) accepted to participate. In order to measure the different variables, the Leadership Sport Scale (LSS), the Sports Emotion Questionnaire (SEQ), the Coping Inventory for Competitive Sport (CICS), and the Oviedo Scale of Infrequency Response (INF-OV) were completed by participants. A partial least square path modelling (PLS-PM) approach was used to examine the relationships between the study variables. The results of PLS-PM showed that: (a) coach democratic behaviour significantly predicted task-oriented coping; (b) task-oriented coping significantly predicted excitement and happiness; and (c) distraction-oriented coping significantly predicted anxiety, dejection and anger. As a conclusion, coach democratic behaviour was the only style that is related with coping (task-oriented coping), whereas task-oriented and distraction-oriented coping were linked with table-tennis players' emotions (excitement, happiness anxiety, dejection and anger). Thus, coach democratic behaviour could be the more adaptive style in relationship with positive table-tennis players' outcomes (coping and emotion). Consequently, it would be interesting to teach table tennis coaches to get a democratic style in terms of leadership.

Key words: *racket sport, explanation, perception, competition*

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DYNAMIC VISUAL ATTENTION ON MOT OF ELITE TABLE TENNIS PLAYERS

Abstract:
Visual skills have been reported by several research as the important role for sport performance. However, limited studies have investigated visual multiple object tracking skill of athletes. The purpose of this study was to analyse the dynamic visual attention of elite table tennis (TT) players by using multiple object tracking task (MOT). Eleven elite male players age between 18 to 25 years old were recruited from the National Taiwan University of Sport (NTUS) and 15 non-athlete males of the same age were enrolled as the control group. All participants received MOT in different conditions. We manipulated the velocity (0.6, 0.9 & 1.2 deg/s), and number of targets (tracking 1 or 2) in four visual fields. Different conditions were displayed randomly. Two-way ANOVAs with mixed design were used to analyse the correct rate in different conditions between elite TT group and control group. The result showed that elite TT players had significant better performance than non-athletes on overall different conditions of MOT tasks ($p = 0.033$) and both group performances were significantly better in bilateral arrangement than in unilateral arrangement when tracking 2 targets with the same velocity ($p < 0.001$). Conclusion: According to the hemisphere-specific resource theory, this study identified that elite TT players have significantly better dynamic visual attention in both hemispheres than the control group. This study may provide a new useful indicator for talent identification in TT players. Investigations among different sports and levels of athletes can be conducted in the future studies.

Key words: *dynamic visual attention, multiple object tracking, sport talent identification, table tennis*

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TRAVEL MEDICAL ISSUES AFFECTING THE ATHLETE'S HEALTH AND PERFORMANCE

Abstract
The athlete's performance is closely correlated to the health status. The periodic health examination is important to monitor chronic diseases, previous injuries, vaccinations…
Travelling represent a risk factor of athlete's illness. Sick athlete may not perform well or even miss the competition. There is 2-3 times increased risk of all illnesses when travelling to destinations more than 5 time-zones difference. It appears high incidence is related to the destination, not the travel. There's a higher risk of respiratory, gastrointestinal, dermatological and all infective illnesses. North/south travel is associated to increased risk of illnesses related to seasonal differences. There's a risk of tropical infections especially in Africa. The medical staff challenge is to reduce illnesses risk in the travelling athlete. They should be aware of the higher risk periods and expected illnesses (destination). Manage illnesses history and allergies. Apply required vaccinations and chemoprophylaxis. Know the destination (altitude, weather, pollution, allergens, foods, water, infections). Manage Jet Lag and travelling fatigue. Plan medical kit, medication, nutrition and fluids. Establish a contact with medical colleagues/ services in the destination country. Educate athletes about weather precautions, appropriate foods and drinks, infections and allergies preventive measures and reporting symptoms early (treatment, isolation if needed).

Key words: *athlete, travel, health, illnesses, performance*

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ACTIVE METHODOLOGIES COMBINED IN THE TEACHING OF RACKET SPORTS AT THE UNIVERSITY. AN EXPERIENCE WITH STUDENTS OF SCIENCE OF PHYSICAL ACTIVITY AND SPORTS OF THE UNIVERSITY OF SEVILLA (SPAIN)

Abstract
ICTs have been a revolution in all areas of society in general and in education and sports in particular. In parallel, the incorporation into the EHEA has led to the need to adapt the teaching practice to its lines of action, determined, basically, by adjusting education to these new subjects. Under this context, this experience arises through the application of active methodologies, in which the main purpose was to know if the student is capable of acquiring the knowledge of the subject without the master class, showing besides the different tasks proposed, the results, the difficulties and advantages perceived. The instruments used were the different active methodologies. Of the 25 students who participated in this educational experience, 90% managed to pass the subject, among which, around 34% achieved very high scores. The level of satisfaction of the students with respect to the methodology used, the scores obtained were around 8.4 / 10 points. Although the use of these methodological procedures implies a constant teaching evaluation, the results obtained, as well as the degree of satisfaction emitted by the students are very positive, so they have a great impact on their motivation and updating of their future teaching activities.

Key words: *active methodologies, racket sports, university*

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ANALYSIS OF SPORTS INJURIES IN ELITE COLLEGIATE TABLE TENNIS PLAYERS

Abstract
Sports Injuries may affect athletes' performance and sport careers. This is an important issue needs to be noticed by athletes, coaches, and medical practitioners. The purpose of this study was to analyse sports injuries in elite collegiate table tennis (TT) players. We recruited 25 elite TT players (8 international levels: 5 males and 3 females, and 17 national levels: 9 males and 8 females). All participants have played TT over 8 years and trained regularly over 15 hours per week. They were invited to the sport injury clinic examined by an experienced doctor major in sports medicine and they were also asked to complete the TT sport injury questionnaire. After evaluations, 17 players (68%) had sports injuries which affected their training and competition and 8 players (32%) had not sports injuries. Seven international players (87.5%) and 10 national players (58.8%) reported to have sports injuries, respectively. In injury areas between genders, male players tend to have higher percentage in shoulder (70%), low back (90%), and knee (40%) , and female players tend to have higher percentage in wrist and forearm (57.1%), shoulder (42.9%), hip (42.9%) and low back (42.9%). Generally, 10 out of 17 players (58.8%) have reported injuries in shoulder and 12 out of 17 players (70.6%) have injuries in low back. We identified that the higher injury areas may relate to TT-specific skills. Particularly, more shoulder and low back pains may relate to forehand attacking strokes such as forehand topspin and smash. This study may provide useful information for TT coaches and players to have proper muscle strength and conditioning training and also avoid TT overtraining in order to prevent TT-specific injuries.

Key words: *table tennis-specific injuries, skills, prevention, rehabilitation*

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INVESTIGATION OF VARSITY TABLE TENNIS PLAYERS' LEISURE PREFERENCE IN TAIWAN

Abstract
The purpose of this study was to investigate the attitude and views on leisure sports of varsity table tennis players in Taiwan. Twenty-five varsity table tennis teams were involved in the study with 368 questionnaires analyzed. Frequencies, percentages, means, standard deviations, t tests, one-way ANOVA and Scheffe's method were used to calculate the results for the study. The findings showed: (1) Top three leisure sports with highest participation rate were table tennis, jogging, and weight training. There was no significant difference in the participation rate between male and female. Nearly one-third of varsity players were willing to spend more than 2000 NT per year for sport related expense. However, close to one-third of respondents hoped to spend 500 NT or less per year. (2) Top three motives for varsity players to participate in leisure sports were to be healthy, to learn new sport and to relax. Lack of time was the top reason to prevent respondents from participation. (3) Regardless of gender, players agreed on participating in leisure sports bring positive benefits that would keep them going. (4) Regardless of years of play, varsity players believed they benefited mentally, spiritually, and physically by participating in the leisure sports.

Key words: *table tennis, leisure motive, leisure preference, leisure sports*

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THE EFFECTS OF A TABLE TENNIS PHYSICAL EDUCATION COURSE ON THE HEALTH AND WELLNESS PROFILES OF FEMALE STUDENTS

Abstract
The study was conducted to determine the effects of a service physical education table tennis course on the health and wellness profile of female students even with a limited time. In the study, the participants (n = 16) were made to undergo one semester (34 hours) of an actual table tennis class which is the standard duration of Physical Education courses in the Philippines. The level of significance was at alpha=0.05. Using descriptive measures, the data revealed that their body fat percentage in the post-test mean = 24.9200 was significantly lower than in their pre-test mean = 26.0667. The pre-test and post-test body fat percentage had a mean difference of 1.1467 with p-value less than 0.05. Their resting metabolic rate had a post-test mean = 1027.6000 which was significantly lower than their pre-test mean = 1137.2000. Their resting metabolic rate mean difference = 109.6000 and p-value less than 0.05. Their body water percentage had a post-test mean = 55.9800 which was significantly higher than their pre-test mean 54.5100. Their resting metabolic rate had a mean difference = -1.4700 with p-value less than 0.05. There were no significant differences in the pre-test and post-test mean in the students' visceral fat and physique rating.

Key words: *service physical education, body fat percentage, body water percentage, resting metabolic rate*

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PERCEPTUAL PERFORMANCE IN ELITE TABLE TENNIS PLAYERS

Abstract
Background & Purpose: The main characteristics of table tennis (TT) require that players making decisions in a short time during competition which means elite players have to process perceptual information rapidly. In addition, players need to transfer their attention between different site of opponents and ball during rallies. Therefore, the aim of this investigation was to figure out the features of perceptual performance in elite table tennis players. **Methods:** Twenty-three elite TT players at the National Taiwan University of Sports (mean age: 19.35 years, SD: 2.50) and 15 non-athlete males (mean age: 21.53 years, SD: 1.36) were recruited in this study. Players were receiving regular training at least 15 hours per week for at least 7 years. Participants were measured with the Covert Orienting of Visual Attention Tasks (COVAT) paradigm (Posner, 1980) for testing their ability of attention shifting (simple task). To increase the difficulty of task, we also asked participants doing the modified COVAT by responding with upper and lower- extremities in the complex task. Invalid-cue effect (ICE) was calculated to represent the ability of attention shifting. We used four-way mixed-design to compare reaction time on the COVAT task. Besides, ICE values of three tasks were analysed with a three-way ANOVA, including groups, extremities, and sides. **Results:** We found main significant effect of extremity and cue type ($p<0.05$) in COVAT reaction time and main effect of extremity and side in ICE values. However, there is no significant main effect of groups in reaction time of COVAT tasks and ICE values. **Conclusions:** Although there is no significant main effect of groups among COVAT reaction time and ICE values, elite TT players showed a trend of faster reaction time in several conditions. Future studies can focus on those conditions as a reference of talent identification in TT.

Key words: *table tennis, perceptual performance, talent identification, attention*

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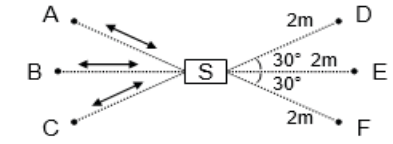
DEVELOPMENT OF TABLE TENNIS-SPECIFIC AGILITY TESTS

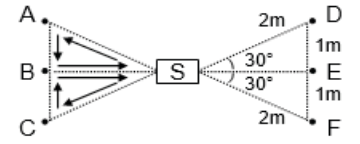
Abstract

Limited agility tests have been developed and used for table tennis. The purpose of this study was to develop table tennis agility tests and determine the validity and reliability of those tests. Twenty college table tennis players (13 males and 7 females) and twenty-five college sprinters (18 males and 7 females) participated in the study. All participants performed a table tennis agility test I (TTAT I, see Figure 1), a table tennis agility test II (TTAT II, see Figure 2) and T-test agility test (TT). All 3 tests were carried out in 2 trials. Validity was assessed using the fastest times for the TTAT I, the TTAT II and the TT, and reliability was assessed using the time from two trials. The results found significant difference in TTAT I (table tennis = 14.07±1.12s, sprint = 14.49±1.13s), and no significant differences in TTAT II (table tennis = 11.21±0.63s, sprint = 11.31±0.66s) and TT (table tennis = 11.66±0.81s, sprint = 11.74±0.94s) between table tennis and sprint athletes. The TTAT I and the TTAT II was significantly correlated to the TT ($r = 0.661$ and $r = 0.706$; $p<0.001$). There was a strong correlation between the TTAT I and the TTAT II ($r = 0.826$; $p<0.001$). In addition, results of intra-class correlation coefficient indicated excellent test-retest reliability for TTAT I, TTAT II and TT (ICC: 0.928-0.970). The findings indicate that the new table tennis agility tests are a valid and reliable tool to appropriately measure agility in table tennis players. The future study may examine different levels of table tennis players to further identify the differences of agility abilities.



Procedures: S-A-S-B-S-C-S-D-S-E-S-F-S

Figure 1. Schematic illustration of the table tennis agility test I (TTAT I)



Procedures: S-A-B-S-C-B-S-D-E-S-F-E-S

Figure 2. Schematic illustration of the table tennis agility test II (TTAT II)

Key words: *agility, change of direction, sport-specific fitness, physical ability, field testing*

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SPLITT-PONG AS AN EASY TOOL TO SELECT TALENTS FOR TABLE TENNIS

Abstract
To find and select table tennis talents is not an easy job. First of all, organize an event either at your club or in schools. The appropriate advertising and needed equipment are very important. SplitT-Pong is an afloat table with measurements of 200cm X 120cm. With SplitT-Pong you can play ping-pong in the water. You can easily move the table and transport it by car. Getting started with SplitT-Pong is equally easy: you put the table into the water, start to play and many children will want to join you. The rackets of SplitT-Pong are glove-paddles which give you a feeling of playing with your palm. The diameter of the SplitT-Pong's ball is about 5 cm, and it is made from rubber or sponge. The shape of the paddles and the ball makes it possible to learn SplitT-Pong in no time. The real talents can play after 2-3 minutes and enjoy the game. The rules are much simpler than in table tennis. You play outside and not in the hall, with large balls allowing you to play in the wind (up until 5 m/s). Another advantage of SplitT-Pong, that you can adjust the high of the table in the water. Despite the differences between SplitT-Pong and table tennis, the same qualities are needed for both types of entertainment. We make recruitment for table tennis mainly in the summer and in the leisure time of children. This is much more effective than the conventional recruitment.

Key words: *table tennis, SplitT-Pong, select talents, recruitment*

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ANALYSIS OF 3S STRATEGIES OF TABLE TENNIS PLAYERS IN SERVICE AND RECEIVING SERVICE: USING THE DECISION TREE

Abstract

Speed, spin, and spot (3S) are the key to victory in table tennis (TT) competitions. This study aims to analyse how the Japanese 15-year-old talented TT player Tomokazu Harimoto (World Ranking No 3) apply the complex 3S strategies in service and receiving the service during highly competitive matches. The 3S principles (Wu, 2011) as the major foundation of this study, we used big data to interpret the hidden information when Harimoto served and received the service, and then employed the decision tree to identify the numerical meanings of each segmental attribute. Moreover, we used the Weka analysis software and applied J48 algorithm to construct the model of the decision tree. The data behind this study were collected from Harimoto´s four matches against four of top players between 2017 and 2018. Besides, we analysed vital attributes that may affect Harimoto's performance in the process of service and receiving the service, such as opponents, techniques, speed, spin, spot, game momentum, point momentum, service sequence, etc. The study found three main results. First, the most important attribute that affects Harimoto's strategy of the „spot" of service is the opponent, followed by the game momentum, and finally the point momentum and the service sequence. Second, the most important attribute that affects Harimoto's strategy of the „spin" of service is the opponent, followed by the game momentum and the service sequence. Third, the important attribute that affects Harimoto's technique when receiving service is the opponent's serving spot, followed by the spin, opponents, and game momentum. Through the analysis of the decision tree

in TT matches, we may effectively interpret the complex 3S of a player during the game. This study only focuses on Harimoto's service and receiving service as an individual case. We suggested that the follow-up research would increase the number of strokes up to the fifth stroke in the decision tree in order to provide players and coaches with a more complete operational strategy.

Key words: *data mining, technique and tactics, service, receiving service*

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COMPARISON AND ANALYSIS OF THE TECHNIQUES AND TACTICS OF ZHANG JIKE USING NEW PLASTIC BALL AND CELLULOID BALL IN THE MATCH

Abstract
As a result of rapidly changing the ball material in table tennis competition. It has brought great challenge to the table tennis players' technique and tactics. It is necessary to understand the impact of material changes in the ball on players' technique and tactics. This paper based on the methods of video observation and mathematical statistics, this paper makes a systematic technical and tactical analysis of Zhang Jike's six games in London 2012 which used the celluloid balls, and 2016 Rio Olympics which use the new plastic balls. In order to find out the impact on Zhang Jike's technique and tactics by using the celluloid balls and the new plastic balls. The results shown that after using the new plastic table tennis, Zhang Jike's technique and tactics had little change, but the technical quality was decreased, and the continuous attack ability was obviously decreased.

Key words: *table tennis, technique and tactics, ball material*

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THE INTELLIGENT RACKET DESIGN AND APPLICATION WITH WIRELESS SENSORING AND MEASURING FUNCTIONS

Abstract
A combination of intelligent sensing and sports technology has covered a wide range of sports. The purpose of this study was to integrate the intelligent sensor to develop an intellectual racket to analyse the hand motions in table tennis (TT) players. The hand motion by detecting the attitude of TT racket when the player uses the intellectual racket t o do the powerful forehand stroke. One motion sensor is set on the inner handle space of the table tennis racket. The motion sensor includes a 3-axis accelerometer, a 3-axis gyroscope, and a 3-axis magnetometer which are MEMS (Micro Electro Mechanical Systems) sensors. The data of the inertial sensor and the magnetic sensor are fused to receive the data of the attitude by AHRS (Attitude and Heading Reference System) algorithm. The attitude detection refers the magnetic field of the earth. The attitudes data of sensor is gathered into a low power consumption microcomputer (Cortex-M3) and all data are sent to the computer by Wi-Fi. The TT racket attitude simulation, and 3-axis accelerometer and a 3-axis gyroscope are computed with Matlab software on the computer. Besides, the TT racket attitude and trajectory are presented on the screen with the Unity software to show the comparison on a liner chart between an excellent TT player and a new beginner. Through the preliminary test of the study, the specific racket is able to capture the nine-axis data of the player's swing and use the EXCEL program to draw the nine-axis data changes and obtain the sports data for the TT players.

Key words: *table tennis, intelligent sensor, AHRS*

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TECHNICAL ANALYSIS OF MEN'S SINGLES FINAL IN THE 2017 WORLD TABLE TENNIS CHAMPIONSHIPS

Abstract
This study was based on the men's singles champion Ma Long, who won the 2017 World Table Tennis Championships, and his final opponent, Fan Zhendong. Video recording was used to analyse and compare various technical performances of their competition. By doing the statistical analysis and discussion, the following conclusions were drawn: (1) The three-staged techniques scoring for Ma Long were: 'attack after serve' and 'rally' were rated "excellent", whereas 'attack after receive' was rated "fail". His technical characteristics were fast in movement, fast paced game, and powerful serve. In addition, usually he was able to score critical point. While playing, often he could make critical attacks and endure long rally with positive attitude to win the point. Although he rarely returned the ball using 'attack after receive' technique, he could effectively position the landing point of the ball when receiving the serve. Therefore, he was able to win the 2017 World Table Tennis Championships in Men's singles. (2) Fan Zhendong's three-staged techniques performance was solid, but it did not score as well as Ma Long's. Overall, he got "excellent" in 'attack after receive', but was rated "fail" in both 'attack after serve' and 'rally'.

Key words: *table tennis, attack after serve, attack after receive, rally*

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COMPARISON OF MOTIVATION AND CURRENT MENTAL STATES BETWEEN ABLE-BODIED TABLE TENNIS PLAYERS AND ("STANDING") TABLE TENNIS PLAYERS WITH PHYSICAL IMPAIRMENT

Abstract
For a competition result in table tennis, psychological factors are of great importance. The aim of this work was to compare differences in perception of motivation and current mental states between able-bodied table tennis players and „standing" table tennis players with a physical impairment. We used a method of qualitative research using an online non-standardized questionnaire with closed answers. The questionnaire was running for 7 days and respondents were addressed individually, either by phone or email address and Facebook. We managed to get answers from 41 respondents – 20 able-bodied players and 21 standing players with physical impairment. Majority of players in both groups reported that they were motivated to play table tennis by intrinsic motivation. The group of able-bodied players have preferred social prestige, while standing players with physical impairment wanted to be better than the others and to qualify to the national team. Non-significant difference was found in perception of pre-competition state, anxiety perception and in a way how the players deal with them. In comparison of motivation and psychic states perception, non-significant differences were found among both groups. However, in table tennis players with physical impairment, there was a slight trend to higher rate of perceived „competition fever", higher perceived anxiety or fear during the competition. This can be of importance for coaches/psychologists to better understand how the players are motivated, and on this basis to work with them individually while searching for new talents.

Key words: *table tennis, para table tennis, motivation, mental states*

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AN INTEGRATED TABLE TENNIS RACKET DESIGN WITH DETECTING MOVEMENTS OF ATHLETES

Abstract
Measurement and analysis of the motion states of athletes is important tasks. Most of sports may use multiple sets of wireless sensing nodes to tie multiple moving parts in bodies. However, such experimental design may cause participants to be unable to simulate the situations of the game. Therefore, in order to reduce the inconvenience of the table tennis (TT) players, when tested, and try to meet the actual handle feel. This study designed an electrical sensing and transmission module which placed in the hollow space of the billiard grip. The sensing circuit uses a nine-axis sensor, including a 3-axis accelerometer, a 3-axis angular accelerometer and a three-axis electronic compass. In addition, the WIFI transmission module is used to achieve a sufficiently high sampling rate to detect the hitting action of the tested athlete. This integrated table tennis racket has be designed almost the same appearance and weight as a general racket. We will demonstrate it during the conference presentation. Therefore, the racket of this study can be applied not only to measure some TT related variables in general training, but also to simulate the hitting movements during competitions. We may also apply the objective measurements for TT players with playing arm problems to consider the conditions of players' hitting skills after injuries in upper extremities.

Key words: *table tennis, intelligent sensor, AHRS*

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ANALYSIS ON HEALTH-RELATED FITNESS OF TABLE TENNIS COURSE IN UNIVERSITY STUDENTS

Abstract
Purpose: This study aimed at the health fitness test of elective students in the table tennis course of National Chung Hsing University. Hoped to evaluate the fitness of students by statistical results, and then served as a reference for organizing physical education curriculum. **Methods:** According to the test time of health fitness, the tests of body mass index, explosion strength, flexibility, muscular strength and muscular endurance, and cardiopulmonary endurance were included. All the data were analysed by descriptive statistics, and then compared to one-way ANOVA for students who choose the table tennis course in different terms. **Results:** First, the body composition of students who ever took table tennis courses in three different calendar years was no difference. Second, the flexibility and muscular strength and muscular endurance both reached a significant difference in each term among the healthy fitness pointers. **Conclusion:** The significant difference of flexibility and explosion strength between male students in elective table tennis course is the pointer that needs to be strengthened, so is the declining performance. A better performance of muscular fitness has no direct influence on cardiopulmonary endurance, which can be studied continuously.

Key words: *Chung Hsing University, table tennis course, health-related fitness*

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A CASE STUDY: PSYCHOLOGICAL SUPPORT FOR TEAM JAPAN IN WORLD JUNIOR TABLE TENNIS CHAMPIONSHIPS-EXPLORING ACTIVITY PRINCIPLES OF PSYCHOLOGICAL SUPPORT DURING A GAME

Abstract
In table tennis world, cases that professional of psychological support is going with National Team during a Game (World Tour, Championships, World Cup...) are very few. The few professionals are groping how should I practice psychological support activity in term of the Game while trying to engage their professionality with psychological problems of National Team members, and asking themselves whether my support activity is adequate for them or not. "Psychological support during a Game" is applied field of sport psychology, so it is expected that activity principles of it will be constructed with continuous practices and case studies. Therefore, purposes of this case study are as follow.

1. to find out significant points of "psychological support during the Game" from psychological support cases for Japanese medallist of the Game.
2. to find out problems of "psychological support during the Game" from psychological support cases for Japanese loser (lose medal) of the Game.

Subject Game of this case study is World Junior Table Tennis Championships in 20XX. Professional of psychological support had been practicing 61 sessions during the Game and pre-camp of the Game for TEAM JAPAN. I will show you some support cases, and some significant points and problems in them.

Key words: *psychological support, during a game, activity principles*

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THE STUDY ON THE DISABLED TABLE TENNIS PLAYER'S JOURNEY – ON THE PARALYMPIC GAMES PROCESS

Abstract
Purpose: The journey of becoming an elite athlete is worthwhile to reflect and learn, that being said, for those elite disabled athletes, their process of becoming one is more noteworthy and remarkable. In this study, we expect the result to immensely inspire other disabled athletes. Therefore, this study is based on this disabled table tennis athlete with a wheelchair Cheng Ming-chih. He got a silver medal in men's singles-TT 5 in 2018 Asian Paralympic Games in India, got a gold medal in men's single in IWAS World Games in Sochi, Russia. He is the star of Taiwan, and we want to use his strenuous journey as the foundation of this study. **Method**: The qualitative research methodology will be utilized, at the same time, the semi-structured interviews will be given, and then, we will analyse the content of the transcript. The approach above will tell the origin of the sport, wheelchair table tennis, the struggles and growth during the Para Games, and the story of from unforgettable tragic accident to being permanently disabled, then to a twist of physical and emotional transformation and acceptance, to becoming a true warrior, lastly to enjoying the victory. Each part of the story holds hand in hand to convey the main idea of this study. **Result**: Cheng Ming-chih used to be a table tennis athlete, however, a serious accident forced him to be amputated, which had challenged him massively physically and emotionally, at the point he almost gave up, his family was his silver linings that gave him strength and support. During his hellish journey, his family has always been his emotional outlet, whether it was positive or negative. And then, he reached his peak in his entire athletic career, he got a silver medal in men's group in 2015 Paralympics in Rio. Unfortunately, in 2017 he got injured again, which stalled his training. With the surgery and his family and friends, however, he once again walked out of the dark and began another pinnacle in his life. **Conclusion**: The victories that the athlete, Cheng Ming-chih has had are built by the discipline, the hard work in training; also by learning from the strengths and weaknesses from the other athletes. After countless competitions, Cheng Ming-chih not only has a better mind-set, a steel-like discipline but also the talent he has in tennis and the calmness from his character, all of this has finally led him to the best performance that brought the victory.

Key words: *wheelchair table tennis, Para Games, difficult journey, qualitative research, semi-structured interviews*

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FACTORS INFLUENCING LEARNING OUTCOME- APPLICATION OF DECISION TREE ALGORITHM

Abstract
The purpose of this study is to address the important factors of learning outcome in table-tennis courses. Classification and regression tree (CART) were employed to evaluate the data. Decision trees are a non-parametric supervised learning method used for classification and as a predictive tool. It is to model a series of events and look at how it affects an outcome. It can also provide information for decision makers in the decision-making process. The following factors were identified: teaching attitude, teaching material, teaching method, grading scheme and class management. Participants were 196 Table Tennis course students (82 male, 114 female). The data obtained from the survey were then analysed by using SPSS Modeller which is statistical analysis software used for data analysis, data mining and forecasting. The findings of this study demonstrate that grading scheme was the most important factor that impact student learning outcomes.

Key words: *classification, table tennis, CART*

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RESEARCH ON PARTICIPATION MOTIVATION, PARTICIPATION BENEFIT AND BEHAVIOR INTENTION OF UNIVERSITY TABLE TENNIS CLUBS STUDENTS

Abstract
Objective: The purpose of this study is to find out the distribution of participation motivation, participation benefit and behavioural intention of college students in National Taiwan University. **Methods:** This study was adopted by a purposive sampling method to conduct a questionnaire survey among college students participating in the table tennis clubs. The questionnaires were distributed to the table tennis clubs in National Taiwan University from 2018 November to December. 50 questionnaires were distributed on the spot and 175 questionnaires were distributed on the Internet. The total questionnaires were 225, and the invalid questionnaires were eliminated. 200 valid questionnaires were obtained, with an effective recovery rate of 88.88%. Data analysis using SPSS19.0 version of the suite of statistical software, the use of exploratory factor analysis, KMO factor analysis validity, reliability and validity of the test, after the test tool, descriptive statistics, inferential statistics. **Results:** In 200 people, males were for 103 people, and the rate was accounted for 51.5%. Females were for 97 people, and the rate was accounted for 48.5%. The grade distribution was up to 28% in the first grade. Most of them were practiced for 1 hours a week, and amount these people, most of their years-pro was 1 years or less, and the followed by more than 3 years. The study showed that the motivation of self-achievement was the highest, followed by social motivation, while the motivation of family and friends was the lowest, and the degree of benefit of college students' participation in table tennis club was interpersonal, emotional and physiological. Most students participate in the table tennis clubs to learn new technology and train themselves. In behaviour intention, they are more willing to spend more money in table tennis. The physiological and interpersonal benefits play an intermediary role between participation motivation and behavioural intention. **Conclusion:** University students participate in the table tennis clubs mainly in self-achievement motivation, and most students participate in the table tennis clubs are willing to spend more money on table tennis sports to train themselves, improve self-skills and develop regular exercise habits. Physiological and interpersonal benefits will affect the degree of participation motivation and behavioural intention.

Key words: *table tennis clubs, participation motivation, participation benefit, behaviour intention, intermediary effect*

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THE PRIORITIZATION AND COMPARISON OF CRITERIA IN THE SELECTION OF NATIONAL TABLE TENNIS COACH: SPORT ELITES PERSPECTIVES (WOMEN & MEN)

Abstract
The purpose of this study was prioritization and comparison of criteria in the selection of Iran's national table tennis coach from the sport elite's perspectives (Women & Men). As this was a descriptive study, survey methodology was employed. The study population consisted of 100 table tennis sport elites of whom 80 subjects were randomly selected using the Morgan table. McLean and Zakrajsk model was used in examining as selection criterion of Iran's national table tennis coach. Questionnaire designed for this study consisted of 44 items. Measure to the importance of each items, 5-point Likert scale was selected. To determine the reliability of the questionnaire, Cronbach's alpha was used (0/968). Data were analysed with both descriptive and inferential statistics. Descriptive statistics was used for demographic data description while inferential statistics such as Kolmogorov-Smirnov test, Friedman ANOVA test for rating the criterion and U Mann-Whitney test for testing the study's hypotheses. Data were analysed using SPSS software. Results of this study indicate that there is difference among the participants in prioritizing as a criterion ($P<0.05$).

Key words: *coaching, criteria, table tennis*

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COMPARISON OF TOP-LEVEL WORLD TABLE TENNIS RALLIES IN RIO AND LONDON OLYMPIC GAMES

Abstract
Notational analyses of 9032 rallies in 108 singles matches at the 2016 Rio Olympic Games and 8541 rallies in 100 singles matches at the 2012 London Olympic Games were conducted for table tennis. These matches were from Round 32 for the individual tournament and from the Quarter Finals for the team tournament. This study aimed to clarify the difference in the characteristics of top-level world table tennis rallies in the two Olympic Games.
The playing styles of the players were classified into all-round types and defensive types (chopper type), and three types of matches were classified by the combination of playing styles: all-rounder vs. all-rounder (AA type), all-rounder vs. defensive (AD type) and defensive vs. defensive (DD type).
The number of shots played per rally, which was the sum of correct service and correct returns, was measured. The winning ratios of server and receiver were determined by the number of shots played per rally. The data for the two Olympic Games was compared.
The main results were as follows:
Regarding the average number of shots played per rally, a significant difference between Rio and London was observed only in men of AA (London<Rio; $p < .05$).
Regarding the average winning ratio of server, no significant difference between Rio and London was observed.
It was suggested that the results would be valuable for considering the changes in the characteristics of table tennis rallies during the 4 year period.

Key words: *notational analysis, number of shots played per rally, winning ratios of server and receiver, playing style, changes in table tennis rally*

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TACTICAL ANALYSIS OF TOP RANKED PLAYERS AND ITS IMPLICATIONS TO EDUCATING PLAYERS AND COACHES IN TABLE TENNIS

Abstract
Top ranked players 2016-19 representing main type-styles of play were selected: topspin and fast attack (ex. Ma Long, Fan Zhendong, Harimoto, Lin Gaoyuan, Boll, Ding Ning), fast and topspin attack (ex. Falk, Ito, Hirano), pen-hold topspin and fast attack (ex. Xu Xin, Wong Chunting, Zheng Peifeng), chopping defence (ex. Joo Sehyuk, Filus, Ma Te, Li Qian, Wu Yang, Kim Songi), 'kombi-attack' (ex. He Zhuojia, Fukuhara, Ni Xialian, Zhou Xintong).
Over 30 matches among and against top ranked players were selected to perform statistical analysis. The method of game analysis of Professor Wu Huanqun, modified by the author, enabled statistical results in main fragments of the game: service-counterattack, return-counterattack, push-counterattack, attack-counterattack, block-counterattack, chop-counterattack, attack-against-chopping. The implications for building training systems in table tennis, especially for FUNdamental 1&2 stages children (ex. talent identification and long-term training) and Level 2 coaching education programs will be presented.

Key words: *tactical analysis, FUNdamental stage training, Level 2 coaching education*

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EVALUATION OF FRICTIONAL PROPERTIES AND CONSEQUENCES ON TABLE BALL INTERACTION FOR DIFFERENT ITTF APPROVED PLASTIC BALLS

Abstract
From 2014 a variety of non-celluloid plastic balls have been approved by the ITTF to replace the highly flammable celluloid as base material for table tennis balls. Actually different manufacturers use different type of plastic material and manufacturing process for these new balls.
An entire study was performed to compare the interaction between the different types of balls in combination with a selection of table tops. Therefore hitting experiments have been executed under realistic conditions. Results are used to show the differences in bounce behaviour but also it was checked whether the Brody/Durey impact model may be applied for the bounce. This model allows to calculate dynamic parameters Coefficient of Friction (CoF) and Coefficient of Restitution (CoR) from special bounces which then allows to describe bounce behaviour for any kind of bounce and thus the consequences on table tennis game.
Further to that there was a check whether it is possible to measure a meaningful CoF from a sliding experiment. At the end a recommendation was given for a measurement method to classify frictional properties of table/ball combinations in a meaningful way which could be used for approval purposes.

Key words: *table tennis, plastic balls, table ball interaction, frictional properties, impact model*

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AI COACH: LEARNING TABLE TENNIS STRATEGY RULES FROM VIDEO

Abstract
We propose a system for automatically extracting rules of table tennis strategy from video using a clustering method. We analysed videos from women's table tennis singles tournament at the 2016 Rio de Janeiro Olympics, including 16 matches from the third round to the final. This new video corpus contains a total of 407 plays, and 7,434 separate ball trajectories. In this work, we use only a subset of 372 plays and 6,862 ball trajectories, after removing cases where the ball trajectory is occluded by either the players or the coach. The videos in the resulting dataset were processed with a fuzzy clustering algorithm, and results demonstrate that it is possible to characterize players' strategies based on the learned relationship between player characteristics and ball position in image-based coordinates. We discuss the implications of these results toward the design of a system for characterizing player strategy in the form of rules extracted by a fuzzy clustering algorithm, in real time and from video data. Through future work, we hope to integrate this new capability into an "AI strategy coach" that can help improve player strategies.

Key words: *table tennis strategy, image processing, fuzzy clustering method, AI coach*

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INVESTIGATING HYSTERESIS IN EXPERT AND NOVICE TABLE TENNIS PLAYERS AS A FUNCTION OF PRACTICE

Abstract
In Dynamical Systems, Hysteresis is a phenomena that refers to the influence of previous experience on the next movement pattern. The aim of this study is to examine Hysteresis through the movement patterns in a table tennis task. Skilled (n=5) and novice participants (n=5) were required to return balls delivered in a scaling manner by a feeding machine to nine locations back to a target. The novices undergo an additional practice period of four weeks as well as a post- and retention test. 3D kinematic data of the upper body was captured and digitised and results were obtained using the cluster analysis approach. Results show that novices adopted five more movement patterns than the experts. The Hysteresis region for novices were notably larger than the skilled and the region decreased due to practice. Individual analysis show that novices that improved the most adopted a wide hysteresis region during practice highlighting an elaborate exploration and searching for the most functional task solution. Hysteresis region could be a probable predictor of future skilled performance – a potentially skilled player may demonstrate inherently narrow Hysteresis but essentially, continue to experiment for the most functional two movement pattern solution during practice.

Key words: *dynamical systems, hysteresis*

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THE STUDIES OF THE RELATIONSHIP AMONG COLLEGE TABLE TENNIS COACHES` LEADERSHIP, TEAM COHESION AND PLAYER SPORT SATISFACTION IN TABLE TENNIS PLAYERS

Abstract
Purpose: The purpose of this study is to understand the status of the relationship among the table tennis coaches` leadership behaviours, organizational climate, team cohesion and player sports satisfaction. The samples were selected form national college table tennis players. **Materials and Methods:** In this study, a total of 220 questionnaires and 201 valid questionnaires were sampling by randomly from table tennis player of college in Taiwan. The rate of the effective questionnaire was 91% and the questionnaire data were obtained and analysed by SPSS Windows 21, independent T-test and one-way ANOVA analysis were utilized on the data. **Results:** The result showed that coaches` leadership behaviour, team cohesion will influences players sport satisfaction and sport performances, game results. **Conclusions:** The result can provide a reference and reflect for table tennis coach, players and the administration in team leading and training.

Key words: *teamwork, caring behaviour, interpersonal attraction*

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REVIEW ON DEVELOPMENT COURSE AND HOT TOPICS OF TABLE TENNIS RESEARCH

Abstract
This paper systematically sorts out the researches on table tennis in recent years, and compares the research progress and key research fields in China and those of foreign countries. The research finds that (1) there are great differences in research progress and hot topics of table tennis in China and those of foreign countries; (2) in China, researches of table tennis mainly focus on table tennis teaching and training, techniques and tactics, development history, reserve talents cultivation, and kinematics, etc. In recent years, interdisciplinary researches have been increasing. Projects of interdisciplinary researches between table tennis and materials science, table tennis and computer science are making more and more achievements. (3) foreign studies on table tennis are mostly studies from the perspectives of psychology (anxiety and arousal of elite athletes during competitions), physiology (energy supply, cardiopulmonary and metabolic variables) and kinematics (correlation analysis of hitting trajectory and biomechanics). In further researches, we should focus on the following aspects: (1) highlighting problem orientated researches, such as researches from the aspects of uneven development of table tennis worldwide, the spread of table tennis culture, comparative analysis of the training modes of elite athletes, etc. (2) table tennis robot research. Researches of this aspect should be interdisciplinary, and apply new findings of disciplinary such as dynamics, biomechanics, visual imaging, and simulation technology. (3) strengthening researches on the training system of table tennis referees and studies on table tennis for the disabled.

Key words: *table tennis, research development, hot topics*

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AN EXPLORATION ON ESTABLISHMENT AND INTERNATIONAL POPULARIZATION OF TABLE TENNIS GRADING SYSTEM

Abstract
Regarded as „national sport" in China, table tennis is of profound culture and numerous participants. However, in recent years, the youth group's interest in table tennis is on the decline. At the same time, lack of unified standards makes it difficult to objectively measure the sports skills of table tennis participants. Internationally, the popularity and promotion of table tennis are regionally imbalanced due to various factors. Exploration of evaluation standards in chess, Taekwondo and martial arts provides a good reference for setting grading system in table tennis. The United States Table Tennis (USATT) has developed a rating system that covers both professional and amateur players. China has also done a lot of theoretical and practice exploration. China Adult Education Association sets a national test center, China Table Tennis College affiliate to Shanghai University of Sport, Shenzhen University and Guangzhou Sport University have all formulated their own table tennis grade assessment standard (grading system). This study probes to establish a standardized grading system of „tests+competition" and suggests ITTF executive committee to demonstrate and support it. The committee may appoint an expert committee to carry out special investigations, and promote grading system „point to area". To establish and implement grading system in table tennis, constant exploration of better management system, operating mechanism and grading standards are necessary. In order to stimulate the exercise enthusiasm of practitioners, grade granting must be scientific and reasonable. The standard of grade is the focus of grading system research and needs further perfection.

Key words: *table tennis, grading system, internationalization, promotion strategy*

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PERSONALITY PROFILE – ENGINE FOR HIGH PERFORMANCE?

Abstract
Athletes who achieve a high level of performance in different sports have distinctive personality features. Explaining the performance of table tennis in juniors from the perspective of personality traits is a challenge for sport psychologists and coaches. Measuring personality traits, sport psychologists use various questionnaires or inventories. This study presents the results from the Big Five personality inventory NEO-PI-R (Costa and McCrae, 1992) used on the national junior girls team of Romania (N = 5, mean 17, S.D = 1.22) comparing with results from the international competitions. The differences between athletes were found at the agreeableness (A) and conscientiousness (C) factors. Athletes seem to have a very high demand of competence, achievement striving and they are less trustable, especially when they should meet new people!

Key words: *personality profile, table tennis, juniors*

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ESTIMATION OF TABLE TENNIS BALL DROP POSITION USING A HIGH-SPEED CAMERA

Abstract
In order to develop a system capable of analysing table tennis matches in real time, we propose a method using the afterimage of balls that have been hit for estimating and predicting their drop position. The drop position is predicted based on the afterimage trajectory prior to bouncing, and it is estimated based on changes in the direction of the afterimage trajectory when the ball bounces. Previously, when the drop position of a hit ball was estimated using a regular commercially available camera, the error between the actual and estimated drop position was 140 mm on average with a maximum of ~300 mm. When predicting the drop position of a hit ball, the average error was 280 mm and the maximum was ~600 mm. However, there are issues with this method. For example, light and dark spots appear in the photographs taken using regular fluorescent lighting; thus, it is difficult to extract ball afterimages from images.
In this study, we investigated a method for more precisely estimating and predicting the drop position of a ball that overcomes the effects of lighting. We photographed table tennis balls using a single high-speed camera and estimated their drop position by combining a background difference method and a particle filter. As a result, the errors between the actual and estimated drop positions of balls was an average of ~40 mm to 60 mm, and the estimation precision was improved because the incorrect estimates were significantly reduced.

Key words: *table tennis ball, afterimage, drop position, estimating, predicting*

Figure 1. The image of the table tennis ball tracking

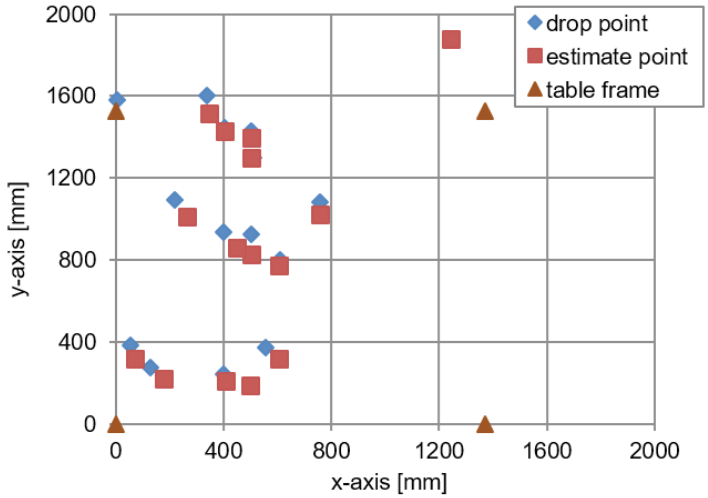

Figure 2. The scatter graph showing the dropping position and estimated position of the ball

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COMPARATIVE STUDY OF BALANCE AND WALKING CAPACITY AMONG ELDERLY WOMEN TABLE TENNIS PLAYERS VERSUS SEDENTARY ELDERLY WOMEN

Abstract
Background and Aim: Aging is associated with decrease in functional walking capacity, balance and fitness. Moreover, sedentary lifestyle in older adults result in increased metabolic disorders including type 2 diabetes, obesity, metabolic syndrome and etc. in contrast, take part in different exercise training such as table tennis can improve physical fitness and balance in subjects with different age including older adults. The aim of present study was to comparison the physical fitness and balance in active (table tennis player) and sedentary older women. **Methods**: the present study subjects consist of 30 older women with the average age of 65.4±4.49 years, height 163.23±4.80 cm and the weight of 65.7±6.30 kg that assigned in two trained and sedentary groups. Sedentary subjects don't participate in any exercise training at least in last years, and trained group participated in table tennis training at least for two continuous years (three session per week, 2 hours per session). All of subjects don't have any metabolic and cardiovascular disease and they were healthy. The berg (for determine the balance), 5 time sit to stand and time up and go tests performed by two groups. Data were analysed by SPSS software version 24 and between group differences determined by using the independent t test. **Results**: present study findings indicated that time up and go test score significantly higher in sedentary group compared to trained group ($p>0.001$). But there is no significant difference for sit to stand ($p=0.390$) and berg ($p=0.270$) tests between sedentary and active groups. **Conclusion**: according to present study results it seem that table tennis training in old women cannot improve balance, however table tennis can be effective for some indicators of fitness in older women.

Key words: *balance, walking capacity, elderly women, table tennis*

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VARIABILITY OF KINEMATIC PARAMETERS DURING TOPSPIN FOREHAND IN TABLE TENNIS

Abstract
The aim of the research was to determine the inter- and intra-subject variability of kinematic parameters of several varieties of topspin forehand strokes. 7 top-level players (national team of Poland) took part in the research. The MyoMotion Noraxon analysis system was used to record the kinematic data. The EMG sensor compatible with the system was used to identify the moment of the ball contact with the racket. The analysis focused on the technique of topspin forehand, it concerned also different types of this stroke. The balls were shot by the dedicated table tennis robot. With the system's sensors attached to the athlete's body, the following parameters were recorded: duration of the time of the cycle and individual phases, changes in the angles in time in main body joints and values of accelerations of individual body segments in the moment of racket's contact with the ball. The coefficient of variation (CV) was calculated and used to determine the variability of kinematic parameters. We found a very large inter-subject variability of kinematic parameters during topspin varieties with respect to the ranges of lower and lower limb movements (eg. Lumbar Rotation's CV=111.64%, Foot Rotation's CV=128.65%) and the upper non-dominant limb. At the same time, in terms of movements of the upper dominant (»playing«) extremity, small differences were found, especially in the movements of Elbow Flexion (16.25%), Shoulder Flexion (20.16%). There was little variability in the Knee Flexion movement (17.25%). Similar observations concerned the values of acceleration. We found also high repeatability in duration of cycle time and particular phases.

Key words: *table tennis, variability of movement, top spin, kinematics*

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PSYCHOLOGICAL CHARACTERISTICS OF THE NATIONAL HUNGARIAN TABLE TENNIS TEAM

Abstract
Aim: The aim of the study was to investigate the relationship between age category, assertiveness, temperament and character dimensions and the playing styles of the players. **Method**: A total of 32 table tennis players from the hungarian national team were tested (average age 19,31, male=7, female=25). Three questionnaires were used. (1) Competitive State Anxiety Inventory-2 (CSAI-2) with 3 subscales (cognitive and somatic anxiety, and self confidence); (2) Assertiveness Questionnaire (AST) with 2 subscales (offensive, deffensive); (3) Temperament and Character Inventory (TCI) with 7 subscales, out of these 4 temperament subscales (novelty seeking, harm avoidance, reward dependence, persistance) and 3 character subscales (self directedness, cooperativeness, self transcendence). **Results**: We used SPSS 22 and found positive relationship between assertiveness and attacking playing style (p=0,024). Significant difference were found between gender in cognitive (p=0,01) and somatic anxiety (p=0,018). Among age categories (adolescent, junior, adult) the only positiv relationship were found between the offensive subscale of assertiveness and junior category (p=0,029). There were no significant difference between the temperament and character dimensions and age categories. **Conclusion**: Results showed that assertiveness can be a core element of the attacking style.

Key words: *table tennis, anxiety, assertiveness, personality temperament*

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A STUDY ON IMAGERY ABILITY, FLOW EXPERIENCE AND PLAYER SATISFACTION IN TABLE TENNIS

Abstract
The objective of the study is to discuss the correlation between imagery ability, flow experience and satisfaction in table tennis. It takes players from institutes of higher education as subjects and gets 212 results by convenience sampling. The method to carry out this study is using the factor analysis, canonical correlation analysis and multiple stepwise regression analysis. The results reveal that imagery ability, flow experience and satisfaction have noticeable difference in different grades. Besides, it also shows imagery ability and flow experience are in significantly positive correlation. Furthermore, the satisfaction can be predicted by imagery ability (skilful imagery, target image) and flow experience (concentration, self-efficacy, self- accomplishment). To sum up, the significant conditions of satisfaction for players are imagery ability and flow experience. Hope the study raises player s' training satisfaction and enhances the performance on players and coaches.

Key words: *skilful imagery, target image, concentration*

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TRACKING A TABLE TENNIS BALL USING ADABOOST: A CASE STUDY

Abstract
Three-dimensional measurement of a table tennis ball is not easy because there is no commercial computer program to track a table tennis ball. Conventionally, many researchers tackled the challenge to detect a table tennis ball using the features of shape and colour. However, the detection performance of them was insufficient for real case scenario. In these days, sophisticated machine learning algorithms were available and easy to use in many computer programing languages. Object tracking, therefore, can be tried without complicated programming. The purpose of this study is to evaluate the accuracy, precision, and computational time of AdaBoost, a kind of classical machine learning technology, for tracking a table tennis ball. An experiment was conducted with the men's final and women's final of All Japan table tennis championships 2017. The main results were, (1) the average computational time of ball detection in a frame was about 0.3 millisecond (=0.0003 sec), (2) the average detection rate was 95%, (3) detection rate became lower when the ball was near an impact point. The results demonstrated the classical algorithm, AdaBoost, may be surprisingly useful to realize automatic ball tracking of a table tennis ball.

Key words: *table tennis, ball, tracking, AdaBoost, machine learning*

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A STUDY ON BRAND, REPEAT PURCHASES AND PLAYER SATISFACTION IN TABLE TENNIS

Abstract
The purpose of the study is to discuss the correlation between brand image, repeat purchases and customer satisfaction in table tennis. By convenience sampling, the data of the study is collected by 211 players who are from high school or institutes of higher education. The statistics of data will be analysed by factor analysis and stepwise regression. The results reveal that different gender prefer different brands; brand image, repeat purchases and customer satisfaction have a significantly positive correlation; besides, repeat purchases can be predicted by "Brand Necessary", "Brand Perception" and "Symbolic Image of brand". To sum up, the significant conditions of repeat purchases to players are "Brand Necessary", "Brand Perception" and "Symbolic Image of brand". The study benefits for corporations on raising brand image and brand trust.

Key words: *brand necessary, brand perception, symbolic image*

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STUDY ON THE CURRENT SITUATION AND COUNTERMEASURES OF MASSES TABLE TENNIS COMPETITIONS IN CHINA

Abstract
The Chinese national ball table tennis, which once promoted international exchanges by opening the diplomatic relationship between China and USA, play the most important role in the nationwide fitness boom. For a long time, table tennis has been almost the first choice for Chinese people due to its characteristics such as small influence of venue, space, climate and equipment, low cost of participation, long sport cycle and wide suitability for different classes. This research selects representative "China table tennis association member league", "Ping Pong in Wo" China unicom's table tennis challenge, "Harmony Cup" table tennis match, "China Family Cup" table tennis TV broadcast invitational contest and "All people's All Table Tennis" amateur points competition as the research objects. They use the methods of literature, questionnaire, expert interview and field investigation to analyse the organization setting, organization operation, mass participation and influence of the competition, summarize the advantages and successful experience of mass events, reveal the problems in the relevant events and put forward feasible countermeasures. In this way, it can provide theoretical reference for the relevant decision-making for the Chinese table tennis mass games.
The results show that there are three main problems in masses table tennis competitions in China: 1) The competition level is uneven and the regional development is unbalanced; 2) There are great differences in tournament organization and service guarantee; 3) The integration of resources is not sufficient and the level of marketization is not high enough.
Suggestions and countermeasures: 1) Increase the scale of the event and create property rights and derivative products of the event; 2) Improve the professional level, strengthen professional guidance, and gather the characteristics of the event; 3) improve the organizational security capability, integrate different resources and improve the marketization level.

Key words: *table tennis, mass sports, status, event management, countermeasures*

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USING TABLE TENNIS RECORD FORM TO EXPLORE 2018 WORLD TOUR GRAND FINALS MEN'S SINGLE PLAYER'S CRUCIAL TECHNICAL AND TACTICAL

Abstract
In table tennis competition, player's on-the-spot response and coaches using different technical and tactical during the match are indispensable. The purpose of the study is to explore the technical and tactical performance and application of men's singles quarter-finals in 2018 World Tour Finals. The study used table tennis record form to record the match and analyse the data. The form recorded player's winning point, hitting technique and error position. The data were analysed through Excel to make hot zone and find out player perfect shot technique and error position. In conclusions, players of quarter-finals had high rate error on two big corner of forehand and backhand. The hitting technique of winning point mostly uses the backhand attack, and winning points are mostly hitting as slash direction. The results of data analysis enable the coach to communicate the tactics clearly and effectively to the player during the game. This analysis technology not only could help the player to improve their self-confidence and confront different opponent tactical changes but also the data could assist the player to strengthen their weaknesses technique during usual practice.

Key words: *table tennis record form, world tour grand finals, skill analysis, crucial techniques*

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DEVELOPMENT OF TACTICAL ANALYSIS METHOD USING MARKOV MODEL IN TABLE TENNIS COMPETITION

Abstract
Tactical coaching in table tennis makes a difference in improving performance of the competition, however study based on objective statistical data is not progressing compared with other competitions. The current situation is that different advice is given by each advisor. Creating a table tennis markov model from the transition probability of table tennis strokes, courses, and spins, and analysing it, we obtain data on the ball delivery rate and score rate of the players and aim to use it at the coaching. In the experiment, simulation was carried out by obtaining the transition probability of hit balls and scores from data of a total of six games, targeting four drive main types using the most mainstream double-sided pimples in. As a result, the actual game and the simulation had a very strong positive correlation. Furthermore, when comparing them, the items of the distribution rate, the score rate, and the average number of rallies were approximately equal. From the above, the markov model of the table tennis could reproduce the actual game. Since objective statistical data can lead to improvement points of play and effective tactics for opponents, this study is useful for improving the competitiveness of the athletes and the leadership of the coaches.

Key words: *table tennis, markov model, simulation*

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SPEED AND SPIN DIFFERENCES BETWEEN THE OLD CELLULOID VERSUS NEW PLASTIC TABLE TENNIS BALLS AND THE IMPACT ON THE RESPONSES OF ELITE VERSUS SUB-ELITE PLAYERS

Abstract
This study measured the 1) speed and spin differences between the old celluloid versus new plastic table tennis balls at three time-points; (i) exit from machine (ii) pre and (iii) post ball-table impact; when projected with topspin at 7.56m/s, and investigated 2) the effect this has on the kinematic responses of 5 elite versus 5 sub-elite players' forehand drive in response to topspin and backspin. Plastic was slower in both speed and spin post flight at pre ball-table impact, and at post ball-table impact compared with celluloid balls. Furthermore, the magnitude of change in speed and spin for each ball material differed between the two time-points. Post flight, plastic balls lost 3.98% more speed and 1.24% more spin than celluloid balls. Post ball-table impact, the speed increment and spin decrement were similar for both ball materials. Kinematic differences in response to the different ball materials were found only when players returned backspin shots. Players supinated their racket more by 2.23% at ball-racket contact and produced 3.37% less ball spin when returning plastic compared with celluloid balls; an indication of early adaptation to the lower spin rate of plastic balls by supinating the racket face more to impart greater horizontal velocity. The lack of movement difference in response to topspin may be due to the similar kinematic change of both balls at ball-table impact. Changes in ball kinematics at ball-table impact may evoke more differences in movement responses from the players and could be explored in future studies.

Key words: *table-tennis, rule change, human kinematics*

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DEVELOPMENT OF GAME ANALYSIS METHOD USING ULTRASONIC SENSOR IN TABLE TENNIS

Abstract

In this research, we collected the ball falling position coordinate data during the match with the distribution characteristic analysis system using the ultrasonic sensor, aimed at verifying the existence of regularity in the ball distribution pattern of the player. For the analysis of the distribution pattern, presence or absence of regularity was verified using autocorrelation.

As a result, there were some regularity in the distribution pattern of only the y axis coordinate (19/204). Also, in analysis of the regularity of service courses, there was one game with a high autocorrelation coefficient, which a competitor who had a regularity had won. However, there were few patterns with regularity in the distribution pattern of only the area and x axis coordinates. This is probably because it is highly likely that rally ends in 3 to 4 times in a table tennis game, and it is difficult to verify the existence of regularity using autocorrelation at 3 to 4 times.

In this study, we examined the existence of regularity of the distribution pattern only with 11 game data, but in order to explain the usefulness of the analysis of the distribution pattern using autocorrelation, it is necessary to increase the number of data and to consider playstyles of the targets.

Key words: *ultrasonic sensor, pattern of course distribution, autocorrelation*

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VALIDATION OF ESTIMATION OF LOWER LIMB MUSCLE ACTIVATION DURING THE TABLE TENNIS TOPSPIN FOREHAND

Abstract
Estimating muscle forces during table tennis strokes improves our understanding of muscle function, which can provide practical insight into injury mechanisms and higher performance in the sport. Muscle activation can be estimated using musculoskeletal modelling. However, the estimation needs to be validated before we apply musculoskeletal modelling to motions in table tennis. The present study aims to validate lower limb muscle activation estimation against electromyography (EMG). Eight advanced table tennis players performed topspin forehands against backspin with maximum effort. Body movements were captured using a motion capture system. EMG was recorded for 16 lower limb muscles. Muscle activation was estimated using the static optimisation method in OpenSim. Cross-correlation coefficient between EMG and estimated activation was higher than 0.5 for 6 muscles (e.g. biceps femoris and gluteus maximus of the back limb) and ranged from 0.3 to 0.5 for 8 muscles (e.g. gastrocnemius lateralis and gluteus medius of the back limb). The coefficient was lower than 0.3 only for 2 muscles (tibialis anterior of the back limb and vastus medialis of the front limb). The results suggest musculoskeletal modelling can be used to estimate lower limb muscle activation during the forehand with consideration of some limitations.

Key words: *table tennis, muscle force, biomechanics*

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COMPARISON OF HIP JOINT MECHANICAL ENERGY IN TABLE TENNIS FOREHAND AND BACKHAND DRIVES: A PRELIMINARY STUDY

Abstract

Hip joints are highly involved in table tennis and some authors found both pelvis angular velocity and hip joint torques related to the racket velocity (1). Others also showed higher lower limb joints ranges of motion for the best players (2). Hence, the mechanical work generated by the dominant hip can be seen as indicator of the playing intensity associated to the different strokes. The aim of the study was to quantify the hip joint mechanical work during classical strokes: forehand drive against topspin, forehand drive against backspin, backhand, and pivot. Motion capture acquisitions were performed on two international players with a set of 91 reflective markers placed on the body and the racket. A biplanar radiographic acquisition was also performed to personalize the biomechanical model (3). Hip joint velocity and torques were calculated on the dominant side, allowing mechanical work and power between the end of backswing and the ball impact (determined as the instant of maximal racket velocity) to be determined. Hip joint mechanical work was found the highest for forehand drive against backspin (2.16 ± 0.91 J/kg) and topspin forehand drive with pivot (2.37 ± 0.25 J/kg). Backhand drive required the lowest hip mechanical work (-0.06 ± 0.06 J/kg) and forehand drive against topspin was found as intermediate (0.81 ± 0.91 J/kg). Those results show that backhand can be used as a waiting strike and the use of backspin strokes can be used to accelerate opponent exhaustion but increase the exposition to opponent attack.

Key words: *table tennis, dominant hip, energy*

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THE TECHNIQUE AND TACTIC ANALYSIS OF ZHOU QIHAO VS CHO SEUNGMIN IN 2018 HONG KONG OPEN

Abstract

Purpose: Zhou Qihao and CHO Seungmin are all young athletes, and they are all very gifted and have the potential to be strong in the future. They met in the men's singles semi-final of 2018 Hong Kong open, and Zhou Qihao lost to CHO Seungmin. The results were surprising. For the technical and tactical level at that time, should be Zhou Qihao better. Therefore, it was necessary to analyse the details of Zhou Qihao and CHO Seungmin's techniques and tactics in that game. The purpose of this study was to provide some scientific basis for Zhou Qihao's future technical and tactic training and matches. **Methods:** The subject of this study was the semi-final of Zhou Qihao vs CHO Seungmin in 2018 Hong Kong Open. The result of the match was 2:4 (-9,3,-4,-9,6,-9). Zhou lost the match. The technique and tactic of Zhou Qihao was analysed by the classical three-phase method, used the software named Table tennis strategist (Developed by CISS). **Results:** The main results were shown in table1.

Table 1 the data of three-phase

	Score	Lose points	Subtotal	Usage	Scoring rate
Serve and attack phase	21	12	33	31.1%	63.6%
Receive and attack phase	21	18	39	36.8%	53.8%
Rally phase	11	23	34	32.1%	32.4%
Subtotal	53	53	106	100.0%	50.0%

Conclusions: (1) As for Zhou Qihao, the scoring rate of serve and attack phase was high, and the using rate was normal. And Zhou had a normal performance in the receive and attack phase, but had a bad performance in the rally phase. (2) Zhou had a lot of serve skills, and had a high ability to attack after serve. Meanwhile, Zhou also had a lot of methods to receive. The excellent technique of forehand drive and control made Zhou score a lot directly. (3) In the rally phase, Zhou was at a disadvantage in every way. In addition, Zhou did a poor job of handling key points. This was the main reason why he lost the game.

Key words: *Zhou Qihao, Cho Seungmin, Hong Kong Open, technical and tactic analysis*

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THE DEVELOPMENT OF TABLE TENNIS COGNITIVE TEST FOR COLLEGE STUDENTS - A PRELIMINARY RESEARCH

Abstract
In the physical education, cognitive learning is an important indicator for assessing learning accomplish. The purpose of this study was to develop a written table tennis cognitive test for college students. The participants were 93 students (age 19-20) selected from 2 basic table tennis class. Item analysis was used to choose the item fit acceptable item difficulty index and item discrimination index, and split-half reliability was applied to analyze reliability of the test. 25 items that met acceptable item difficulty index and item discrimination index were chosen from 35 items to be included in the final test. Regarding reliability, the Cronbach's α coefficients and split-half coefficients of all item were .60 and .56. Content validity were established according to the goals and contents of teaching and approved by table tennis instructors and sport pedagogy researcher. 25 items of table tennis cognitive test were developed for college students that fit item analysis index. But due to the moderate reliability, this test needed further research to revise and verify it.

Key words: *table tennis, cognitive learning, sport rules, physical education, college students*

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CONSIDERATION ABOUT "NAGARE" IN TABLE TENNIS GAMES -ANALYSIS OF THE FACTORS IN THE CONTINUOUS LAST POINTS-

Abstract
I defined that "Nagare" is series of trend in human psychology, focus on the continuous lost point. I paid attention to the continuous lost points in games. What kind of situation makes them occur? The analysis will help the improvement of my own competition ability and mentality. I defined continuous lost points as continuous 3 lost points or more. 8 students in table tennis club played games. After that, I observed and analysed their mental states and contents of games with them. As written below, I will reveal the factors in the continuous lost points paying attention to the 7 cases.
①The first lost point in the continuous lost point ②The second lost point ③The third lost point ④The got point after breaking the continuous lost point ⑤ The first lost point which is not included in the continuous lost point ⑥ The second lost point which is not included ⑦ The third get point which is not included in the continuous lost point, I didn't get the result in the mental states.
However, I obtained the date about the significant difference in the contents of games.
I found that it is related to the difference in competition ability among subjects.
The origins of the continuous lost points are different one by one. It is important to grasp the contents of the continuous lost points which is prone to occur, understand the situations in the point, and modify the tactics effectively in the situations.

Key words: *table tennis, the continuous lost point*

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THE ROLE OF AFFECTS IN PREDICTING THE SUCCESS OF EXPERT TENNIS PLAYERS

Abstract
The relationship between psychological variables and sporting performance has been a key matter for sports psychologists for many years. For example, in the multidimensional anxiety theory (Martens et al., 1990), it is assumed that cognitive anxiety has a negative linear relationship, somatic anxiety has an Inverted-U shape relationship, and self-confidence has a positive linear relationship with the performance. Therefore, the purpose of present study was to predict the success (Winning or losing) of table tennis athletes based on arousal, self-confidence, cognitive and somatic anxiety. The subjects were 56 expert table tennis players (28 men and 28 women, mean age of 25.36 ±2.70 years) who participated in Iran Super League competitions. Self-confidence and somatic anxiety were measured by two items of the Mental Readiness Form (MRF-3; Krane, 1994), and cognitive anxiety and arousal levels were assessed by "sport grid-revised" (Ward & Cox, 2004), 15 minutes before the start of the first match in the morning. Logistic regression was used for prediction. Results revealed that one model with two factors was significant. Cognitive anxiety, and Self-confidence have been able to significantly predict winning the match. This model supports the part of the multidimensional anxiety theory. These findings established effects of psychological variables on final success of champions.

Key words: *table tennis, arousal, anxiety, self-confidence, prediction*

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RESEARCH AND DEVELOPMENT OF SPECIAL TECHNICAL AND TACTICAL VIDEO ANALYSIS SOFTWARE OF "TABLE TENNIS STRATEGIST"

Abstract
According to the requirements of video analysis of Chinese national table tennis team, Using Visual Studio 2015, C++ language, MFC framework combined with MYSQL database and XMLin Windows 10 system, the special technical and tactical video analysis system of „ Table tennis strategist „ was researched and developed, which consists of three modules: technical and tactical indicators information acquisition module, technical and tactical indicators information processing module and report generation module. The software has been successfully applied to Chinese national table tennis team. It improved the efficiency of collecting and analysing techniques and tactics and improved the accuracy of work. Compared with other technical and tactical analysis software, this software has the following advantages and characteristics: (1) In view of the special characteristics of table tennis, the software not only retains the method of open template design, but also adds template library to save the commonly used template. (2) Provides the function of checking whether the acquisition is correct or not, which facilitates the generation of technical and tactical analysis reports. (3) It realizes the function of video automatic interception. (4)The cost of the software was low, and it had a wide range of application prospects and popularity.

Key words: *table tennis, technique and tactics analysis, nonlinear editing, video analysis*

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GOVERNANCE INDICATORS IN BRAZILIAN TABLE TENNIS CONFEDERATION: HOW THE CONCEPT IMPACTS IN THE MANAGEMENT OF A SPORT FEDERATION

Abstract
Due to numerous external changes in regulations and legislation from Government and independent institutions in Brazil, which have given objective focus on aspects related to Governance, the sport system in the country has seen a significant transformation of several traditional entities. With the need to have a vision oriented to the external environment and to the impact of various organizational decisions on different stakeholders, sports federations have adopted new organizational models that are impacting their management. In this sense, the Brazilian Confederation of Table Tennis (CBTM) was one of the pioneer institutions in this regard. Since 2015, it has been executing objective changes that, together with the organization and processes implemented in the past, have contributed to placing CBTM among the best entities in Brazil in terms of performance on Governance. The methodology of this work consists of the organization of documents and processes that were implemented from 2015 to 2018 in relation to Governance, observing how much this changed the way of managing and making decisions in the entity. The result points to a differentiated posture of employees, athletes, clubs and other sports leaders for a greater awareness of the need to respond clearly with their actions to the external environment, as well as to ensure predictability, transparency and compliance of CBTM's management actions. It is understood that the entity, for the work developed, is prepared for the future changes and the continuous evolution of its management system.

Key words: *governance, indicators, stakeholders*

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STRATEGIC PLAN OF BRAZILIAN TABLE TENNIS CONFEDERATION: LOOKING FOR DEVELOPMENT

Abstract
The Brazilian Table Tennis Confederation (CBTM) has systematically advanced in the modernization of its management and is attentive to the new demands of the sport market. According to these premises, in 2016 CBTM developed a strategic plan that could allow institutional orientation for the new challenges of modern sport. The planning methodology consisted of documental study, semi-structured interviews, workshops and benchmark with main reference cases of sport and entertainment. The result was the redesign of functions and institutional approach from the year 2017, with KPIs measurement. The organizational structure was based on 6 major areas: (1) International Talents, linked to the Brazilian team; (2) National Talents, linked to competitions and the Brazilian ranking; (3) Table Tennis for Leisure, associated with table tennis enthusiasts; (4) Marketing and Business, connected to communication, media, sponsorship and relationship with fans; (5) Corporate University, focused on the training and promotion of knowledge; (6) Management and Governance, oriented to the administrative aspects of the entity. From this strategic plan, CBTM begins to reach a differentiated level, both nationally and internationally, with the expectation of consolidating a sustainable management model for the future.

Key words: *strategic plan, management, organization*

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THE BENEFICIAL EFFECTS OF INFORMATION TECHNOLOGY SOLUTIONS ON AMATEUR TABLE TENNIS

Abstract
The attracting and retaining amateur table tennis players requires a completely different approach than the one used in case of active professionals. The motivation for amateurs includes:
- spending their leisure time with sport activities
- health promotion
- and of course, earning prestige in their micro-community by getting good results in tournaments

There are several known on the benefits of table tennis, especially among elderly people. Our study shows the possible IT solutions for motivating a delicate, but essential group of the sports audience, which is beneficial for all. It is important for:
- the individual for health promotion and sport experience,
- the sport federations to reach and rouse a wider crowd,
- the national healthcare by reducing healthcare costs.

This study is based on data provided by the Csongrád County Table Tennis Federation consisting a 5 year period with participation of 385 people. The basic problem which we search practical answers for: the declining number of amateur players, and the trend of decreasing activity among them. Our goal was/is to reverse this tendency.
The software, developed in association with the federation produced measurable results, which opens new horizons for improving the activity of amateur players, mainly by providing a social experience for the participants.
We succeeded not only in stopping the above mentioned decrease, but we were able to attract new groups for the sport.
The IT capabilities are still far from being utilized, we see a lot of new possibilities in this development.

Key words: *amateur table tennis players, software, game development*

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MULTIBALL TRAINING. A REVIEW

Abstract
The structure of table tennis training is governed by the training rules that outline all organized sports and divides into two categories; general and specific training. General training refers to the development of physical abilities while specific training refers to the improvement and development of technical and regular skills. This review aims to collect and analyse the studies that refer to table tennis training with the Multiball method. Even though this method has been extensively used for years, the volume, frequency and duration of the training stimulus have not been clearly defined yet. The literature review shows that modification in the parameters of this training method makes it possible to simulate competition conditions and improve technical and regular skills. Therefore, it is crucial for table tennis coaches to be familiar with the application methodology of Multiball training in order to provide the training stimuli that reinforce the training process depending on the athletes' needs and requirements. This study presents researches that refer to Multiball training and provides highlights for the organization of the training process.

Key words: *table tennis training, multiball, technical skills*

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THE NEURAL UNDERPINNINGS OF VISUOMOTOR REACTION SPEED IN ELITE YOUTH TABLE TENNIS PLAYERS

Abstract
Previous studies on badminton players have shown the visuomotor reaction time is strongly affected by the speed of neurophysiological and especially visual processes. This study aimed to validate these findings in a group of highly trained youth table tennis players.
37 international youth table tennis players (mean age: 14 years) nominated by the International Table Tennis Federation (ITTF) or the European Table Tennis Union (ETTU) participated in this study. The athletes' onset of muscular activation (EMG onset) and visuomotor reaction time (VMRT) in response to visual motion stimuli on a computer screen at two different motion velocities were measured. A 64-channel EEG system was used to investigate the stimulus and response-locked event-related potentials (ERPs) in the brain's visual motion sensitive area MT as well as the pre- and supplementary motor cortex (BA6) reflecting the speed of neural visual and motor information processing, respectively.
The VMRT (232 vs. 258 ms, $P<0.001$) and EMG onset (181 vs. 206 ms, $P<0.001$) were significantly accelerated in the fast motion velocity condition which was accompanied by an earlier stimulus-locked N2 (187 vs. 193 ms, $P<0.001$) and later response-locked N2-r (17 vs. -0.1 ms, $P<0.001$) peak activation of area MT. Further, the N2 and N2-r ERPs in area MT correlated with EMG onset and VMRT and explained 80-90% of the variance in visuomotor reaction speed using multiple regression analyses.
The results validate our previous findings and emphasize the importance of visual processes for the visuomotor reaction speed in table tennis athletes.

Key words: *table tennis, brain, visuomotor reaction speed, visual training*

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CAN SPORT MANAGEMENT CHANGE THE STATUS OF A COUNTRY ON THE WORLD STAGE? COMPARISON BETWEEN BRAZIL AND PORTUGAL

Abstract
Organizational actions and public policies for high-performance sports have been associated with good international sports performance. Portugal has gone from supporting to world-class power in recent years. In the last years, Brazil has been struggling to change the scene and start fighting among the best teams in the world. Knowing if strategic organizational actions and public sports policies supported this improvement in Portuguese sports performance, can be a way to find a route to the high level. To this end, the management in recent years of the national federations of the two countries has been compared based on the theoretical model Sports Policy Factors Leading to International Sporting Success. After analysis, the change in the Portuguese level in the world scenario of table tennis does not seem to have been related to actions relevant from the organizational or public policy point of view. Brazil, on the other hand, has managed to increase its performance in the world based on strategic actions and its federation, but there are still many areas in which it is possible to improve. Both countries need to increase their organizational strategies to maintain and improve their technical performance worldwide.

Key words: *sport management, table tennis, public sport policies*

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COMPARISON OF THE EFFECT OF TABLE TENNIS AND DART INTERVENTION PROGRAMS ON PERCEPTUAL- MOTOR SKILLS AMONG CHILDREN WITH INTELLECTUAL DISABILITY

Abstract
Introduction: One of the most effective ways to gain motor skills is engage in physical activity. Performing sports activities such as table tennis and dart can affect the physical capacity of individuals with intellectual disability. **Aim and theoretical framework:** Table tennis and dart were used as interventions for this research. Therefore, our aim in this study was to determine the effectiveness of table tennis and dart intervention programs on perceptual-motor skills among children with intellectual disability. **Method:** 30 girls with intellectual disability with age 8 to 14 years old and IQ of 50-70 were selected and randomly divided into control and 2 training groups. The interventions included 20 sessions of 45 minutes table tennis and dart interventions. For evaluation of perceptual-motor skills in pre-test and post-test, all groups were assessed with Bruininks-Oseretsky test of Motor Proficiency. **Results:** The results showed a significant improvement in balance, visual motor control, upper limb speed and dexterity in table tennis group compared to the control and dart group ($p<0.05$). **Discussion and conclusion:** Children with intellectual disability due to their weaker physical condition and lack of adequate body awareness and poor coordination of physical activity, need to improve their body mechanic and physical abilities. Table tennis as a comprehensive sport with involvement of all body organs can provide physical needs for these people.

Key words: *intellectual disability, table tennis, dart, perceptual- motor skills*

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RECEIVE ANALYSES IN ELITE EUROPEAN TABLE TENNIS MATCHES

Abstract

The purpose of this study was to analyse serve and receive outcome activities in elite European players. Twenty matches (78 games, 1435 points) of semi-final and final German League and Europe TOP 16 in men's were analysed. All players were in the top 30 of ETTU Rank list.

Difference in receiving activities (type, placement, outcome) was analysed according final outcome of match, game and point, then instead phase of game and considering result (easy, normal, tight game) between winners and losers. An expert coach analysed game video and collected data about the serve activities. Results showed that forehand and backhand stroke in receiving ratio is 59/41%, mostly with forehand backspin stroke (41.1%) than backhand flick (14.2), forehand side of the opponent (55.7%) in middle forehand (31.2%). The ratio between active and passive receive were 43.8/56.2%. Percentage of point won directly with receive is high (24.1), then follow point won after receiving (23.6), lost point after received were noted in 40.6% while errors were 11.7%. Winners' use less active receive instead defeated players. In the 2nd phase of the game (5-8 point) were noted most of active receive, more than in 1st phase (1-4 point), while in 3rd phase (8-11) most of receive was with passive strokes. Results of chi-squared test showed differences between winners and losers (p=.000) in receive realization (outcome).

This data can be useful for Performance analysts and coaches, to design specific training sessions related to receive of serve.

Key words: *serve, tactic, notational analysis, match analysis*

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SERVE ANALYSES IN ELITE EUROPEAN TABLE TENNIS MATCHES

Abstract
The purpose of this study was to analyse serve and serve outcome activities in elite European players. Twenty matches (78 games, 1466 points) of semi-final and final German League and Europe TOP 16 in men's were analysed. All players were in the top 30 of ETTU Rank list. Difference in serving activities (type, placement, outcome) was analysed according final outcome of match, game and point, then instead phase of the game and considering the result (easy, normal, tight game) between winners and losers. Expert coaches analysed game video and collected data. Results showed that forehand short serves prevailed (76.8%) instead other types of serve, mostly placed in the middle of the table on the backhand side (50.4%). Percentage of point one directly with serve is high (11.6), then follow points won with 3rd stroke after serving (22.4) and points won with 5th stroke (10.9). So, serve realization is related to short rallies. Lost points after serving mostly were after 3rd stroke (25.0) and loss after 5th stroke (22.4), while serving error were noted in 1.5% of all analysed points. In the 3rd phase of the game (8-11 point), winning points are more related after 3rd and 5th stroke instead previous phases of the game. Results of chi-squared test showed differences between winners and losers (p=. 000) in serve realization (outcome). These data should be useful to practitioners and researchers, providing useful information for establishing the model of top table tennis player and design of a quality training program.

Key words: *activity analyses, notational analyses, player performance*

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INVESTIGETION OF RATE OF AGILITY, SHOULDER FLEXIBILITY, VO2MAX, EXPLOSIVE RUNNING SPEED, SPEED OF HAND MOVEMENT, AND REACTION TIME

Abstract
Background and Aim: Today, talent is an interest field in sport science and attracted a lot of attention. Especially Iran talent identification committee has noticed this subject since 2014 till now. This study aimed to investigate the rate of agility, shoulder flexibility, VO2max, explosive running speed, speed of hand movement and reaction time in table tennis talent boy's age ranging 6-8 years old. **Methods**: present study subjects including the 200 boy's age range between 6 to 8 years old that recruited in the national talent festival in Iran. After three-time monitoring, 12 boys (BMI= 19.47±4.07 kg.m2) have been chosen for final testing. Different tests conducted in order to monitoring the players. All of subjects completed the ruler test (reaction time), T test (agility), 6 second running (explosive speed), shuttle run (VO2max), shoulder flexibility and hand speed tests. Finally, data were analysed by means of SPSS software. **Results**: in the present study it's observed that functional scores of subjects in different tests is as following: reaction time (25.5±6.28), shoulder flexibility (66.6±67.10), agility (16.92±1.15), hand speed (12.8±1.64), explosive speed (20.30±1.94) and VO2max (30.08±4.92). **Conclusion**: unfortunately, there is no standard norm for table tennis talent in children and further study is needed for exact conclusion.

Key words: *physical fitness factors, boys talented 6-8 ages*

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A STUDY OF THE EFFECT OF TABLE TENNIS BALL CHANGE FOR THE SECONDARY SCHOOL TABLE TENNIS PLAYERS IN KAOHSIUNG CITY

Abstract
The purpose of the study was to investigate the effect of changing table tennis ball material for the secondary school table tennis players in Kaohsiung City and the differences in sports training of different table tennis players' background variable. The survey was conducted personally by the researcher, and valid samples of the survey consisted of 197 secondary school table tennis players in Kaohsiung City in 2017. The researcher adopted survey method, and the data were analysed by descriptive statistics, one-way ANOVA, and Pearson correlation. The statistical result revealed that the effect of table tennis ball change: (1) the influence level of "Physical Fitness" was the highest; (2) there was significant difference of "Tactics" training in different gender in all background variables; (3) "Skill", "Physical Fitness" and "Tactics" showed positive correlation. In conclusion, the researcher suggests that: (1) The table tennis coaches need to realize the characters of plastic 40+ table tennis ball and bring professional training model into practice; (2) The table tennis coaches need to consider the individual differences of table tennis players and strengthen the training of stamina and rally.

Key words: *plastic 40+ table tennis ball, table tennis training, table tennis skill, table tennis stamina, table tennis tactics*

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A STUDY OF TABLE TENNIS SPECTATORS' SPONSOR EFFECTS

Abstract
The purposes of the study were to investigate the sponsor effects of the table tennis spectators and to discuss the differences between the sponsor effects in different background variances. Through questionnaires which objects were spectators of 2013 Junior Open, there were 362 valid copies of questionnaires retrieved in total. The results were based on descriptive statistic and one-way MANOVA. The conclusions of this study were as follows: (1) the highest score of the sponsor effects was image effect, the second one was identification effect and the third one was perception effect, (2) there were significant differences between sponsor effect, genders, ages, occupation and married status. The study suggested the table tennis association should hold more international tournaments, set levels of corporate sponsorship, and establish the cooperation with the sponsors; sponsors should construct long-term sponsorship with the table tennis tournaments, use leverage strategies and resources to hold more activities and design marketing projects for spectator to the maximize sponsor effects between the sponsors and the tournaments.

Key words: *table tennis tournament, sponsorship, sponsor effects*

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THE STUDY ON PREDICAMENTS AND STRATEGIES OF PROMOTING PROFESSIONAL TABLE TENNIS IN TAIWAN

Abstract
Professional sports will help the development and promotion of sports. It not only extends the sports career of the players, but also retains outstanding sports talents for the country, and can promote the development of the sports industry, improve economic efficiency and increase the spectating population. Table tennis is a very popular sport in Taiwan. It is also one of the sports that the people like to watch. In particular, the national table tennis team players have made great achievements in international competitions, creating great results and attracting the attention of the audience. Thus, the government announces the establishment of the professional table tennis. However, the announcement is passed for years but still can't become reality. What are the problem they faced and how to solve the problem? Therefore, the purpose of this study was to understand predicaments and offer strategies of promotion professional table tennis in Taiwan. Interview was used in the qualitative study. The content analysis was chosen in the result analysis. The subject was 2 national coaches, 3 university coaches and 3 national players. The results indicated: (1) Predicaments of promoting professional table tennis in Taiwan were need to change mind-set of government and table tennis association mind-set, lack of population dominant players, financial resource, and corporate investment; (2) Strategies of promoting professional table tennis in Taiwan were building new executive unit, increasing foreign aid policy, establishing table tennis corporate league, changing the sports competition system and setting up a short and long season. Suggestions of this study were as follow: (1) There is a need to understand successful professional table tennis or sports abroad; (2) There is a need to create incentives for corporate sponsored table tennis; (3) The findings of this study should be taken into consideration in developing strategies on professional table tennis in Taiwan; and (4) There is a need for further studies on professional table tennis in Taiwan.

Key words: *predicament, strategy, professional table tennis*

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THE STUDY ON PADDLE BRAND IMAGE OF TABLE TENNIS CLUB PARTICIPANTS IN KAOHSIUNG

Abstract
The purpose of this study was to explore paddle brand images of the table tennis club participants in Kaohsiung and discussed difference between paddle brand images and the participants' background information. The investigation tool was self-constructed questionnaire. Five hundred and thirteen were returned. These data were analysed by means of Descriptive Statistics, one-way ANOVA, and T-test. The results were as follows: First, the scores of brand image in this study was slightly over the average. Among the three factors, the average scores of functional image was the highest, that of experiential image was in between and that of symbolic image was the lowest. Second, functional image was affected by ages, the brands of paddles people bought most, and the average spending on every single paddle. According to the results above, three suggestions were provided for the corporations. First, the marketing plans should be made based on the different functions of paddles. Second, besides keeping the existing consumers, brands should increase the cooperation with the table tennis associations and clubs to hold diverse matches and activities. This can expand the sources of consumers and elevate purchase intention. Third, the corporations can attract more consumers by means of improving the quality of service, providing unique services, and designing distinctive features of the brands. This study can be further developed via different brands and subjects in the future research.

Key words: *paddle, brand image, table tennis*

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RELATIONSHIP BETWEEN POSTURAL ABNORMALITIES AND FUNCTIONAL MOVEMENT ASSESSMENTS IN TABLE TENNIS PLAYERS

Abstract
Introduction: Table tennis is one of the popular sports that many people playing this sport. During matches and exercises, especially in young athletes, the body adapts to postural deviations that are suitable for table tennis and affect movement efficiency. **Aim and theoretical framework:** Athletes need to spend a lot of time in the dominant physical habit of the sport, so the posture in athletes may be affected and lead to changes in functional movements. Therefore, our aim in this study is to determine the Relationship between postural abnormalities and Functional Movement Assessments in table tennis players. **Method:** 51 male table tennis players with age (13.68±2.83) were selected randomly. For evaluation of movement efficiency, three functional movements including double limb squat, double limb squat with heel lift, and single limb squat were conducted for assessing movement dysfunctions and scored using Fusionetics algorithms. For assessing postural abnormalities, New York test and plumb line were used. **Results:** The results shown that table tennis players had poor (48.59±1.4%), moderate(65.51±5.94%), and good (84.11±5.75%) movement efficiency in single leg squat, double limb squat, and double limb squat with heel lift, respectively. Similarly, there is a positive and significant correlation between the total movement efficiency scores and New York test scores ($p<0.05$). **Discussion and conclusion:** Table tennis players had movement dysfunctions during functional movement patterns. There were correlations between functional movement errors and postural abnormalities. Based on the results it is recommended to coaches to concern about their athlete's postures.

Key words: *movement dysfunctions, fusionetics, postural abnormalities*

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NET HEIGHT IMPACT TO TABLE TENNIS GAME

Abstract
Table tennis is the fastest game among the major racket sports (table tennis, tennis, badminton and squash) if we take the average speed of the rallies into account. Consequently the rallies are short and the viewing pleasure for the live and also for the TV spectators is reduced. In the last decades the ITTF introduced several changes into the table tennis game to supress this. The ball size was increased from 38 to 40 mm in 2000, a 21-point scoring system was changed to an 11-point in 2001. The rules of service were changed in 2002 to reduce the server's advantage. In 2014 a new 40+ mm plastic ball was introduced to further slow down the game and to decrease the gap among the best players. Each change caused the adaptation of the material producers especially rubber producers and the players who adapted their training exercises and the way of playing. In the last few years a discussion was brought up in the table tennis community regarding a new change which should be implemented in the next years. It is a change on the net height. At the ITTF Annual General Meeting held in Kuala Lumpur on March 23rd 2016, Suisse Table Tennis Federation proposed tests on the height of the net. We followed this initiative and investigated the impact of the net height to the table tennis game by statistically observing 7 parameters across the 5 net heights within the 6 sets played at each net height. Additionally, we observed 2 parameters within the three rally parts (the service, the return, the rest of the rally) using about 100 rallies played at each of the 5 net heights in order to determine which part of the rally is affected the most. We used the descriptive and the inferential statistics and in both cases only the impact on the ball height and speed above the net at the service was observed. No significant differences either at the set level or at the rally level in any of the other measured parameters across the five net heights were determined.

Key words: *table tennis, net height, statistics*

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RESEARCH ON THE SOFTWARE OF DRAW ARRANGEMENT FOR TABLE TENNIS COMPETITION

Abstract
By using the methods of literature review, comparative analysis and empirical research, this paper makes a comparative analysis of the software used by ITTF, Dr. WU software and two table tennis competitions of China table tennis association. Research results: the software used by ITTF is based on EXCEL, and its operation relies on various formula Settings of EXCEL. Advantages: professional, friendly interface, easy to print; High flexibility. Disadvantages: difficult learning; Advantages of Dr. WU software: friendly interface, convenient printing, professional arrangement; Disadvantages: low flexibility, used in competitions for the disabled; Advantages of Chinese software, CAT: high technical content, strong applicability and strong professionalism; Disadvantages: no English operation, learning difficult; Advantages of Chinese software Tournament Assistant: quick learner, friendly interface, strong flexibility; Disadvantages: no English operation; too much arbitrariness.

Key words: *table tennis, draw arrangement, software, competition schedule*

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THE EFFECT OF CONTEXTUAL INTERFERENCE AND AGE DIFFERENCES (CHILDREN-TEENAGERS) ON LEARNING SELECTED TECHNIQUES OF TABLE TENNIS

Abstract
The aim of this study was to assess the effects of contextual interference and age differences on learning selected techniques of table tennis. Based on the type of exercise (random-blocked) and age difference (children-teenagers), 80 participants unfamiliar with techniques of table tennis were organized in four different exercise groups (children / random, children / blocked, teen / random, teen / blocked). Using a training movie, techniques of servis, forhand, and backhand were taught to all training groups. Blocked training groups exercised each technique 24 times a session and for 3 sessions. Random practice groups exercised each technique 8 times and completely randomly for three sessions. Retention and transfer tests were taken twenty-four hours after attending training sessions. Results of two-way ANOVA showed that age was the only significant effect in the retention phase and teenagers showed a better performance in all three techniques. The effect of age on performing flying mare and rear throw was significant in transfer phase implying teenagers' better performance. Moreover, random training groups performed duck under arm and rear throw significantly better than blocked training groups ($P \leq 0.05$). It seems that the factor of exerting appropriate body strength that is important for table tennis techniques was the reason of the better performance. In transfer phase non excellence of blocked and random practice was likely due to the complexity of the flying mare technique. According to the results of transfer phase, random training of table tennis techniques is recommended.

Key words: *contextual interference, table tennis, transfer, learning*

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DEVELOPMENT OF MOTION RESPONSE TRAINING SYSTEM FOR BADMINTON APLICABLE ALSO IN TABLE TENNIS

Abstract
Background: This project is to implement the sports science professional to design and develop the badminton agility reaction training equipment with intelligent functions to assist players' training and monitoring. Product design with a Bluetooth wireless function of the LED lamp module, with the development of the APP system program, so that the operating interface simple and easy to understand. Products with functions to sub-timing, training mode, test and record, feedback and so on. **Objective:** First of all, design and develop a badminton visual action reaction training system based on cross-field design, which provided agility, assistance and monitoring of the badminton footwork. Second, the design can meet the needs of domestic training, and the product has the features of wisdom and the lower cost. **Method:** The design of product architecture is designed with LED lamps, infrared sensor modules, and programmable controllers to operate the interface by the touch panel. The product has functions such as segment timing, step training, game simulation mode, testing, recording, and feedback. **Results:** The visual action reaction training system with the characteristics of auxiliary training, monitoring, testing, recording and the lower cost. It can precisely record the sports time, reaction time, action time in all directions and the simulation game. What's more, do the analysis through the built-in formula to output the action time pattern. And in the next study we will apply to the training of table tennis and tennis.

Key words: *reaction time, action time, simulation*

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ABSENCE OF HOME-ADVANTAGE IN TABLE TENNIS INDIVIDUAL COMPETITIONS

Abstract
Home-advantage means that a player performs better at home field like at away field (e.g. can beat a higher ranked opponent with higher possibility). The individual competitions don't guarantee that two players can compete in both of their own land against each other usually.
The Hungarian youth and senior national team players' individual matches were examined between 2009 and 2018. In addition they were asked by a questionnaire about their feelings playing in front of the home crowd.
The home-advantage wasn't significant at the Hungarian World Tour and World Junior Circuit events by the examination of the number of gained medals. Regarding the final positions of the players the senior players in the singles competitions and the juniors in the doubles had a light home-disadvantage.
22% of the Hungarian national players think that they can do a better performance in Hungary and 17% feel that they play worst at home. There was a significant relationship between the Hungarian players' subjective feeling about their home success and their willingness to play in Hungarian international competitions. (χ^2 = 21,66, $p < 0.01$, Cramer V = 0.776)
The results are similar like at other individual sports which means that in the individual sports with objective measured results there is no home-advantage for the players.

Key words: *home advantage, unbalanced schedule, table tennis, individual competitions*

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FOOTWORK TECHNIQUE USED IN ELITE TABLE TENNIS MATCHES

Abstract
Notational and Match analysis are very well-recognized methods to collect information about the most common technical-tactical performance indicators in Table Tennis: footwork and stroke types.
The aim of this study was to compare footwork distributions in men (M) and women (W) elite Table Tennis competitions. Nine men's and nine women's matches were analyzed. All players were in the top 120 (M) and 111 (W) positions of the ITTF world ranking.
An expert coach analyzed game video footages in slow motion with the software Kinovea and collected data about the footwork types used by the players across the games.
The results showed differences between M and W: M prefer to use One step (35.6%, W: 21.9%), W prefer to hit the ball without performing any step (W: 40.2%, M: 20.4%). The Chassè is equally used (M: 19.7%, W: 21.7%), and the Crossover is mainly used by M (11.1%, W: 3.7%). The Pivot is mainly used by M (9.9%, W: 7.8%), and W prefer the Slide (4.9%, M: 3.2%).
In conclusion, this study can be useful for Physical Trainers, Performance analysts, and Coaches, to design specific footwork training sessions for M and W elite table tennis players.

Key words: *notational analysis, match analysis, footwork*

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HOME-ADVANTAGE IN TABLE TENNIS LEAGUE COMPETITIONS

Abstract
Home-advantage means that a team performs better at home field like away field. A non-typical aspect of researching the presence or absence of home-advantage in table tennis is the balanced (e.g. national leagues) schedules perspective. A previous paper didn't find the home-advantage as a significant phenomenon in the men's German Bundesleague 1.
The Austrian Bundesleague 1's team matches between 2008 and 2018 were examined. 46% of the matches ended with a home victory, 41% ended with a guest victory and 14% ended with a draw. The presence of home-advantage was significant for the final result of team matches ($Z(604) = -2.910$, $p < 0.01$) and for the difference of won and lost matches by the home teams ($Z(604) = -3.623$, $p < 0.01$). There was no significant difference between top, average and low level teams in the difference of home and away winning ratio ($\chi^2(2) = 1.339$, $p > 0.5$) and in the difference of gathered points ratio at home and away ($\chi^2(2) = 0.796$, $p > 0.5$).
The result is suitable to other team sports' results but unusual if we take into consideration the individual sport competitions like tennis or boxing. However the difference is maybe caused that the individuals are cooperating as a team in this situation.

Key words: *home advantage, balanced schedule, league competitions, table tennis*

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ANTHROPOMETRIC CHARACTERISTICS AND MOTOR ABILITIES OF YOUNG FEMALE PLAYERS IN RELATION TO COMPETITIVE SUCCESS

Abstract
The aim of this research is to establish the correlation between anthropometric characteristics, motor and specific abilities and competitive success. The study included 40 young female table tennis players at the age 11±0.33 with training experience a 3.01 ± 0.91 years. The predictive variables were 15 anthropometric measures, 24 motor tests and 6 specific table tennis tasks. The criterion variable – the competitive success was verified on points won and registered on the Croatian Table Tennis Association ranking lists for categories (cadets and young cadets). The correlation between the predictive variables and competitive successfulness was analysed with the Pearson correlation coefficient. The results show that height, arm length, leg length and biacromial range has a statistical positive correlation with the competitive success. The positive correlation with the competitive success was obtained with 4 agility tests in which the intensive body movement or some parts of the body on a relatively small, limited space has been highlighted, and where the outcome has been connected with fast changes of the movement direction, the explosive power of the leg and the arm, the repetitive strength of the arms and the body, and cardiorespiratory endurance. Significant positive correlation was obtained with all 6 specific table tennis tests. This information can help trainers with talent identification, precise selection of players and planning of the training process. Programmes at this age should be targeted towards those abilities which demonstrate the biggest influence on the competitive success.

Key words: *young female table tennis players, anthropometric characteristics, motor abilities, specific table tennis tasks, success*

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MONITORING SLEEP BEHAVIOURS IN TABLE TENNIS PLAYERS IN THE NIGHTS BEFORE THE HOME AND AWAY TOURNAMENTS

Abstract
There is growing body of evidence suggesting that sleep can impact both physical and cognitive performance in sports. Given that table tennis places a high demand on muscles and brain during tournaments, it is important to monitor sleep patterns as a potential enhancing-performance factor before tournaments. 95 tennis (age) players competing in different levels including regional, national, and intergenerational completed the Athlete Sleep Behavior Questionnaire (ASBQ). A higher global score indicated poor sleep behaviors. The mean global score for the ASBQ across all the athletes was 41 ± 5. One on the ASBQ that resulted in the highest average scores were: "I use light-emitting technology in the hour leading up to bedtime (e.g laptop, phone, television, video games)"with mean scores of 4.0/5.0. Furthermore, total sleep time (TST) was negatively correlated with the above-mentioned item (r=-0.40, moderate). There was a significant difference in TST between home (8:24±1:12) and away (7:46± 1:43) tournaments ($p<0.05$). In conclusion, athletes might receive benefits in relation to sleep from early arrivals to the tournaments. Also, the usage of electronic devices should be minimized in order to attenuate the possible negative effects of red light on physiological hormones such as melatonin, thereby improving the sleep quality.

Key words: *total sleep time, cognitive function, sport performance*

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INVESTIGATING DIETARY INTAKE AND EATING HABITS OF TABLE TENNIS PLAYERS

Abstract
Table tennis is a racquet sport characterized by high intensity intermittent effort interspersed by short duration of rest. Given that peak power, speed, force, and agility are the main physiological factors of match play which can significantly influence the tournament performance. Therefore, it is crucial to ensure that athletes are aware of proper nutrition thereby meeting the physiological energy demands of sport. In a pilot study, using an observational design, 71 table tennis players (females, n= 36), 28 ± 9 years of age, were completed a 3-day food recall and self-administered eating habits questionnaire. The results showed that 89% of athletes did not following any specific diet. The food recall analysis indicated that the total energy intake consisted of carbohydrates (52.6± 7%), fat (22.9±3%), and protein (21.5±3%). Also, athletes fell short of the recommended intake of fruit and vegetable consumption. Despite that the total energy intake was the greatest on competition days versus training and non-training days, no specific timing of food consumption was found in competition days. In conclusion, table tennis players appear to unable to meet the energy requirements for training days as well as during tournaments.

Key words: *sports nutrition, healthy eating, performance*

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COMPARING AND PRIORITIZING OF TABLE TENNIS TALENT DETECTION CRITERIA FROM THE VIEW POINT OF TABLE TENNIS ELITE COACHES AND FORMER PLAYERS

Abstract
Purpose and background: talent detection contributes to extend the scope and domain for talented individuals who have the opportunity for the development of sport skills. The most important task for coaches and counsellors is to recognize and measure the talents, and to identify individual differences of various talents. The purpose of present study is to compare and prioritize of table tennis talent detection criteria form the view point of table tennis elite coaches and former players. **Methodology:** the research method is descriptive- analytical and it is a kind of applied research. The statistical population of study composed of elite coaches and former players of table tennis of Iran whose number according to the tennis federation includes 80 superior individuals of male adult, 32 superior of females, 32 individuals who have the first grade coaching certification, and 32 former players. Random- stratified method is used for sampling. Tennis players' talent detection questionnaire which is designed by researcher is used to assess the variables of research. In order to analyze the data of research we used the descriptive- statistical methods (mean and standard deviation) and inferential statistics of situation analysis and Friedman's test. **Results:** results of the study revealed that from the view point of table tennis elite coaches prioritizing the table tennis talent detection is the first priority and proper equipment and good aerobic power is the second priority. Prioritizing table tennis talent detection from the view point of table tennis former players showed that if tennis player has the appropriate personality traits he will have the highest priority from the perspective of former players. Then he should be psychologically flexible and the Flamingo balance test must be performed properly. There is a significant difference between the table tennis talent detection criteria from the view point of coaches and former players. These criteria have a higher mean for former players ($p<0/05$). **Conclusion:** as a result, it could be said that the more efficient equipment and provided training for the development of talent will lead to more satisfactory and desirable results. In other words, by taking advantage of appropriate training environment and identifying individuals' characters, the medium talents will grow as well.

Key words: *prioritize, talent detection, table tennis, elite coaches, pioneers*

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AN ANALYSIS OF 2017 ANTI-DOPING TESTING FIGURES IN TABLE TENNIS

Abstract
Statistical research on doping control focusing on table tennis was last reported in 2014. The purpose of this study is to examine 2017 anti-doping testing figures in table tennis and compare them with past findings and the results for all sports. This analysis is based on data published by the World Anti-Doping Agency. In table tennis, the 2017 data show a decrease of 18.8% in the number of overall samples analyzed, from 1,037 in 2016 to 842 in 2017. The ratio of Out-of-Competition (OOC) to In-Competition (IC) and OOC urine samples was lower in table tennis (37.9%) than in all sports (50.5%). There were three (0.4%) Adverse Analytical Findings (AAFs). The percentage of AAFs has been approximately the same for several years and remains below that for all sports. The classification of detected substances was S4 (Hormone and Metabolic Modulators), S7 (Narcotics), and S8 (Cannabinoids). Anabolic agents most frequently reported in all sports were not detected in table tennis. The presented results suggest that the ratio of OOC to IC and OOC testing still have room for improvement even though table tennis is one of the cleanest sports.

Key words: *table tennis, anti-doping*

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STUDY ON HOW TO FIND OUT COUNTERMEASURES TO CONTRADICTIONS BETWEEN LEARNING AND TRAINING THROUGH CHINESE TABLE TENNIS TALENTS DEVELOPMENT

Abstract
Table tennis is China's national ball, and also competitive sports advantage project. For a long time, it has occupied the dominant position in the international table tennis world, which has played an immeasurable role in the promotion of China's international status, the national spirit. However, the education of athletes has always been a major problem in the development of competitive sports in China.
Olympic champion Li Xiaoxia once urged people at the two sessions to pay attention to the placement of retired athletes. Competitive sports is cruel, there is only one champion forever. If you cannot get to the top of the pyramid, it means that after retirement you will face the problem of „unemployment". For another example, in the women's table tennis final of London Olympic Games in 2012, the referee judged Ding Ning's serve fouls for three times, which became the focus. The main reason was that Ding Ning was not good at English at that time and could not communicate well with the referee.
Although the government and relevant departments attach great importance to the above problems and take corresponding remedial measures, it is difficult to make up for the lack of basic education. Most athletes start systematic training when they are young children, and most of the time of each day is occupied by training. Athletes gradually get away from cultural education and the basic education they must receive at their age. In the final analysis, the lack of education of athletes is rooted in the youth. Many experts and scholars have pointed out in their studies that there is a serious lack of athletes' culture in China, and the contradiction between learning and training always exists. The problem of learning and training of athletes originates in their youth and develops in the process of long-term and continuous training. Only by addressing the root cause of the problem can we solve the problem effectively. This study focuses

on the contradiction between learning and training in the youth of athletes, In-depth understanding of the current table tennis reserve talent-training process in the contradiction between learning and training. In addition, according to its characteristics, put forward the corresponding countermeasures to make young athletes cultural learning and sports training to maintain a balance in a certain degree, to solve the problem of lack of cultural education athletes from the root. The study found China adopts the „whole nation system" to cultivate sports talents, and gradually forms a three-level training network athlete training system based on sports technical schools, amateur sports schools and excellent sports teams in the process of sports development. However, with the continuous progress of the society, the competition for talents is increasingly fierce, and the demand for talents is also increasing. Athletes need not only excellent athletic performance, but also comprehensive ability in several aspects.
The cultivation of competitive sports talents forms a new mode of introduction—absorption—independent training, and realizes a win-win situation for individual athletes and universities. Therefore, „the combination of sports and education" will certainly become the development direction of our competitive sports talent training strategy.

Key words: *table tennis, training system, learning and training contradiction, countermeasures*

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INVESTIGATION AND ANALYSIS ON THE SKILL LEVEL OF TABLE TENNIS AMONG TEENAGERS IN GARDEN EXPERIMENTAL PRIMARY SCHOOL OF WUXI, JIANGSU PROVINCE

Abstract
Background: The purpose of the skill level of table tennis among teenagers in Wuxi, Jiangsu Province is to publicize the standard of skill grade of table tennis among teenagers. It also aims at the optimization of the model of students' comprehensive evaluation, as well as the promotion of the reform in school physical education curriculum and the development of youth sports work in Wuxi. This test takes the table tennis skill level test of teenagers in China Table Tennis Institute as the background. And the respondents of the investigation and analysis are the students in Garden Experimental Primary School who participated in this test. **Methods**: This essay adopts the literature method, the experiment method, the expert interview method and the questionnaire survey method to carry on the research. It investigates the influence of basic information, personal cognition and environmental factors on the table tennis skill level among the students who took part in the teenagers table tennis skill level test. **Results:** (1) Basic information; The age of the respondents ranges from 9 to 10. Among them, 73.1% play table tennis for two years and below, 78% of them use knife grip two-side loop. 91% of them did not obtain a national athlete's grade certificate and 95.6% have never won a prize. (2) Personal cognition: 66.7% of the students said they knew only a little about table tennis, and 50% said they didn't have the basic knowledge of it. Among all the table tennis techniques, forehand loop is the most difficult one that students think. Besides, it may be the serve. (3) Environmental factors: The environmental factors of this survey are school, community, family and association. As to school factor, 86.7% of the students were satisfied with the school sports stadiums and equipment, and 20% were satisfied with the school's ping-pong reward policy. As to community factor, the number of table tennis stadiums and stadiums around the community was less satisfied, and the environment and atmosphere of the stadiums and stadiums were satisfied. As to family factor, 25% of students often play table tennis with their parents. As to teaching environment factor, 91.1% of the students said the head teacher encouraged them to participate in table tennis, and 88.9% said the teacher praised the outstanding students. As to association factor, 68.2% of the students thought table tennis is a promoter of friendship. **Conclusion**: In

response to the problems existing in Wuxi Garden Experimental Primary School by this investigation, we put forward the following solutions: 1.Introduce the incentive policy 2.Increase the input of hiring teachers and improve the wages and benefits for teachers in order to encourage them to lead competitions 3. Improve the diversified development of technique and grip.

Key words: *table tennis, skill level, influencing factor*

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APPLICATION OF 3S & 3C THEORY TO DEVELOP THE ANALYSIS INFORMATION SYSTEM IN TABLE TENNIS

Abstract

Table tennis (TT) is a fast-paced and interactive sport. While playing elite TT, usually a few hundreds of milliseconds for each shot may response and counterattack precisely and properly. The instant reactions, solid TT skills, and quick movements play particularly an important role. Based on the 3S (spin, speed, spot) and 3C (control consistency, change) principles developed by Dr. Sheng K Wu, combination of 3S and 3C will be the significant factor for TT players in scoring and winning the game. However, there is no any data analysis system to validate and examine the 3S & 3C principles in elite TT matches. The purpose of this study was to construct a WEB-based cloud service information system following the 3S & 3C principles. We uploaded clips of table tennis matches as well as recorded characteristics such as players´ techniques, speed and rotation of the ball, and the exact landing spots of each shot during the games. Later, we analyzed the status of the 3S of each shot including service, return service and rally, and the 3C of the players in the games. We will demonstrate the analysis of some international events and show some results using the Analysis Information System during presentation. Through this system, we can solve main problems posed by manual collection and analysis of data which are both cumbersome and labor-intensive. This system also provides useful guidelines for TT players and coaches on technical training, and subsequently strengthens 3S skills and enhances tactical skills of the players. Moreover, in the future we can promote the system and also introduce the analysis of big data in artificial intelligence. This will help analyze the complex 3C of the players during the games as well as effectively assist coaches in guiding players to improve their skills, tactics, and performance.

Key words: *tactics, 3S & 3C principles, match analysis, artificial intelligence*

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ON THE TWIST OF THE TRUNK THAT AFFECTS THE FOREHAND HITTING SPEED OF TABLE TENNIS

Abstract
Forehand Smash is the most powerful way to beat a table tennis match. It is possible to hit a fast ball by concentrating the power of the whole body, but this fact has been reported in the past. In order to increase the speed of the ball, it is assumed that the twisting of the whole body, in particular the twisting of the waist, is important. This experiment focused on the influence of body twist, especially waist twist, in order to increase the ball speed. The subject wore a thin bodysuit with a small, highly sensitive inertial sensor (gyro, acceleration, geomagnetic sensor) embedded. The subject hit the ball at two places on the left and right of the table tennis table, and the ball speed at that time was measured. The number of inertial sensors on the "Xsens Link" is 17, the total weight is approximately 1.1 kg, the battery life is 9.5 hours, and the sampling rate is 240 Hz. The subjects are four regular players from Waseda University (all Nippon University top class). We acquired 23 dimensional 3D coordinate data of the whole body, but the main analysis item is the plane angle between shoulder and waist. We analyzed the player's shoulder and waist twist, wrist speed, and ball speed for the four players. The movement data of the player was compared with the data of 60 hits at a rate of once per second. The shoulder and hip twist angles are negative when the racket is pulled backwards and positive when the racket is shaken forward. The wrist speed was used as an index corresponding to the racket speed. In addition, Casio's high-speed camera was installed horizontally to the subject at 300 frames per second. The fastest ball speed was the maximum ball speed (m / sec) during 60 strokes. During the operation of pulling the racket backward, the horizontal angle between the shoulders and the hips was minus 30 degrees with respect to the four players. In the action of swinging the racket forward, K was 15 degrees, I was 20 degrees, O was 0 degrees, and H was 10 degrees. This difference in angle symbolizes the difference in play style. In other words, players who swing the racket relatively large play away from the court to continue the rally. On the other hand, players who swing relatively small rackets play close to the court. The wrist speed and the ball speed are K (15.2 m / s: 25.5 m / s), I (20.3 m / s: 30.1 m / s), O (20.1 m / s: 28.5 m / s), H (18.3 m / s: 26.2 m / s). That is, as the speed of the wrist was higher, the ball speed tended to increase. The relationship between the ball speed and the horizontal angle between the shoulders and hips was examined, but no clear trend was observed. Based on the results of this experiment, it has been suggested that more detailed studies are needed.

Keywords: *trunk, forehand, hitting speed, table tennis*

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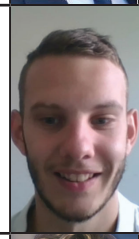
011	Cece, Valérian		valerian.cece@orange.fr	University of Claude Bernard Lyon, Laboratory of Vulnerabilities and Innovation in Sport (EA 7428), France	FRA
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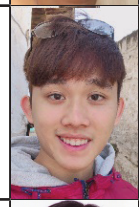
014	Chang, Hua-Lin		alice999049@gmail.com	National University of Kaohsiung of Department of Athletic Performance, Taiwan	TPE
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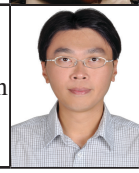
017	Chang, Wen-Dien		changwendien@gm.ntupes.edu.tw	College of Sport Performance, National Taiwan University of Sport, Taiwan	TPE

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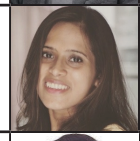
041	Gambhir, Megha		meghagambhir1703@gmail.com	STUPA (Sports Training Under Performance Analytics), India	IND
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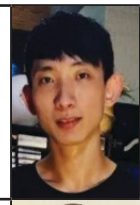
055	Hsu, Chia-Wei		ak4746988@gmail.com	Department of Graduate Institute of Sports and Health Management, National Chung Hsing University	TPE
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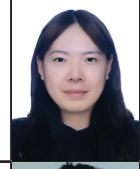
060	Huang, Hsiang-Han		smilehan1118@gmail.com	Department of Sport Performance, National Taiwan University of Sport, Taichung, Taiwan	TPE
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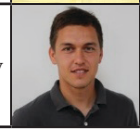
063	Hublin, Tomislav		thublin@mev.hr	Polytechnic of Međimurje in Čakovec, Croatia	CRO

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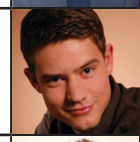
065	Hülsdünker, Thorben		t.huelsduenker@dshs-koeln.de	China Table Tennis College Europe, Luxembourg	LUX
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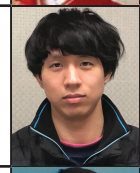
069	Ishida, Hikaru		hikaru4453@outlook.jp	Graduate School of Modern Society and Culture, Niigata University, Japan	JPN
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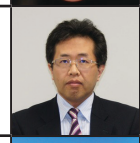
071	Ito, Kenichi		itoh@iee.niit.ac.jp	Department of Engineering, Niigata Institute of Technology, Japan	JPN
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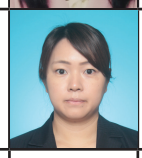
075	Kamijima, Kei		kamijima@niit.ac.jp	Department of Engineering, Niigata Institute of Technology, Japan	JPN
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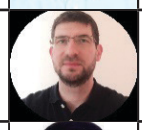
077	Karai, Péter		karai.peter@ponger.eu	Ponger, Hungary	HUN
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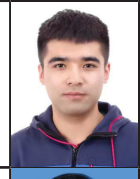
091	Lei, Qian		757350115@qq.com	China Institute of Sport Science, Beijing, China	CHN
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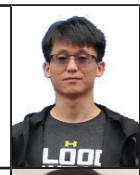
093	Liang, Zhiqiang		ail_liang@yeah.net	Ningbo University, Faculty of Sports Science, China	CHN
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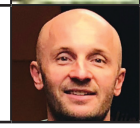
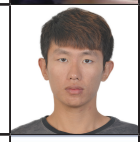
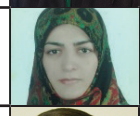
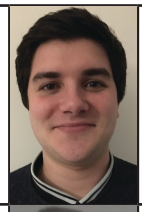
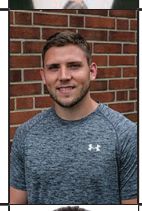
101	Lindner, Ádám		adamlindner75@yahoo.com	University of Pecs, Faculty of Health Sciences, Hungary	HUN

102	Liu, Jing-Wei		liujingwei.ntus@gmail.com	Department of Sport Information and Communication, National Taiwan University of Sport, Taiwan	TPE
103	Liu, Meihan		liumeihancm@163.com	Shanghai University, China Table Tennis College of Sports, China	CHN
104	Liu, Shuai		534333084@qq.com	North China University of Technology, Beijing, China	CHN
105	Liu, Yue-Ming		bigliu925@yahoo.com.tw	Department of Marine Leisure Management, National Kaohsiung University of Science and Technology, Taiwan	TPE
106	Lu, Chiu-Ju		cjlu@niu.edu.tw	Sports Education Center, National Ilan University, Yilan County, Taiwan	TPE
107	Lyu, Xiang		742175392.qq.com	Ningbo University, Faculty of Sports Science, China	CHN
108	Major, Zoltan		zoltan.major@jku.at	Johannes Kepler Universität Linz, Institute of Polymer Product Engineering, linz, Austria	AUT
109	Malagoli, Lanzoni Ivan		ivan.malagoli@unibo.it	School of Pharmacy, Biotechnology and Sport Sciences, University of Bologna, Italy	ITA
110	Mansouri Fayaz, Fatemh		saba.tehrani88@gmail.com	Hamedan table tennis complex, I.R. Iran	IRN
111	Marguc, Karl Rudolf		k.marguc@gmx.at	Johannes Kepler Universität, Institute of Polymer Product Engineering, Graz, Austria	AUT

112	Marsan, Thibault		thibault.marsan@ensam.eu	Arts et Metiers ParisTech, Institut de Biomecanique Humaine Georges Charpak, Paris, France	FRA
113	Martinent, Guillaume		guillaume.martinent@univ-lyon1.fr	University of Claude Bernard Lyon, Laboratory of Vulnerabilities and Innovation in Sport (EA 7428), France	FRA
114	Martínez Díaz, Inmaculada Concepcion		martinezdiaz@us.es	Department of Physical Education and Sports, University of Seville (Spain), Faculty of Education Sciences	ESP
115	Matsuo, Shiro		shiro-matsuo@jcom.home.ne.jp	Anti-Doping Committee, Japan Table Tennis Association, Japan	JPN
116	McClinton, Austin		ajm1045@sru.edu	Department of Physical and Health Education, Slippery Rock University of Pennsylvania, PA, USA	USA
117	Meng, Yao		jymengyao@gmail.com	Faculty of Sports Science, Ningbo University, Ningbo, China	CHN
118	Mierau, Andreas		mierau@dshs-koeln.de; andreas.mierau@lunex-university.net	Department of Exercise and Sport Science, LUNEX International University of Health, Exercise and Sports, Differdange, Luxembourg	LUX

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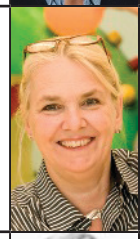
124	Moşoi, Adrian Alexandru		adrian.mosoi@unitbv.ro	Transilvania University of Braşov, Faculty of Physical Education and Mountain Sports, Romania	ROM
125	Nijhuis-Van der Sanden, Maria W.G.		ria.nijhuis-vandersanden@radboudumc.nl	Radboud university medical centre, Radboud Institute for Health Sciences, IQhealthcare, Nijmegen, The Netherlands	NED
126	Nikolić, Ivana		ivana.nikolic@ufzg.hr	Faculty of Teacher Education, University of Zagreb, Zagreb, Croatia	CRO
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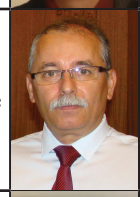
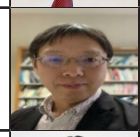
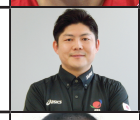
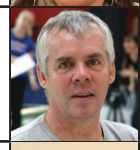
129	Ochianã, Nicolae		sochiana@yahoo.com	Faculty of Health, Sports and Movement Science, University "Vasile Alecsandri", Bacau, Romania	ROM
130	Ogino, Masaki		ogino@kansai-u.ac.jp	Kansai University, Faculty of Informatics, Japan	JPN
131	Okada, Takuro		takuro_okada1987@yahoo.co.jp	Department of Pharmacy, Kameda General Hospital, Japan	JPN
132	Osterman, Martin		martin.ostermann@me.com	Fédération Luxembourgeoise de Tennis de Table, Luxembourg	LUX
133	Ozaki, Hiroki		hiroki.ozaki@jpnsport.go.jp	Japan Institute of Sports Science, Japan	JPN
134	Paár, Dávid		david.paar@etk.pte.hu	University of Pecs, Faculty of Health Sciences, Hungary	HUN
135	Pálvölgyi, Ágnes		agnes.palvolgyi@etk.pte.hu	University of Pécs, Faculty of Health Sciences, Hungary	HUN
136	Pion, Johan		johan.pion@han.nl	HAN University of Applied Sciences, Nijmegen, The Netherlands	NED
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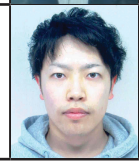
143	Ren, Jie		renjiemail2008@163.com	Shanghai Institute of Physical Education, China Table Tennis Academy, China	CHN
144	Rouch, Philippe		philippe.rouch@ensam.eu	Arts et Metiers ParisTech, Institut de Biomecanique Humaine Georges Charpak, Paris, France	FRA
145	Sagharchi, Majid		mansory2025@yahoo.com	Payam – noor University (PNU), I.R. Iran	IRN
146	Sato, Yuki		styk7006@gmail.com	Graduate School of Science and Technology, Niigata University, Japan	JPN

147	Sauret, Christophe		christophe.sauret@ensam.eu	Arts et Metiers ParisTech, Institut de Biomecanique Humaine Georges Charpak, Paris, France	FRA
148	Schorer, Jörg		joerg.schorer@uni-oldenburg.de	University of Oldenburg, Institute of Sport Science, Germany	GER
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157	Shioiri, Akiyoshi		z18n407a@mail.cc.niigata-u.ac.jp	Graduate School of Modern Society and Culture, Niigata University, Japan	JPN
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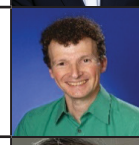
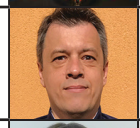
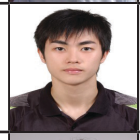
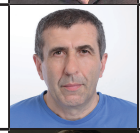
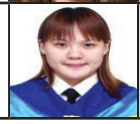
159	Stocker, Miklós		miklos_stocker@yahoo.com	Corvinus Business School, Corvinus University of Budapest, Hungary	HUN
160	Straub, Gunter		straub@vdtt.de	Association of German Table Tennis Coaches (VDTT), Germany	GER
161	Sujae, Ian Harris		ian_harris_sujae@rp.edu.sg	School of Sports Health and Leisure, Republic Polytechnic, Singapore	SIN
162	Sun, Qilin		sunqilin@sjtu.edu.cn	Shanghai Jiao Tong University, PE department, China	CHN
163	Sun, Yi		sunyi3426@gmail.com	National Cheng Kung University Institute of Physical Education, Health & Leisure Studies, Tainan, Taiwan	TPE
164	Sung, Ching-Yi		ching@nkust.edu.tw	National Kaohsiung University of Science and Technology, Physical Education Office, Taiwan	TPE

165	Supej, Matej		matej.supej@fsp.uni-lj.si	University of Ljubljana, Faculty of Sport, Slovenia	SLO
166	Szanka, Csaba		szanka.csaba@ponger.eu	Ponger, Hungary	HUN
167	Szily, Márta		marta.szily@gmail.com	SplitT-Pong Ltd, Budakeszi, Hungary	HUN
168	Tamaki, Sho			Meio University, Faculty of Human Health Science, Japan	JPN
169	Tang, Chia-Yu		jimmy_lin19@yahoo.com.tw	Institute of Clinical Medicine, National Yang-Ming University, Taiwan	SCO
170	Teraoka, Eishin		eishin.teraoka@strath.ac.uk	University of Strathclyde, School of Education, Scotland	ENG
171	Thoreux, Patricia		patricia.thoreux@aphp.fr	Hôpital Avicenne, université Paris 13, Sorbonne Paris-Cité, Bobigny, France	FRA
172	Tiefenbacher, Konrad		tiefenbacher@wassing.com	Wassing Messtechnik GmbH, Osnabrück	GER
173	Torkar, Drago		drago.torkar@ijs.si	Jožef Stefan Institute, Ljubljana, Slovenia	SLO
174	Trpkovici, Melinda		melinda.trpkovici@gmail.com	University of Pécs, Faculty of Health Sciences, Hungary	HUN
175	Tsai, Kuei-Lan		tkl@kmu.edu.tw	Kaohsiung Medical University, Taiwan	TPE

176	Tsai, Meng-Hsiun		mht@nchu.edu.tw	National Chung Hsing University, Department of Management Information Systems, Taiwan (R.O.C.)	TPE
177	Tu, Hsin-Yu		tusinyu@gmail.com	Sports Education Center, National Ilan University, Yilan County, Taiwan	TPE
178	Tung, Mu-Chiao		ilgatfe@hotmail.com	National Pingtung University of Science and Technology, Taiwan	TPE
179	Ushiyama, Yukihiko		ushiyama@ed.niigata-u.ac.jp	Institute of Humanities, Social Sciences and Education, Niigata University, Japan	JPN
180	Valovics, Gyula		valovics.gyula@gmail.com	SplitT-Pong Ltd, Budakeszi, Hungary	HUN
181	Wan, Rizal		wan_rizal2@rp.edu.sg	School of Sports Health and Leisure, Republic Polytechnic, Singapore	SIN
182	Wang, Ming-Yueh		mywang@mail.cyut.edu.tw; mywang@nuk.edu.tw	National University of Kaohsiung of Department of Athletic Performance, Taiwan	TPE
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191	Yan, Sen		yansen@sus.edu.cn	China Table Tennis College, Shanghai University of Sport, China	CHN
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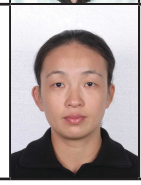
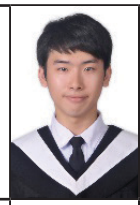
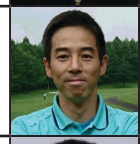
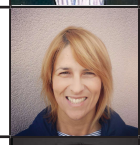
193	Yang, Yi-Chen		40543203@gm.nfu.edu.tw	National Formosa University, Computer Science and Information Engineering, Taiwan	TPE
194	Yanling, Sun		1577008260@qq.com	Guangdong University of Foreign Studies, Guangdong, China	CHN

195	Yeh, Chih-Wei		t604533@hotmail.com	National Kaohsiung Normal University, Student of Physical Education Department, Taiwan, R.O.C	TPE
196	Yeh, Yu-Shan		gto7966@hotmail.com	National Kaohsiung Normal University, Student of Physical Education Department, Taiwan, R.O.C	TPE
197	Yoshida, Kazuto		yoshida.kazuto@shizuoka.ac.jp	Shizuoka University, Academic Institute, College of Education, Japan	JPN
198	Yoshioka, Shinsuke		yoshioka@idaten.c.u-tokyo.ac.jp	The University of Tokyo, Graduate School of Arts & Sciences, Japan	JPN
199	Yquel, Rozenn Jacquet		rozenn.jacquet-yquel@insep.fr	INSEP, Pôle France de Tennis de table, 11 Avenue du Tremblay, Paris, France	FRA
200	Yu, Changxiao		yuchangxiao.nbu@foxmail.com	Ningbo University, Faculty of Sports Science, China	CHN
201	Zarei, Mostafa		zareeimostafa1362@gmail.com	Department of sport injuries and corrective exercise, faculty of sport sciences and health, Shahid Beheshti University, Tehran, I.R. Iran	IRN
202	Zenić, Nataša		natasazenic@gmail.com	Faculty of Kinesiology, University of Split, Split, Croatia	CRO
203	Zhang, Rui		zhrui@pku.edu.cn	Peking University, Beijing, China	CHN

204	Zhang, Tong		1174115093@qq.com	Shanghai University of sport, China	CHN
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206	Zhao, Jianyao		361349050@qq.com	Hangzhou Urban Construction Training Center, Hangzhou, China	CHN
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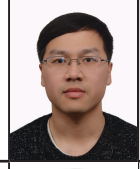
209	Zhou, Xingdong		1760003566@qq.com	Beijing Sport University, Beijing, China	CHN
210	Zhou, Zhexiao		zhouzhexiao@126.com	Ningbo University, Faculty of Sports Science, Ningbo, China	CHN
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THE 16TH ITTF SPORTS SCIENCE CONGRESS TIME SCHEDULE

Thursday, April 18th, 2019
Arrival: all day
Location: Danubius Hotel Flamenco, Budapest

Friday, April 19th, 2019
Time: (09:00 AM – 19:00 PM)
Location: Danubius Hotel Flamenco, Budapest

Saturday, April 20th, 2019
Time: (09:00 AM – 15:00 PM)
Location: Danubius Hotel Flamenco, Budapest

THE 16TH ITTF SPORTS SCIENCE CONGRESS' OPENING CEREMONY

Group photograph of all participants and guests:
Date: April 19th (08:50 AM)
Location: Danubius Hotel Flamenco, Budapest

Opening ceremony
Date: April 19th (09:00 AM)
Location: Danubius Hotel Flamenco, Budapest
Host: Andras Olah (Chairman of organizing committee)

Opening remarks:
Welcoming address
- Tünde Szabó (State Secretary for Sport)
- Roland Nátrán (President of Hungarian Table Tennis Association)
- Pongrác Ács (Vice-Dean of Faculty of Health Sciences, University of Pécs)

Congratulatory address
- Mr. Thomas Weikert (President of the ITTF)

Closing remarks:
- Dávid Paár (General secretary of the organizing committee)

Keynote Speakers:
Date: April 19th (09:30 AM)
Dr. Sheng K Wu (National Taiwan University of Sport, Taiwan; ITTF)
Classification, impairments, and research in para table tennis: past, current, and future

Date: April 19th (14:30 PM)
Prof. Damir Sekulić (Dean of Faculty of Kinesiology, University of Split, Croatia)
How should we test agility components in racket sports, including table tennis?

Date: April 20th (09:15 AM)
Miklós Stocker, PhD Corvinus University of Budapest
Economic Impacts of International Sport Events Organized in Hungary

PODIUM PRESENTATIONS SCHEDULE

Date: **April 19th (09:30 AM)**
Location: Danubius Hotel Flamenco, Budapest – Room Bolero
Chairpersons: **Michael Fuchs, Tsung Min Hung**

Keynote Speaker**:**
Dr. Sheng K Wu (National Taiwan University of Sport, Taiwan; ITTF)
Classification, impairments, and research in para table tennis: past, current, and future

Time	Name	Cou	Title
09:30-10:00	Sheng K Wu	TPE	CLASSIFICATION, IMPAIRMENTS, AND RESEARCH IN PARA TABLE TENNIS: PAST, CURRENT, AND FUTURE

10 minutes time to change the rooms.

Section 1 - Room Bolero

Time	Name	Cou	Title
10:10-10:25	Irene R. Faber	GER	BIOLOGICAL MATURITY AND THE RELATIVE AGE EFFECT IN DUTCH ELITE YOUTH TABLE TENNIS PLAYERS
10:25-10:40	Mojtaba Kaviani	CDN	INVESTIGATING DIETARY INTAKE AND EATING HABITS OF TABLE TENNIS PLAYERS
10:40-10:55	Thibault Marsan	FRA	COMPARISON OF HIP JOINT MECHANICAL ENERGY IN TABLE TENNIS FOREHAND AND BACKHAND DRIVES: A PRELIMINARY STUDY
10:55-11:10	Yoichi Iino	JPN	VALIDATION OF ESTIMATION OF LOWER LIMB MUSCLE ACTIVATION DURING THE TABLE TENNIS TOPSPIN FOREHAND
11:10-11:35	Coffee Break		
11:35-11:50	Higinio Gonzalez Garcia	ESP	RELATIONSHIPS BETWEEN PERCEIVED COACHING LEADERSHIP, COPING AND EMOTIONS AMONG TABLE TENNIS PLAYERS
11:50-12:05	Ee Won Liew	TPE	DYNAMIC VISUAL ATTENTION ON MOT OF ELITE TABLE TENNIS PLAYERS

12:05-12:20	Andreas Mierau	LUX	THE NEURAL UNDERPINNINGS OF VISUOMOTOR REACTION SPEED IN ELITE YOUTH TABLE TENNIS PLAYERS
12:20-12:35	Adrian Alexandru Moşoi	ROM	PERSONALITY PROFILE – ENGINE FOR HIGH PERFORMANCE?
12:35-12:50	Higinio Gonzalez Garcia	ESP	SPANISH TABLE TENNIS PLAYERS EMOTIONAL PROFILES: RELATIONSHIP WITH BURNOUT AND COPING SKILLS

Section 2 – Room Ravel

Chairpersons: **Drago Torkar, Miklos Stocker**

Time	Name	Cou	Title
10:10-10:25	Gunter Straub	GER	IN THE BEGINNING WAS THE HALF-VOLLEY: THE HISTORY OF DEFENSE IN TABLE TENNIS–REVISED
10:25-10:40	Sun Qilin	CHN	AN EXPLORATION ON ESTABLISHMENT AND INTERNATIONAL POPULARIZATION OF TABLE TENNIS GRADING SYSTEM
10:40-10:55	Zhou Xingdong	CHN	EXPLORATION ABOUT THE COMPETITIVE PERFORMANCE AND WINNING RULES OF TABLE TENNIS BASED ON BOARD CHARACTERISTICS IN THE CONTEXT OF THE NEW BALL ERA
10:55-11:10	Ming-Hua Hsu	TPE	ANALYSIS OF 3S STRATEGIES OF TABLE TENNIS PLAYERS IN SERVICE AND RECEIVING SERVICE: USING THE DECISION TREE
11:10-11:35	Coffee Break		
11:35-11:50	Zoran Djokić	SRB	SERVE ANALYSES IN ELITE EUROPEAN TABLE TENNIS MATCHES
11:50-12:05	Yi Sun	CHN	USING TABLE TENNIS RECORD FORM TO EXPLORE 2018 WORLD TOUR GRAND FINALS MEN'S SINGLE PLAYER'S CRUCIAL TECHNICAL AND TACTICAL
12:05-12:20	Ivan Malagoli Lanzoni	ITA	FOOTWORK TECHNIQUE USED IN ELITE TABLE TENNIS MATCHES

12:20-12:35	Sheng K Wu	TPE	SYSTEMATIC DEVELOPMENT OF TABLE TENNIS SPORT SCIENCE PROJECT IN TAIWAN: TALENT SELECTION, MEASUREMENT OF PRESSURE, SPORT INJURY, TECHNOLOGICAL RACKETS, AND INTELLECTUAL TACTICAL SYSTEM
12:35-12:50	Isao Hayashi	JPN	AI COACH: LEARNING TABLE TENNIS STRATEGY RULES FROM VIDEO

LUNCH TIME – 12:50 – 14:30

Date: **April 19th (14:30 PM)**
Location: Danubius Hotel Flamenco, Budapest – Room Bolero
Chairpersons: **Higinio Gonzalez Garcia, Nicolae Ochiana**

Keynote Speaker:
Prof. Damir Sekulić (Faculty of Kinesiology, University of Split, Croatia)
How should we test agility components in racket sports, including table tennis?

Time	Name	Cou	Title
14:30-15:00	Damir Sekulić	HUN	HOW SHOULD WE TEST AGILITY COMPONENTS IN RACKET SPORTS, INCLUDING TABLE TENNIS?

10 minutes time to change the rooms.

Section 3 – Room Bolero

Time	Name	Cou	Title
15:10-15:25	Konrad Tiefenbacher	GER	EVALUATION OF FRICTIONAL PROPERTIES AND CONSEQUENCES ON TABLE BALL INTERACTION FOR DIFFERENT ITTF APPROVED PLASTIC BALLS
15:25-15:40	Sho Tamaki	JPN	TRACKING A TABLE TENNIS BALL USING ADABOOST: A CASE STUDY
15:40-15:55	Drago Torkar	SLO	NET HEIGHT IMPACT TO TABLE TENNIS GAME
15:55-16:10	Hua-Lin Chang	TPE	A STUDY ON BRAND, REPEAT PURCHASES AND PLAYER SATISFACTION IN TABLE TENNIS
16:10-16:30	Coffee Break		
16:30-16:45	Michail Katsikadelis	GRE	MULTIBALL TRAINING. A REVIEW

16:45-17:00	Zoran Djokić	SRB	RECEIVE ANALYSIS IN ELITE EUROPEAN TABLE TENNIS MATCHES
17:00-17:15	Dávid Paár	HUN	HOME-ADVANTAGE IN TABLE TENNIS LEAGUE COMPETITIONS
17:15-17:30	Jerzy Grycan	POL	TACTICAL ANALYSIS OF TOP RANKED PLAYERS AND ITS IMPLICATIONS TO EDUCATING PLAYERS AND COACHES IN TABLE TENNIS
17:30-17:45	Megha Gambhir	IND	"MATCH ANALYSIS" USING NOTATIONAL ANALYSIS IN TABLE TENNIS

Section 4 - Room Ravel

Chairpersons: **Kazuto Yoshida, Rizal Wan**

Time	Name	Cou	Title
15:10-15:25	Istvan Kovacs	USA	TABLE TENNIS LOOP-DRIVE TRAINING: A NEUROMOTOR EXERCISE MODALITY FOR THE ADULT POPULATION
15:25-15:40	Irene R. Faber	GER	RELATIVE AGE EFFECTS IN ELITE TABLE TENNIS IN INTERNATIONAL AND NATIONAL CONTEXTS
15:40-15:55	Eishin Teraoka	GBR	AFFECTIVE EXPERIENCES AND BENEFITS OF TABLE TENNIS FOR YOUTH AND ADULTS: A REVIEW OF LITERATURE
15:55-16:10	Fethi Regaieg	QAT	TRAVEL MEDICAL ISSUES AFFECTING THE ATHLETE'S HEALTH AND PERFORMANCE
16:10-16:30	Coffee Break		
16:30-16:45	Sagharchi Majid	IRN	THE EFFECT OF CONTEXTUAL INTERFERENCE AND AGE DIFFERENCES (CHILDREN-TEENAGERS) ON LEARNING SELECTED TECHNIQUES OF TABLE TENNIS
16:45-17:00	Irene R. Faber	GER	IS TABLE STARS @SCHOOL OF ADDED VALUE AS PART OF THE PHYSICAL EDUCATION PROGRAM IN PRIMARY SCHOOLS? – A PILOT INTERVENTION STUDY

17:00-17:15	Tahereh Rahmati	IRN	THE PRIORITIZATION AND COMPARISON OF CRITERIA IN THE SELECTION OF NATIONAL TABLE TENNIS COACH: SPORT ELITES PERSPECTIVES(WOMEN & MEN)
17:15-17:30	Ching-Hsiu Chiang	TPE	PERCEPTUAL PERFORMANCE IN ELITE TABLE TENNIS PLAYERS
17:30-17:45	Sima Limoochi	IRN	THE ROLE OF AFFECTS IN PREDICTING THE SUCCESS OF EXPERT TENNIS PLAYERS

17:45 -
After the last presenter there will be a poster session. All authors who have submitted their posters, should present their work.
After the afternoon session there will be official dinner at 20:45 in hotel restaurant.

Date: **April 20th (09:15 AM)**
Location: Danubius Hotel Flamenco, Budapest – Room Bolero
Chairpersons: ***Shiro Matsuo, Tsung Min Hung***

Keynote Speaker:
Miklós Stocker, PhD Corvinus University of Budapest
Economic Impacts of International Sport Events Organized in Hungary

Time	Name	Cou	Title
09:15-09:45	Miklós Stocker	HUN	ECONOMIC IMPACTS OF INTERNATIONAL SPORT EVENTS ORGANIZED IN HUNGARY

10 minutes time to change the rooms.

Section 5 - Room Bolero

Time	Name	Cou	Title
09:55-10:10	Inmaculada C. Martínez Díaz	ESP	ACTIVE METHODOLOGIES COMBINED IN THE TEACHING OF RACKET SPORTS AT THE UNIVERSITY. AN EXPERIENCE WITH STUDENTS OF SCIENCE OF PHYSICAL ACTIVITY AND SPORTS OF THE
10:10-10:25	Gyula Valovics	HUN	SPLITT-PONG AS AN EASY TOOL TO SELECT TALENTS FOR TABLE TENNIS
10:25-10:40	Jao Ming-Kai	TPE	RESEARCH ON PARTICIPATION MOTIVATION, PARTICIPATION BENEFIT AND BEHAVIOR INTENTION OF UNIVERSITY TABLE TENNIS CLUBS STUDENTS
10:40-11:05	Geraldo Ricardo H. Campestrini	BRA	GOVERNANCE INDICATORS IN BRAZILIAN TABLE TENNIS CONFEDERATION: HOW THE CONCEPT IMPACTS IN THE MANAGEMENT OF A SPORT FEDERATION
11:05-11:20	Wan Rizal	SIN	INVESTIGATING HYSTERESIS IN EXPERT AND NOVICE TABLE TENNIS PLAYERS AS A FUNCTION OF PRACTICE
11:20-11:40	Coffee Break		
11:40-11:55	Mei-Jen Huang	TPE	THE STUDY ON PREDICAMENTS AND STRATEGIES OF PROMOTING PROFESSIONAL TABLE TENNIS IN TAIWAN

11:55-12:10	Mojtaba Kaviani	CDN	MONITORING SLEEP BEHAVIOURS IN TABLE TENNIS PLAYERS IN THE NIGHTS BEFORE THE HOME AND AWAY TOURNAMENTS
12:10-12:25	Geraldo Ricardo H. Campestrini	BRA	STRATEGIC PLAN OF BRAZILIAN TABLE TENNIS CONFEDERATION: LOOKING FOR DEVELOPMENT
12:25-12:40	Péter Karai Ponger	HUN	THE BENEFICIAL EFFECTS OF INFORMATION TECHNOLOGY SOLUTIONS ON AMATEUR TABLE TENNIS
12:40-12:55	Xiao Dandan	CHN	RESEARCH AND DEVELOPMENT OF SPECIAL TECHNICAL AND TACTICAL VIDEO ANALYSIS SOFTWARE OF „TABLE TENNIS STRATEGIST”
12:55-13:10	Karl Rudolf Marguc	AUT	DISCUSSION OF TABLE TENNIS RACKET PROPERTIES 2019

13.15 Closing remarks by the chairman of the ITTF Sports Science and Medical Committee prof. Miran Kondrič.

LUNCH TIME – 13:30 – 15:00

DEPARTURE – 15:00

POSTER PRESENTATIONS

Nr.	Name	Country	Title
1	Zhiqiang Liang, Changxiao Yu, Yuqi He, Xiang Lyu, Yaodong Gu	CHN	THE KINEMATICS ANALYSIS OF STRIDE STEP OF ELITE TABLE TENNIS PLAYER
2	Changxiao Yu, Shirui Shao, Zhiqiang Liang, Yuqi He, Yaodong Gu	CHN	THE BIOMECHANICAL EFFECTS OF TWO PERFORMANCE LEVELS DURING TABLE TENNIS CROSS STEP
3	Chia-Yu Tang, Jiann-Li Chen, Mu-Chiao Tung	TPE	PATHOGENESIS AND BASIC HANDLING PRINCIPLES OF COMMON INJURIES CAUSED BY FOREHAND SPIN IN TABLE TENNIS
4	Shuping Xu, Lixin Liang	CHN	STUDY ON THE EFFECT OF PHYSICAL FUNCTION TRAINING ON COLLEGE STUDENTS' TABLE TENNIS SPORTS INJURY
5	Shuping Xu, Chengbin Ji, Lixin Liang	CHN	STUDY ON THE INTERESTING TABLE TENNIS TEACHING METHOD OF "ONE PLAYER, ONE TABLE AND ONE BALL"
6	Yuqi He, Changxiao Yu, Zhiqiang Liang, Xiang Lyu, Zhexiao Zhou, Yaodong Gu	CHN	COMPARING THE KINEMATIC CHARACTERISTIC BETWEEN DIAGONAL AND STRAIGHT SHOT IN FOREHAND LOOP FROM WORLD-
7	Peyman Norouzi, Amin Ghavimi, Mahdi Norouzi	IRN	INVESTIGATION OF THE LOYALTY OF PROFESSIONAL AND AMATEUR ATHLETE OF TABLE TENNIS PLAYERS TO SPECIFIC BRANDS IN THIS FIELD OF SPORT
8	Ghuneim Mahmoud	JOR	HISTORY AND ANALYSIS OF THE BACKHAND STROKE IN TABLE – TENNIS SPORT, FROM HUNGARY TO THE WORLD, WITH EMPHASIS ON NEW STYLES
9	Amin Ghavimi, Peyman Norouzi	IRN	THE RELATIONSHIP BETWEEN BIORHYTHM AND SPORT PERFORMANCE IN TABLE TENNIS ATHLETES
10	Xiaoxue Zhao, Yao Meng, Siqin Shen, Yaodong Gu	CHN	VISUALIZATION ANALYSIS OF RESEARCH FRONTIERS AND HOT SPOTS IN TABLE TENNIS

Nr	Name	Country	Title
11	Meng-Hsiun Tsai, Chi-Yuan Hsia, Chien-Yu Lin, Sheng K Wu	TPE	ANALYSIS AND PREDICTIVE CLASSIFICATION MODEL OF ATHLETES' BRAINWAVE BASED ON MACHINE LEARNING - A CASE STUDY OF TABLE TENNIS ATHLETES IN TAIWAN
12	Zhang Ying-qiu, Zhou Xing-dong, Xiao Dan-dan	CHN	TABLE TENNIS UMPIRE TRAINING VIDEO DESIGN BASED ON VIRTUAL REALITY TECHNOLOGY
13	Higinio González-García, Guillaume Martinent	ESP	PERCEIVED ANGER PROFILES IN TABLE TENNIS PLAYERS
14	Ping-Feng Wang, Sheng K Wu	TPE	ANALYSIS OF SPORTS INJURIES IN ELITE COLLEGIATE TABLE TENNIS PLAYERS
15	Chyong-Huoy Huang	TPE	INVESTIGATION OF VARSITY TABLE TENNIS PLAYERS' LEISURE PREFERENCE IN TAIWAN
16	Fernando Florendo	PHL	THE EFFECTS OF A TABLE TENNIS PHYSICAL EDUCATION COURSE ON THE HEALTH AND WELLNESS PROFILES OF FEMALE STUDENTS
17	Ching-Hsiu Chiang, Li-Chun Chang, Hsiang-Han Huang, Chih-Hsian Kuo, Sheng-K Wu	TPE	DEVELOPMENT OF TABLE TENNIS-SPECIFIC AGILITY TESTS
18	Yu-Fen Chen,Yung-Hoh Sheu, Guan-Rong Zhu, Sheng K Wu	TPE	AN INTEGRATED TABLE TENNIS RACKET DESIGN WITH DETECTING MOVEMENTS OF ATHLETES
19	Yung-Hoh Sheu, Guan-Rong Zhu , Cheng-Yen Chung , Yan-Qi Liao , Yi-Chen Yang , Yu-Fen Chen, Sheng K Wu	TPE	THE INTELLIGENT RACKET DESIGN AND APPLICATION WITH WIRELESS SENSORING AND MEASURING FUNCTIONS
20	Ching-Yi Sung	TPE	TECHNICAL ANALYSIS OF MEN'S SINGLES FINAL IN THE 2017 WORLD TABLE TENNIS CHAMPIONSHIPS

Nr	Name	Country	Title
21	David Půlpán, Klára Daďová	CZE 	COMPARISON OF MOTIVATION AND CURRENT MENTAL STATES BETWEEN ABLE-BODIED TABLE TENNIS PLAYERS AND (“STANDING”) TABLE TENNIS PLAYERS WITH PHYSICAL IMPAIRMENT
22	Chiwen Shen, Tong Zhang, Nan Gu, Ling Zhu	CHN 	COMPARISON AND ANALYSIS OF THE TECHNIQUES AND TACTICS OF ZHANG JIKE USING NEW PLASTIC BALL AND CELLULOID BALL IN THE MATCH
23	Ming-Kun Chen, Chia-te Hsu	TPE 	ANALYSIS ON HEALTH-RELATED FITNESS OF TABLE TENNIS COURSE IN UNIVERSITY STUDENTS
24	Sadayuki Mizushima	JPN 	A CASE STUDY: PSYCHOLOGICAL SUPPORT FOR TEAM JAPAN IN WORLD JUNIOR TABLE TENNIS CHAMPIONSHIPS - EXPLORING ACTIVITY PRINCIPLES OF PSYCHOLOGICAL SUPPORT DURING A GAME
25	Hsing-Lee Lin, Kuei-Lan Tsai, Hsing-I Kao, Yue-Ming Liu	TPE 	THE STUDY ON THE DISABLED TABLE TENNIS PLAYER’S JOURNEY – ON THE PARALYMPIC GAMES PROCESS
26	Chia-Jung Lin	TPE 	FACTORS INFLUENCING LEARNING OUTCOME- APPLICATION OF DECISION TREE ALGORITHM
27	Kazuto Yoshida, Sho Tamaki, Koshi Yamada	JPN 	COMPARISON OF TOP-LEVEL WORLD TABLE TENNIS RALLIES IN RIO AND LONDON OLYMPIC GAMES
28	Yiyang Zhao, Jianyao Zhao, Siqin Shen, Guoqin Shen	CHN 	STUDY ON HOW TO FIND OUT COUNTERMEASURES TO CONTRADICTIONS BETWEEN LEARNING AND TRAINING THROUGH CHINESE TABLE TENNIS TALENTS DEVELOPMENT
29	Wen-Chuan Chuang, Chuan-Chen Huang	TPE 	THE STUDIES OF THE RELATIONSHIP AMONG COLLEGE TABLE TENNIS COACHES` LEADERSHIP, TEAM COHESION AND PLAYER SPORT SATISFACTION IN TABLE TENNIS PLAYERS

Nr	Name	Country	Title
30	Chen Weiwei, Sun Qilin	CHN 	REVIEW ON DEVELOPMENT COURSE AND HOT TOPICS OF TABLE TENNIS RESEARCH
31	Bańkosz Ziemowit, Winiarski Sławomir	POL 	VARIABILITY OF KINEMATIC PARAMETERS DURING TOPSPIN FOREHAND IN TABLE TENNIS
32	Goh Wan Xiu, Hiroki Ozaki, Lee Marcus J.C.	SIN 	SPEED AND SPIN DIFFERENCES BETWEEN THE OLD CELLULOID VERSUS NEW PLASTIC TABLE TENNIS BALLS AND THE IMPACT ON THE RESPONSES OF ELITE VERSUS SUB-ELITE PLAYERS
33	Guoqin Shen, Yiyang Zhao, Yafang Zou, Siqin Shen, Jianyao Zhao, Gusztáv Fekete	CHN 	STUDY ON THE CURRENT SITUATION AND COUNTERMEASURES OF MASSES TABLE TENNIS COMPETITIONS IN CHINA
34	Jianyao Zhao,Guoqin Shen, Yiyang Zhao	CHN 	STUDY ON THE MECHANISM OF IMPROVING CHILDREN'S EYESIGHT BY TABLE TENNIS
35	Yuki Sato, Yukihiko Ushiyama, Kei Kamijima, Akiyoshi Shioiri, Asahi Ishiguro, Hikaru Ishida	JPN 	DEVELOPMENT OF TACTICAL ANALYSIS METHOD USING MARKOV MODEL IN TABLE TENNIS COMPETITION
36	Akiyoshi Shioiri, Yukihiko Ushiyama, Kei Kamijima, Yuki Sato, Hikaru Ishida	JPN 	DEVELOPMENT OF GAME ANALYSIS METHOD USING ULTRASONIC SENSOR IN TABLE TENNIS
Nr.	Name	Country	Title
37	Hikaru Ishida, Yukihiko Ushiyama, Kei Kamijima, Akiyoshi Shioiri, Asahi Ishiguro, Yuki Sato	JPN 	CONSIDERATION ABOUT "NAGARE" IN TABLE TENNIS GAMES -ANALYSIS OF THE FACTORS IN THE CONTINUOUS LAST POINTS-
38	Raphael Moreira de Almeida, Flávia da Cunha Bastos	BRA 	CAN SPORT MANAGEMENT CHANGE THE STATUS OF A COUNTRY ON THE WORLD STAGE? COMPARISON BETWEEN BRAZIL AND PORTUGAL
39	Ki-Chuan Huang, Mei-Jen Huang, Chih-Wei Yeh, Yu-Shan Yeh	TPE 	A STUDY OF THE EFFECT OF TABLE TENNIS BALL CHANGE FOR THE SECONDARY SCHOOL TABLE TENNIS PLAYERS IN KAOHSIUNG CITY

Nr	Name	Country	Title
40	Wei-Lin Hsieh, Mei-Jen Huang	TPE	THE STUDY ON PADDLE BRAND IMAGE OF TABLE TENNIS CLUB PARTICIPANTS IN KAOHSIUNG
41	She Jingyan, Yan Sen	CHN	ANALYSIS ON SPORT COMPETITION TRAIT ANXIETY OF CHINESE ELITE FEMALE JUNIOR TABLE TENNIS PLAYERS
42	Assar Shirin, Rahavi Ezabadi Rosa, Shojaei Baghini Ahmad	IRN	THE RELATIONSHIP BETWEEN REACTION TIME, EYE-HAND COORDINATION WITH VISUAL FIELD IN ELITE TABLE TENNIS PLAYERS
43	Kuei-Pin Kuo	TPE	DEVELOPMENT OF MOTION RESPONSE TRAINING SYSTEM FOR BADMINTON APPLICABLE ALSO IN TABLE TENNIS
44	Fatemeh Keyvani , Sima MohammadKhan Beigi, Sepideh MohammadKhan Beigi	IRN	COMPARATIVE STUDY OF BALANCE AND WALKING CAPACITY AMONG ELDERLY WOMEN TABLE TENNIS PLAYERS VERSUS SEDENTARY ELDERLY WOMEN
45	Fatemeh Keyvani, Farshid Kokabi, Masomeh Akbari, Amir Amidi	IRN	INVESTIGETION OF RATE OF AGILITY, SHOULDER FLEXIBILITY,VO2MAX, EXPLOSIVE RUNNING SPEED, SPEED OF HAND MOVEMENT, AND REACTION TIME
46	Melinda Trpkovici, Ágnes Pálvölgyi, Pongrác Ács	HUN	PSYCHOLOGICAL CHARACTERISTICS OF THE NATIONAL HUNGARIAN TABLE TENNIS TEAM
47	Wu Fei, Xiao Dandan, Zhang Rui	CHN	RESEARCH ON THE SOFTWARE OF DRAW ARRANGEMENT FOR TABLE TENNIS COMPETITION
48	Sun Yanling, Zhou Xingdong, Xiao Dandan	CHN	THE TECHNIQUE AND TACTIC ANALYSIS OF ZHOU QIHAO VS CHO SEUNGMIN IN 2018 HONG KONG OPEN
49	Lale Pooryamanesh, Mohammad Moradi, Mostafa Gheisary	IRN	COMPARISON OF THE EFFECT OF TABLE TENNIS AND DART INTERVENTION PROGRAMS ON PERCEPTUAL- MOTOR SKILLS AMONG CHILDREN WITH INTELLECTUAL DISABILITY

Nr	Name	Country	Title
50	Lale Pooryamanesh, Mostafa Zarei, Mohammad Ali Ansari, Shahaboddin Dana	IRN	RELATIONSHIP BETWEEN POSTURAL ABNORMALITIES AND FUNCTIONAL MOVEMENT ASSESSMENTS IN TABLE TENNIS PLAYERS
51	Kei Kamijima, Kenichi Ito, Yukihiko Ushiyama, Akiyoshi Shioiri, Miran Kondrič, Drago Torkar	JPN	ESTIMATION OF TABLE TENNIS BALL DROP POSITION USING A HIGH-SPEED CAMERA
52	Hui Ji, Wenwen Huang	CHN	INVESTIGATION AND ANALYSIS ON THE SKILL LEVEL OF TABLE TENNIS AMONG TEENAGERS IN GARDEN EXPERIMENTAL PRIMARY SCHOOL OF WUXI, JIANGSU PROVINCE
53	Lu Chiu-Ju, Tu Hsin-Yu, Chia-Jung Lin	TPE	THE DEVELOPMENT OF TABLE TENNIS COGNITIVE TEST FOR COLLEGE STUDENTS - A PRELIMINARY RESEARCH
54	Wan-Chun Kuo, Mei-Jen Huang	TPE	A STUDY OF TABLE TENNIS SPECTATORS' SPONSOR EFFECTS
55	Wen-Chung Chiang, Ming-Hua Hsu, Sheng-K Wu, Chin-Fa Chen, Jing-Wei Liu	TPE	APPLICATION OF 3S & 3C THEORY TO DEVELOP THE ANALYSIS INFORMATION SYSTEM IN TABLE TENNIS
56	Dávid Paár, Tamás Laczkó	HUN	ABSENCE OF HOME-ADVANTAGE IN TABLE TENNIS INDIVIDUAL COMPETITIONS
57	Ivana Nikolić, Miran Kondrič, Tomislav Hublin	CRO	ANTHROPOMETRIC CHARACTERISTICS AND MOTOR ABILITIES OF YOUNG FEMALE PLAYERS IN RELATION TO COMPETITIVE SUCCESS
58	Ming-Yueh Wang, Hua-Lin Chang, Chuan-Chen Huang	TPE	A STUDY ON IMAGERY ABILITY, FLOW EXPERIENCE AND PLAYER SATISFACTION IN TABLE TENNIS
59	Kazem Cheragh Birjandi, Omid Abbaspour Fard	IRN	COMPARING AND PRIORITIZING OF TABLE TENNIS TALENT DETECTION CRITERIA FROM THE VIEW POINT OF TABLE TENNIS ELITE COACHES AND PIONEERS

Nr	Name	Country	Title
60	Chi Chiu Hung, Cheung Ka Fu, Feng Liao, Chan Sau Chu, Qin Feng	HKG 	EFECT RESEARCH OF THE CONNECTION TECHNIQUE ON THE TACTICAL CAPABILITY OF HIGH-LEVEL TABLE TENNIS PLAYERS
61	Takuro Okada, Shiro Matsuo	JPN 	AN ANALYSIS OF 2017 ANTI-DOPING TESTING FIGURES IN TABLE TENNIS

Note: all authors should bring their posters to the welcome centre at their arrival!

Venue

Budapest is one of the most visited city in Europe by tourist and as the capital of Hungary it has a lot of tourist attractions like the Hungarian Parliament, the Buda Castle, the Matthias Church and the Fishermen's Bastion, the Széchenyi Chain Bridge or the Heroes' Square etc. The history of the city began in the Roman Empire and it's more than 13 centuries built a unique tradition in the middle of Europe. The city is the centre of the Hungarian literature, culture, arts, sports and science too. It is an ideal place for the most important scientific congress in table tennis not only because it's central role but because of the traditions of the Hungarian table tennis in the world.

Accomodation

Hotel Flamenco offers something rare – accommodation close to the centre of Budapest yet surrounded by beautiful parkland. This four-star hotel near the so-called "Bottomless Lake" in Budapest's 11th district has its own garage and rooftop car park, although it's also easily accessible by public transport with metro, bus and tram stops a short walk away.

Danubius Hotel Flamenco Tas vezer utca. 3-7 1113 Budapest, Hungary

MY NOTES