COMMITTEE FOR THE ASSESSMENT OF DOCTORAL DISSERTATION

TO THE TEACHING AND SCIENTIFIC COUNCIL OF THE UNIVERSIT OF BELGRADE - FACULTY OF SPORTS AND PHYSICAL EDUCATION

Subject: Review and assessment report of doctoral dissertation of Mladen Jovanović, a doctoral program student.

Based on the decision that was made on the 1st teaching and scientific meeting which took place on October 5th, 2023 on the University of Belgrade - Faculty of sport and physical education, in accordance with the article 40 of the Doctoral academic studies Rulebook - revised version number 02-бр.532/22-4 from November 9th, 2022, and articles 41-43 of the University of Belgrade-Faculty of sport and physical education Statute - revised version (02-бр. 188/23-2 from February 13th, 2023), on the proposal of the Doctoral Academic Studies Council (02-бр. 1958/23-2 from September 28th, 2023) it was decided to form the committee for the assessment of doctoral dissertation written by Mladen Jovanović titled:

"EFFECTS OF THE FLYING START ON ESTIMATED SHORT SPRINT PROFILES USING TIMING GATES (УТИЦАЈ ЛЕТЕЋЕГ СТАРТА НА ПРОЦЕНУ ПРОФИЛА КРАТКИХ СПРИНТЕВА ПРИМЕНОМ ФОТО ЋЕЛИЈА)".

Committee was formed from the following members:

1. Dr. Olivera Knežević, assistant professor, Faculty of sport and physical education, chair;
2. Dr. Milan Matić, associate professor, University of Belgrade, Faculty of sport and physical education, member;
3. Dr. Amador García-Ramos, assistant professor, University of Granada, Faculty of sport science, member.

After evaluating the doctoral dissertation, biography, and bibliography of the candidate, Committee is handing in to the Teaching and Scientific board the following:

REPORT
OF THE ASSESSMENT OF DOCTORAL DISSERTATION

BIOGRAPHY OF THE CANDIDATE

Personal data

Mladen Jovanović was born on the 17th of October 1982, in Šabac, Serbia. In 1990, he moved with his family to Pula, Croatia, where he finished the "OŠ Centar" elementary school. After finishing Technical high school as a computer technician in 2001, he moved to Belgrade, Serbia, to study strength and conditioning at the "Faculty of Sport and Physical Education" where he graduated as a professor of sport in 2007. Afterward, he worked as a strength and conditioning coach and sports scientist for Hammarby Football Club from Stockholm, Sweden, Aspire Academy from Doha, Qatar, and Port Adelaide Football Club from Adelaide, Australia. He started a successful website www.complementarytraining.net in 2010. In the 2016/17 school year, he enrolled in the doctoral program at the "Faculty of Sport and Physical Education – University of Belgrade". He published three books: *HIIT Manual*, *Strength Training Manual*, and *bmbstats: Bootstrap Magnitude-based Statistics for Sports Scientists.*

SCIENTIFIC PRODUCTION AND COMPETENCE OF THE CANDIDATE

Mladen Jovanović published as a single author or a co-author one paper in journal category M21, three papers in journal category M22 and 7 articles in professional journals:

1. **Jovanovic M.** 2017. Uncertainty, heuristics and injury prediction. *Aspetar Journal* 6.
2. **Jovanovic M.** 2018a. Data Preparation for Injury Prediction. *Sport Performance & Science Reports*:1.
3. **Jovanović M**, Flanagan E. 2014. Researched applications of velocity based strength training. *Journal of Australian Strength and Conditioning* 22:58–69.
4. **Jovanovic M**, Jukic I. 2019. Optimal vs. Robust: Applications to Planning Strategies. Insights from a simulation study. *SportRxiv*. DOI: 10.31236/osf.io/8n4jf.
5. **Jovanovic M**, Jukic I. 2020. Within-Unit Reliability and Between-Units Agreement of the Commercially Available Linear Position Transducer and Barbell-Mounted Inertial Sensor to Measure Movement Velocity. *Journal of Strength and Conditioning Research* Publish Ahead of Print. DOI: 10.1519/JSC.0000000000003776.
6. **Jovanović M,** Vescovi J. 2022. {shorts}: An R Package for Modeling Short Sprints. *International Journal of Strength and Conditioning* 2. DOI: 10.47206/ijsc.v2i1.74.
7. Orendurff MS, Walker JD, **Jovanovic M,** L. Tulchin K, Levy M, Hoffmann DK. 2010. Intensity and Duration of Intermittent Exercise and Recovery During a Soccer Match. *Journal of Strength and Conditioning Research* 24:2683–2692. DOI: 10.1519/JSC.0b013e3181bac463.
8. Piatrikova E, Willsmer N, Altini M, **Jovanovic M,** Mitchell L, Gonzalez J, Sousa A, Williams S. 2020. Monitoring the heart rate variability responses to training loads in competitive swimmers using a smartphone application and the Banister Impulse-Response model. *International Journal of Sports Physiology and Performance*.

9. Stephens Hemingway B, Greig L, **Jovanović M,** Ogorek B, Swinton P. 2021. *Traditional and contemporary approaches to mathematical fitness-fatigue models in exercise science: A practical guide with resources. Part I.* DOI: 10.31236/osf.io/ap75j.
10. Vescovi JD, **Jovanović M.** 2021. Sprint Mechanical Characteristics of Female Soccer Players: A Retrospective Pilot Study to Examine a Novel Approach for Correction of Timing Gate Starts. *Frontiers in Sports and Active Living* 3:629694. DOI: 10.3389/fspor.2021.629694.
11. **Jovanović M. 2023.** Bias in estimated short sprint profiles using timing gates due to the flying start: simulation study and proposed solutions. Computer Methods in Biomechanics and Biomedical Engineering, 1–11. DOI: 10.1080/10255842.2023.2170713

Mladen Jovanović also published three books:

1. Jovanovic M. 2018. *HIIT Manual: High Intensity Interval Training and Agile Periodization*. Ultimate Athlete Concepts. ISBN: 978-1726337502
2. Jovanović M. 2020a. *Strength Training Manual: The Agile Periodization Approach.* Mladen Jovanović. ISBN: 979-8604459898
3. Jovanović M. 2020b. *bmbstats: Bootstrap Magnitude-based Statistics for Sports Scientists*. Mladen Jovanović. ISBN: 978-8690080359

BASIC DATA ABOUT DOCTORAL DISSERTATION

The final version of the dissertation is presented on 79 pages, A4 format, using the English alphabet and English language, with 7 tables, 30 figures, and 155 bibliographic units. The dissertation has been presented through the following chapters and subchapters: Introduction; Problem, Scope, And Aim Of The Study; The Hypothesis Of The Study; Potential Benefits Of The Study; The First Part Of The Study; The Second Part Of The Study; General Conclusion; References; Supplementary Documents; Ethic Committee Approval; Online Accepted Version Of The Paper One; Online Accepted Version Of The Paper Two; Online Accepted Version Of The Paper Three; Biography; Bibliography; and Statements.

INTRODUCTION

The candidate starts the **introduction** by pointing out the importance of physical ability testing, to explain individual differences, quantify the effects of training interventions, and gain a better knowledge of the limiting variables of performance. The physical attribute of sprint speed is widely recognized and esteemed in sports. Short sprints in most team sports, such as soccer, basketball, field hockey, and handball, are characterized by maximal sprinting from a stationary position over a distance that does not lead to deceleration upon completion. When it comes to the assessment of sprint performance, the author emphasizes that the timing gates are unquestionably the most prevalent method available for that purpose to capture split or total times but also within the method for determining sprint mechanical properties. Timing gates are unquestionably the most prevalent method available for evaluating sprint performance. Multiple gates are frequently placed at different distances to capture split times split times (e.g., 10, 20, 30, and 40 *msplitsplit times sploit*split times (e.g., 10, 20, 30, and 40 m), which can now be incorporated into the method for determining sprint mechanical properties (Jean-Benoit Morin et al. 2019; Samozino et al. 2016). Practitioners can utilize the outcomes to explain individual differences, quantify the effects of training interventions, and gain a better knowledge of the limiting variables of performance, which is an advantage of this method. Through parameters of the mono-exponential equation, including estimated maximal sprinting speed (MSS) and relative acceleration (TAU), and derived maximum acceleration (MAC) and relative propulsive maximal power (PMAX), further referred to as the No Correction model. However, different modelling approaches can be utilized in estimating short sprint parameters. To get accurate estimates of the short sprint parameters, it is crucial to synchronize the initiation of force generation with the commencement of the sprint timing, usually known as the "first movement" trigger. This has been highlighted in various studies (Haugen et al., 2012; Haugen et al., 2019, 2020c, 2020a; T. Haugen & Buchheit, 2016a; Samozino et al., 2016). The acquisition of sprint data through timing gates poses a challenge that can significantly affect the estimated parameters.

Then the candidate describes the mathematical models (chapters 1.1 – 1.3) that can be utilized in estimating the short sprint parameters. However, he came to recognition that the bias introduced in short sprint profile parameters when measured using timing gates due to athletes utilizing a flying start can lead to under or over estimation of some parameters, thus stating that as the problem of the research. To get accurate estimates of the short sprint parameters, it is crucial to synchronize the initiation of force generation with the commencement of the sprint timing, usually known as the "first movement" trigger. This has been highlighted in various studies (Haugen et al., 2012; Haugen et al., 2019, 2020c, 2020a; T. Haugen & Buchheit, 2016a; Samozino et al., 2016). This was illustrated by three hypothetical examples of scenario involving three triplet siblings, Andrew, Ben, and Cole, who possess identical characteristics for short sprints. In this hypothetical scenario, utilized timing gates offer a high level of accuracy, with measurements being recorded up to two decimal places (specifically, the nearest ten milliseconds). However, it is essential to note that this precision also introduces a potential source of inaccuracy in the measurements obtained.

In the chapter 1.5 the candidate contemplates on the potential approaches to overcome bias in estimated parameters when using timing gates. According to existing literature, a feasible approach to convert to "first movement" triggering while employing the suggested 0.5 *m* flying distance behind the initial timing gate is to apply a correction factor of +0.5 *s* (i.e., the addition of +0.5 *s* to split times) (Haugen et al., 2012; Haugen et al., 2019, 2020c; T. Haugen & Buchheit, 2016a). He than goes on to describe two models (Estimated time correction model and Estimated flying distance model) that could be of interest to compare to the typically applied model that he named No correction model.

The candidate brings attention to the fact that the acquisition of sprint data through timing gates poses a challenge that can significantly affect the estimated parameters. There is a need to remove this bias in short sprint profiling with the aim of improving the validity of the profiles and understanding the sensitivity to intervention changes.

The problem, scope and the aim of the study are presented in chapter 2. The bias introduced in short sprint profile parameters when measured using timing gates due to athletes utilizing a flying start represents **the problem of the research**. There is a need to remove this bias in short sprint profiling with the aim of improving the *validity* of the profiles and understanding the *sensitivity* to intervention changes. **The scope of the research** is exploration, evaluation, and validation of the *No Correction*, *Estimated TC*, and *Estimated FD* models for estimating short sprints parameters (i.e., MSS, TAU, MAC, and PMAX) using timing gates under different flying start conditions. The aim is to explore the behavior of the models and to evaluate their ability to estimate short sprint parameters, as well as to estimate their sensitivity to short sprint parameter changes due to the training interventions.

The exploration, evaluation, and validation of the proposed models are achieved using (1) simulations and (2) validations using athletes against the *criterion* measurement method (i.e., radar or laser gun).

This study aims to achieve these objectives using three distinctive methods with specific aims.

Specific aims of the first part of the study
The first part of the study aims to retrospectively compare model estimates of short sprint characteristics using timing gates with and without time correction. High-level female soccer players (n = 116) were evaluated on a 35-m linear sprint with splits at 5, 10, 20, 30, and 35 m. Sprint parameters were estimated in three ways: without a time correction (i.e., *No Correction* model), with a fixed (+0.3 s) time correction, and with an *Estimated TC* model. Separate repeated-measures *ANOVAs* were used to compare the sprint parameter estimates and the residuals between models.

Specific aims of the second part of the study
The second part of the study explored the behavior of *No Correction, Estimated TC*, and *Estimated FD* models under simulated and known conditions. This is needed to provide a theoretical understanding of the limits and expected errors of the short sprints modeling, which will later inform more practical studies involving athletes.

In addition to estimating *agreement* between *true* and estimated parameter values (i.e., model validity or precision), practitioners are often interested in whether they can use estimated measures to track changes in the *true* measures. Thus, the second aim of the second part of the study is to estimate the theoretical validity and sensitivity of the models under simulated scenarios.

Specific aims of the third part of the study
The third part of the study is to validate the models against the *criterion* measure (i.e., the radar gun or the laser gun) involving athletes. In the second part of the study (i.e., simulation study), the precision and sensitivity to change of the models are evaluated against the *true* (i.e., simulated) values across different flying start distances. In this part of the study, the precision and sensitivity to change will be evaluated against the *criterion* measure, serving as the proxy to the *true* measure.

The hypothesis of the research are stated in chapter 3. The following hypotheses were used for this study:
1. When estimated using the No Correction model using timing gates, flying start induces bias in short sprint parameters,
2. Estimated TC and Estimated FD models alleviate this bias and improve the sensitivity of short sprint profiling to detect true change in individual sprint characteristics.

Before getting to the main part of the research, **Potential benefits of the study** were outlined (chapter 4). If proven to alleviate bias associated with flying sprint during timing gates measurement and improve profiling sensitivity, then Estimated TC and Estimated FD models might replace the No Correction model with practitioners and become standardized estimation models.

This research consisted of two parts, both organized in subchapters (Methods, Results and Discussion).

The First part of the study (chapter 5) is a simulation study. Split times were computer generated assuming timing gates positioned at 5, 10, 20, 30, and 40 meters, with the rounding to the closest 10 ms. In total, there were 334,611 sprints simulated. For each stimulated sprint, MSS, MAC, TAU, and $PMAX$ were estimated using the (1) No Correction, (2) Estimated TC, and (3) Estimated FD models. Percent difference ($\%Diff$) estimator was used to evaluate the agreement between true and estimated parameter values. Region of practical equivalence ($ROPE$), as well as the proportion of the simulations that lie within $ROPE$ ($inside\ ROPE$; expressed as a percentage) (Jovanović, 2020a; Kruschke, 2015, 2018; Kruschke & Liddell, 2018a, 2018b; Makowski et al., 2019) were calculated to provide a magnitude interpretation of the $\%Diff$ distribution. For the purpose of this part of the study, $ROPE$ was assumed to be equal to 95% $HDCI$ of the $\%Diff$ using the No Correction model and no flying distance. This value denotes the minimum level of inaccuracy, indicating the highest level of agreement that may be attained. The determination is only based on the precision of the timing gates measurement (i.e., rounding to the closest 10 ms) as well as the parameters used in the simulation. A minimal detectable change estimator with 95% confidence ($\%MDC95$) (Furlan & Sterr, 2018; Jovanović, 2020a) was utilized to estimate this sensitivity. Percent residual standard error ($\%RSE$) of the linear regression between true (predictor) and estimated parameter values (outcome) represents the percent standard error of the measurement ($\%SEM$) in the estimated parameters. Results with Discussion are presented in subchapters 5.2 and 5.3. The first part of the study yielded an unforeseen outcome, namely, the superior performance of the No Correction model in accurately estimating the change sensitivity of the MAC and TAU parameters, surpassing the performance of the other two models. The Estimated FD model failed to be fitted for certain parameter combinations in the simulated data and these sprints were disregarded from further analysis. When making estimations of short sprint parameters across models based on simulation parameters, it is observed that the MSS parameter and its change can be estimated with greater precision in comparison to the parameters of TAU, MAC, and $PMAX$, as well as their respective changes. This part of the study presented the $ROPE$s and $\%MDCs95\ lowest$, in addition to evaluating model performances. These findings have the potential to contribute to the advancement of validity and reliability studies that assess the performance of short sprint models among.

The Second part of the study (chapter 6) had an experimental design. It involved the participation of 31 basketball players, comprising of 23 males and 8 females who were selected from the highest youth level of Hungary. Following the standardized warm-up, the participants executed two trials of maximal sprints covering a distance of 30 m, with a minimum rest period of 3 minutes between each trial. The sprint times were recorded using a set of five wireless photocell pairs (WittyGATE™ v1.5.34, Microgate S.r.l, Bolzano, Italy) positioned at the start line, as well as at distances of 5, 10, 20, and 30 m (Figure 13). The accuracy of the timing measurements was 0.01 s. At the beginning of each sprint, the participants assumed a split stance with their lead foot positioned behind a line affixed to the floor at a distance of 0.5 m from the initial pair of photocells. The photocells were situated at a height of 1 m to prevent premature interruption of the beam by the upper body during the starting position. The velocity measurements were continuously recorded for each attempt utilizing a laser gun (CMP3 Distance Sensor, Noptel Oy, Oulu, Finland) at a sampling rate of 2.56 KHz. A polynomial function was utilized to model the relationship between distance and time, which was subsequently resampled at a frequency of 1,000 Hz through the use of Musclelab™ software v10.232.107.5298 (Ergotest Technology AS, Langesund, Norway). The laser gun was situated at a distance of roughly 3 m from the initial timing gate, while the reference point (i.e., zero distance) was established at a distance of 1 m behind the initial timing gate. To compare the short sprint mechanical parameters: (1) the maximal sprinting speed (MSS), (2) the relative acceleration (TAU), (3) the maximal acceleration (MAC), and (4) the net relative propulsive power ($PMAX$) were calculated based upon the sprint times at 5, 10, 20, and 30 m measured with the timing gates and with the laser system by using open-source package (Jovanović, 2023; Jovanović & Vescovi, 2022). The mechanical parameters for the timing gates were estimated through five different models: (1) No Correction, (2) Fixed +0.3 s time correction (Fixed +0.3s TC), (3) Estimated time correction (Estimated TC), (4) Fixed 0.5 m flying start distance (Fixed 0.5m FD), and (5) Estimated flying start distance (Estimated FD) models explained previously. Sprint mechanical parameters for the laser gun were estimated using the raw velocity-time signal and time correction polynomial model, after filtering out velocities below 0.5 $ms{-}1$ using smoothed velocity provided by the Musclelab™ software.

Results and discussion section were organized according to the specific aims of The second study. *Descriptive analysis* was presented first, followed by *Agreement*, and *Sensitivity* subchapters. Under the Descriptive analysis, the author states that individual percent coefficient of variation ($\%CV$) demonstrated higher variability and higher median value for the 5-meter split times compared to the 30-meter, as well as for the initial versus last average split velocity. This was also a pattern demonstrated in parameters' $\%CV$ across timing gates models, with MSS parameter showing smaller median value as well as the interquartile range (IQR) compared to the MAC parameter. Initial and last split average velocity (i.e., 0-5 and 20-30 m) demonstrated a statistically significant relationship (p = 0.002), although with low variance explained ($R2$ equal to 22%). Relationship between estimated MSS and MAC parameters was statistically significant only for the laser gun ($p < 0.001$), although with similar low variance explained ($R2$ equal to 29%). The relationship between the estimated MSS parameter and the 20-30 meter average split velocity demonstrated statistical significance for all models ($p < 0.001$). This relationship was highest for the Estimated TC model ($R2$ equal to 93%) and lowest for the Fixed 0.5m FD model ($R2$ equal to 62%). However, the author points out that the relationship between estimated MAC parameter and the 0-5 meter average split velocity demonstrated statistical significance ($p < 0.001$) with large variance explained ($R2$ over 95%) for the No Correction, Fixed +0.3s TC, and Fixed 0.5m FD models, which are models with two estimated parameters. Estimated TC and Estimated FD models didn't demonstrate statistical significance. The laser gun model demonstrated a statistically significant relationship between MAC parameter and the 0-5 meter average split velocity demonstrated (P = 0.01), but will low variance explained ($R2$ equal to 15%).

Regarding the agreement between laser gun and timing gates estimates using the percent bias ($\%Bias$, or percent mean difference), the author underlines that the estimator demonstrated expected results, given the first part of the study implementing simulation. This was evident using the confidence intervals of the simulated timing gates and observed data being overlapping or touching for all models (apart from the Estimated TC model for the MAC and $PMAX$ parameters).

Using the confidence intervals to judge statistical significance the No Correction model showed bias involved in all parameters when estimated using a laser gun as the criterion. The Estimated TC model also demonstrated statistically significant bias for all parameters except MSS, but no bias was observed in other models.

Agreement estimated using the percent mean absolute difference ($\%MAD$) estimator demonstrated expected results for the No Correction model, while very other model demonstrated a higher $\%MAD$ compared to expected values using the simulated data. Of all parameters, only MSS demonstrated high agreement between laser gun and timing gates

estimates, using the $\%MAD$ estimator (below 5% for all models except for the No Correction and Fixed 0.5m FD models). All other parameters demonstrated unsatisfying agreement with the laser gun ($\%MAD > 10\%$).
Author applied two models to investigate *Sensitivity* to detect changes across time. The first method utilized the agreement with the laser gun (i.e., assuming laser gun estimates represent the true scores), while the second method utilized the change between trials (i.e., intra-session biological variability). When using the agreement with the laser gun, MSS parameter showed the highest sensitivity (i.e., lowest $\%MDC95$), and interestingly, it was the highest for the No Correction model. All other parameters and models demonstrated an unsatisfying level of sensitivity, beyond what was expected by the simulated data set. When estimated using the Trial 1 and Trial 2 differences, the highest sensitivity was demonstrated by the laser gun across all parameters, with the MSS parameter showing the highest sensitivity across all models. All models demonstrated higher $\%MDC95$ than expected by the simulation. Overall, maximum sprinting speed indicators (i.e., MSS parameter or 20-30-meter average split velocity) demonstrated higher sensitivity than the maximum acceleration indicators (i.e., MAC parameter or 0-5 meter average split velocity).
The author summarized the findings of both studies in the chapter titled **General Discussion,** where he draw main conclusions of the research but also outlined limitations as well as possible directions for future research. The results of the current study question the validity, reliability, as well as sensitivity of the AVP, estimated using timing gates, even with the novel correction models that were introduced. Maximum acceleration indicators (i.e., MAC and 0-5 m average split velocity) demonstrated low agreement when compared to the laser gun, as well as unsatisfactory sensitivity to detect changes. Maximum sprinting speed indicators (i.e., MSS and 20-30 m average split velocity) demonstrated much better agreement with the laser gun, and satisfactory sensitivity to detect changes. Interestingly, the results indicated that the simplest No Correction model demonstrated the highest sensitivity to detect changes in MSS compared to all other timing gate models, although showing significant bias. Thus, practitioners should be wary of using timing gates to estimate maximum acceleration traits and changes in their respective levels. In conclusion, although maximum-sprinting speed indices demonstrated satisfactory agreement and sensitivity, if interested in measuring and tracking maximum acceleration indices, researchers and practitioners should be cautious when using timing gates and should probably invest in more precise and sensitive technology such as the laser gun.

References were presented in the volume of 57 bibliographic units, all written in English. The the reference list suggests that the literature used is actual and referent to write this dissertation. Bibliographic units are correctly mentioned in the text and in the bibliography.

Chapter **Supplementary Documents** (69 - 79) contains the data required by the Regulations of Doctoral studies of the Faculty of Sports and Physical Education and the Instruction on Formation repository of doctoral dissertations: (1) The Approval of the Ethics Committee for implementation of the research; (2) Title page of the published work 1; (3) Title page of the published work 2; (3) Title page of the published work 3; (4) Biography; (5) Bibliography; (6) Statement of authorship; (7) Statement on the identity of printed and electronic versions of doctoral thesis; (8) Statement of Use.

Material presented in this dissertation is partly based on the results that was published in international scientific journal (1), scientific journal (2), and in professional journal (3):

1. Jovanović, M. (2023). Bias in estimated short sprint profiles using timing gates due to the flying start: Simulation study and proposed solutions. Computer Methods in

Biomechanics and Biomedical Engineering, 1–11. https://doi.org/10.1080/10255842.2023.2170713
2. Vescovi, J. D., & Jovanović, M. (2021). Sprint Mechanical Characteristics of Female Soccer Players: A Retrospective Pilot Study to Examine a Novel Approach for Correction of Timing Gate Starts. Frontiers in Sports and Active Living, 3, 629694. https://doi.org/10.3389/fspor.2021.629694
3. Jovanović, M., & Vescovi, J. (2022). {shorts}: An R Package for Modeling Short Sprints. International Journal of Strength and Conditioning, 2(1). https://doi.org/10.47206/ijsc.v2i1.74

On October 16, 2023, the authenticity of Mladen Jovanović's doctoral dissertation was completed by University Library Svetozar Marković. The summary report states 1% similarity index. This additionally confirms the authenticity of Mladen Jovanović's doctoral dissertation.

CONCLUSION

This doctoral dissertation provides both theoretical and practical meaning to short sprint assessment considering that valid and reliable estimation of the short sprint performance is one of the most important athlete profiling components. The results of the current study question the validity, reliability, as well as sensitivity of the acceleration-velocity profile, estimated using timing gates, even with the novel correction models that were introduced. Maximum acceleration indicators demonstrated low agreement when compared to the laser gun, as well as unsatisfactory sensitivity to detect changes. Maximum sprinting speed indicators demonstrated much better agreement with the laser gun, and satisfactory sensitivity to detect changes. Interestingly, the results indicated that the simplest No Correction model demonstrated the highest sensitivity to detect changes in *MSS* compared to all other timing gate models, although showing significant bias. Thus, practitioners should be wary of using timing gates to estimate maximum acceleration traits and changes in their respective levels.

COMMITTEE'S PROPOSAL TO TEACHING-SCIENTIFIC COMMITTEE

Candidate Mladen Jovanović has fulfilled all legal requirements for acquiring the right to defend his doctoral dissertation. His scientific background and professional work in the field of physical education and sport are clearly defining him as an adequate candidate. Regarding his future work he plans to continue his research in biostatistics, training periodization and related topics.
Teaching-Scientific Council of the University of Belgrade - Faculty of Sport and Physical Education on the 1st teaching and scientific meeting which took place on October 5th, 2023 on the University of Belgrade - Faculty of sport and physical education, in accordance with the article 40 of the Doctoral academic studies Rulebook - revised version number 02-бр.532/22-4 from November 9th, 2022, and articles 41-43 of the University of Belgrade-Faculty of sport and physical education Statute - revised version (02-бр. 188/23-2 from February 13th, 2023), on the proposal of the Doctoral Academic Studies Council (02-бр. 1958/23-2 from September 28th, 2023) decided to form the committee for the assessment of the doctoral dissertation written by Mladen Jovanović.

The committee has a uniform opinion that the present doctoral dissertation is original and independent scientific work of the author, as well as that it has significant value for sport sciences i.e., short sprint assessment and profiling. With this dissertation Mladen Jovanović presented himself as a devoted young albeit experienced researcher who has a good theoretical background in mathematical modelling and statistics, as well as practical knowledge necessary for successful independent scientific work.

Based on the qualitative and quantitative analysis of the candidate's professional, scientific and practical work, the committee has a uniform opinion that Mladen Jovanović has fulfilled all legal and scientific requirements for the defence of the doctoral dissertation, therefore, we are suggesting Teaching-Scientific Council to accept the Committee positive assessment report of doctoral dissertation named "EFFECTS OF THE FLYING START ON ESTIMATED SHORT SPRINT PROFILES USING TIMING GATES (УТИЦАЈ ЛЕТЕЋЕГ СТАРТА НА ПРОЦЕНУ ПРОФИЛА КРАТКИХ СПРИНТЕВА ПРИМЕНОМ ФОТО ЋЕЛИЈА)" and, in accordance with legal rights, to direct it further to Social-Humanistic Scientific Council of University of Belgrade for assessment and acceptance.

In Belgrade, 15.11.2023. године

Committee members:

Dr. Olivera Knežević, assistant professor, University of Belgrade – Faculty of Sport and Physical Education, chair

Dr. Milan Matić, associate professor, University of Belgrade – Faculty of Sport and Physical Education, member

Dr. Amador García-Ramos, assistant professor, Department of Physical Education and Sport, Faculty of Sport Sciences, University of Granada, Granada, Spain