Proceeding

Use of a video-clip in blended learning approach to support decision-making skills of basketball referees

DAGMAR HRUSOVA ✉ , PETR HRUSA

Department of Leisure and Tourism, Faculty of Informatics and Management, University of Hradec Kralove, Czech Republic

ABSTRACT

The core of the study was to design and describe possibilities of use of online learning platform (OLP) to help to systemize and centralize the current system of Czech basketball referees' education and training. The aim was to analyse and evaluate the possibilities of use of video-clip as a key learning and teaching method to develop decision-making skills of basketball referees, with the support of referee coaches, via an OLP. The research follows on from the pilot study of the educational project of #Betterrefs. The target group comprises all the Czech basketball referees registered in the season 2019/20 (n = 165). Before the beginning of the COVID-19 pandemic, the vast majority of learning and teaching was delivered through traditional face-to-face sessions. The research designed, analysed and described a technical and methodological solution for the partial integration of blended learning into basketball referees' education and training. The suitability and validity of the selected method of video-clip was evaluated by means of content analysis with regard to the given aspects of the referee's decision-making profile. The contribution of the research is seen in centralizing and systemizing the learning methods and structure of basketball referees' education and training.
Keywords: Basketball referee; Decision-making; Video-clip; Educational method; Video analysis.

✉ **Corresponding author.** *Department of Leisure and Tourism, Faculty of Informatics and Management, University of Hradec Kralove, Rokitanskeho 62, 500 03 Hradec Kralove, Czech Republic. https://orcid.org/0000-0002-6345-0805*
E-mail: dagmar.hrusova@uhk.cz

INTRODUCTION

The impulse to start the research on methods to support referees' education and training was an unexpected interruption of the season due to COVID-19 pandemic. The Czech Association of Basketball Referees (CABR) tried to respond to the situation and support the referees by creating the educational project #Betterrefs, launched in March 2020. The problem was how to support referees' decision-making skills in the period of season interruption. Due to the coronavirus social distancing measures, focus was on the possibilities of distant learning and selection and evaluation of suitable methods. The project was in fact an initiative to work on systemization and centralization of the educational methods via an online learning platform, with partial transition to blended learning, which gives an opportunity to share knowledge and experience among all the CABR referees, across all the performance groups.

THEORETICAL FRAMEWORK

Within the theory of sport performance, different authors use terms that can slightly differ, but basically, they cover physiological, psychological and technical-tactical points of view (Nabli et al., 2019; Gullén & Felz, 2011; Ahmed et al., 2017). A systematic review was carried out (Garcia-Santos et al., 2020) to present an analysis of factors that influence a basketball referee's performance, when 51 articles were included after the review process and classified from the physical/physiological, psychological and decisional points of view. Decision-making is considered the most important skill for sport officials in general (Garcia-Santos and Ibáñez, 2011; Kittel et al., 2019). Based on the review of the selected studies on the decision-making of basketball referees (Garcia-Santos & Ibáñez, 2011), correct decision-making reflects the following important aspects: reaction time, movement mechanics, team and players' characteristics, workmate collaboration, contacts' valuation, game control, violations, referee experts' presence.

Referees' decisions in contact situations relies on intuitive processing (Schweizer et al., 2011). Referees can get under pressure when they are expected to make correct decisions within in a fraction of a second. A potential possibility of making a mistake can be stressful for referees (Sors et al., 2019). However, the referees have to be able to live their mistakes (Macmahon & Mildenhall, 2012). Training programmes are recommended to improve the referees' decision-making, such as reviewing game conflictive situations and their possible solutions or proposing real situations where the referees have to make the best possible decision with a limited time (Garcia-Santos et al., 2020). Players, coaches and spectators expect perfection, with no mistakes and consistency from referee to referee and from game to game (FIBA, 2016). Referee's decision may be perceived as incorrect and can trigger negative behaviour of players or coaches (Weinberg & Gould, 1995; Rainey et al., 1992) or pressure of spectators (Sors et al., 2019).

Video-based testing appears to be a valid measure to evaluate decision-making skills of the referees in a controlled off-field environment (Kittel et al., 2019). Being able to judge a game situation or player's action based on a video-clip incorporates a perfect knowledge and ability to apply the rules (Schweizer et al., 2011; Calmet, 2019). In the context of e-learning, the use of online learning platform as a support for basketball referees' education and training opens the possibility of blended learning approach. Blended learning approach is recommended to be used in educational process in general, to increase students' interest or satisfaction (Al Awamleh, 2020; Li et al., 2016). It provides flexibility of face-to-face instructions, abundance of e-learning resources, flexible and timely interaction, autonomous and personalized learning (Zhank, 2017). In blended learning approach in the field of sport, face-to-face interaction usually combines distant training with support of modern technologies, such as smart phones, sport watch, or virtual platforms. The tutor is expected to master specific technical skills, for example to prepare video and audio format to support visual and auditorial learning style (Fathoni, 2018). Two types of blended learning models are recommended in

basketball referees' training, the enriched virtual model and the flex model. In the enriched virtual model, face-to-face sessions precede the online completion of the course assignments (Horn & Staker, 2015). In the flex model, support and instructions are provided on a flexible, as-needed basis while the participants work through course curriculum and content. This model offers individualized learning pace. Performance sport has a specific position in educational process, being based mainly on practice, which is why the models had to be adjusted to the specific needs.

METHODS

Research design
The research follows on from the pilot study of #Betterrefs (Hrusa & Hrusova, 2020), which was launched at the very beginning of the unexpected basketball season interruption due to the coronavirus pandemic. The original idea was to propose a potential solution to help to maintain the level of basketball referees' decision-making skills during the period of season interruption or the common off-season. The evaluation of the results of the #Betterrefs pilot study identified that major problems laid in unsatisfactory technical support to train referees' decision-making skills. Before the beginning of the coronavirus pandemic, the vast majority of learning and teaching was delivered through traditional face-to-face sessions and pre- and post-game conferences. The suggested innovation lays in a partial transition to a blended learning form, offering a centralized and systematic support for referees' decision-making skills, via an online learning platform. Full implementation into practice was not a part of this research study.

Aim
The core of the study is to design and describe possibilities of use of online learning platform (OLP) to help to systemize and centralize the current system of Czech basketball referees' education and training. Major focus is on a video-clip, as the key learning and teaching method, providing analysis, evaluation, and feedback, to develop decision-making skills. The research aim is to analyse the possibilities of use of the learning and teaching method of a video-clip, as the key method to develop decision-making skills of basketball referees, with the support of referee coaches, via an OLP.

The research aim was operationalized into the following phases:
- To select a suitable OLP, that will allow to take full advantage of the learning and teaching method of a video-clip, and thus enable a partial transition to a blended learning (BL) form of referees' education and training,
- To design and optimize OLP structure that would meet the needs of both traditional face-to-face and online education (i.e., BL), from the point of view of referees and referee coaches,
- And to analyse and evaluate the suitability of video-clip, as a key training method to develop the referees' decision-making profile, in terms of the content validity.

Basic sample
The basic sample comprises the whole target group of all the Czech basketball referees. The actual number of basketball referees registered in the season 2019/20 was 165 (age 16 – 64). The target group for potential use of the online learning platform is the same as the research sample of the preceding pilot study (Hrusa & Hrusova, 2020). There were 18 women and 147 men, but it played no role concerning the decision-making profile, because the referees' intervention in the game does not differ in men and women.

Referee coach

Referee coaches are responsible for education and training of referees as tutors, in cooperation with the national instructor and the chair of CABR. As active referees with many years of experience at the European level, referee coaches have professional insight and bring new topics related to decision-making, mechanics and game management. The author of this paper (Petr Hrusa) is among eight appointed referee coaches in CABR.

Video-clip

Video-clip is a short video sequence cut out from the basketball game games, which are recorded from a camera placed several metres above the level of the court. As a part of post-game analysis, the referees select difficult or debatable game situations in co-operation with referee coaches, cut them out (e. g. in VLC player) and prepare clips for further analysis, evaluation and feedback. The average length of a video-clip is 20 – 30 seconds. It should cover on-court action a few seconds before the given game situation and a few seconds after the referee's decision. Video-clip is used as a method of analysis, evaluation and feedback of referees' decision-making. A referee coach labels each video clip to categorize it and comments on the correctness of the decision of the given game situation.

RESULTS

Possibilities of use and possible benefits of OLP in basketball referees' education and training

The starting point was to select a suitable OLP. Three referee coaches tested various platforms and agreed to select G Suite for Education. The most important requirement was taking full advantage of the learning and teaching method of a video-clip, and thus enabling a partial transition to a blended learning (BL) form of referees' education and training. The platform is free and user-friendly. G Suite for Education is a comprehensive hosted suite of free cloud-driven services that provide tools for teaching, giving instructions and learning. The platform allows collaboration between the users and makes it easy to connect whether inside or outside the organization, and thus access learning resources at any time. Useful tools include institution-wide email, shared calendars, google classroom, unlimited cloud storage, and common google docs, like spreadsheets, presentations, and forms. Among other functions and features, the referee coaches can for example create assignments, send announcements, share resources, interact real-time, start discussions, and also get instant feedback or evaluation of the assignments. The scheme in Table 1 summarizes the suggested practical benefits of OLP use, both within the season and in the season interruption or common off-season.

Table 1. Suggested use of OLP for education and training throughout the whole season.

Online learning platform support in the referees' education and training	
Continuous online tests (video-clips, rules)	Online testing in pre-season and mid-season seminars
Viewing clips from the gallery	Cutting and uploading clips from own games
Communication with referee coaches	Watching video-clips released in seminars
Sharing different topics to study	Discussion about chosen topics
Sending a selection of clips to study to all referees	Team-working of the crew referees
Video-conferences	Watching problem clips and finding best solution
Watching and analysing videoclips of the teams nominated for the upcoming game	Clustering clips on different topics (violation, fouls, behaviour, game management, etc.)

Optimized structure of OLP in basketball referees' education and training

Next phase of the research project was to design and optimize OLP structure that would meet the needs of both traditional face-to-face and online education. The advantages of both approaches are combined in blended learning. The methods suggested for referees' education and training draw on a flex model (Horn & Stoker, 2015) in online learning, when the referee coaches provide support and instruction on a flexible, as-needed basis while the referees work through the course curriculum and content. This model provides a high degree of control over the learning and training. Flex model will be combined with an enriched virtual model (Horn & Stoker, 2015), when face-to-face sessions precede the online completion of the referees' coursework on their own, for example as a part of their pre- and mid-season seminars. The table 2 shows an optimized structure of OLP.

Table 2. Optimized content structure of OLP.

Online learning platform - Content structure	
Referee coaches	Referees´ evaluation, video-clips: fouls, violations, mechanics, management, behaviour, body language of referees, communication skills, psychological aspects.
All referees	Fouls: off-ball, act of shooting, moving screen, protect of the shooter, verticality, hand checking, illegal use of elbows, unsportsmanlike fouls, technical fouls, disqualification fouls; violations: time violations, backcourt, goaltending, travelling; mechanics: 2 people officiating (2PO), 3 people officiating (3PO); management: criteria, behaviour, flopping.
KNBL referees	Round 1 (game 1 - game 6), round 2 (game 1 - game 6), round 3 (game 1 - game 6), … round x (game 1 - game 6).
Feedback KNBL 2020-21	Round 1, round 2, round 3, round 4, … round x.
#Betterrefs – rules-tests	Test 1, test 2, test 3, test 4, … test x.
#Betterrefs - video-tests	Test 1, test 2, test 3, test 4, … test x.
#Betterrefs - physical training	Physical training 1, ... physical training x.

All folders contain video-clips divided into specific categories to make it easier for users to navigate. To make the categorization process clear and efficient, international abbreviations (in compliance with FIBA) are used to label the video-clips, all the CABR referees being familiar with their use. Details of video-clip categorization are described below. The folders of KNBL (the top CBF league) will give names of the playing teams and the officiating referees. This will be useful for "*scouting*" - analysing previous games of the given teams, players' and team statistics, following game systems (defensive x offensive) and identifying key and problematic players (behaviour, provoking an opponent, conflicts).

Video-clip as a key method of education and training

Video-clip is a common method of analysis, evaluation and feedback of referees' decision-making. It gives opportunity to share experience and see examples of different game situations and learn from mistakes. With support of referee coaches, the referees train their own self-evaluation and self-reflexion. What is a decision? The referee on the court sees the situation, evaluates it and decides whether to call or not - there are two categories of decisions: to call and not to call. Both categories are divided into 2 further subcategories: correct decision ("*correct call*"– CC and "*correct no call*"– CNC) or incorrect decision ("*incorrect call*"– IC and "*incorrect no call*"– INC). Concerning the content classification of the video-clips, they are divided into fouls (contact situations) and violations (contactless situations), with further classification (see above, Table 2).

Different methods are used to analyse the clips. The simplest option is to play the clip repeatedly and give comment on the correct solution. Another option is to release it with or without repetition offering the answers - yes/no or multiple-choice. A supplementing tool in face-to-face sessions is Kahoot application, which allows online voting, giving instant feedback on correctness, calculating the total score of respondents and creating their ranking. Another form is teamwork with a limited time to agree on the correct answer. This method helps to practice communication skills when the referee needs to present team's opinion correctly. This model situation draws on from real-like situations on the court and the communication between referee/coach and referee/player.

Evaluation of the method of video-clip with regard to the referees' decision-making profile
Based on the review of the selected studies on the decision-making of basketball referees, correct decision-making reflects the following important aspects (Garcia-Santos et al., 2020): reaction time, movement mechanics, team and players' characteristics, workmate collaboration, contacts' valuation, game control, violations, referee experts' presence. The suitability and validity of the selected method of video-clip was evaluated by means of content analysis with regard to the above-mentioned aspects of the referee's decision-making profile. The question was to what extent the method of video-clip addresses the given aspects of the referee's performance.

Game control
Video-clip shows whether and how the participants accept the individual decision (call x no call). This is seen on the basis of their reaction (verbal x nonverbal). An individual game situation can be decided well on the court, but that does not necessarily mean that the whole game is under control. The complex control of the game cannot be fully addressed based on the individual video-clips.

Violations
It can be clearly decided based on the video-clips of individual game situations whether or not there was a violation (traveling, backcourt, time violation, goal tending etc.).

Contacts' valuations
It can be clearly decided based on the video-clips of individual game situations whether or not a foul occurred (off-ball, moving screen, pushing, illegal use of hands, unsportsmanlike fouls, etc.).

Reaction time
This aspect can be addressed if the decision on the correctness of the call is limited by a time limit. This brings the reaction time closer to reality.

Movement mechanics
Video-clip reveals immediately whether the decision is made in motion, or whether the position of the referee is wrong so that he/she cannot see the game situation clearly (guess call, fantasy call).

Team and players' characteristics
It is difficult to determine game systems and team and players' characteristics from individual video-clips. Video-clips do not integrate this component of decision-making, because the sequence of the game covered is too short.

Workmate collaboration
This can be addressed partly. Video-clips presenting collaboration are not so frequent (act of shooting, out of bounds, etc.).

Referee expert's presence
This aspect comes into play mainly in the case of being on the court. When analysing the video-clips in the referees' training, the expert opinion is provided by referee coach.

DISCUSSION

Decision-making is considered the most important skill for sport officials in general (Garcia-Santos et al., 2020; Kittel et al., 2019). To design an optimized support for development and training of basketball referees' decision-making skills was challenging because sport performance as such poses challenges when required to be supported online. Analysis of video-sequence is recommended in sport practice in general, as a support for coaches and athletes (Calmet et al. 2019) and referees (Schweizer et al., 2011). There are findings supporting the use of video-clips in referee's decision-making skills training (Kittel, et al., 2019). Video-based testing appears to be a valid measure to evaluate decision-making skills of the referees in a controlled off-field environment (Kittel, et al., 2019). The referees have to make the best possible decision with a limited time (Garcia-Santos et al., 2020). This is recommended to be considered in distant practice. When the time is limited, the situation becomes more real-like for the referee, since in common refereeing the decision must be very prompt. Immediate feedback on correctness of decisions is essential for training and improving intuitive decisions (Schweizer et al., 2011). This is ensured by the feedback given by referee coaches.

The project in this phase only focused on decision-making skills, which seemed to have been convenient for online approach. However, there are other dimensions, like communication, strategic skills, physical or psychological preparedness, for the referee's performance to be developed in a complex way. Blended learning approach is recommended to be used in educational process in general, to increase students' interest or satisfaction (Al Awamleh, 2020; Li et al., 2016). Recent research findings support the assumption of expected effectiveness of use of online learning platform for referees' education and training. Concerning basketball courses, the findings indicate (Papastergiuo & Gerodimis, 2013), that blended learning approach can facilitate students' satisfaction and effectiveness of students' cognitive learning in blended learning course combining modern technologies with conventional face-to-face instructions.

CONCLUSIONS

The research designed, analysed and described a technical and methodological solution for the partial integration of blended learning into basketball referees' education and training. The suitability and validity of the selected method of video-clip was evaluated by means of content analysis, with regard to the given aspects of the referee's decision-making profile. Online learning platform should by no means replace the current methods of referees' education. The contribution in the common season is seen in a continuous online educational support to the conventional teaching and training sessions with face-to-face interaction. The suggested implementation of the online learning platform into the current educational system is a step forward to centralize the methods, open the resources and libraries of video-clips with commented feedback to be accessible for all the referees from anywhere, any time. The platform gives an opportunity to share knowledge and experience among all the registered referees, across all the performance groups and competition levels. It is a way how to support the referees' performance, with focus on decision-making skills, not only throughout the season, but also during the periods of season interruption or common off-season.

ACKNOWLEDGEMENTS

REFERENCES

Ahmed, H., Davison, G. & Dixon, D. (2017). Analysis of activity patterns, physiological demands and decision-making performance of elite futsal referees during matches. Int. Journal of Performance Analysis in Sport, 17(5), 737-751. https://doi.org/10.1080/24748668.2017.1399321

Al Awamleh, A. (2020). Students Satisfaction on Blended Learning in the School of Sport Sciences. Annals of Applied Sport Science, 8(1). https://doi.org/10.29252/aassjournal.803

Garcia-Santos, D., Gómez-Ruano, M. A., Vaquera, A. & Ibáñez, S. J. (2020). Systematic review of basketball referees' performances. Int. Journal of Performance Analysis in Sport. https://doi.org/10.1080/24748668.2020.1758437

Garcia-Santos, D. & Ibáñez, S. J. (2011). Diseño y validación de un instrument de observación para la valoración de un árbitro de baloncesto. SporTK-Revista EuroAmericana de Ciencias del deporte, 5(2), 15-26. https://doi.org/10.6018/264601

Calmet, M., Sallantin, J., Monino, J. L. & Lyons, K. (2019). Evaluation of analysis of a live or recorded video sequence: An example from an analysis of sports videos. Journal of Martial Arts Anthropology, 19(4), 36-44. https://doi.org/10.14589/ido.19.4.5

Fathoni, A. F. (2018). The role of blended learning on cognitive step in education of sport teaching by adjusting the learning style of the students. In Proc. of the Int. Seminar on Public Health and Education. Paris: Atlantis Press. https://doi.org/10.2991/isphe-18.2018.49

FIBA Homepage (2016). FIBA recruitment, retention and education of referees. Retrieved from: https://vbra.basketball.net.au/wp-content/uploads/sites/4/2016/04/fiba-recruitment-retention-and-education-of-referees1.pdf, last accessed 2020/08/29

Guillén, F. & Feltz, D. (2011). A conceptual model of referee efficacy. Frontiers of Psychology, 2, 1-5. https://doi.org/10.3389/fpsyg.2011.00025

Horn, M. B. & Staker, H. (2015). Blended: Using disruptive innovation to improve schools. San Francisco: Jossey-Bass. ISBN 978-1118955154.

Hrusa, P. & Hrusova, D. (2020). Educational project #Betterrefs - possibilities of using technologies to maintain basketball referees' performance during season interruption: a pilot study. Int. symposium on educational technology. 229-233. Bangkok: IEEE. https://doi.org/10.1109/ISET49818.2020.00057

Kittel, A., Larkina, P., Elsworthyc, N. & Spittlea, M. (2019). Video-based testing in sporting officials: A systematic review. Psychology of Sport & Exercise, 43, 261-27. https://doi.org/10.1016/j.psychsport.2019.03.013

Li, N., Marsh, V. & Rienties, B. (2016). Modelling and Managing Learner Satisfaction: Use of Learner Feedback to Enhance Blended and Online Learning. Experience Decision Sciences Journal of Innovative Education, 14(2), 216-242. https://doi.org/10.1111/dsji.12096

Macmahon, C. & Mildenhall, B. (2012). A practical perspective of decision making influences in sports officiating. Int. Journal of Sports Science&Coaching, 7(1), 153-165. https://doi.org/10.1260/1747-9541.7.1.153

Nabli, M., Ben Abdelkrim, N., Fessi, M. S., DeLang, M., Moalla, W. & Chamari, K. (2019) Sport science applied to basketball refereeing: a narrative review. The Physician and Sportsmedicine. https://doi.org/10.1080/00913847.2019.1599588

Papastergiou, M. & Gerodimos, V. (2013). Can learning of basketball be enhanced through a web-based multimedia course? Education and Information Technologies, 18(3), 459-478. https://doi.org/10.1007/s10639-012-9186-z

Rainey, D., Santili, N. R. & Fallon, K. (1992). Development of Athletes' Conceptions of Sport Officials' Authority. Journal of Sport and Exercise Psychology, 14, 392-404. https://doi.org/10.1123/jsep.14.4.392

Sors, F., Lourido, D. T., Parisi, V., Santoro, I., Galmonte, A., Agostini, T. & Murgia, M. (2019) Pressing Crowd Noise Impairs the Ability of Anxious Basketball Referees to Discriminate Fouls. Frontiers of psychology, 10. https://doi.org/10.3389/fpsyg.2019.02380

Schweizer, G., Plessner, H., Kahlert, D. & Brand, R. (2011). A video-based training method for improving soccer referees' intuitive decision-making skills. Journal of Applied Sport Psychology, 23(4), 429-442. https://doi.org/10.1080/10413200.2011.555346

Weinberg, R. S. & Gould, D. (1995). Foundations of Sport and Exercise. Psychology Journal of Sport Behaviour, 21(1), 113.

Zhang, J. A. (2017). General Model of E-learning for Supporting Blended Learning in Higher Education In: Proc. of the 2017. Int. Conf. on Management, Education and Social Science. Paris: Atlantis Press. https://doi.org/10.2991/icmess-17.2017.95