Institution: University of Worcester

Unit of Assessment: 24 Sport and Exercise Sciences, Leisure and Tourism

Title of case study: Enhancing elite disability sport performance through disability sport performance analysis (DSPA) research

Period when the underpinning research was undertaken: 2014-2020

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Dr John W Francis	Lecturer in Performance Analysis	2016-present
Prof Derek M Peters	Professor of Sport, Health & Exercise Science	2001-present

Period when the claimed impact occurred: 2014-2020

Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact

In this case study, we exemplify how our applied research in Disability Sports Performance Analysis (DSPA) has impacted globally on national and International governing bodies (organisations), coaches, sport science support staff and athletes (practitioners), and the delivery of DSPA (professional services). Our DSPA research, through knowledge exchange, has been used to improve the quality and efficiency of DSPA provision; contributed directly to enhanced performance outcomes at the highest levels of international disability sport (European Championships, World Championships and Paralympic Games), and resulted in developments in workforce planning and policy change in national and international organisations.

2. Underpinning research

Peters received funding from British Wheelchair Basketball (BWB) in 2014 to explore the impact of notational analysis, analyst and feedback on performance enhancement in elite wheelchair basketball (Grant 1). The research was undertaken by Francis, who was then embedded as Head of Performance Analysis within the BWB world-class programme (based at the University of Worcester Arena, a facility purposely designed for wheelchair disability sport). Through his emerging and unique 'lived-experience' research insight, Francis delivered synchronous and cyclical learning that was used by BWB day-to-day, camp-to-camp, championship-to-championship and cycle-to-cycle to impact the success of their elite men's, women's, and junior teams. Due to potential competitive advantage, these data have only been available for publication since 2019.

Performance Analysis Template: In 2014, we created, validated, and demonstrated the reliability of the first-ever template for objectively assessing team performance in wheelchair basketball. The research uniquely involved coach and practitioner expert validation, robust intra- and inter-observer reliability assessments, and produced original, agreed operational definitions and video-clip exemplars of each action variable for use across the sport (Reference 1).

Team Performance Model (TPM): From data collected using our template at the 2015 Men's European Championships, we employed logistic regression modelling to explore the offensive and defensive tactics used by the top five finishing teams who as a result qualified for the 2016 Paralympic Games. The final model calculated the interactive effect of game status, offensive and defensive line-ups, start of possession, end of possession and defensive system used by

the opponent and demonstrated 76% accuracy in predicting the probability of winning a game Reference 2).

Field-Goal Shooting Model (FGSM): From the 5105 field-goal shots attempted by the 12 teams competing in the 2016 Paralympic Games men's wheelchair basketball competition, we created the first valid and reliable template for assessing field goal shooting attempts in elite men's wheelchair basketball. We then employed logistic regression modelling to develop a final model that included player classification, defensive pressure, pre-shot action, team ranking, shot clock remaining, shot location, and shot movement that could predict shot outcome with 68% accuracy (Reference 3).

Embedding performance analysis and analyst as a learning resource within elite level disability sport: Francis had previously explored the role of Sport Performance Analysis (SPA) in elite team sport (Reference 4) in which the importance of the coach-athlete-analyst relationship was first established. Peters had also identified from his qualitative analysis of elite disability sport coach narratives, the need for the development and wider implementation of SPA across disability sport to 'level the playing field' of sport science provision for elite disability sport (Reference 5). Francis has also explored learning from the provision and use of DSPA within Para-Football (Reference 6) providing unique knowledge regarding athletes use of DSPA, the role of the analyst and their cumulative impact on learning and performance. Through researching the use of an online-learning DSPA portal with elite deaf futsal players, Francis demonstrated increased engagement with and attitudes towards DSPA from coaches and athletes that resulted in enhanced performance.

3. References to the research

1) **Francis, J.W.**, Owen, A. & **Peters, D.M.** (2019a). A new reliable performance analysis template for quantifying action variables in elite men's wheelchair basketball, *Frontiers in Psychology*, 10(16): 1–16. DOI: 10.3389/fpsyg.2019.00016.
2) **Francis, J.W.**, Owen, A. & **Peters, D.M.** (2019b). Making every "point" count: Identifying the key determinants of team success in elite men's wheelchair basketball, *Frontiers in Psychology*, 10(1431): 1-14. DOI: 10.3389/fpsyg.2019.01431
3) **Francis, J.W.**, Owen, A**.** & **Peters, D.M.** (2021). Predicting field-goal success according to offensive, defensive and contextual variables in elite men's wheelchair basketball. *PLOS ONE,* 16(1), e0244257. DOI: 10.1371/journal.pone.0244257 [First made publicly available in Dec 2020].
4) **Francis, J.W**., & Jones, G. (2014). Elite rugby union players perceptions of performance analysis, *International Journal of Performance Analysis in Sport*, 14(1): 188-207. DOI: 10.1080/24748668.2014.11868714.
5) Kohe, G. & **Peters, D.M.** (2016). Beyond high performance disability sport coaching? in Kohe, G. and **Peters, D.M.** (eds) *High performance disability sport coaching*. Abingdon: Routledge, pp. 186–207. DOI: 10.4324/9781315716497.
6) De Martin Silva, L. & **Francis, J.W.** (2020). '"It is like a little journey": Deaf international futsal players' and coaches' experiences in collaborative blended learning, *International Sport Coaching Journal*, 1-14. DOI: 10.1123/iscj.2019-0101.

Grants

1) Peters, D. (PI), 'The impact of notational analysis, analyst and feedback on performance enhancement in elite wheelchair basketball', Great Britain Wheelchair Basketball, 2014-17, £30,000 (matched by the University of Worcester).

All outputs above were subject to peer review as per the processes set out in the University's REF2021 Code of Practice. Outputs 1, 2 and 6 are included in the unit's output submission. All other outputs were identified of at least 2* standard through these processes.

4. Details of the impact

Our DSPA research, through synchronous and asynchronous knowledge exchange, has:

Significantly improved DSPA practice and provision for individuals, teams, and national & international organisations

The project outlined above explored how SPA could be used within BWB's world-class performance throughout the 2016 Rio De Janeiro Paralympic Games Cycle and beyond. The foundational development of a performance analysis template created significant advancement in the effective use of game data, providing unique objective insight into team and individual playing performance that has been used widely (a-e), allowing players and coaches "*to get more detail…It then helped us understand how effective that analysis could be"* (d). Francis worked within the sports science support team to raise awareness and understanding of how SPA could be used to enhance learning and understanding, resulting in notable improvements in SPA provision and practice (a-g) as the research "*allowed for conversations and debates regarding measuring performance that wouldn't have taken place that solved performance problems that were present that hadn't been identified yet*" (c). The new template was used to provide objectivity and enhance provision across the men's, women's, and junior performance squads from 2015 to 2017: "*In particular, [the] research around offensive and defensive team performance metrics assisted in the playing style, offensive and defensive strategies and line-up decisions that were adopted*" (f). Following dissemination at the BASES 2015 conference, analysts for Para-Football teams of the Football Association used the fundamental components of the template "*to ensure the data and information collected on a team and/or individual performance is meaningful and contains context through analysing sequences of events, for coaches and staff to understand the entire picture and develop performance plans based on objective information*" (h). Various Para-Football performance teams have now embedded our DSPA provisions and online learning platforms to aid learning and understanding tailored to individuals' learning needs (h). World Rugby has also incorporated aspects of the template into wheelchair rugby because of our research "*to ensure meaningful information can be collected by World Rugby analysts moving forward*" (i).

Extensively used by elite disability sport coaches, sport-science support staff, teams, and athletes to enhance performance at the highest levels

The Team Performance Model (TPM) and the Field-Goal Shooting Model (FGSM) are comprehensive predictive models of wheelchair basketball performance and were the first in the world to include sequential analysis. BWB practitioners used the TPM to formulate strategic plans and adjust training sessions in the build-up and during major international competitions e.g., the model formulated optimal offensive and defensive line-ups at the 2016 Rio de Janeiro Paralympic Games and subsequent competitions in 2017 and 2018 across the entire BWB world class performance programmes (c-f).

The FGSM was developed to quantify and predict individual and team shooting success whilst incorporating the actions and behaviours of the opposition and helped players "*to adapt [their] game, increase awareness of [their] shooting action and encouraged debates around the current practice, training methods, tactics and game plan between teammates, coaches and support staff*" (b). The overall work and models "*directly influenced and positively impacted the ascent of the Great Britain Teams on the world stage, leading to the attainment of three out of four World Champions titles (Great Britain Men, Great Britain U23 Men and Great Britain U25 Women) and a silver medal for the Great Britain Women*" (g). The ability of the models to simulate and predict the likely outcome of various game situations added game-changing value to scientists at the England Institute of Sport and coaches within the named organisation (c-f). Coaches, practitioners, and athletes have since embedded the models into different settings in Germany, Spain, Italy, and Canada leading to significant improvements in individual and team performance (d, e, f).

Improved the quality, efficiency, and professional standing of DSPA across a range of disability sports at the highest-level influencing workforce planning in national disability sport world class programmes and international governing body strategy

Our research has been used by several national and international organisations, across an array of disability sports, to enhance the provision, quality, efficiency, and professional standing of DSPA. "*The changes to current practice based on research findings aided and improved the current methods adopted by staff and the performance team*" (g). Our research "*influenced how British Wheelchair Basketball recruited staff for the start of the Tokyo Paralympic Games Cycle*" and led to a full-time sport performance analyst being employed to lead the provision (g). The Football Association have employed two consultant sport performance analysts to lead the DSPA provisions for the Blind, Deaf Futsal, Deaf Football and Cerebral Palsy teams (h). "Based on a key finding within this work…the opportunity for staff to learn British Sign Language has been and will continue to be embedded within camps and away from camps" staff to ensure key performance advantages can be communicated effectively (h). World Rugby have subsequently appointed a Game Analyst Consultant to lead the wheelchair rugby provision (i).

Our research has resulted in the International Wheelchair Basketball Federation (IWBF) introducing "a new component within its Competition Strategy to ensure performance analysis provisions and facilities are available at all major competitions", requiring the inclusion of DSPA provision as a key and fundamental element in all competition bids (g). This was first included at the 2018 World Wheelchair Basketball Championships and is included in the rearranged 2020 Tokyo Paralympic Games. Furthermore, our research has contributed to the sport's current classification philosophy, IWBF's player classification system (g).

5. Sources to corroborate the impact

a) Female Paralympian, British Wheelchair Basketball

A post-game interview video clip with a three times Paralympian following GB Women's win over China televised live on Channel 4 outlining how DSPA and Francis as the analyst directly improved her own and the team's performance during the 2016 Rio de Janeiro Paralympic Games.

b) Male Paralympian, British Wheelchair Basketball

This letter is from a male Paralympic wheelchair basketball athlete who is currently part of British Wheelchair Basketball Senior Men's squad and plays for a club team in the Spanish elite wheelchair basketball league. This letter states how British Wheelchair Basketball used the TPM and FGSM to enhance performance, resulting in GB Men's successful performances at major competitions since 2013. The research findings increased his self-awareness and generated debates around the current practice, training methods, tactics and game plan between teammates, coaches, and support staff. Furthermore, the athlete has and is continuing to use the models and knowledge to enhance performance levels within his elite club team in Spain.

c) Sports Science Practitioner, England Institute of Sport

This letter is from a former sports scientist who worked at the English Institute of Sport and British Wheelchair Basketball. His work involved supporting the wider sports science and sports medicine (SSSM) team during the Rio de Janeiro Paralympic Games Cycle. The letter details how the research and knowledge exchange underpinned SSSM practice, influenced the sports "What It Takes To Win" model and solved performance problems.

d) Wheelchair Basketball Coach, British Wheelchair Basketball

Transcript extracts from a series of interviews that outline how the research enhanced performance: "*we started to get more detail about what are we looking for and why. With your help, it was good as you knew what you wanted to do and achieve and help out. It then helped us understand how effective that analysis could be. We could then start going into more detail about offensive sets and defensive sets, shots taken, shots missed, rebounds a whole bunch of things that we could do*".

e) Wheelchair Basketball Coach, British Wheelchair Basketball, Federación Española de Deportes de personas con Discapacidad Física, Federazione Italiana Pallacanestro in Carrozzina and Koln Wheelchair Basketball
This letter is from the previous Talent Development Coach and Performance Coach for British Wheelchair Basketball. It outlines how he used the models developed to prepare players to transition from the junior squads into the GB senior squads. It also outlines, how knowledge exchange using our DSPA research has impacted on his subsequent role in Spain and current roles as junior and assistant senior coach for the Federazione Italiana Pallacanestro in Carrozzina (Italian Wheelchair Basketball) team, and RBC Koln 99ers, our research is used to improve playing strategy and recruitment of players.

f) Wheelchair Basketball Coach, British Wheelchair Basketball and Wheelchair Basketball Canada
This letter is from a previous British Wheelchair Basketball coach, employed from 2016 to 2017, who is currently employed as a coach for Wheelchair Basketball Canada. His letter identifies how our research findings were used to support offensive and defensive strategies adopted by the team at the 2016 Rio de Janeiro Paralympic Games (Bronze medal) and in the 2017 European Wheelchair Basketball Championships (Silver medal). He also explains how our research has enhanced his current role and his ability to work with an analyst.

g) Chief Executive, British Wheelchair Basketball and Chairman for Competition & Board Member, International Wheelchair Basketball Federation
The letter details how our research directly changed practice through the world-class performance programme, subsequently impacting performance results for all GB performance teams. Furthermore, the letter provides evidence of how our research has changed Competition Strategy for all future major international wheelchair basketball competitions, underpins IWBF current classification philosophy, and influenced the novel inclusion of 3X3 wheelchair basketball in the Commonwealth Games in 2022.

h) Futsal and Para-Football Performance Manager, Football Association
This letter outlines how our research has directly impacted performance-related decisions since 2017, aiding several of the national Para-Football teams on the international stage. The letter also demonstrates how our research has resulted in increases in workforce and improvements in staff practice aiding the Para-Football Performance Unit’s vision and mission.

i) Game Analyst Consultant, World Rugby
This letter outlines how our research and knowledge exchange is being used by World Rugby to ensure meaningful information can be collected by World Rugby analysts in elite level Wheelchair Rugby globally.