Institution: Liverpool John Moores University

Unit of Assessment: 26

Title of case study:

"Sporting Playgrounds: Its time to play" – modifying school playground environments to increase physical activity

1. Summary of the impact:

This case study summarises impact consequent to empirical research related to the concept of "*Sporting Playgrounds"* from the Research Institute for Sport and Exercise Sciences (RISES). The "*Sporting Playgrounds*" project addressed the global problem of falling levels of childhood physical activity through the introduction and assessment of innovative markings and physical structures to the school playground. Research outcomes have changed National and International school playground planning and design as well as altering educational policy. Associated health economics analysis has demonstrated the cost effectiveness of these interventions. The project has also developed novel approaches to the overall practice of assessing children's physical activity levels which have informed continuing efforts to monitor and improve children's physical activity within educational settings.

2. Underpinning research:

The "*Sporting Playgrounds*" project began with empirical work undertaken between 1996 - 2000. This work was led by Professor Gareth Stratton (LJMU: 1990-2011) and supported by Professor Stuart Fairclough (2001-present) and Dr Nicola Ridgers (2003-2010). The overall project assessed complex playground marking interventions within longitudinal study designs and produced 9 peer-reviewed publications to 2013.

One of the first publications (**Sec.3, Ref.1**) used a novel approach to change the physical playground environment in infant schools. By painting the playground surface with multi-coloured markings, playtime moderate-to-vigorous physical activity (MVPA), and vigorous physical activity (VPA) significantly increased by 10% and 6%, respectively. Uniquely, the laboratory-based technique of indirect calorimetry was used to generate heart rate and oxygen consumption regression curves for individuals that allowed accurate quantification of energy expenditure during play. Subsequently, a competitive grant from "Health Promotion Wales" funded further exploration of the effects of painting multi-coloured markings in school playgrounds on children's physical activity. Again, multicolour playground markings significantly increased children's MVPA and VPA by a similar amount (13.4% and 4.5%, respectively). This research proposed that if these observed levels of physical activity could be sustained, then multi-coloured playground markings could make a valuable contribution to the attainment of health-related physical activity recommendations in young people, thereby leading to short and long-term health benefits (**Sec.3, Ref.2**).

In 2003 competitive grant funding was obtained from Sport England to undertake a controlled trial of school playground design and markings on children's physical activity. This was part of a £12M intervention project, involving 500 schools nationally, sponsored by Nike Inc. and organised by the DfES. Thirty-four schools were recruited in Liverpool to the "*Sporting Playgrounds*" project to assess both the initial and long term effects of playground redesign on children's physical activity and energy expenditure. In extending the work of Stratton and Mullan (**Sec.3, Ref.2**), the next RISES study by Ridgers et al., (**Sec.3, Ref.3**) re-designed playgrounds at fifteen intervention schools into three specific colour-coded zones; ball games (red zone), less structured active games, such as chase and tag (blue zone), and quiet activities, such as socialising and inactive cooperative games (yellow zone). The project also installed physical structures that included soccer goal posts, basketball hoops, fencing and seating as well as ensuring manipulative sports equipment such as soccer balls, skipping ropes and tennis balls were provided to promote activity. A unique aspect of this study was the medium and long-term follow-up measurements at 6 and 12

months, respectively. The strongest positive effects of the playground redesign on MVPA and VPA were observed after 6 months, and were still evident on VPA after 12 months.

Concomitant to these studies, peer review publications utilising heart rate data, accelerometry indices (**Sec.3, Ref. 3&4),** and a new systematic observation tool (System for Observation of Children's Activity Relationships during Play; **Sec.3, Ref.5**) assessed the modifiable conditions (physical activity levels, social group sizes, activity type, and social behaviour) that influence play behaviour and are needed to design optimal playground-based physical activity interventions. Techniques such as 'draw and write' have also been used in recent empirical work to provide rich representations of the playground experiences of children and how these can be altered by novel playground designs. More recent studies have also used multi-level modelling to allow for changes in participants activity levels over time, as well as adjusting data at individual and school levels. Overall these methodologies have enabled the demonstration of sustained changes in physical activity at 6 and 12 months post-intervention and therefore have provided practitioners with greater confidence in altering the playground environment.

3. References to the research:

Reference for the peer-reviewed outputs from the RISES research described in Section 2.

1. Stratton G. Promoting children's physical activity in primary school: An intervention study using playground markings. Ergonomics. 2000;43(10):1538-46. **Cited 60 times Web of Knowledge (WoK).** [doi.org/10.1080/001401300750003961]

2. Stratton, G & Mullan, E. (2005). The effect of multicolor playground markings on childrens physical activity level during recess. *Preventive Medicine*, 41, 828-833. **Cited 84 times WoK.** [doi.org/10.1016/j.ypmed.2005.07.009]

3. Ridgers, N.D., Fairclough, S.J. & Stratton, G. (2010). 12-month effects of a playground intervention on children's morning and lunchtime recess physical activity levels. *Journal of Physical Activity and Health, 7*, 167-175. **Cited 25 times WoK and classed as "Recent Original Research of Particular Note" by the journal.** No DOI, PDF available upon request.

4. Ridgers, N.D., Stratton, G., Fairclough, S.J. & Twisk, J.W.R (2007). Long-term effects of a playground markings and physical structures on children's recess physical activity levels *Preventive Medicine, 44, 393-397* **Cited 21 times WoK.** [doi.org/10.1016/j.ypmed.2007.01.009]

5. Ridgers, N.D., Stratton, G. & McKenzie T.L (2007) Reliability and Validity of the System for Observing Children's Activity and Relationships During Play (SOCARP) *Journal of Physical Activity and Health, 7*, 1, 17-25 **Cited 11 times WoK.** No DOI, PDF available upon request.

The journal papers have been subjected to blind peer review by Internationally-based editorial boards. Outputs listed above were generated from competitive grant funding. A grant of £5,000 was awarded by Health Promotion Wales in 2000 to explore the effects of painting playgrounds on children's PA levels. A grant of £50,000 was awarded by Sport England in 2003 titled Sporting Playgrounds: A Mixed longitudinal research project.

4. Details of the impact:

The "*Sporting Playgrounds*" research (**Sec.3, Refs.1-5**) demonstrates impact by increasing children's MVPA and VPA and represents an improvement in childhood health attained in a cost effective manner. By way of a narrative context from research to impact, between 2000 and 2008, alongside the peer reviewed journal outputs, outcomes from the "*Sporting Playgrounds*" research were disseminated to over 1000 practitioners and policy makers via invited sessions at 13 local, regional and National events for schools, public health play and public sector agencies. These included PE and School Sport Club Links (Hyde-2005); Lancashire Healthy School Good Practice Conference (Chorley-2005): Play research Network, (Bristol-2006) and Rotherham PCT (2006).

Since 2008 the LJMU "*Sporting Playgrounds*" research has featured in both National and International evidence-based reviews, educational policy statements and practical guidance in printed formats. In the UK, "*Sporting Playgrounds*" research has been promoted in reviews by Play England and the National Children's Bureau that advocate the role of recess based play in moving children towards the recommended accumulation levels for physical activity (**Sec.5, Source.Ai/Aii**). In the USA, The National Association of Physical Education (**Sec.5, Source.B**) reported evidence (**Sec.2, Ref.2**) within their position statement in the drive to increase appropriate and novel opportunities for non-curricula physical activity within schools. Active Living Research Briefs (2011, 2012; **Sec.5, Source.Ci/Cii**) featured multiple exemplars of RISES "*Sporting Playgrounds*" research within its "key" results that subsequently informed policy statements within the USA (**Sec.5, Source.Cii p.5**). To further demonstrate the geographic reach and significance of this research, in 2008 'A Call for Action' was made to change legislation by the Government of Western Australia via the Children's Physical Activity Coalition (CPAC) Charter for Active Kids. Within this document RISES "*Sporting Playgrounds*" research was highlighted when constructing the action point to "provide traditional and innovative playground markings in schools to motivate participation in physical activity before school and during breaks in classes" (**Sec.5, Source.D p.18-19**). Most recently the American Journal of Paediatrics (**Sec.5, Source.E**) published a policy statement on the crucial role of recess in promoting physical activity. RISES "*Sporting Playgrounds*" research (**Sec.3, Ref.4**) are the only references cited from outside the USA and this has led to policy recommendations (**Sec.5, Source.E; 3 & 4, p 185**) outlining the benefits of playground design for child development and recess as a contributor to daily MVPA targets.

The Liverpool "*Sporting Playgrounds*" work was incorporated in to the 2008 NICE Public Health Guidance 8. The NICE Environment and Physical Activity group was reconvened in 2010 to discuss new research evidence and update Public Health Guidance 8. The consensus was that RISES "*Sporting Playgrounds*" research remained central to the "environment" guidance produced in January 2008. Public Health Guidance 17 'Promoting Physical Activity for Children and Young People', published in January 2009, was chaired by Professor Gareth Stratton and promoted aspects of play for families, including children's active play (**Sec.5, Source.Fi/Fii**).

Locally, the "*Sporting Playgrounds"* project has informed the School Improvement Policy of Liverpool City Council **(Sec.5, Source G)**, and impacted the redesign of school playgrounds in a region of the UK that is exposed to significant health inequalities. Furthermore, the UK based company Magical Markings was commissioned by the "*Sporting Playgrounds*" project to implement the playground markings. The economic impact of this research was reflected by the Director of Magical Markings (**Sec.5 Source.H**) who stated that "*the research at the Liverpool John Moores University helped me to form integral parts of my business plan and helped gain a 'competitive edge' at a time, when at is most prosperous, 47 employees were employed by the company working all over the UK"*.

The health impact of changing physical activity in this manner is important, since it has recently been demonstrated that increasing VPA by 5 minutes per day reduces the long-term risk of cardiovascular disease. Health economics analysis of our RISES "*Sporting Playgrounds*" data concluded that the cost of increasing playtime VPA by 5 minutes per day was £5.40 per child per year (**Sec.5, Source.I**). According to current NICE criteria, this modest amount represents an extremely cost-effective intervention to enhance the health outcomes of children.

5. Sources to corroborate the impact:

External Source to Corroborate Impact	Nature of Evidence
A(i). A world without play NCB/Play England (2012, UK) http://www.playengland.org.uk/resources/a-world-without-play-literature-review.aspx) **A(ii). A time to play NCB/Play England (2009, UK**) http://www.playday.org.uk/playday-campaigns/2009-make-	National evidence-based reviews.

time/playday-2009-research.aspx)	
B. NASPE document (USA 2008) http://www.aahperd.org/naspe/standards/upload/Comprehensive-School-Physical-Activity-Programs2-2008.pdf	International evidence-based review &, policy statement (USA)
C(i). Active Living Research (2012 - USA) The potential of safe, secure and accessible playgrounds to increase childrens physical activity http://activelivingresearch.org/potential-safe-secure-and-accessible-playgrounds-increase-childrens-physical-activity **C(ii). Active Living Research (2012 - USA)** Building Evidence to Prevent Childhood Obesity and Support Active Communities. http://activelivingresearch.org/increasing-physical-activity-through-recess	International evidence-based review &, policy statement (USA)
D. CPAC- A Blueprint for active and healthy children in Western Australia (2008) https://www.heartfoundation.org.au/active-living/Documents/Charter-for-Active-Kids%20(WA).pdf.	International evidence-based review and policy statement (Australia)
E. Policy document American academy of paediatrics (2012 - USA) http://pediatrics.aappublications.org/content/early/2012/12/25/peds.2012-2993.full.pdf+html	International policy statements (USA)
F(i). NICE Public Health Guidance 8 document http://www.nice.org.uk/nicemedia/live/11917/52207/52207.pdf **F(ii). NICE PH17** http://publications.nice.org.uk/promoting-physical-activity-for-children-and-young-people-ph17/appendix-a-membership-of-the-programme-development-group-the-nice-project-team-and-external	National policy statement
G. School Improvement Lead for Liverpool City Council	Impact of sporting playgrounds project on schools in Liverpool
H. Director of Magical Playground Markings	Impact of research on UK registered company
I. Professor of Health Economics, Swansea University	Corroborates the Health economics analysis