## 

## Physically active lessons & their effects on physical activity, education, health and cognition: A systematic review & meta-analysis



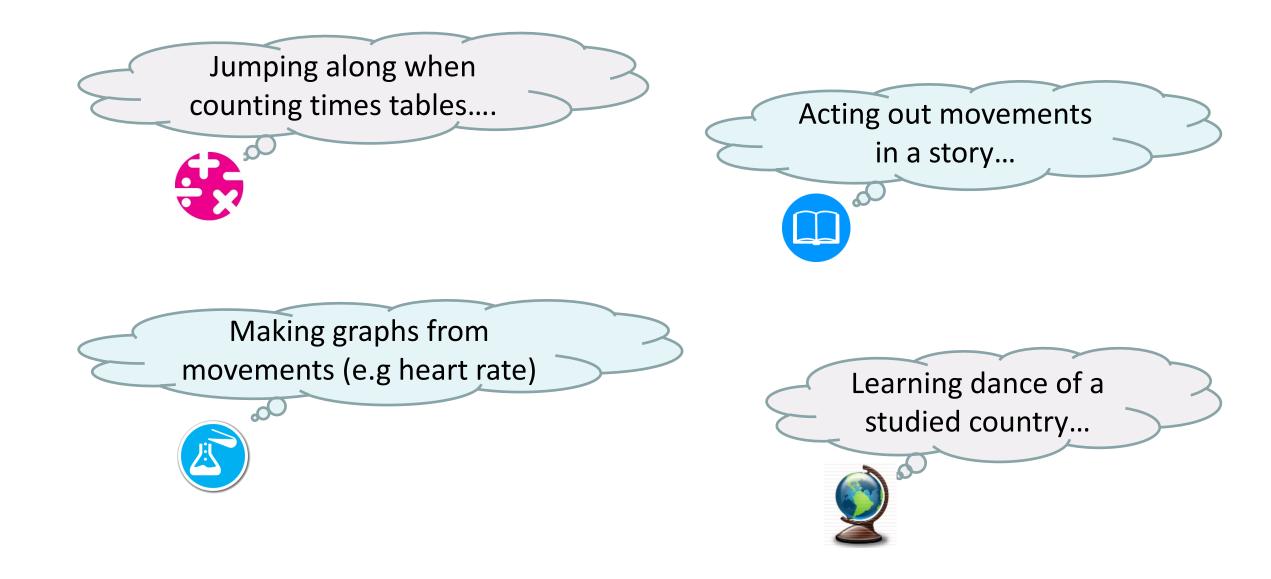
## **Dr Emma Norris**

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**NOPREN School Wellness Working Group Webinar – 10.12.19** 





- First systematic review of physically active lessons found 11 studies (Norris et al., 2015). Not enough for firm conclusions.
- Since then, growing number of studies comparing physically active lessons to typical teaching
- Reviews explored classroom activity interventions collectively e.g active breaks and physically active lessons (e.g Daly-Smith et al., 2018; Watson et al., 2017)

- No meta-analysis of studies testing physically active lessons compared to typical teaching

## **Bringing together the evidence**



#### Review

Physically active lessons in schools and their impact on physical activity, educational, health and cognition outcomes: a systematic review and meta-analysis

British Journal of Sports Medicine

With:

Dr Tommy van Steen, Leiden University Dr Artur Direito, National University of Singapore Prof Emmanuel Stamatakis, University of Sydney

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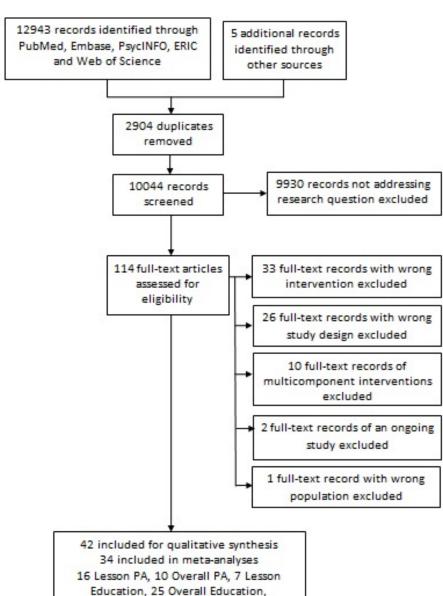
20 readers on Mendeley







## How did we identify papers?



3 Health, 3 Cognition

 PubMed, Embase, PsycINFO, ERIC and Web of Science, grey literature and reference lists searched in December 2017 & April 2019

- Inclusion criteria PA lessons compared to a control group, published after January 1997
- Exclusion criteria PA lessons as part of multicomponent intervention, PE, active breaks, afterschool or recess interventions; exclusively special populations (such as disabled or obese children), protocol, qualitative, process evaluation and review papers, Lab-based studies & non-English language studies

= 42 identified papers: 34 included in meta-analyses

Identification

**Sample size:** Range: n=21 to n=2,493, *ntotal*=12,663

## **Intervention Setting:**

- 18/42 USA, 7 Australia, 5 UK, 4 the Netherlands, 2 Denmark, 1 Croatia, China & Ireland, Israel, Portugal, Sweden

- **29/42 in elementary school**, 9 pre-school, 2 high school, 1 pre-school to elementary, 1 elementary to middle school

**Dose of intervention:** Median of 8 weeks length of intervention, range of one-off PA lesson to 3 year intervention

**Source of intervention:** 23/42 delivered by existing classroom teacher

Use of theory: 2/42 applied COM-B/Behaviour Change Wheel. No other theories applied

## Behaviour Change Techniques used: M=3.9 BCTs per paper

4.1: Instruction on how to perform the behaviour (31/42 studies)

e.g teacher training on how to deliver active lessons

## 12.5 Adding objects to the environment (27/42)

e.g USB stick of pre-prepared sessions, audio CD

## 2.3 Self-monitoring of behaviour (16/42)

e.g teachers logging when they deliver active lessons

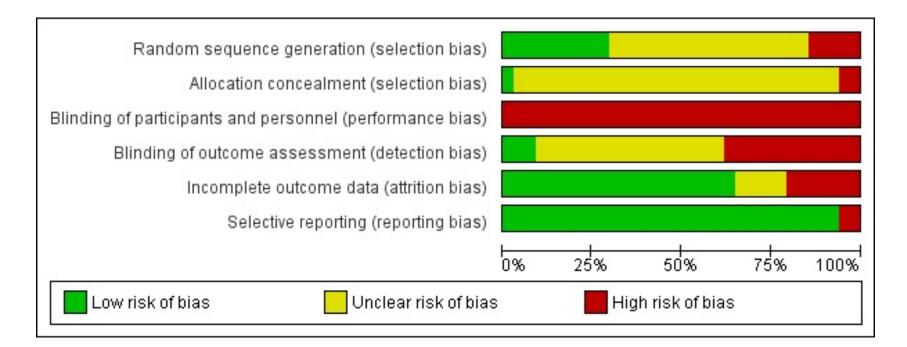
## 2.2 Feedback on behaviour (10/42)

e.g staff or researchers observing and giving feedback to teachers



Michie et al., 2013.

- Assessed using Cochrane Collaboration tool for assessing risk of bias
- All 42 studies high risk on at least one domain (blinding of participants & personnel)
  - Blinding not possible common issue in behavioural interventions
- 25/42 having additional high risk of bias in at least one other domain
- Ratings across all studies: Unclear (33.45%), low risk (33.1%), high risk (33.45%)



- 24/42 papers assessed physical activity
  - 17/24 used devices e.g. accelerometers/pedometers, 8 observations, 2 questionnaires

Author, year, (reference number), sample size		Effect size, [95% CI]
Kirk 2016 (57)   N = 54	4-1	0.38 [-0.22, 0.98]
Riley 2016 (66)   N = 240	P <b>=</b> 4	0.45 [ 0.19, 0.71]
Norris 2018 (18)   N = 191	i=i	0.55 [ 0.26, 0.84]
Mavilidi 2016 (52)   N = 58	<b>⊢</b> ∎-1	0.71 [ 0.18, 1.24]
Nomis 2015 (48)   N = 83	H=-1	0.77 [ 0.32, 1.22]
Martin 2017 (37)   N = 186	H=1	1.08 [ 0.77, 1.39]
Bartholomew 2018 (53)   N = 2354		1.49 [ 1.40, 1.59]
Beck 2016 (62)   N = 33	<b>→</b> →	1.90 [ 1.08, 2.72]
Mavilidi 2018 (19)   N = 57	<b>⊢</b> •••	2.01 [ 1.38, 2.65]
Klinkanborg 2011 (61)   N = 53	<b>—</b>	2.53 [ 1.80, 3.26]
Szabo-Reed 2017 (39)   N = 633	1=1	2.66 [ 2.45, 2.87]
Donnelly 2017 (44)   N = 448	)=I	3.20 [ 2.92, 3.48]
Donnelly 2009 (54)   N = 24	<b>—</b>	3.57 [ 2.28, 4.85]
Trost 2008 (59)   N = 42		4.37 [ 3.26, 5.49]
Grieco 2016 (51)   N = 148	<b>⊢</b> •→	6.14 [ 5.37, 6.90
Mavilidi 2017 (55)   N = 56	<b></b>	6.26 [ 4.98, 7.53
Random Effects Model	-	2.33 [ 1.42, 3.25
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-	202469	
	Effect size	

Lesson-Time Physical Activity

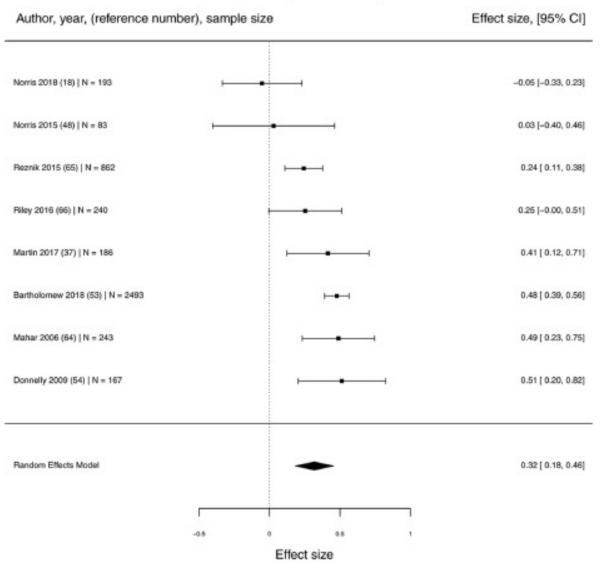
**PA during lesson-time**: 21 studies, *n*= 4660

d=2.33 (95% CI 1.42, 3.25)
= large, significant positive effect of PA lessons on lesson-PA

Shorter interventions (<8 weeks) showed larger effects



## **Effects of PA lessons on Physical Activity**



#### **Overall Physical Activity**

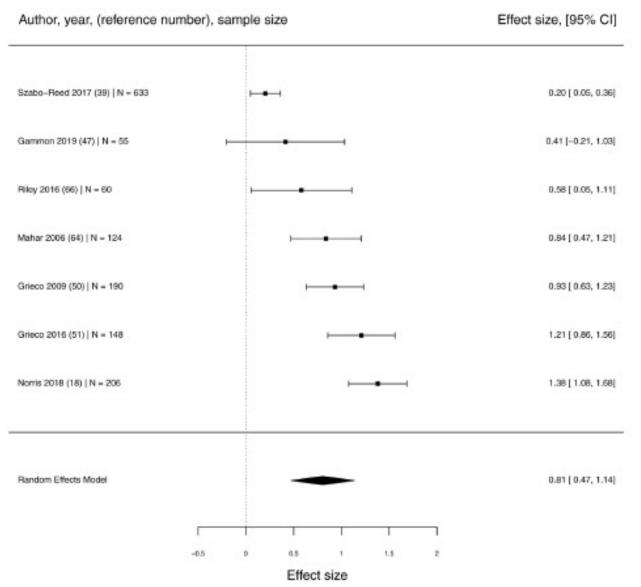
**Overall PA time**: 8 studies, *n*=4467

d=0.32 (95% CI 0.18, 0.46)
= small, significant positive effect of
PA lessons on overall PA



## **Effects of PA lessons on Educational Outcomes**

#### Lesson–Time Educational Outcomes



**Education during lesson-time (ontask behaviour)**: 7 studies, *n*=1416

d=0.81 (95% CI 0.47, 1.14)
= large, significant positive effect of
PA lessons on lesson-time education



## **Effects of PA lessons on Educational Outcomes**



**Overall Educational Outcomes** 

Author, year, (reference number), sample size		Effect size, [95% CI]
Graham 2014 (49)   N = 21	<b>—</b>	-0.23 (-1.11, 0.66
Mullender–Wijnsma 2015 (42)   N = 102	⊢ <b>e</b> -i	-0.20 [-0.59, 0.19
MullenderWijnsma 2015 (42)   N = 112	<b>→→</b> •1	-0.19 [-0.56, 0.18
Hraste 2018 (73)   N = 34	H	-0.16 [-0.83, 0.52
Helgeson 2013 (35)   N = 69	H	-0.13 [-0.63, 0.37
Norris 2015 (48)   N = 84	H <b>4</b> -1	-0.04 [-0.46, 0.39
Mullender-Wijnsma 2016 (43)   N = 341	H <b>#</b> -1	-0.03 [-0.24, 0.18
Riley 2016 (66)   N = 60	<b>→</b> →	-0.01 [-0.53, 0.51
Miller 2015 (38)   N = 228	H#H	0.01 [-0.25, 0.27
Kirk 2014 (58)   N = 72	<b>⊢</b> •−1	0.01 [-0.50, 0.52
Shoval 2018 (56)   N = 106	H +	0.07 [-0.31, 0.46
Fedewa 2015 (72)   N = 429	H=1	0.11 [-0.09, 0.30
Donnelly 2017 (44)   N = 448	in	0.14 [-0.05, 0.33
Helgeson 2013 (35)   N = 61	<b>⊢−</b> −	0.16 [-0.37, 0.69
Reed 2010 (60)   N = 155	H=-1	0.18 [-0.14, 0.49
Beck 2016 (62)   N = 100	H=-1	0.19 [-0.20, 0.58
Callcott 2015 (69)   N = 144	H=-	0.22 [-0.11, 0.55
Elofsson 2018 (70)   N = 53	<b>⊢</b> ∎1	0.24 [-0.30, 0.78
Klinkenborg 2011 (61)   N = 53	<b>—</b>	0.48 [-0.08, 1.03
Leandro 2018 (74)   N = 117	<b>⊢•</b> →	0.57 [ 0.20, 0.95
Viazou 2017 (46)   N = 225	H=-	0.68 [ 0.41, 0.95
Mavilidi 2018 (19)   N = 57	<b>⊢</b> ∎→1	1.20 [ 0.64, 1.77
Mavilidi 2016 (52)   N = 58	<b>⊢⊷</b> ⊣	1.28 [ 0.71, 1.84
Mavilidi 2017 (55)   N = 56		2.13 [ 1.47, 2.78
Erwin 2012 (71)   N = 29		4.55 [ 3.17, 5.94
Random Effects Model	•	0.36 ( 0.09, 0.63
	r	
	-2 0 2 4 6	
	Effect size	

# **Overall Education (standardised tests)**: 25 studies, *n*=3214

d=0.36 (95% CI 0.09, 0.63)
= small, significant positive effect of
PA lessons on overall education



## **Effects of PA lessons on Cognitive testing**

**Cognitive Outcomes** Effect size, [95% CI] Author, year, (reference number), sample size Fedewa 2015 (72) | N = 446 -0.16 [-0.35, 0.04] de Greeff 2016 (40) | N = 499 -0.03 [-0.21, 0.14] Read 2010 (60) | N = 155 0.31 [-0.01, 0.63] Random Effects Model 0.01[-0.23, 0.25] -2.4 -0.2 0.2 6.4 a o 0.8 Effect size

#### Green Red Green Green INCONGRUENT Yellow Blue Red Blue Green CONGRUENT Green Green Blue -Blue Blue Red Red Green NEUTRAL

3 studies, *n*=1100

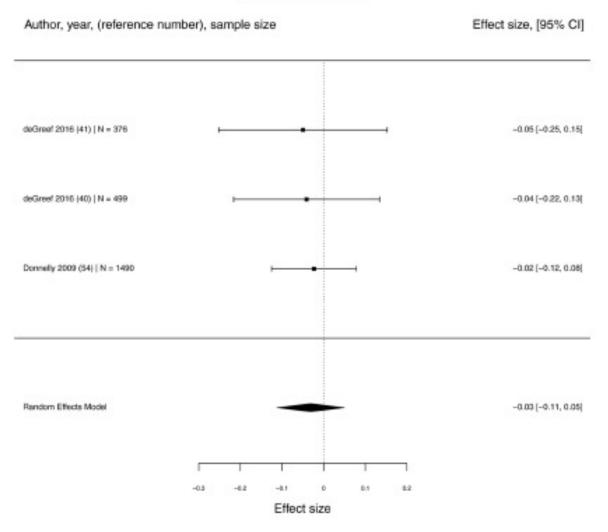
*d*=0.01 (95% CI -0.23, 0.25) = **no change** to cognitive testing

Few studies, important to schools?



## **Effects of PA lessons on Health**

Health Outcomes



Fitness testing/ BMI

3 studies, *n*=2365

*d*=-0.03 (95% Cl -0.11, 0.05) = **no change** in health

Few studies, PA lessons alone sufficient?





- No downsides to implementing physically active lessons
- No evidence that PA lessons reduce behaviour or learning = key concern of teachers
- To address children's health, should be provided as part of whole-school approach



## Future work for physically active lesson research

- More extensive outcome assessment
  - Post-intervention follow-up needed
  - Assess activity beyond school-time
    - Only 2 studies assessed activity beyond school time



- Need for theory & specified mechanisms of action for change
- More diverse samples (Neelon et al. 2016)
- Secondary school samples?
- Need for effective integration of PA lesson training across CPD and initial teacher training



## Thank you for listening! Questions / Discussion

### Thanks to co-authors:

Dr Tommy van Steen, Leiden University Dr Artur Direito, National University of Singapore Prof Emmanuel Stamatakis, University of Sydney



Review

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Physically active lessons in schools and their impact on physical activity, educational, health and cognition outcomes: a systematic review and meta-analysis

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