Title: Implementing physically active learning: future directions for research, policy and practice.

Running title: Implementing PAL: research, policy and practice

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Abstract

Objective. Identify co-produced multi-stakeholder perspectives important for successful widespread physically active learning (PAL) adoption and implementation.

Method. Thirty-five stakeholders (policy-makers, *n*=9; commercial education sector, *n*=8; teachers, *n*=3; researchers, *n*=15) attended a design-thinking PAL workshop. Participants formed five multi-disciplinary groups with at least one representative from the different stakeholder groups. Each group, facilitated by a researcher, undertook two tasks (i) using post-it notes: within the school day, what are the opportunities for learning combined with movement? (ii) washing line task: how can we establish PAL as the norm? All discussions were audio recorded and transcribed. Inductive analyses were conducted by four authors. Once complete, main and sub themes were assigned to four predetermined categories; (i) PAL implementation, and priorities for (ii) practice, (iii) policy and (iv) research.

Results. PAL implementation main themes: opportunities for PAL within the school day, delivery environments, learning approaches, intensity of PAL. Priorities for practice main themes: teachers confidence and competence, resources to support delivery, community of practice. Policy priorities main themes: self-governance, The Office for Standards in Education, Children's Services and Skill (Ofsted), policy investment in initial teacher training and curriculum reform. Research priorities main themes: establishing a strong evidence base, school-based PAL implementation, whole-systems-approach.

Conclusion. The study is the first to identify PAL implementation factors using a combined multi-stakeholder perspective. To achieve wider PAL adoption and implementation, future interventions should be evidence-based, addressing

implementation factors at the classroom- (e.g approaches and delivery environments), school- (communities of practice) and policy-levels (e.g. initial teacher training).

1.0 Introduction

The majority of youth do not accumulate the recommended 60 minutes of daily physical activity (PA).[1,2] With increasingly sedentary pursuits dominating leisure-time,[3] the World Health Organisation[4] has identified the essential role that schools play in creating a more active society. Concurrently, schools present the only setting where all youth, irrespective of social background, can be engaged for an extended period of time.[5]

Unfortunately, a school day largely consists of seated lessons. In response, physically active learning (PAL), the integration of PA into lessons in learning areas other than physical education,[6] has grown in prominence to reduce time spent sedentary and "expand" PA into normal curriculum lessons.[7] Systematic reviews and meta-analyses suggest there are beneficial effects of acute[8] and chronic[6,9–11] PAL interventions on PA, health, cognition and academic performance. Moreover, unlike other segment specific school-based PA interventions,[12] a recent large-scale randomised controlled trial (RCT) has established that PAL can benefit all demographic subgroups.[13]

As such, the use of PAL has expanded internationally to increase PA across the school day, and is often employed as a part of a whole-school approach.[14] One of the earliest examples was Action Schools! BC, which began with a case study, expanded to a large RCT, and was later distributed throughout the province of British Columbia.[15] A similar trajectory is occurring with the Finnish 'Schools on the Move' program[16] and in Norway,

whose ASK program[17,18] has lead to the establishment of a Center for PAL to support schools and teachers with competence, resources and equipment.

Despite these initiatives, the broader uptake of PAL is disappointing. Even in RCTs, more than a third of teachers fail to implement 15 minutes of PAL/day.[19] This occurs despite the fact that teachers recognise the benefits and degree to which students enjoy PAL.[20–22] Barriers to implementing PAL include concern for class disruption, lack of time to prepare and implement, lack of knowledge and training, resistance from parents, and a shortage of appropriate space for delivery.[21,23–26] These barriers are consistent with previous curricular changes attempted in schools, such as, increased problem solving for mathematics[27] and the inclusion of special education students in mainstream classrooms.[28] Both initiatives have required substantial modification of teaching approaches, new teacher training, and increased investment. Yet, they have been fully embraced in countries across the world. This successful uptake of educational innovation raises the question as to how a similar change in the implementation of PAL can be achieved.

Previous research has used the socio-ecological framework[29] to establish factors that influence PAL implementation at each layer of the school environment.[25,26] Yet, the outcomes are generated from teachers only,[21,24–26] which may present a limited understanding of factors beyond their classroom. To provide insights into the broader contexts needed to create the most effective PAL interventions, there is a need to capture perspectives of policy-makers, the commercial education sector, teachers and even

researchers who are in a position to support PAL efforts.[14,30,31] Further to this, rather than capturing the understanding of each stakeholder group in isolation, for a whole-systems perspective,[30,32] these insights should be produced collaboratively. Therefore, the aim of this study was to identify multi-stakeholder perspectives deemed important for successful widespread PAL implementation and adoption.

2.0 Method

2.1 Participants

Participants were invited to a PAL symposium and workshop at the lead author's institution in October 2017. The event was advertised through a regional PA network, on social media platforms and through word of mouth. Attendees were notified prior to the event, and again on the day of the event, that the workshop would be recorded and used for data collection. Participants were informed that participating in the research was optional. In total 35 participants consented. Prior to commencement of the study, ethical clearance was provided by the Leeds Beckett University Ethics Committee (Nº 38830).

The participant sample included researchers, policy-makers, teachers and the commercial PAL sector (Table 1). In total eight participants were qualified teachers with school-based experience; three teaching in schools and five working in professions

aligned to education (*n*=8, total=139 years school-based teaching experience). A further nineteen participants actively supported schools with their PA, physical education and school sport provision.

ADD TABLE 1 HERE

2.2 Methods

Following the symposium, participants took part in a workshop that explored key and emerging questions around national-level implementation and adoption of PAL lessons within the UK. The workshop was informed by a design thinking approach, a method that provides a solution-based approach to solving problems.[33] Rather than being problem focused, it is an action oriented approach toward creating a desired future.[33] Comprising of five phases, this study drew primarily from the ideation phase of design thinking, placing a strong emphasis on brainstorming.

Within the workshop, participants were arranged into five heterogenous and multi-disciplinary groups (e.g., Group 1 (G1), Group 2 (G2)….), each with a minimum of one representative from the different stakeholder groups. Each group, facilitated by a researcher, was asked to introduce themselves and their background before being invited to engage with the following tasks:

Task one, post-it notes: "within the school day, what are the opportunities for learning combined with movement?".

Participants were provided with post-it notes in order to identify opportunities for learning combined with movement within the school day. Participants were encouraged to share and discuss these amongst the group. During brainstorming no idea was dismissed as being too far-fetched or rejected, a central feature of a design thinking approach.[33] Once complete, subsequent discussions were recorded in an informal focus group setting. Resulting post-it notes were presented for viewing by other groups during a period of sharing and reflection. Following this viewing, participants reconvened with their group and were (i) able to add further ideas to their original list and (ii) were asked to denote the PA intensity and school context of the identified activity opportunities.

Task two, washing line task: "how can we establish physically active learning as the norm?"

Following task one, participants wrote key objectives for policy-makers (red pen), researchers (black pen) and practitioners (green pen) on postcards. Each card was hung on the lowest of three horizontal string lines. Once complete, groups ranked the objectives from highest priority (top line) to lowest priority (bottom line). To encourage critical discussion, a maximum of one-third of the responses were allowed on the top line. Once complete, groups were encouraged to view the lines of other groups. On returning to their table, groups were prompted to review their objectives, add new objectives, and re-

prioritise if appropriate. Finally, groups ranked their top line - highest priority - objectives. All of the discussions during these activities were recorded on dictaphones.

2.3 Data analysis

Group discussions were transcribed verbatim and analysed inductively.[34] Four authors (AD-S, TQ, VSJA, JLM) read the transcripts and coded the data via a process of open coding.[35] Following this, authors met to discuss their independent analysis and emerging patterns. This process involved the data being coded into main themes and sub-themes, with each author describing their justification.[35] Discussions between authors resulted in a consensus regarding theme selection. These patterns were identified in primarily an inductive ('bottom up') approach, which ensured emergent themes were strongly linked to the data themselves without trying to fit them into a pre-existing coding frame. As part of this process, negative cases were sought to expand, adapt or restrict the emerging themes,[35] though none were identified. Once complete, the emergent themes were assigned to four predetermined categories; (i) PAL implementation, (ii) priorities for practice, (iii) priorities for policy and (iv) priorities for research. These categories were chosen by the requirements of a whole-system approach to co-designing an active lifestyles intervention.[30] The main themes are highlighted within each category and then subsequently discussed, drawing on underlying sub-themes.

3.0 Results and Discussion

3.1 PAL design and implementation

Four sub-themes emerged: (i) PAL opportunities, (ii) delivery environment, (iii) learning approaches and (iv) intensity of PAL (Appendix A, Table 1).

(i) PAL opportunities

> *"Is the outcome of active learning to use learning or education to get people more active or is it to help people to learn whilst being active? Which way round is it, or is it both?" (G1)*

Participants suggested multiple opportunities for PAL delivery, including outside the classroom. Opportunities beyond the classroom were framed around questioning if PAL is a means of integrating PA into the school day, or a tool to enhance learning through PA. It could be argued that this is a false dichotomy - PAL provides the means to achieve a dose of PA sufficient to improve health,[17,19] while also improving the approach to learning.[36] Further discussion identified when opportunities might occur within the school day. This reflects the flexibility inherent in PAL. Implementation could focus on curriculum delivery, learning methods, or key periods when pupils sit the longest. There was

consensus that delivery could occur throughout the school day, and that a chronological structure is useful for framing delivery opportunities, especially to those new to PAL. Delivery opportunities identified across the school day included classroom lesson time, break/recess and lunch time, homework, before/after school clubs, school trips, sports days, celebration days, and school challenges.

(i) Delivery environment

> *"so changing the word 'classroom' but without necessarily changing the classroom. So, yeah, just moving in different environments of the school, taking our association of what the classroom is." (G2)*

For PAL delivery within the classroom, discussions focussed on tensions between the desire to achieve higher PA intensity and to increase learning. To enhance PA and overcome typical classroom barriers,[25] suggestions included making small adaptations to the classroom such as "chucking the chairs away"(G3) or introducing "exercise balls"(G1). Group One were keen to stress such changes "immediately changed the way the children learnt." While the above approaches likely reduce time spent sedentary and enhance light PA,[8] in agreement with previous research, it was suggested more intense activity could be achieved if PAL was implemented outside the classroom.[37]

Embracing non-traditional learning spaces was a novel insight: *"We've got specialist schools that use absolutely every element of their school including corridors. So that*

whole thing of not hanging round corridors, it doesn't exist in this school." (G2). While challenging the typical use of corridors, these were still seen as confined spaces. Greater potential was seen in the entire school being used as a learning space to include halls, playgrounds and green space.

(iii) Learning approaches

Suggested classroom-based approaches mirrored previous research;[9] summarised as drill and practice of (new) factual information, answering questions using physical responses and active quizzes.[36] While lacking research evidence, the group also discussed other approaches, including learning circuits:

> *"So I did a history lesson with primary school kids……there was one table where I buried artefacts in sand, then they had to solve an Egyptian puzzle with hieroglyphics. It was such a nice lesson, even though it was quite labour intensive to set up, it ran itself perfectly. And every time the music started they'd move on, so if we could have more lessons like that." (G2)*

The approach to PAL appears to vary with the setting. For example, participants suggested that environments beyond the classroom provide a greater opportunity for more moderate-to-vigorous PA (MVPA) through: *"retrieving letters in the playground"*

(G2), "matching games in the hall" (G2) and *"computing skills games through moving*" (G3). In addition, green space was highlighted as an approach to achieve learning objectives: *"go outside and measure lengths of grass." (G2).* In this case, PA was seen as a byproduct of the outdoor lesson rather than a key outcome for the lesson. Thus, the matching of the approach to the environment was central to the expected dose of PA, defined by duration and intensity.

(iv) Intensity of PAL

Stakeholders discussed the intended outcome of PAL as a factor that influences the intensity of delivery: *"Sometimes you only have it as a light activity, sometimes you may want to have it as a vigorous activity" (G5)*. There was a recognition that the intensity required to deliver health benefits is important. However this was tempered by an appreciation that it may not be feasible for schools to focus on meeting intensity targets when starting to implement PAL, e.g., *" to try to contribute to sixty minutes of MVPA" (G1)*. Moreover, the intended intensity level may be dependent upon the desired learning outcome: *"the classroom constraint is it's not a physical environment and if most activities are moderate to vigorously active you're not going to be able to learn"* (G3). These aforementioned issues related to the intensity of PAL is a particularly novel finding that has received little or no attention in previous literature.

Finally, one participant stated that the intensity of delivered PAL may be dependent upon the school culture towards PA, and the *"capability and the confidence of the teachers" (G5)* to deliver varying levels of intensity.

3.2 Priorities for practice

This second category discusses the main emergent themes for practice and practitioners, and explicitly explores challenges associated with (i) teachers confidence and competence, (ii) resources to support delivery and (iii) a community of practice (Appendix A, Table 2).

(i) Teacher confidence and competence

Despite an awareness of the potential positive experiences that PAL can facilitate for pupils,[38] in agreement with previous studies, there was recognition among participants that a lack of awareness and knowledge about how to effectively introduce PA into classroom learning was a potential barrier and area for future consideration.[20,23,25,26] This appeared to centre around a lack of competence due to minimal training or continuing professional development:

> *"Teachers could have all the knowledge in the world about the benefits of physical activity but if they don't know how to implement it then there's just no point having it." (G5)*

Alongside a lack of awareness about how PAL might be implemented, where and when to use it, and how it might be sustained throughout a period of time, participants also identified a lack of teacher confidence as a central barrier to implementation, e.g.,: "*knowledge, passion, skill base, confidence, the main thing is confidence isn't in?" (G2).* This lack of confidence was central and, in agreement with previous research, stemmed from worries around classroom management.[23,25] For teachers and teaching assistants to employ more PAL methods it seemed imperative that they feel confident with a more 'chaotic' classroom and with being less 'in control' of the pupils.[23,25]

These findings are reflective of the broader literature which suggests that the integration of PA into classroom lessons could pose problems for teachers who lack confidence.[25,39] Similarly, self-efficacy is suggested as a key barrier to integrating activity into classroom contexts.[40,41] In addition, results point to reasons why the 'table-centric' concept consistently prevails in classrooms, with an inhibition and fear to deliver PAL methods leading to a lack of creativity and innovation in teacher practice.[25 40]

(ii) Resources

In line with developing teachers confidence and competence, participants recognised the availability of resources as a potential barrier, highlighting the need to support practitioners in better ways.

"It's a little bit of understanding but for me where that falls down is we don't necessarily have the resources for teachers to be able to implement that in lessons. So, we'll give all this information, but then it's up to the teacher to go on and write the lesson plans and maybe that's something…" (G1)

"I suppose for practitioners it could be incorporation with schemes of work. So every scheme of work or schemes of work has to have an active learning component in a scheme of work" (G4)

Hence, in order to support teachers confidence and competence and provide them with the knowledge of how to incorporate PA into their lessons, resources and ready-made schemes of work could be made available. Providing resources to support the facilitation of PA may also reduce the time required for preparation, which may act as an additional barrier for practitioners.[21,25,26]

(iii) A community of practice

Finally, participants spoke about the need for practitioners to engage in a community of practice (CoP).[42] They identified the need for teachers to share their passion and enthusiasm for PAL with colleagues in a supportive environment, and one in which they could learn from each other. For instance:

"A sharing of best practice yeah, I think that's something that's always, you know leaders, lead practitioners, leaders or active learning within an authority. Lead schools? Active learning lead school? Like we have active learning, like we have sport colleges, so we're an active lead. Oh and also practitioners, an active leader… a champion active teacher, champion" (G4)

These findings, while PAL specific, reflect the use of CoP within the broader whole-school physical activity literature. [43–45] Similar to whole-school PA implementation participants recognised the need for an in-school "PAL champion", at the micro-level, to actively lead PAL provision.[26,46] At the macro level, connecting to the wider PAL community was deemed important. However, widening the CoP beyond trusted networks has previously proved challenging due to a lack of trust and familiarity. One solution is the use of private, tailored virtual networks.[45] Yet, at present, there is a limited understanding about the essential characteristics required to create successful virtual PAL multi-stakeholder networks.

3.3 Priorities for policy

This third category explores key emergent themes of (i) self governance: the role of senior management teams, (ii) Ofsted (The Office for Standards in Education, Children's Services and Skill; UK Schools Inspectorate): their power in governance, accountability & competence, and (iii) need for policy investment in initial teacher training (ITT) and curriculum reform. (Appendix A, Table 3).

(i) Self governance: the role of senior management teams

> ”*With the head teacher on board it helps massively. It really does yeah… outstanding schools have an active policy within their curriculum. So they have active aspects of what they're actually doing, which is huge.” (G5)*

The UK National Activity Plan[47] came into effect in 2011, offering educational authorities the opportunity to integrate PAL within schools. Coupled with the Primary PE and Sports Premium Scheme allocation of £320 million per year (approximately £16,000 to £20,000 per school)[48] this provides a prime opportunity for UK schools to adopt PAL. However, as previously identified, embracing PAL across the core curriculum and creating policy reforms is a significant challenge.[26]

Encouragingly, the Department for Education[48] (DfE) have now recognised PAL (under the caveat of ‘active teaching’) within the Sports Premium guidance. However, in agreement with previous literature, delegates stressed the extent to which successful PAL can, or does occur, is still subject to the “*systems, support, permission or even obligation” (G4)* by the senior management team - ultimately the head teacher.[20,26,49] While the Teacher Standards Framework (standard 2, 4 & 5) emphasises the need for schools to self-govern their approach,[50] a schools focus is often determined by the policy direction of the external school education inspectorate.

(ii) Ofsted– their power in governance, accountability & competence

> "*Certainly the academic performance is the driver, and Ofsted are increasingly looking at health and well-being. So if you can have an additional offer in your school it can give you… well it won't be measured officially, it's one of those additional things that they…The impact measured might be improved academic grading, but it will also increase activity levels as well." (G1)*

The current UK-based Ofsted Assessment Framework[51] and inspectorate provides judgements on overall effectiveness of leadership and management, quality of teaching, learning and assessment, personal development, behaviour and welfare, and outcomes for pupils.[51] In agreement with previous literature,[26] most discussions supporting this theme emphasised that if PAL did "*not directly support academic results then it was questionable whether it would be likely to be supported by the educational setting" (G4)*. A need for PAL to be compatible with Ofsted criteria was considered and discussed extensively within the workshop. Concurrently, delegates also highlighted their concerns with the lack of training inspectorates currently hold when assessing PE or PAL as highlighted below:

> "*The inspectorate aren't probably the people that would be, shouldn't be looking at PA.... part of my role was tracking Ofsted reports over the last couple of years with regard to Ofsted comments around P.E. and Sport Premium and PA and sport…. ninety percent of reports there wouldn't even have a comment" (G5)*

Moreover, delegates stressed a need for top down curriculum reform by the DfE: *"The government… where it all comes from ultimately… where the DfE will say 'right..like you have to…', it has to be a national (strategy)" (G2). Additionaly,* solution focussed discussions around current DfE enforcements were also suggested "*get rid of SAT(s)...So policy, remove what's the barrier, which then has a knock on effect" (G5)*. Finally, on top of the recognition of Ofsted being essential in PAL implementation, the requirement for PAL to be embedded in ITT programmes was emphasised.

(iii) Need for policy investment in ITT and curriculum reform.

> *"Students who are going into teacher training, they're getting a minimal amount of P.E. training. They get two hours out of the full… that sort of needs to be changed so they can have a better understanding" (G1)*

Investment in more hours for PAL within ITT was seen as a policy that could positively impact PAL implementation. Integration of PAL within ITT has previously shown promise in increasing teachers confidence and creating more in-service PAL opportunities.[31] However, as there continues to be limited 'accountability' of policy benchmarks, it is questionable how sustainable this may be after ITT.

In conclusion, a re-think of the Ofsted inspectorate 'accountability" framework is needed. Curriculum reform could be seen as an opportunity for policy makers, commissioners,

school management teams and teachers to adopt PAL within school strategies,[20] with self-governance at the school-level. The School Sports Premium funding also offers schools an opportunity to move beyond the historic 'sports' discourse and effectively implement PAL across the whole-school system.

3.4 Key research priorities

The final category explores two main research themes (i) establishing a strong evidence base of PAL benefits, and (ii) exploring how PAL can be implemented in schools. In addition, the overarching theme of a whole-systems approach by researchers, policy-makers and practitioners to support the implementation and sustainability of PAL within schools has been discussed (Appendix A, Table 4).

(i) Need for a strong evidence base

> *"if you haven't got the evidence to demonstrate that it's going to work then are you gonna get the buy in?... is there any point trying to parachute in with this if actually the schools don't buy into it?" (G1)*

Discussions indicated that practitioners and policy-makers wanted evidence on the effectiveness and sustainability of PAL, particularly for outcomes of relevance to them, e.g., academic achievement. Several studies have reported positive effects of PAL including improved PA, learning outcomes, on-task behaviour, enjoyment during lessons, and reductions in student BMI.[6,8,9,10,52] Consistent with workshop discussions, previous research identifies a need for more high-quality studies (to strengthen the evidence base), longer term follow-up measures (to understand sustainability), and more studies conducted in real-world settings to understand the external validity of PAL benefits observed in controlled settings.[53]

Workshop attendees identified that measures of program effectiveness relevant to policy-makers and practitioners (e.g., academic achievement and mental health) may facilitate greater buy-in and adoption.[54,55] Analysis of differential effects of PAL interventions may also provide evidence for the value of PAL, particularly if found to benefit demographic groups commonly identified as priority targets for public health or educational interventions, e.g., low socio-economic status groups or overweight children.[13] Further, it was identified that more effective dissemination strategies may be required to draw the attention of policy-makers and practitioners to the current evidence base on PAL effectiveness.[56]

(ii) Need for evidence on successful implementation

"Teachers could have all the knowledge in the world about the benefits of physical activity… if they don't know how to implement it then there's just no point" (G5)

Workshop discussions indicated a need for evidence on how teachers and schools can effectively implement PAL. Research on PAL implementation is in its infancy.[55] The few studies exploring implementation of PAL strategies have identified predictors (e.g., teacher's perceived competence) and challenges (e.g., standardised testing pressures) and suggest that intervention among pre-service teachers could increase the implementation of PAL.[57,58] Initial findings on predictors and barriers provide valuable guidance for the design/delivery of PAL interventions, but more evidence on effective implementation is needed, particularly given the wide range of PAL strategies and variation in school environments. For greater insights, future studies should progress beyond retrospective process evaluations and collect context-specific information on implementation throughout the PAL programme.[55]

Workshop attendees expressed the need for specific guidance on how to implement PAL within the classroom. More research on implementation and outcomes is needed before evidence-based recommendations on the type, time, intensity and frequency of PAL strategies for preschool, elementary/primary and high/secondary schools can be recommended.[58] The widely varying physical and social environments of schools means that any guidance resources must allow for context-specific tailoring.[59] Process

evaluations capturing context-specific tailoring of PAL will be particularly helpful for identifying effective strategies for integrating movement into the classroom.

In summary, evidence suggests benefits and/or no harm of PAL on children's PA, learning, attention and enjoyment during class, and weight status.[6,8–10] More evidence is needed on the benefits and sustainability of different types of PAL (e.g., active lessons vs. movement breaks) across different school settings (e.g., preschools, primary/elementary, high/secondary). PAL implementation research is emerging and has the potential to elucidate differences in outcomes across settings and support the effective introduction and maintenance of PAL. High-quality studies in real-world settings are needed, and rigorous process evaluations that begin at initial implementation and capture context-specific tailoring will be particularly helpful for informing the direction, design and delivery of PAL interventions.

4.0 Summary

This is the first study to examine multi-stakeholder perspectives on a broad range of challenges and opportunities regarding the design and implementation of PAL in schools. The unique results move beyond teacher views that dominate the current literature,[25,26] providing a co-produced perspective from policy-makers, teachers, the commercial education sector and researchers. As a result, the outcomes have implications beyond

the classroom setting and raise the importance of school- and national-level contextual factors e.g., the need for funding and national policies. While it is challenging to establish, and then maintain, multi-stakeholder partnerships, the unique insights from each stakeholder group are essential to the initial design and sustained implementation of PAL interventions. To increase success, programs must address challenges at all levels of the socio-ecological framework - class, school and national policy. [29]

INSERT FIGURE 1

To enhance the translational impact of the current findings, we present a future directions model that summarises the study outcomes in combination with the extant literature (Figure 1). The model is underpinned by a socio-ecological framework; presenting key implementation drivers within the context of the classroom, school and national policy. In the *classroom context*, a teacher's competence and confidence influences their willingness to implement varied PAL approaches across different school environments. Combined, the PAL approach and delivery environment influence the PA and learning outcomes, which in turn determine the mode and level of implementation. A reflection on these outcomes should inform future PAL delivery. In the *school context*, implementation is influenced by the senior leadership team, governors, school mission and vision, teacher performance management and appraisal, school improvement priorities and parents.[25] In the *national context*, national education and health policies and ITT are essential in determining implementation. Arrows are included within the model to demonstrate the direction and range of influence. Both bottom up and top down processes are required

for sustainable and effective systems change.[32] Finally, the model is underpinned by research, highlighting the importance of evidence-informed decision making.

This research supports, and expands upon, the current knowledge base on PAL adoption and implementation, both within and beyond the classroom. The main strength of the study is the engagement of policy-makers, the commercial education sector, researchers and teachers in co-producing outcomes. While these are UK centric, they may be used to influence PAL implementation in culturally similar countries. To deepen understanding and address limitations of the current study, future work should (i) include head teachers, governors, parents and pupils, (ii) capture the number of years of PAL expertise of the participants and (iii) increase the number of practising teachers within the sample. In conclusion the original findings, summarised in Figure 1, will inform future PAL intervention design through (i) establishing the importance of cooperation and communication between different PAL stakeholder groups, (ii) highlighting challenges and opportunities for PAL implementation within the classroom, school and national contexts and (iii) providing a model that can inform future research, policy and practice in relation to PAL.

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Author's Contributions

ADS and TQ were the study coordinators and conducted the data collection. ADS, TQ, VA and JM led the analysis of the transcripts, all authors checked the emerging main and sub-themes. All authors contributed to writing at least one section of the manuscript. All authors revised and edited the manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing Interests

None of the authors declare competing financial interests.

References

1. Cooper A, Goodman A, Page A, Sherar L, Esliger D, van Sluijs E, et al. Objectively measured physical activity and sedentary time in youth: the International children's accelerometry database (ICAD). *Int J Behav Nutr Phys Act* 2015;**12**:113.

2. Tremblay MS, Barnes JD, González SA, Katzmarzyk PT, Onywera VO, Reilly JJ, et al. Global Matrix 2.0: Report Card Grades on the Physical Activity of Children and Youth Comparing 38 Countries. *J Phys Act Health* 2016;**13**:S343–66.

3. Arundell L, Fletcher E, Salmon J, Veitch J, Hinkley T. A systematic review of the prevalence of sedentary behavior during the after-school period among children aged 5-18 years. *Int J Behav Nutr Phys Act* 2016;**13**:93.

4. World Health Organisation. Global action plan on physical activity 2018–2030: more active people for a healthier world [Internet]. Geneva: World Health Organisation, 2018. Available from: http://apps.who.int/iris/bitstream/handle/10665/272722/9789241514187-eng.pdf

5. Naylor P-J, Nettlefold L, Race D, Hoy C, Ashe MC, Wharf Higgins J, et al. Implementation of school based physical activity interventions: a systematic review. *Prev Med* 2015;**72**:95–115.

6. Watson A, Timperio A, Brown H, Best K, Hesketh KD. Effect of classroom-based physical activity interventions on academic and physical activity outcomes: a systematic review and meta-analysis. *Int J Behav Nutr Phys Act* 2017;**14**:114.

7. Beets M, Okely A, Weaver R, Webster C, Lubans D, Brusseau T, et al. The theory of expanded, extended, and enhanced opportunities for youth physical activity promotion. *Int J Behav Nutr Phys Act* 2016;**13**:120.

8. Daly-Smith AJ, Zwolinsky S, McKenna J, Tomporowski PD, Defeyter MA, Manley A. Systematic review of acute physically active learning and classroom movement breaks on children's physical activity, cognition, academic performance and classroom behaviour: understanding critical design features. *BMJ Open Sport Exerc Med* 2018;**4**:e000341.

9. Martin R, Murtagh EM. Effect of Active Lessons on Physical Activity, Academic, and Health Outcomes: A Systematic Review. *Res Q Exerc Sport* 2017;**88**:149–68.

10. Norris E, Shelton N, Dunsmuir S, Duke-Williams O, Stamatakis E. Physically active lessons as physical activity and educational interventions: a systematic review of methods and results. *Prev Med* 2015;**72**:116–25.

11. Singh AS, Saliasi E, van den Berg V, Uijtdewilligen L, de Groot RHM, Jolles J, et al. Effects of physical activity interventions on cognitive and academic performance in children and adolescents: a novel combination of a systematic review and recommendations from an expert panel. *Br J Sports Med* 2018. https://doi.org/10.1136/bjsports-2017-098136.

12. Ridgers N, Salmon J, Parrish A, Stanley R, Okely A. Physical activity during school recess: a systematic review. *Am J Prev Med* 2012;**43**:320–8.

13. Bartholomew JB, Jowers EM, Roberts G, Fall A-M, Errisuriz VL, Vaughn S. Active Learning Increases Children's Physical Activity across Demographic Subgroups. *Transl J Am Coll Sports Med* 2018;**3**:1–9.

14. McMullen J, Ní Chróinín D, Tammelin T, Pogorzelska M, van der Mars H. International Approaches to Whole-of-School Physical Activity Promotion. *Quest* 2015;**67**:384–99.

15. McKay HA, Macdonald HM, Nettlefold L, Masse LC, Day M, Naylor P-J. Action Schools! BC implementation: from efficacy to effectiveness to scale-up. *Br J Sports Med* 2015;**49**:210–8.

16. Blom A, Tammelin T, Laine K, Tolonen H. Bright spots, physical activity investments that work: the Finnish Schools on the Move programme. *Br J Sports Med* 2018;**52**:820–2.

17. Resaland GK, Moe VF, Aadland E, Steene-Johannessen J, Glosvik Ø, Andersen JR, et al. Active Smarter Kids (ASK): Rationale and design of a cluster-randomized controlled trial investigating the effects of daily physical activity on children's academic performance and risk factors for non-communicable diseases. *BMC Public Health* 2015;**15**:709.

18. Resaland GK, Aadland E, Moe VF, Aadland KN, Skrede T, Stavnsbo M, et al. Effects of physical activity on schoolchildren's academic performance: The Active Smarter Kids (ASK) cluster-randomized controlled trial. *Prev Med* 2016;**91**:322–8.

19. Donnelly JE, Greene JL, Gibson CA, Smith BK, Washburn RA, Sullivan DK, et al. Physical Activity Across the Curriculum (PAAC): a randomized controlled trial to promote physical activity and diminish overweight and obesity in elementary school children. *Prev Med* 2009;**49**:336–41.

20. Dyrstad SM, Kvalø SE, Alstveit M, Skage I. Physically active academic lessons: acceptance, barriers and facilitators for implementation. *BMC Public Health* 2018;**18**:322.

21. McMullen JM, Martin R, Jones J, Murtagh EM. Moving to learn Ireland--Classroom teachers' experiences of movement integration. *Teaching and Teacher Education* 2016;**60**:321–30.

22. Stylianou M, Kulinna PH, Naiman T. "… because there"s nobody who can just sit that long' Teacher perceptions of classroom-based physical activity and related management issues. *Eur Phys Educ Rev* 2016;**22**:390–408.

23. Gammon C, Morton K, Atkin A, Corder K, Daly-Smith A, Quarmby T, et al. Introducing physically active lessons in UK secondary schools: feasibility study and pilot cluster-randomised controlled trial. *BMJ Open* 2019.

24. McMullen J, Kulinna P, Cothran D. Chapter 5 physical activity opportunities during the school day: classroom teachers' perceptions of using activity breaks in the classroom. *J Teach Phys Educ* 2014;**33**:511–27.

25. Quarmby T, Daly-Smith A, Kime N. "You get some very archaic ideas of what teaching is … ": primary school teachers' perceptions of the barriers to physically active lessons. *Education 3-13* 2018:1–14.

26. Routen AC, Johnston JP, Glazebrook C, Sherar LB. Teacher perceptions on the delivery and implementation of movement integration strategies: the CLASS PAL (Physically Active

Learning) Programme. *Int J Educ Res* 2018;**88**:48–59.

27. Hiebert J, Carpenter TP, Fennema E, Fuson K, Human, Piet, Murray H, et al. Problem Solving as a Basis for Reform in Curriculum and Instruction: The Case of Mathematics. *Educ Res* 1996;**25**:12–21.

28. Idol L. Toward Inclusion of Special Education Students in General Education: A Program Evaluation of Eight Schools. *Remedial Spec Educ* 2006;**27**:77–94.

29. Bronfenbrenner U. The ecology of human development Cambridge. *MA: Harvard* 1979.

30. Rütten A, Frahsa A, Abel T, Bergmann M, de Leeuw E, Hunter D, et al. Co-producing active lifestyles as whole-system-approach: theory, intervention and knowledge-to-action implications. *Health Promot Int* 2017. https://doi.org/10.1093/heapro/dax053.

31. Webster CA, Russ L, Vazou S, Goh TL, Erwin H. Integrating movement in academic classrooms: understanding, applying and advancing the knowledge base. *Obes Rev* 2015;**16**:691–701.

32. Fullan M. Leadership & Sustainability: System Thinkers in Action. Corwin Press, 2005. 116 p.

33. Brown T. Design thinking. *Harv Bus Rev* 2008;**86**:84–92, 141.

34. LeCompte MD, Goetz JP. Ethnography and Qualitative Design in Educational Research, 2nd Edition. Emerald Group Publishing Limited, 1993. 425 p.

35. Cohen L, Manion L, Morrison K. Research Methods in Education. Routledge, 2017. 916 p.

36. Bartholomew JB, Jowers EM. Physically active academic lessons in elementary children. *Prev Med* 2011;**52 Suppl 1**:S51–4.

37. Grieco LA, Jowers EM, Errisuriz VL, Bartholomew JB. Physically active vs. sedentary academic lessons: A dose response study for elementary student time on task. *Prev Med* 2016;**89**:98–103.

38. McMullen JM, MacPhail A, Dillon M. “I want to do it all day!”—Students’ experiences of classroom movement integration. *Int J Educ Res* 2018. https://doi.org/10.1016/j.ijer.2018.11.014.

39. Welch M. Collaboration: Staying on the Bandwagon. *J Teach Educ* 1998;**49**:26–37.

40. Parks M, Solmon M, Lee A. Understanding Classroom Teachers’ Perceptions of Integrating Physical Activity: A Collective Efficacy Perspective. *J Res Child Educ* 2007;**21**:316–28.

41. Gibson CA, Smith BK, Dubose KD, Greene JL, Bailey BW, Williams SL, et al. Physical activity across the curriculum: year one process evaluation results. *Int J Behav Nutr Phys Act* 2008;**5**:36.

42. Lave J, Wenger E, Wenger E. Situated learning: Legitimate peripheral participation. Vol. 521423740. Cambridge university press Cambridge, 1991.

43. Castelli DM, Centeio EE, Nicksic HM. Preparing Educators to Promote and Provide

Physical Activity in Schools. *Am J Lifestyle Med* 2013;**7**:324–32.

44. MacPhail A, Patton K, Parker M, Tannehill D. Leading by Example: Teacher Educators' Professional Learning Through Communities of Practice. *Quest* 2014;**66**:39–56.

45. Webster C, Beets M, Weaver R, Vazou S, Russ L. Rethinking Recommendations for Implementing Comprehensive School Physical Activity Programs: A Partnership Model. *Quest* 2015;**67**:185–202.

46. Carson R, Castelli D, Beighle A, Erwin H. School-based physical activity promotion: a conceptual framework for research and practice. *Child Obes* 2014;**10**:100–6.

47. Department for Health. Start Active, Stay Active: A report on physical activity for health from the four home countries' Chief Medical Officers [Internet]. 2011. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/216370/dh_128210.pdf

48. Department for Education. PE and sport premium for primary schools - GOV.UK [Internet]. 2017 [cited 2018 Feb 27]. Available from: https://www.gov.uk/guidance/pe-and-sport-premium-for-primary-schools

49. Mwaanga O, Dorling H, Prince S, Fleet M. Understanding the management challenges associated with the implementation of the physically active teaching and learning (PATL) pedagogy: a case study of three Isle of Wight primary schools. *Managing Sport and Leisure* 2019:1–14.

50. Department for Education. Teachers' Standards: Guidance for school leaders, school staff and governing bodies [Internet]. 2013. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/665520/Teachers__Standards.pdf

51. Ofsted. School Inspection Handbook: Handbook for inspecting schools in England under section 5 of the Education Act 2005 [Internet]. 2018. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/730127/School_inspection_handbook_section_5_270718.pdf

52. Howie EK, Newman-Norlund RD, Pate RR. Smiles count but minutes matter: responses to classroom exercise breaks. *Am J Health Behav* 2014;**38**:681–9.

53. Daly-Smith A, McKenna J, Defeyter G, Manley A. A review of school-based studies on the effect of acute physical activity on cognitive function in children and young people. In: Meeusen R, Schaefer S, Tomporowski P, Bailey R, editors. *Physical Activity and Educational Achievements: Insights from Exercise Neuroscience*. New York: Routledge, 2018.p.277–302. (ICSSPE Perspectives).

54. Morton KL, Atkin AJ, Corder K, Suhrcke M, Turner D, van Sluijs EMF. Engaging stakeholders and target groups in prioritising a public health intervention: the Creating Active School Environments (CASE) online Delphi study. *BMJ Open* 2017;**7**:e013340.

55. Routen AC, Chalkley AE, Sherar LB. Getting a GRIP (getting research into practice) on movement integration in the school classroom. *Phys Ther Rev* 2017;**22**:139–46.

56. Tripathy JP, Bhatnagar A, Shewade HD, Kumar AMV, Zachariah R, Harries AD. Ten tips to improve the visibility and dissemination of research for policy makers and practitioners. *Public Health Action* 2017;**7**:10–4.

57. Cothran DJ, Kulinna PH, Garn AC. Classroom teachers and physical activity integration. *Teaching and Teacher Education* 2010;**26**:1381–8.

58. Webster CA, Buchan H, Perreault M, Doan R, Doutis P, Weaver RG. An exploratory study of elementary classroom teachers' physical activity promotion from a social learning perspective. *J Teach Phys Educ* 2015;**34**:474–95.

59. Hawe P, Shiell A, Riley T. Complex interventions: how "out of control" can a randomised controlled trial be? *BMJ* 2004;**328**:1561–3.

Table 1 Participant summary

Stakeholder group (*N*=35)	Typical roles	Time in current role *Mean (range) yrs*	School-based experience *Mean (range) yrs*
Researchers (*n*=15)	PhD student, Senior Lecturer, Research associate, Reader, Professor	4.3 (1 to 13)	2.1 (4 to 22)
Policy/ local authority (*n*=9)	Public health lead, active schools manager, physical activity officer, behaviour change specialist	3.3 (1 to 7)	4.4 (0 to 40)
Teachers (*n*=3)	PE specialist teacher, Primary teacher	16.7 (8 to 32)	16.7 (8 to 32)
Commercial education sector (*n*=8)	Managing/ commercial directors of PAL private companies, specialist PAL advisors	3.8 (1 to 9)	4 (0 to 20)

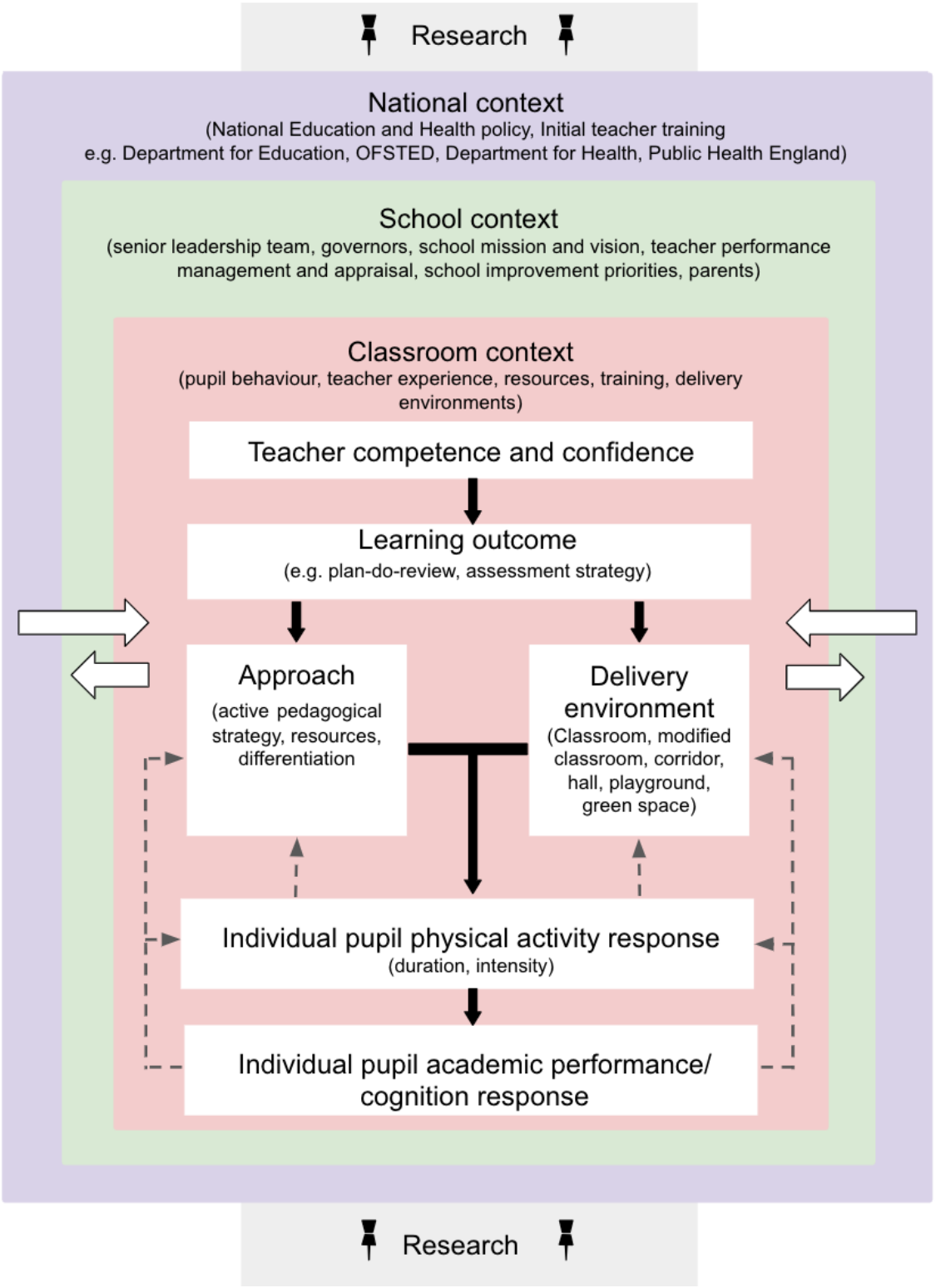

Figure 1: A research informed physically active learning implementation framework