

THE POTENTIAL IMPACT OF INCREASED PHYSICAL ACTIVITY ON PRIMARY-AGE PUPILS' LITERACY AND NUMERACY

The context

The concept of physically active lessons in schools has recently grown in prominence, with national physical activity guidelines acknowledging it as having a positive correlation with learning. With the amount, duration and intensity of physical activity that may be beneficial to learning still being open to debate, an aspiration of a recent study in south-west England was to investigate this theme, by exploring the effect of short bursts of physical activity on academic attainment.

As a parent myself, statistics indicate that the likelihood of my children receiving an outstanding education are low, with O'Leary (2018) highlighting Plymouth (the city I currently call home) as being ranked in the bottom 20 areas of the UK for poorest educational outcomes for children. This is further compounded by international benchmarks, such as that of the Programme for International Student Assessment (PISA), which studies school systems from around the world. The most recent 2018 results, involving 76 countries, places England as being 13th for reading, 15th for numeracy and 12th for science, which, when compared to our international peers, is not quite the world-beating system for which parents like myself had hoped.

My own interest in this topic was first piqued by research into the impact of physical activity on academic attainment conducted by Professor John Ratey at Harvard University. Ratey's investigations at Naperville Central High School in Chicago found that the school had undertaken the Trends in International Mathematics and Science Study (TIMSS) with its 19,000 students and discovered that "3% of their children were overweight... at a time when 33% of our kids were overweight [in America]" (Ratey, 2012). This low level of overweight children had been achieved over a 20-year period, wherein the school had implemented and developed a fitness-based programme of exercise, based upon 45 minutes per day. The subsequent TIMSS test scored the school as being "number 1 in the world in science and number 6 in maths" (Ratey, 2012). This was at a time when America had a world-ranking of 36th in maths, 25th in reading and 28th in science.

My aspirations as a teacher and parent were (and still are) to explore innovative ways to raise standards and attainment across educational contexts. If I can make even a marginal positive impact for my own children and learners, this would to me be a significant achievement. My personal teaching background and interests are specific to physical education (PE) contexts and have provided insight into an evolving body of evidence that indicates possible links between physical activity levels and academic attainment. This is an area that has more recently been acknowledged by the UK Chief Medical Officers' (CMO) Physical Activity Guidelines, which state that "physical activity improves concentration and learning" (Davies, Atherton, McBride & Calderwood, 2019, p.28)

Other studies come to similar conclusions of a positive correlation between physical activity and learning. Pertinent examples include a study comparing an exercise-conditioned and unconditioned group, which sought to study the impact of physical activity on memory – arguably a key facet in achieving mastery in learning. This particular study found that "students in the exercise condition retained a greater percentage of words learned than students in the control condition" (Etnier, Labban, Piepmeyer, Davis & Henning, 2014, p.255). A separate three-year study conducted across 24 schools served to conclude that "physically active academic lessons of moderate intensity improved overall performance on a standardised test of academic achievement by 6%". (Donnelly & Lambourne, 2011).

Leading and respected further education guru, Geoff Petty, adds voice to the claims, stating how the cumulative effects of regular physically active learning can potentially result in students improving their academic scores and grades. Petty highlights how "professors John Hattie and Robert Marzano have independently used careful statistical methods to average the findings of many thousands of the most rigorous studies on active learning. Their findings show that, for the best active methods, if you put a student in the experimental group, then, on average, they will do more than a grade and a half better than



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if they had been placed in the control group.” (Petty, 2019). Wonderful – but how?

Arguably two of the most important skills individuals need to develop as they move into adulthood are literacy and numeracy. An article in *The Guardian* (2021) reported that “17 million adults have such poor numeracy skills that they can’t understand deductions on wage slips, read bus timetables or pay household bills” (Jones, 2012). If, as research suggests, there is a positive association between physical activity and academic attainment, then there may be benefits in schools seeking to align and combine the teaching of literacy and numeracy with that of PE. A two-year study exploring possible improvements in progress within literacy and numeracy from enhanced physical activity reported that for those undertaking physical activity interventions, there was a “significantly greater gain in numeracy... and spelling scores. This equates to 4 months more learning gains in comparison with the control group”. Given this, there is, arguably, no counter-argument for not exploring the wider integration of number, literacy and physical activity.

There is increasing evidence, I suggest, that our lives are becoming increasingly inactive and sedentary, and the challenges of the pandemic have brought this into sharp focus. We now have the power to turn on a light bulb via an interface, can have our food delivered to our sofas and have no statutory minimum requirement for the number of minutes spent undertaking physical activity during our educational years. Our collective ability to advance technology to make our lives more comfortable is a commendable one – but with what impact on our health and wellbeing? The potential positive impact of physical activity on our physical health is well-documented. The

UK Chief Medical Officers’ Physical Activity Guidelines make clear recommendations about how active children and young people should be yet findings from the most recent Active Lives Children and Young People Survey show that only “44.9% of children and young people (3.3 million)” are meeting the daily recommendation of 60 minutes physical activity (Sport England, 2021, p.5).

A positive correlation between physical activity and health has been known for many years, so it is concerning to read national statistics, such as “one third of children are overweight or obese by the time they leave primary school” (Department for Education, Department for Digital, Culture, Media & Sport, Department of Health and Social Care, 2019, p.4). On a purely health-related basis, there is surely a justification for raising physical activity levels across our schools to build positive individual habits and relationships with physical activity. Research by Loughborough University reports that “during weekdays, primary school children spend the majority of their waking hours at school, where between 50% and 70% of time is spent sitting” (Routen *et al.*, 2017, p.1). I argue that practitioners should be reflecting upon the extent to which initiatives such as removing chairs from classrooms may be beneficial. I argue that young people could stand to gain in terms of their cognitive development if we embed physical activity across other areas of the curriculum, as we have done in core subjects, such as English and maths.

The literature I reviewed postulates a varying but positive correlation between physical activity and academic attainment. Perhaps one of the key challenges for educators is how to now incorporate this within the school day, especially as one study highlights how “the 60 minutes per day of physical activity that

is health enhancing is nearly impossible to achieve through PE, even with the highest-quality PE curriculum” (Kohl & Cook, 2013, p.4). It is certainly the case through my own professional experience that a PE lesson will often fall short of the full hour of being physically active, with much of the session lost to getting changed and instruction alone. I argue that we need to be smarter in embedding physical activity across other areas of the curriculum, in support of this minimum activity level recommendation. The ‘mile a day’ initiative is a great first step but are there even smarter and innovative ways we can achieve this?

Many questions will be posed from any potential links between physical activity and academic attainment, such as how much, how often and what type of exercise is most beneficial? To this end, this research sought to apply simple methods that are easily accommodated within the school day. As a teacher myself, I am aware of how challenging it can be to implement any new tool or approach to your pedagogy, without significant planning, preparation and resource (commodities that many teachers do not have in abundant supply). This is echoed in the findings of a review exploring the key barriers to implementing physically active lessons. The report highlights that “teachers’ confidence and competence, concerns over classroom space, preparation time and resources, coupled with the wider school culture that is influenced by governors and parents, reinforce a didactic approach and act as barriers to physically active lessons” (Quarmby, Daly-Smith, & Kime, 2019, p.308).

The research project

This research explored the effect of short, high-intensity bursts of physical activity on academic attainment through the medium of skipping. The choice of skipping was derived from research conducted by Jamie Timmons, Professor of Ageing Biology at Birmingham University. He highlighted that when doing high-intensity exercise “80% of the body’s muscle cells are activated, compared to 20-40% for walking or moderate-intensity jogging or cycling” (Timmons, 2013). The impact of activating more of our muscle cells has a profound impact on blood flow, which is of particular interest regarding our brain and learning. New research undertaken by UT Southwestern Medical Centre

reported that “mapped brain changes after one year of aerobic workouts has uncovered a potentially critical process: exercise boosts blood flow into two key regions of the brain associated with memory” (Thomas *et al.*, 2020). This research indicates that if the hippocampus region of our brain is receiving more energy and oxygen, it can have a positive impact on our learning and memory. If this is true, then skipping could be a suitable activity to ‘switch on our brains’ to retain new knowledge. Memory plays a key part in our learning, enabling pupils to retain and apply new knowledge to solve problems.

The research was undertaken within two primary schools in south-west England, focusing on individual and comparative year group classes. To provide a comparison, it studied an unconditioned group, which followed a traditional teaching approach and school timetable with no interventions, and a conditioned group, which participated in two-minute skipping challenges on either a daily or twice-daily basis. School A worked with two Year 5 classes (one conditioned, one unconditioned) in maths; School B worked with two Year 6 classes (conditioned and unconditioned) in English. Data was gathered over a seven-week period, from November to December 2020.

The findings were benchmarked against the results of standardised assessment tests (SATS) in literacy and numeracy that pupils took before and after the study. The initial assessment provided some baseline data against which to measure pupils’ progress and ensured high-achieving pupils were not all in the conditioned group, which could have created a bias in the results.

The findings

The study found that the conditioned groups of pupils participating across both schools gained an average SATS improvement score of 1 mark. The effect of the frequency of physical activity also raises questions for further exploration. Pupils undertaking a physical activity intervention once a week gained an extra mark on a test paper, and this doubled for those who undertook a physical activity intervention twice a week (see Figure 1).

Figure 1: Correlation between weekly skipping intervention and pupil raw test scores

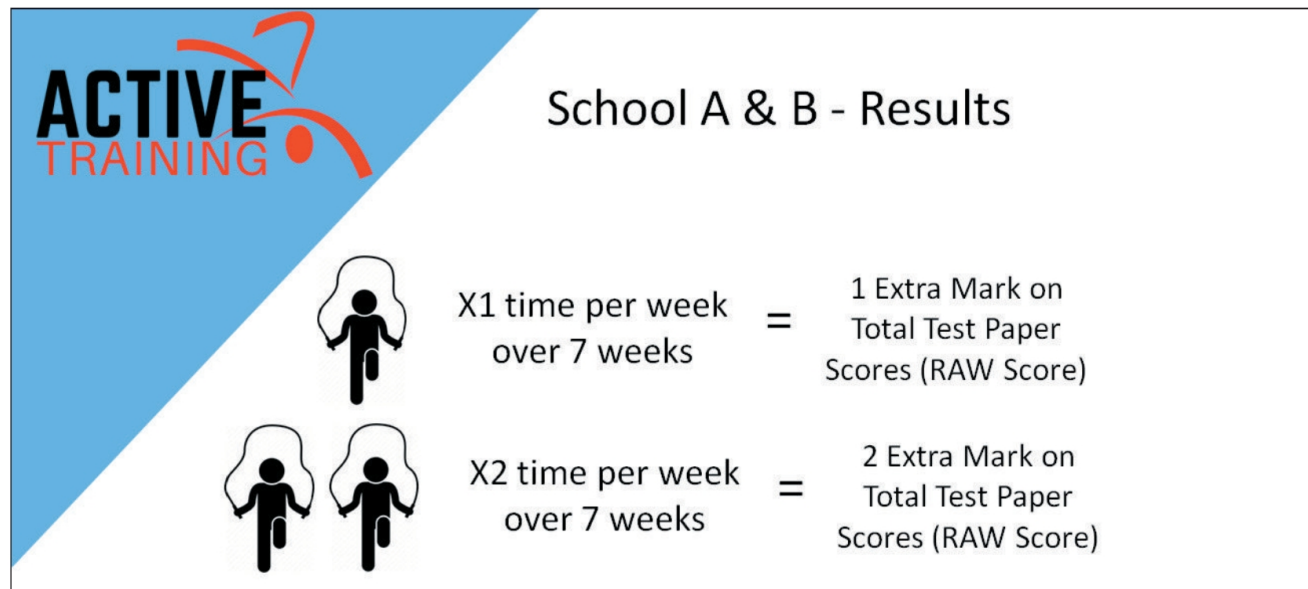
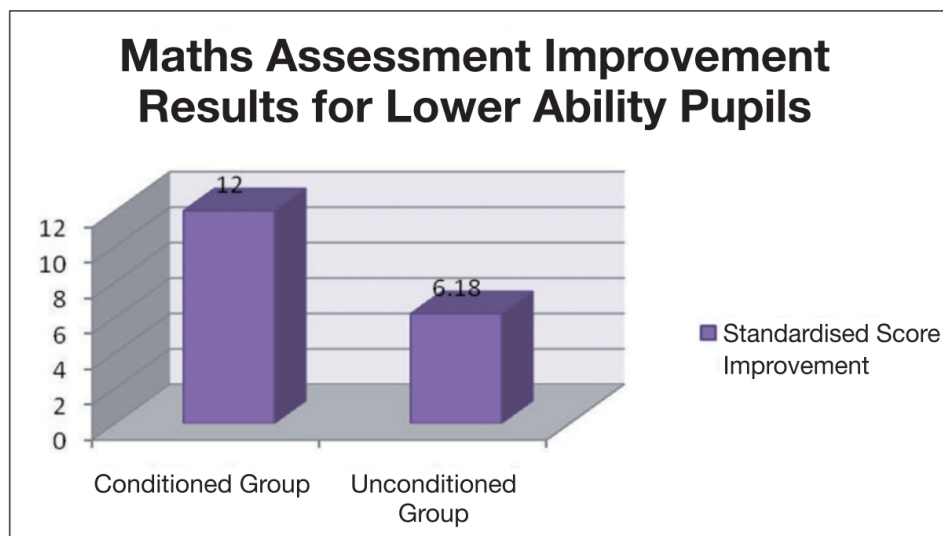


Figure 2: SATS scores in maths for lower attainment pupils.



These improvements were consistent across both literacy and numeracy, with a notable improvement for low ability pupils in numeracy (see Figure 2).

The results from this study suggest that short, high-intensity physical activity bursts, when placed strategically within the context of a school day, can have a positive impact on pupils' literacy and numeracy. A conservative analysis of the data suggests that a child who completes a high-intensity two-minute skipping challenge once a week, over the duration of a term, will record an improved SATS score of one mark. This positive comparison to that of pupils who were less active in their usual school day is a thought-provoking outcome.

Conclusion

Taking a holistic approach to health is one of the recommendations in the International Journal of Behavioral Nutrition and Physical Activity. This report researched factors such as diet, physical activity, sleep, screen time and body weight status and concluded that "school-based health promotion approaches that address multiple lifestyle behaviors instead of single behaviors may have more benefit for academic achievement" (Faught *et al.*, 2017, pg.11). Whilst the findings of this study provide an encouraging basis upon which to inform active curriculum development, the impact of this could be lost without appropriate consideration of these other external factors. I argue, however, that physical activity is one key piece of the jigsaw as we strive for a high-quality education that results in high levels of academic attainment for all.

My hope is that this study encourages teachers and schools to undertake their own action research. This sentiment is endorsed

by Kohl and Cook (2013) who recommend that "governments, school systems at all levels... city governments and city planners, and parent-teacher organisations should systematically consider access to and provision of physical activity in all policy decisions related to the school environment as a contributing factor to improving academic performance, health, and development for all children" (Kohl & Cook, 2013, pg.9). The study presents a low-cost approach to raising physical activity levels throughout the school day, particularly given current government funding through the Primary PE and Sport Premium. The current cost of the skip2bfit resources used in this research represent less than two per cent of a primary school's annual Premium funding. Even run in isolation, the evidence from this study suggests it will yield a positive outcome for academic attainment. However, adopting a wider school active curriculum, alongside addressing other external factors such as diet, sleep, screen time and body weight, could have an even greater impact. It represents a genuine opportunity for senior leaders to support their pupils to fulfil their true potential.

If this article has made you pause for thought, then it has achieved its objective. The challenge for us as practitioners is to strive to embed knowledge of physical activity benefits at the same pace as we have been able to embed technology in schools during the pandemic. Our pupils are too important to deserve anything less from us! ■

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