An intervention to improve the physical activity levels of children: Design and rationale of the 'Active Classrooms' cluster randomised controlled trial

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A B S T R A C T

Background: Recent evidence demonstrates that children are not engaging in the recommended 60 min of moderate to vigorous physical activity per day. Physical activity (PA) interventions have been acknowledged by the WHO (2010) as a key strategy to increase the PA levels of children. School has been recognised as a primary location for reaching the majority of children and providing PA opportunities for them. However, the sedentary nature of lessons carried out in the classroom has been identified as a contributing factor to physical inactivity among this age group.
Purpose: The aim of this study is to develop and evaluate a classroom-based intervention which integrates PA and academic content, and evaluate its effects on the PA levels of children aged 8–11 in Ireland.
Methods: Active Classrooms is an 8-week classroom based intervention guided by the behaviour change wheel (BCW) framework (Michie et al. 2011) that will be evaluated using a cluster randomised controlled trial (RCT). Study measures will be taken at baseline, during the final week of the intervention and at follow-up after 4 months. The primary outcome is minutes of moderate-to-vigorous intensity physical activity during school time objectively assessed using accelerometers (Actigraph). Teachers' perceptions on the effectiveness and use of the intervention and students' enjoyment of the programme will be evaluated post intervention.
Conclusions: Changing teacher behaviour towards using physically active teaching methods may increase the moderate to vigorous physical activity levels of their students. Therefore, the results of this study may have important implications for the health of children both now and into the future.
Trial Registration: ISRCTN14265493

1. Introduction

Recent evidence has shown that children who engage in high levels of physical activity (PA) are at a reduced risk of cardiovascular disease, obesity, Type II Diabetes, cancer and other chronic illness [1]. It has been suggested that for health improvements to occur reducing the risks of premature death and the burden of non-communicable diseases (NCDs), physical activity should be made a public health priority throughout the world [2]. It is estimated that less than 20% of children globally [3,4] and less than 50% of children in Ireland [5] meet public health guidelines which recommend that children aged 5–17 years should accumulate at least 60 min of moderate- to-vigorous physical activity (MVPA) every day [4]. Increasing the physical activity levels of children has been identified as particularly important given the long-term impact on public

health [6]. PA plays an important role in the prevention of overweight and obesity in childhood and adolescence, and reducing the risk of obesity in adulthood [7]. Many studies have shown that interventions [8] can increase PA levels and childhood is a critical time to intervene.

Schools have been targeted as one of the best environments to implement PA interventions as they are a primary location to reach the majority of children. However, ironically, schools internationally are reported to be one of the dominating environments of sedentary behaviour in children with class time representing a significant sedentary period of the day [9]. The school curriculum is an ideal avenue for accessing all children and encouraging them to be physically active throughout the day. However, emphasis on literacy and numeracy in primary school classrooms has resulted in a lack of time for activity breaks and a lack of emphasis on physical education. In order to address this problem which places emphasis on academic content to the detriment of physical activity, methods of integrating PA into academic lessons in the classroom are warranted.

In reviews of the literature [10,11] it has been found that very few studies focus on classroom-based interventions [12–17] and of those which have only three studies have integrated PA into academic content [17–19]. These interventions demonstrate that integrating PA into academic content improves students' PA levels during school time without affecting academic teaching time. However, only one of these studies used accelerometer measures and a randomised control trial [17]. The other studies [18,19] use predominantly pedometer measures and have no control group for comparison measures or do not include randomisation. The Theory of Planned Behaviour [20] and the Ecological Model [21] were used to guide these interventions. The Physical Activity Across the Curriculum (PAAC) study [17] refers to Bandura's Social Cognitive Theory and the importance of self-efficacy and goal setting to successfully perform a desired behaviour [22]. The literature suggests that when designing interventions for children the application of a behavioural theory is essential [23] since it allows the researcher to determine how the intervention worked and how future interventions can be improved [24]. Therefore, the proposed study aims to build on the strengths and recommendations of previous research through the use of accelerometers, a RCT, behaviour change theory, as well as teacher and student evaluations of the programmes which will enable a robust design.

This study aims to develop an innovative and engaging, 8 week, classroom-based intervention which integrates physical activity and academic content of the English and Maths curricula, and evaluate its effects on the PA levels of Irish primary school boys and girls. The primary outcome is change in minutes of MVPA measured using accelerometers. Secondary outcomes are teacher satisfaction with the programme and its implementation, and student enjoyment of the programme. The proposed study builds on a successful pilot of the 'Active Classrooms' programme where significant intervention effects were found for MVPA levels of the participants during active lessons. Furthermore, the children and teacher reported on the enhanced learning experienced through participating in the programme. However, the pilot study was carried out in a single classroom and there was no control group.

This paper describes the methodological procedures used to implement and evaluate the effectiveness of the Active Classrooms intervention.

2. Methods

2.1. Study design

Active Classrooms is an 8 week classroom-based PA intervention guided by the Behaviour Change Wheel (BCW) and will be evaluated using a Cluster RCT with follow-up after 4 months. Fig. 1 illustrates the flow of participants through the study. Ethical approval for the study has been granted by Mary Immaculate College Research Ethics Committee (MIREC), Limerick, Ireland.

Design, conduct and reporting of the Active Classrooms intervention will adhere to the Consolidation Standards of Reporting Trials (CONSORT) guidelines [25,26].

A randomly selected sample of primary schools in the study region will be invited to participate. Following the initial recruitment process, school principals, teachers, parents and study participants will provide written informed consent and/or assent. The schools will be randomly allocated to receive an intervention to be implemented over 8-weeks and to commence after baseline data collection, or to a delayed-treatment control group. All eligible participants will complete baseline assessments and follow-up evaluations which will be conducted during week 8 and week 16.

The primary outcome will be change in minutes of moderate-to vigorous-intensity physical activity (MVPA) measured using accelerometers at baseline, post intervention and four months follow-up.

2.1.1. Use of behaviour change theory

Previous PA interventions have been grounded in Bandura's Social Cognitive Theory (1977), Skinner's PRECEDE model (1953), the Theory of Planned Behaviour [20], the Ecological Model [21] and Rosenstock's Health Belief Model (1966) to initiate short and long term behaviour change [10]. The applications of behavioural theories are deemed essential when designing interventions for children [23]. Theoretical frameworks can help researchers determine how the intervention worked and how future interventions can be improved. Indeed, there is evidence that physical activity interventions informed by theoretically-driven behaviour change models are more successful and lead to stronger and more lasting changes [24]. However, many of these theoretical models have been criticised as they do not address impulsivity, habit, self-control, associative learning and emotional processing which all have important roles in behavioural outcomes, and they do not analyse the target behaviour to develop effective interventions [27]. The Active Classrooms intervention design is therefore, guided by the Behaviour Change Wheel (BCW) framework [27]. This framework is based on the theory that outcome behaviours must be understood in their context with consideration given to the individuals' existing capability, opportunity and motivation to achieve these target behaviours (COM-B) i.e. the capability of the individual, the opportunity provided to the individual and the individual's motivation in a particular context, result in particular behaviour. Table 1 summarises how these factors have been considered and how they relate to the target