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Translating Interventions From Research to Reality: Insights From Project Spraoi, an Irish Multicomponent School-Based Health-Promotion Intervention

Yvonne O'Byrne, Joan Dinneen, & Tara Coppinger*

Department of Sport, Leisure & Childhood Studies

Munster Technological University

Abstract

Project Spraoi (PS) is a school-based health-promotion intervention aimed at increasing physical activity (PA) and improving nutritional knowledge among primary-school children in Ireland. The study explored the fidelity of the intervention, namely, whether PS was delivered as intended, and examined the processes through which PS and each of the school contexts adapted to one another. Stakeholders, including teachers (n = 65), support staff (n = 22), Energisers – PA specialists tasked with leading change in the schools (n = 5), and children (n = 246), participated in the study. Quantitative data were collected through PA logs and questionnaires to assess the fidelity of intervention delivery. Process evaluation was undertaken based on three themes: implementation, context, and mechanism of impact, which were subcategorised into six evaluation dimensions. Qualitative data were collected through interviews, focus groups, and "write and draw" activities to elicit information about contextual barriers, facilitators, adaptations, and interactions. Results showed that intervention fidelity was low, and teachers delivered roughly 50-80% of the prescribed daily moderate to vigorous physical activity (MVPA), on average. Common barriers identified were lack of time, curricular constraints, weather, and lack of support from school staff. Adaptations made to achieve better contextual fit included shorter activity breaks, cross-curricular games, and PA challenges and competitions. There was much variability in how PS was delivered and received, but adaptations that supported better contextual fit facilitated intervention delivery. The findings offer solutions to inherent contextual barriers when delivering health-promotion interventions in primary schools.

Keywords: primary-school intervention, physical activity, health promotion, evaluation

Author Note

*Tara Coppinger may be contacted at tara.coppinger@mtu.ie
Tara Coppinger's ORCID iD is: https://0000-0002-7251-4516
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Globally, children's physical activity (PA) has decreased, and one of the most recent national studies among Irish primary-school children reported that just 17% were undertaking sufficient PA (Woods et al., 2018). Schools hold much potential to act as critical settings for influencing healthy eating and PA behaviours because they have long-term contact with children who spend many of their waking hours at school (Cavanagh et al., 2012). Yet, in a systematic review, Grao-Cruces et al. (2020) found children's school-based PA to be low. Further, in a systematic review and meta-analysis of PA and sedentary time in structured settings, Tassitano et al. (2020) reported that children spent a high proportion of the school day in a sedentary state. The challenges associated with densely populated curriculums may play a role, by impacting the ability of schools to offer physically-active opportunities during curriculum delivery (Martin & Murtagh, 2015).

School-based interventions present an important opportunity for change and development (Ní Chróinín et al., 2012) but systematic reviews investigating the effectiveness of school-based interventions on children's PA levels, sedentary time, and healthy-eating behaviours have, to date, produced mixed findings (Evans et al., 2012; Love et al., 2019; Naylor et al., 2015). The variability between studies could be due to the complexity of implementing and evaluating school-based interventions and the challenges in identifying key successful components (Langford et al., 2015). Understanding the contextual variables that dictate why only some interventions are effective in achieving their outcomes is therefore important (Naylor et al., 2015; Schaap et al., 2018).

School-based interventions can be interpreted as an attempt to positively disrupt the prior functioning of the school system. However, the challenges associated with creating change within the school environment often differ between schools. Every school has its own unique working dynamic, which is shaped by many interacting elements and ever-changing agents within the school system (Van Geert & Steenbeek, 2014). Schools can, therefore, be conceptualised as complex adaptive systems (CAS) (Keshavarz et al., 2010). The system's functioning is typically not easily controlled or predicted, and it tends to self-organise to a state of stability (Moore et al., 2015; Turunen et al., 2017). Considering schools as CAS implies that the extent to which a health-promotion intervention succeeds is dependent on the specific school context, and that, in each school, the implementation process of specific intervention components may need to be adapted to achieve better contextual fit (Moore et al.,

2015). It also implies that even when identical intervention activities are delivered, these can have different effects across schools as the changes may be moderated by the unique context of the school and the agents within it (Keshavarz et al, 2010; Moore et al., 2015).

Project Spraoi (PS) (https://doi.org/10.1016/j.conctc.2016.04.007) was an Irish multi-component school-based intervention based on the fully evaluated and internationally recognised 'Project Energize' (Rush et al., 2016). The intervention, with a focus on PA and healthy eating, aimed to improve children's health and well-being by prompting health-promoting changes throughout the whole school system. Central to the PS concept was the 'Energiser', a PA specialist responsible for leading and supporting health-promoting change. Their role included modelling structured PA sessions known as 'Huff & Puff', delivering healthy-eating workshops, and providing PA and healthy-eating resources to support teachers in achieving the daily intervention target of 20 minutes of moderate to vigorous PA (MVPA) in addition to each school's designated weekly physical education (PE) time (Coppinger et al., 2016). On the days when the Energiser was not present, class teachers were expected to deliver intervention activities. Parents were encouraged to support the project by participating in after-school healthy-eating workshops and helping their children with 'active homework'.

The current study was part of the larger PS Randomised Control Trial (ISRCTN926 11015), registered by team members from the Department of Sport, Leisure & Childhood Studies within Cork Institute of Technology (CIT) (now Munster Technological University) in September 2013. Full details of the school recruitment process can be found in Coppinger et al. (2016). A team of seven researchers, who were also the Energisers in their respective schools, undertook unique research projects in ten primary schools (seven intervention and three control) within a 20km radius of CIT. The researchers looked at nutritional knowledge and attitudes (Merrotsy et al., 2018), PA levels (O'Leary et al., 2019), fundamental movement skills (FMS) (Bolger et al., 2018), dietary intake (Merrotsy et al., 2021), and sedentary behaviour (Murphy, 2017). Evaluations of these studies to date have reported positive impacts on the prevalence of overweight and obesity, as well as on a wide range of health markers including waist circumference, cardio-respiratory fitness, PA levels, FMS, and dietary behaviours of Irish primary-school children (O' Leary et al., 2018; Bolger et al., 2018; Merrotsy et al., 2018). PS has also been found to positively impact the school context and those who interact with it, including teachers, parents, and pupils (O' Leary et al., 2019).

The current study, led by the lead author, was a process evaluation, designed to facilitate better understanding of the implementation processes of PS. It focused not only on the fidelity of the intervention but also on the adaptation of the intervention and the school system to one another, with a view to identifying contextual factors necessary for sustained change. In "multi-site" interventions like PS, where the same intervention theory may be implemented and received in different ways, process

evaluation is crucial in interpreting overall outcomes and understanding potential variances between schools (Day et al., 2019; Moore et al., 2015).

The aim of the current study was to share key learning points from PS. Specifically, the study explored the extent to which the prescribed intervention was delivered as intended across five intervention primary schools and examined the processes through which PS and the school context adapted to one another throughout the course of an academic year (2015/2016).

Methods

Implementation

Central to the delivery of PS was the researcher's ability to act as an Energiser and to be an "agent of change" within their intervention school(s). This included leading healthy lifestyle initiatives, modelling PA and healthy-eating classes, and providing resources on PA and healthy eating to help teachers achieve the intervention goals of delivering 20 minutes extra daily MVPA to pupils during the school day and improving pupils' nutritional knowledge and behaviours (Coppinger et al., 2016). As advocated for in the literature (Naylor et al., 2015), a whole-school approach to intervention delivery was adopted by PS, with all classes in an intervention school receiving equal contact time with the Energiser each week. On the days when the Energiser was not present, each teacher was responsible for delivering 20 minutes of MVPA to all pupils in their class to meet the intervention requirements. Participating schools decided on the specific content/theme of their intervention based on a needs analysis undertaken with their assigned Energiser at study commencement. A memorandum of understanding outlining the expectations of all stakeholders was agreed and signed in advance by the school principal.

Participants

A formal evaluation of PS took place in 2015. A total of 658 children from ten schools (seven intervention, three control) participated in the full evaluation between 2013 and 2017 (Coppinger et al., 2018). The evaluation reported in this study took place in 2015/16 and included all intervention schools that were participating during that time (n = 5). These schools were at varying stages of the PS intervention at the time of this process evaluation (Table 1). The schools were situated in urban (n = 3) and rural (n = 2) locations. The average socio-economic status (SES) of the pupil intake was medium to high in four of the participating schools and low in the fifth school, ascertained via each school's Delivering Equality of Opportunity In Schools (DEIS) status.[1] Three were

1 The DEIS programme is the government of Ireland's main policy initiative to respond to educational disadvantage for children aged 3 to 18 years. Schools are assigned to DEIS Urban Band 1, DEIS Urban Band 2 or DEIS Rural on the basis of the location of the school and its level of disadvantage. More information is available at https://assets.gov.ie/25273/0771d5663800429eaab15f8897ea164e.pdf

mixed-gender schools and two were single-gender schools, one male and one female (Table 1). All relevant categories of stakeholders in each of the five schools participated in the current project, including teachers (n = 65), support staff (n = 22), Energisers (n = 5)[2], and pupils (n = 246). Teachers who taught class groups from junior infants to second class were assigned to the junior category (n = 33), while teachers who taught class groups from third class to sixth class were assigned to the senior category (n = 32). Testing classes refer to classes that participated in the full PS study impact evaluation and included senior infants and first-class pupils in the junior category, and fourth- and fifth-class pupils in the senior category. Each school had two testing cohorts, one junior class and one senior class, included in the evaluation. During the evaluation period for this study, the schools identified here as S1, S2 and S5 were participating in their second year of the PS intervention and so the testing classes evaluated were first- and fifth-class pupils. Schools S3 and S4 were participating in their first year of the PS intervention and the testing classes evaluated in these schools included senior infants and fourth-class pupils.

TABLE 1

Characteristics of Evaluation Schools

Site	Gender	Location	School SES	Energiser contact days per week	Year of Intervention	Research focus	Facilities
S1	Boys	Urban	Non- DEIS	2	2	Fundamental movement skills	Yard Sports hall
S2	Girls	Urban	Non-DEIS	2	2	Fundamental movement skills	Yard Sports hall
S3	Mixed	Urban	DEIS	1	1	Sedentary time	Yard Sports hall
S4	Mixed	Rural	Non-DEIS	1	1	Sedentary time	Yard Playground Sports hall All-weather pitch Grass pitch
S5	Mixed	Rural	Non-DEIS	1	2	Nutrition	Yard Sports hall Grass pitch

Data Collection

Table 2 presents the data collection instruments used in this study and the total numbers of responses by respondent/participant group.

2 There were four Energisers participating in the study but one Energiser worked across two schools (S3 & S4) and completed separate data sheets to reflect experiences in two separate schools. Therefore, 5 Energiser responses were provided in total for each of the different data collection instruments.

TABLE 2

Data Collection Instruments and Number of Responses

Data Collection Tool	**Stakeholder (n)**			
	Teachers	Support Staff	Energisers	Pupils
Physical Activity Logbook	65			
Write & Draw				246
Interview				20
Reflective Journal			5*	
Teacher Questionnaire	58			
Energiser Questionnaire			5*	
PA & Nutrition Profile	16			
End-of-Year Survey	50	12		
Focus Group	65	22		

* Five Energiser instruments were completed, as one of the four Energisers completed instruments to reflect experiences in two separate schools.

Focus Groups

Focus groups were used to interview all teachers and school staff who interacted with the intervention. These were conducted, and the content analysed, throughout the course of the intervention year to document barriers and facilitators e.g., "What do you think works well? What are the biggest challenges to delivering 20 minutes MVPA every day?", and to track adaptations made to implementation across sites e.g., "How is Project Spraoi delivered in your classroom?".

Physical Activity Logs

PA logs were completed weekly by class teachers (n = 65) between November 2015 and May 2016. Utilising a "tick the box" option for efficiency, teachers indicated the type ("Huff & Puff", learning games, organised sport or other) and length of time (either 5, 10, 15 or 20 minutes) of PS MVPA delivered, as well as the day(s) and number of minutes regular PE was delivered. A comments box was also provided so that teachers could specify, if necessary, any reasons for not delivering PS MVPA on any given day.

Write and Draw

The Write and Draw activity was delivered to all consenting pupils (n = 246) in testing classes (junior & senior evaluation cohorts) by the lead researcher. Pupils were asked to draw a picture in an outlined drawing area and then write a few lines below about what PS meant to them. A "spelling holiday" was granted for the duration of the task and reassurance was offered that this was not a test and drawings would not be displayed at school.

Possible limitations of using drawings as a source of feedback are that they convey only experiences and views that can be represented graphically and are limited by an individual's skills (MacPhail & Kinchin, 2004). To address this, drawings were analysed in conjunction with text about "What Project Spraoi means to me" and a sub-sample of children (n = 20) also participated in interviews. In this way, children were not limited to expressing experiences that could be represented only graphically, and they had the opportunity to explain their pictures, increasing the clarity of the data.

Semi-Structured Interviews

Semi-structured interviews were conducted one week after completion of the Write and Draw task, whereby participants were asked to explain their Write and Draw contributions in more detail. Two children from each evaluation class, one girl and one boy, if the class was mixed, were selected to participate (n = 20). Despite much qualitative research involving the use of purposive sampling, random sampling was selected for this component to avoid the risk of researcher bias in the selection of participants (Shenton, 2004). Both the interview protocol and questions were piloted in advance with a test sample (n = 20) of pupils who were not attending any of the intervention schools and amendments were made, where necessary.

The interviews were conducted by the lead researcher, accompanied by a research assistant. In addition to obtaining their original consent to participate in the research, further consent was sought from both parents/guardians and children to participate in the interview and to have it audio recorded. Interviews were conducted in a private quiet space, separate to the main classroom. For ethical reasons, two children were present in the interview room at all times.

Questions were grouped under three headings: (i) Write and Draw (e.g., last week you drew a picture about Project Spraoi, can you tell me about your picture?); (ii) intervention activities within or as part of PS (e.g., how do you feel when it is time for Project Spraoi games and healthy-eating lessons with your teacher and/or [Energiser name]?); and (iii) school environment (e.g., what opportunities do you have at school to be physically active?). The interview protocol employed was influenced by the considerations outlined by Westcott et al. (2005) with open-ended questions favoured to encourage more in-depth responses.

Questionnaires

Questionnaires were developed for completion by school staff and Energisers to analyse key stakeholders' interactions with PS, record adaptations to intervention delivery, and identify barriers and facilitators to PS activities across all intervention sites. As questionnaires were specific to the implementation of PS, questions were piloted in a preliminary study in one school, involving all staff, before being used across all

intervention schools. Following recommendations from the literature and feedback from the pilot, all questionnaires were condensed to a single A4 size page using mostly "tick the box" Likert-scale questions to maximise response, while minimising burden and additional workload for school staff (Griffin et al., 2014). Two open-ended questions were retained per questionnaire, to allow respondents to document their interactions with PS and suggest innovations to improve intervention delivery or contextual fit.

Five different questionnaires were administered throughout the course of the school year: Teacher Questionnaire; PA & Nutrition Profile; End-of-Year Survey; Energiser Questionnaire; and Reflective Journal. The Energiser Questionnaire (administered in May 2016) and Reflective Journal (administered weekly throughout 2015/2016) were completed by the assigned Energisers (n = 5). The Teacher Questionnaire was completed by class teachers (n = 58) mid-year (January 2016), and the follow up End-of-Year Survey was completed in May 2016 by both teachers (n = 50) and school support staff (n = 12). The PA & Nutrition Profile was completed by teachers of testing classes only (n = 16; junior n = 8; senior n = 8) at the end of the academic year.

Questions were presented as a set of statements, e.g., "I make every effort to deliver 20 minutes of extra physical activity every day", with which respondents indicated their level of agreement using a 5-point Likert scale, ranging from "strongly agree" to "strongly disagree". Open-ended questions were also used to gather information about stakeholders' interactions with PS, prompt any unanticipated information, and allow respondents to suggest innovations to improve intervention delivery and support at each site, e.g., "Please note: Any improvements that you suggest could be made to Project Spraoi".

Analyses

Qualitative data were recorded and transcribed verbatim. All interview transcripts were checked by a second researcher to ensure accuracy of recording. Thematic analyses were conducted on the interviews, focus groups, and open-ended survey questions. Data were coded into categories based on programme theory (i.e., the activities or inputs, the intended outcomes or outputs, and the mechanisms through which the intended or actual outcomes are achieved), using Quirkos (version 2.0), a computer-assisted qualitative data analysis software (CAQDAS) (Rogers, 2003). During the coding process, Quirkos was used to identify key words and associated synonyms across all attached data sources. Themes were identified, and reviewed several times to check if they were still applicable when assigned to new data sources. After all data were coded, subcategories were identified per theme, if necessary, and, when possible, a distinction between inhibiting and promoting implementation was made for each of the influencing factors. Next, the coded text was retrieved to create an overview per theme (or per subcategory), with the findings split by school to study similarities and

differences across schools. Furthermore, for each school, the frequency of counts per theme/subcategory was calculated. Themes and subcategories identified and coded during analysis were reviewed by a second researcher to ensure consistency and compatibility throughout.

The mean amount of extra daily MVPA (in minutes) reported by each teacher on the PA logs was calculated for each month in Microsoft Excel, and results were compared using separate repeated measures between- and within-subjects (or mixed) ANOVA tests. The within-subjects factor was time for both analyses and the between-subjects factors were (i) the class category taught by the relevant teacher (i.e., junior category and senior category as defined above) and (ii) the school (S1 – S5). A Shapiro-Wilk test was used to determine the normality of the distribution of the data sets. The assumptions of normality and homogeneity of variance (using Levene's test) were met. The assumption of sphericity was violated, however, and so the ANOVA results were interpreted using the Greenhouse-Geiser correction. Interaction effects between time and class group taught were explored, and the Bonferroni correction was used to correct estimates based on the number of comparisons made.

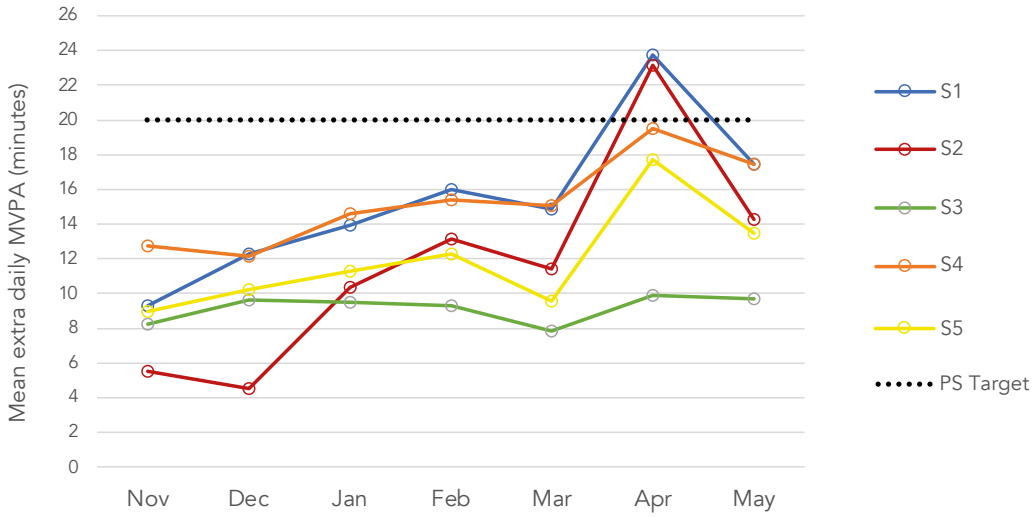
Results

Implementation – Fidelity and Dose Delivered

Over the course of an academic year, the mean amount of extra daily MVPA delivered by teachers each month varied significantly ($p < .001$, $\eta^2 = 0.403$) (Figure 1). A Bonferroni post-hoc test was conducted as part of the ANOVA to explore the monthly difference across the seven months of intervention evaluated. Although the increase in the amount of extra daily MVPA delivered by teachers over time did not occur in a linear manner, overall, a statistically significant mean increase of 6.76 minutes ($p < 0.001$, $\eta^2 = 0.570$) was reported between November 2015 and May 2016. The largest month-to-month increase across all schools was between March and April (mean difference = 7.34 minutes, $p < 0.001$).

FIGURE 1

Mean Extra Daily MVPA (Minutes) Delivered by Teachers, by School



In addition to differences reported over time, there was also a statistically significant difference between schools ($p = 0.024$, $\eta^2 = 0.275$). The mean value of MVPA delivered by teachers was significantly different between School 1 (15.37 minutes) and School 3 (9.15 minutes) ($p = 0.010$, 95% CI = -11.363, -5.587), as shown in Table 3. The interaction effect of time and class group taught indicated that junior-class teachers delivered significantly more extra daily PA than teachers of senior classes ($p = 0.050$, $\eta^2 = 0.070$).[3,4]

3 All statistically significant results of the ANOVA are presented in text. No additional statistically significant results were identified during analysis.

4 In the ANOVA test, six dummy-coded variables were created for time and the interaction term for each of them was included with the class-group variable.

TABLE 3

Implementation Fidelity – PS Target Versus Dose Delivered by Teachers, in Minutes

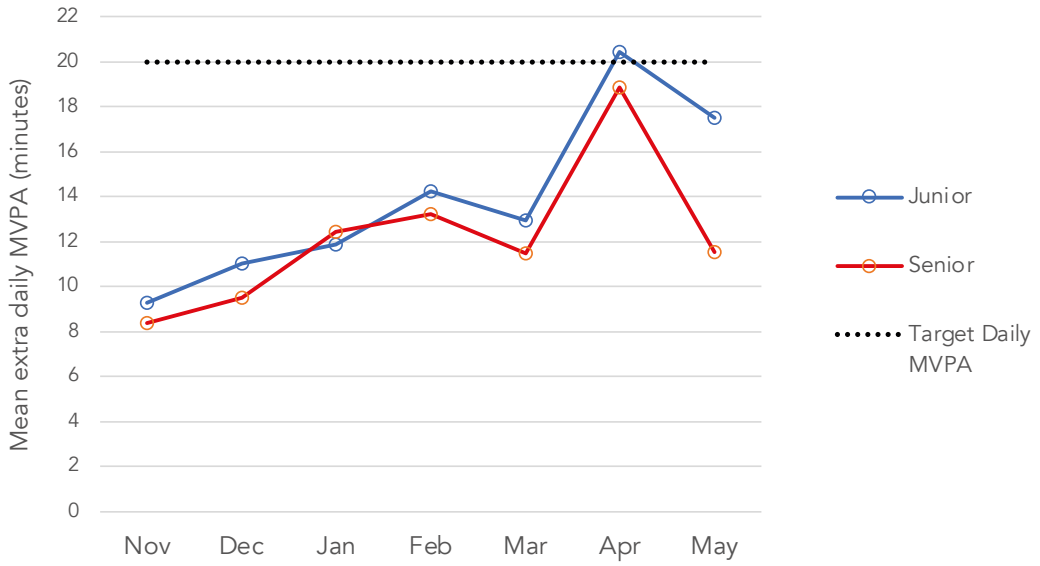
	November	December	January	February	March	April	May	Total
School 1 (S1)								
n	16	16	16	16	15	15	15	16
Mean daily MVPA (min)	9.33	12.26	13.94	16.00	14.85	23.73	17.45	15.37
SD	5.82	9.57	8.02	11.20	11.25	11.63	18.38	
p value	**0.000***	**0.005***	**0.009***	0.174	0.098	0.234	0.600	
School 2 (S2)								
n	10	8	11	11	11	11	11	11
Mean daily MVPA (min)	5.51	4.51	10.38	13.14	11.40	23.17	14.27	11.77
SD	2.03	5.72	7.34	5.94	7.06	3.44	5.09	
p value	**0.000***	**0.000***	**0.001***	**0.003***	**0.002***	0.122	**0.004***	
School 3 (S3)								
n	13	14	14	15	12	15	14	15
Mean daily MVPA (min)	8.23	9.60	9.49	9.27	7.87	9.87	9.71	9.15
SD	3.77	2.39	6.54	5.50	4.35	6.80	4.94	
p value	**0.000***	**0.000***	**0.000***	**0.000***	**0.000***	**0.000***	**0.000***	
School 4 (S4)								
N	11	11	12	12	12	12	12	12
Mean daily MVPA (min)	12.73	12.18	14.58	15.42	15.07	19.50	17.46	15.28
SD	5.97	3.52	5.42	3.12	2.60	2.39	2.76	
p value	**0.002***	**0.000***	**0.005***	**0.000***	**0.000***	0.484	0.109	
School 5 (S5)								
n	10	11	10	11	8	11	10	11
Mean daily MVPA (min)	9.00	10.22	11.28	12.27	9.55	17.73	13.5	11.94
SD	3.20	2.28	4.99	3.13	4.39	2.28	1.96	
p value	**0.000***	**0.000***	**0.000***	**0.000***	**0.000***	**0.008***	**0.000***	

* Significant difference between daily MVPA dose delivered and PS target of 20 minutes daily MVPA, p≤0.05

Further analysis of the PA logs using a one-sample t-test, corrected for multiple comparisons, revealed discrepancies in the fidelity of intervention delivery by class teachers. The mean amount of extra MVPA delivered by teachers daily (junior: 14.18 minutes; senior: 12.41 minutes) was significantly lower than the PS target of 20 minutes from November to May ($p < 0.05$), with the exception of April (see Table 3 and Figure 2).

FIGURE 2

Mean Extra Daily MVPA (Minutes) Delivered by Teachers, by Class Category



At the beginning of the intervention evaluation in November, only 5.0% ($n = 3$) (junior: 3.1% [$n = 1$]; senior: 7.4% [$n = 2$]) of teachers were meeting the PS target of 20 minutes extra daily MVPA. This increased to 16.1% ($n = 10$) (junior: 21.9% [$n = 7$]; senior: 10.3% [$n = 3$]) of teachers meeting the target at intervention end in May, with a peak of 42.9% ($n = 27$) (junior: 50% [$n = 16$]; senior: 35.5% [$n = 11$]) of teachers meeting the target in April.

Mechanisms of Impact: Interactions

The teacher survey assessed teachers' attitudes towards delivering PS and their interactions with the intervention and Energiser. Overall, more than half of teachers (60.3%, $n = 35$) either agreed or strongly agreed that delivering 20 minutes extra daily MVPA was manageable; however, the level of agreement varied across schools. One teacher found difficulty delivering the daily MVPA because it *"meant leaving out a full lesson from one of the other subject areas"* (Teacher, School 5).

Teachers largely agreed (98.3%, $n = 57$) that the activities delivered by the Energiser were appropriate and easy to manage with their class, and most teachers (93.1%, $n =$

54) were confident in their ability to deliver intervention activities on their own on the days when the Energiser was not there. Almost three quarters of teachers (72.4%, *n* = 42) reported that their pupils were more attentive in class following these activities, while, in contrast, 13.8% (*n* = 8) reported that their pupils were more boisterous in class. An interesting observation by a teacher in School 4 was: *"children are more distracted after 20 minutes straight, whereas they are more attentive after 5/10-minute bursts throughout the day"*.

Following implementation of PS, 91.4% (*n* = 53) of teachers noticed an improvement in their pupils' fitness levels and 56.9% (*n* = 33) noticed improvements in their eating habits. A teacher in School 5 wrote, *"I can see a huge improvement in overall fitness in the class and their lunchboxes"*. Similarly, most teachers (93.1%, *n* = 54) agreed that, as a result of PS, they themselves were more aware of the importance of PA, while 77.6% (*n* = 45) agreed that they were more aware of the importance of healthy eating. This opinion is supported by a teacher in School 5: *"I am an active person and I eat healthily. I have learned a lot personally from (Energiser) about healthy eating"*.

During the end-of-year review, all teachers and school staff surveyed (*n* = 62) agreed that they would like PS to continue in their school. However, only one in four (25.8%, *n* = 16) agreed that PS could continue successfully in their school without the presence of an Energiser. One teacher commented that it was *"hugely beneficial to have an experienced coach to guide both the teacher and the children"* (Teacher, School 3), with another adding that it "*would be great to have an Energiser in the school full time"* (Teacher, School 4).

Overall, PS was well received by schools, with many teachers commending the project's content and staff for their work. A teacher in School 1 said *"PS is an excellent project, delivered in a very positive and motivating way. Definite improvements in children's attitudes to PA and fitness levels. Some great ideas that can be easily implemented within the school spaces and using school resources"*.

Interactions and Activities: Write and Draw

Children's interactions with PS, as interpreted from their drawings (*n* = 246), reflected the intervention's three main components: PA (72.3%, *n* = 178), healthy eating (8.1%, *n* = 20), and sedentary time (4.5%, *n* = 11). The remainder of drawings were categorised as feelings (10.2%, *n* = 25) and other (4.9%, *n* = 12)[5] (see Figure 3 for examples).

5 The percentages presented in text were computed with the full sample of pupils as the unit of analysis unless otherwise stated. The figures presented in Table 4 have been computed with schools as the unit of analysis.

FIGURE 3

Write and Draw Responses on What Project Spraoi Meant to Participants

** Pupils/parents gave specific consent for their write and draw responses to be reproduced in published research.*

Spending time with friends also emerged as a prominent feature, with over half (57.3%, *n* = 141) of drawings featuring a group of children playing together. The Energiser also featured, with 9.8% (*n* = 24) of children including the Energiser in their drawing.

TABLE 4

Number of Write and Draw Samples per School, Energiser Focus, and Emerging Themes

School	Energiser research focus	N	Theme (%)				
			Physical activity	Healthy eating	Sedentary time	Feelings	Other
S1	Fundamental movement skills	53	73.6	1.6	0.0	18.9	5.9
S2		55	75.5	0.0	0.0	19.0	5.5
S3	PA and reduced sedentary time	24	76.2	4.8	3.0	8.3	7.7
S4		59	87.9	5.2	5.2	0.0	1.7
S5	Healthy eating	55	67.3	27.3	0.0	3.6	1.8

Organised sport (41.9%) and games (27.2%) were the most frequently drawn activities by children across all five schools. A detailed breakdown by individual schools provided in Table 4 shows that movement skills were most frequently drawn by children in School 1 (73.6%), and in School 2 (75.5%), where the Energiser's main focus was on improving fundamental movement skills. On the other hand, activities relating to healthy eating were most frequently drawn by children in School 5 (27.3%), where the main focus was on improving healthy-eating habits. The type of activities children associated with PS appears to align with each Energiser's main focus, indicating that how the PS intervention was delivered and received in each school varied and made a difference to how children experienced the intervention.

Most children (junior: 83.3% [*n* = 131]; senior: 98.8% [*n* = 161]) accompanied

their drawing with a short paragraph about what PS meant to them. The word they most frequently used to describe PS was "fun" (32.0%); other words used were, "the Energiser" (14.5%), "exercise and fitness" (12.0%), "health" (8.0%), and "being outdoors" (8.0%). Unusually, in School 2, 14.6% of children described PS as PE time, instead of identifying it as a separate activity. This did not occur at any other site.

Intervention Barriers and Facilitators

Table 5 provides an overview of the factors stakeholders identified as positively or negatively affecting the implementation of PS, while Table 6 provides a summary of the differences between schools. Where possible, factors identified as part of this study have been linked to the relevant categories identified in Durlak and DuPre's (2008) model. Presenting findings in this format allows for comparison with similar studies such as that conducted by Naylor et al. (2015).

Despite each group's unique perspective, and each school's unique context, barriers including a lack of time, curriculum constraints, and weather were identified by all categories of stakeholders (Energisers, teachers, and children) and in all schools as key factors inhibiting intervention delivery. Similarly, common facilitators to intervention delivery identified across all schools and stakeholders included the Energiser, perceived and/or observed benefits of PS, PA competitions and challenges, and the availability and/or quality of resources in schools (Tables 5 & 6).

Notably, many schools identified their lack of access to facilities as a barrier to delivering the intervention, with the exception of School 4 where it was noted that access to a wide range of facilities including a large indoor hall, playground, two yards, artificial turf pitch, and grass pitches facilitated the delivery of PS (Table 6).

TABLE 5

*Summary of Factors Affecting Implementation of Project Spraoi**

Factor		Teachers (*n* = 65)		Energisers (*n* = 5)		Children (*n* = 20)	
		Barrier	Facilitator	Barrier	Facilitator	Barrier	Facilitator
1	Time (e.g., competing requirements, teacher overload) [IV]	45	0	4	0	10	0
2	Curriculum (pressure to deliver core subjects, preparation for exams) [IV]	32	0	4	0	16	0
3	Weather	10	0	2	0	4	5
4	Class management (student behaviour etc.)	4	0	2	0	2	1
5	Availability/quality of programme resources (e.g., games, activity resources, nutrition lessons) [III]	9	35	0	5	2	8
6	Availability/quality of school resources (e.g., facilities, equipment, classroom space) [II]	8	5	4	1	2	1
7	Quality of training and technical support staff (Energiser) [III, V]	0	78	0	3	0	9
8	Supportive school climate (e.g., shared vision/administrative support/teacher motivation) [I]	0	4	3	2	0	0
9	Adaptability (flexibility to react to issues or individual circumstances, e.g., shorter activity breaks, cross curricular games) [III]	0	17	0	4	0	15
10	Teacher characteristics, engagement, and motivation [II]	5	13	3	1	0	2
11	Perceived/observed benefits of PS (improved fitness, health, nutritional choices, FMS competency/ increased concentration) [II]	3	75	0	2	1	5
12	Competition and incentives (PA challenges/prizes)	0	20	0	4	0	5
13	Lesson scheduling (programme structure, routine, integration within the school day) [IV]	7	12	1	2	0	2

Superscript Roman numerals refer to categories within the Durlak and DuPre model (Durlak & DuPre, 2008):

[I] Community level; [II] Provider characteristics; [III] Characteristics of the intervention; [IV] Organizational capacity; [V] Prevention support system.

** Counts may include multiple references to a factor made by a single participant.*

TABLE 6

*Summary of Factors Affecting Implementation of Project Spraoi, by School**

Factor		School									
		S1		S2		S3		S4		S5	
		n = 18		*n = 15*		*n = 17*		*n = 14*		*n = 13*	
		B	F	B	F	B	F	B	F	B	F
1	Time (e.g., competing requirements, teacher overload) [IV]	10	0	12	0	14	0	12	0	11	0
2	Curriculum (pressure to deliver core subjects, preparation for exams) [IV]	13	0	11	0	11	0	8	0	9	0
3	Weather	3	0	4	1	4	0	1	2	4	2
4	Class management (student behaviour etc.)	3	0	1	0	2	0	2	1	0	0
5	Availability/quality of programme resources (e.g., games, activity resources, nutrition lessons) [III]	6	12	3	15	2	6	0	7	0	8
6	Availability/quality of school resources (e.g., facilities, equipment, classroom space) [II]	3	1	5	0	4	0	0	5	2	1
7	Quality of training and technical support staff (Energiser) [III, V]	0	18	0	26	0	13	0	10	0	23
8	Supportive school climate (e.g., shared vision/administrative support/teacher motivation) [I]	0	1	1	1	1	0	0	3	1	1
9	Adaptability (flexibility to react to issues or individual circumstances, e.g., shorter activity breaks, cross curricular games) [III]	0	9	0	12	0	6	0	4	0	5
10	Teacher characteristics, engagement and motivation [II]	2	3	4	2	2	2	0	5	0	4
11	Perceived/observed benefits of PS (improved fitness, health, nutritional choices, FMS competency/ increased concentration) [II]	3	16	1	17	0	16	0	14	0	17
12	Competition and incentives (PA challenges/ prizes)	0	10	0	6	0	4	0	4	0	5
13	Lesson scheduling (programme structure, routine, integration within the school day) [IV]	2	3	3	8	1	1	1	2	1	2

B = Barrier; F= Facilitator. Superscript Roman numerals refer to categories within the Durlak and DuPre model (Durlak & DuPre, 2008): [I] Community level; [II] Provider characteristics; [III] Characteristics of the intervention; [IV] Organisational capacity; [V] Prevention support system.

** Counts may include multiple references to a factor made by a single participant.*

Discussion

The aim of this study was to explore the extent to which PS was delivered as intended across five intervention schools and to examine the processes through which PS, and each of the school contexts, adapted to one another throughout the course of an academic year. Overall, across all sites, intervention fidelity was generally low with as few as 5.1% of teachers meeting the PS target of 20 minutes extra daily MVPA in November and only 16.4% meeting the target in May. Generally, the mean amount of extra daily MVPA that teachers managed to deliver in addition to PE varied between 9.15 and 15.37 minutes across sites. This represents roughly 50-80% of the prescribed PS intervention.

Similar issues with fidelity were encountered by Naylor et al. (2006), who reported that in a school intervention in British Columbia, Canada, teachers managed to deliver on average only two-thirds of the prescribed 15 minutes of additional daily PA. Similarly, Holt et al. (2013), describing a US-based PA intervention, reported that at the beginning and midpoint of the school year, respectively, only 40% and 4% of elementary school teachers met the requirements of a district-mandated 20-minute daily PA policy in addition to PE and break time. Despite low fidelity, 60% of teachers successfully implemented the policy three days per week, suggesting that potentially an MVPA policy delivered three days per week would provide a more attainable target for schools (Holt et al., 2013).

Other PA intervention studies recommend amending the duration of the prescribed daily MVPA instead of the number of days, suggesting that 10-15 minutes additional daily MVPA would be an attainable and more sustainable target for primary schools (Naylor et al., 2006; Ryde et al., 2018). Based on the results of the current study, prescribing 20 minutes every day may be overreaching and if the prescribed daily PA dose were closer to 15 minutes, it is possible that intervention fidelity might be higher.

In April, there was a significant peak in the mean amount of daily MVPA delivered by teachers, with 42.9% (junior: 50%; senior: 35.5%) meeting the PS target. This peak coincided with a 1km running challenge, which was a PS initiative in collaboration with a sports shoe brand. Energisers mapped a 1km route around each school and teachers were challenged to undertake this route daily with their class. The classes and teachers who were deemed by the Energiser to put in the most effort, or most improve their class time over the course of the month, were rewarded with entry into a lottery to win a prize. It was clear from the PA logs and the Teacher Questionnaire that teachers found both the competition and the prize incentive of a PA challenge to be a facilitator to the overall PS intervention goal of delivering 20 minutes of additional daily MVPA.

Other PA challenges undertaken as part of the PS intervention, which implementers quoted as facilitating additional daily MVPA, were the "Stride for 5" and classroom-based Christmas-themed challenge, the "12 Days of Fitness". The "Stride for 5" challenge

involved all children in the class aiming to run for one minute, then two, then three, and working their way up to five minutes. A chart in each classroom monitored their progress, so they could only move up to the next level of the challenge (for example, from one minute to two minutes) if everyone in the class, and not just some, maintained a pace above a walk. These findings support those of a systematic review by Barte & Wendel-Vos (2017), who reported that interventions that placed conditional reward incentives on total PA behaviour, including duration and intensity, have positively influenced PA levels and health outcomes in the short term. Nevertheless, there is need for further research to investigate the long-term effects of reward incentives, as currently it is unclear whether such strategies, and the positive effects of incentives on PA behaviours, are sustainable over time.

Despite Energisers modelling MVPA and/or healthy-eating lessons for 20 minutes once a week, teachers had autonomy as to when and how they delivered PS every other weekday. The average MVPA dose delivered by teachers varied significantly across schools with School 1 delivering the most (15.37 minutes) and School 3 delivering the least (9.15 minutes). Given that improvements in health outcomes tend to increase in line with increased levels of PA, it is likely that pupils attending schools with greater amounts of extra daily PA (higher fidelity) would benefit more in terms of health outcomes than those in schools with lower levels of fidelity (Foulds et al., 2014; Loprinzi et al., 2013). As referenced above, however, further research on the long-term nature of any benefits is required.

Some of the teachers in School 2 stated that they delivered PS as part of the compulsory one hour of weekly PE time, which could offset the benefits of having PS as a stand-alone activity, as was intended. Furthermore, the weekly time slot allocated to the Energiser in School 2 was during scheduled PE time, causing PS activities to replace PE instead of being delivered in addition to it. This 'drift' from the intended PS intervention caused some teachers to view PE as being outsourced to the Energiser and no longer part of their remit. As has been reported, children in School 2 also started to align PS activities with PE, often describing their time with the Energiser as PE time, instead of as an independent activity. Although a detailed outline of PS and the expectations of all involved was signed by school principals prior to the beginning of the intervention, policing of teacher fidelity became an issue throughout the course of the year in this and other schools to a lesser extent. Outsourcing of PE and/or PA was never the intention of PS; however, some teachers viewed the introduction of a PA specialist into the school as an opportunity to step back from their role in delivering both daily PA and, at times, the PE curriculum. Support from principals and the senior leadership staff towards health-promotion programmes in schools has been reported to help sustain staff engagement and build an intervention's capacity for creating positive and lasting change (Day et al., 2019). Therefore, it is crucially important that both the principal and the appointed lead PS teacher reinforce the delivery of intervention activities by all staff in the absence of the Energiser. It is also important that Energisers and class

teachers maintain a collaborative relationship, in which teachers engage with, and are supported in, their role as implementers of PS.

Similarly, in School 3, the Energiser noted that some teachers viewed PA as being outsourced for the duration of the intervention and did not comply in their role as implementers of intervention activities on the remaining days of the week. Children in School 3 supported this opinion, commenting that they "only do Spraoi when the Energiser is here". Balancing teacher autonomy with intervention fidelity presented a challenge across several sites, as Energisers struggled at times to get teachers to commit to deliver intervention activities, and this inevitably reduced the amount of daily MVPA received by children. Previous research suggests similar findings, with unsupportive school environments said to be related to poor implementation of school-based PA interventions (Masse et al., 2012; Naylor et al., 2006), as shown by the results of a cross-sectional survey of 720 principals and teachers in schools in Canada who took part in a comprehensive school-based health-promotion programme. These indicate that the principals and teachers who reported greater levels of support from administrative staff, teachers, and parents, were twice as likely to implement the programme, which included 15 minutes of PA each day. compared to those who reported lower levels of support (Masse et al., 2012).

An innovative adaptation to address this issue in the current study was the appointment, by the Energiser, of an "active agent" in the class each week who was a pupil responsible for reminding the teacher of daily PA on days when the Energiser was not there. As well as providing a helpful reminder for teachers, this solution empowered children to take a leadership role in intervention delivery. It has previously been reported that health-promotion programmes and initiatives are most successful when pupils are given a central role in delivery. For example, it was found that pupils who were given leadership roles, in the Food Dudes programme delivered in primary schools across the UK and Ireland, valued the responsibility and encouraged their peers to participate (Day et al., 2019).

Despite their different contexts, three common barriers faced by all schools were a lack of time in the school day, curriculum constraints, and weather. As priority was generally placed on academic lessons across all sites, teachers sometimes felt under time pressure with the number of curricular subjects that had to be covered, alongside implementing the additional 20 minutes of daily PA. Many teachers expressed concerns over the potential negative consequences of lost learning time due to PS and the additional time pressures that PS created in an already overcrowded curriculum, a finding which is supported by studies of other school-based PA initiatives (Day et al., 2019; Holt et al., 2013). The PA logs, alongside subjective comments collected via questionnaires and focus groups, indicated that teachers struggled to deliver PA every day, noting that at certain times of the year academic lessons, exams, and/or events including school shows and preparation for religious celebrations took priority. This

finding aligns with existing reports that increasing focus on academic achievement decreases PA opportunities in schools (Howie & Pate, 2012).

To overcome this inherent contextual barrier and ease teachers' concerns over existing curricular time constraints, some Energisers adapted their delivery of PS to include a variety of cross-curricular games. Studies have shown that implementing PA within the traditional academic curriculum increases daily energy expenditure (Holt et al., 2013) and enhances academic achievement among primary-school pupils (Howie & Pate, 2012). This adaptation was deemed innovative and was identified by both teachers and Energisers at two schools as a key facilitator to the delivery of daily MVPA. Despite evidence that PA can have a positive effect on measures related to academic performance (Howie & Pate, 2012; McPherson et al., 2018), there are also contrasting studies which demonstrate a stronger association between academic achievement and sedentary time, rather than with PA (Dumuid et al., 2017; Maher et al., 2016). These conflicting findings highlight the fact that, at present, not enough is known regarding the optimal balance of sedentary time and PA for academic performance. However, with academic achievement under constant scrutiny, providing evidence to assess whether PS promotes cognition and supports academic performance could deepen teachers' understanding of how the time they invest in daily PA might be likely to impact on other educational outcomes. Future evaluations of PS or similar school-based PA interventions should, therefore, consider incorporating measures of academic performance into their design.

Similar to other school-based PA interventions, weather, and the availability of facilities and equipment, were identified as influential factors in the implementation of PS. Lack of appropriate clothing was also identified as a barrier in poor weather, with some children not having a rain jacket or appropriate footwear to exercise outside in the rain. These findings are consistent with other school-based PA interventions (Ryde et al., 2018). Unsurprisingly, weather had a greater effect in the four schools where staff identified their lack of access to facilities as barriers to PA. It was clear from the PA logs that School 4, which had the best facilities of the five schools evaluated, including a large indoor multisport hall and all-weather pitch, in addition to a large yard and playground, was able to deliver greater levels of daily MVPA during the winter months. Furthermore, in contrast to other sites, teachers in School 4 identified their access to on-site facilities as facilitators of PS, enabling implementation of intervention activities regardless of adverse weather conditions.

Overall, teachers' attitude towards PS was positive and the intervention was widely praised by all stakeholder groups. Following MVPA activities, almost three quarters of teachers reported that their pupils were more attentive in class. In addition, most teachers agreed that because of PS, they were more aware of the importance of PA, and two thirds agreed that they were more aware of the importance of healthy eating. Although every teacher experienced limited time and curricular pressures as

a barrier, some teachers prioritised the intervention and delivered it despite these constraints because of the value they placed on it (Naylor et al., 2015). For teachers, the immediate perceived benefits of PA in refocusing and re-energising the children appeared to be of importance and it is possible that these could contribute towards teachers' continued delivery of PS, beyond the intervention period. Similar findings were reported by Holt et al. (2013) who evaluated the effect of a 20-minute PA policy in primary-school children in the US. Teachers in Holt et al.'s study also noted positive classroom behaviour immediately after the PA had been implemented. Whilst longer-term health outcomes, such as improved fitness or improved body composition, might be desirable to policy makers, the acute effects of PS may be more important to encourage continued participation by teachers in the intervention.

Strengths and Limitations

It should be acknowledged that the current study's sample size was small and, therefore, reflects only the population of the participating schools rather than the population of primary school pupils in Ireland as a whole. However, the contribution of a diverse range of stakeholders, including Energisers, teachers, support staff, and children, allowed for the evaluation of PS from multiple perspectives and for the triangulation of findings. Triangulation, using multiple data collection tools to measure the same evaluation dimension, complemented by the contributions of multiple stakeholders, has contributed towards the trustworthiness of findings (Shenton, 2004). In addition to presenting the diverse range of challenges faced when attempting to implement health-promoting changes in school settings, our study also presents recommended strategies for overcoming the barriers identified and specific recommendations for future school-based health-promotion programmes.

Similar to Holt et al. (2013) and Griffin et al. (2014), a limitation of this study was the inconsistent completion of the PA log by teachers. While the majority of teachers (74%) returned completed logs regularly, overall completion of the logs was at times erratic so that the extent of implementation of the intervention or the types of activities, if any, of those teachers who did not return the PA log or who returned logs with incomplete data cannot be determined. In addition, although this study included the contributions of many stakeholders in the school context, a limiting factor is the omission of parents' perspectives. Their perspectives could provide important additional insights for the development of primary school-based health-promotion programmes in the future.

Conclusion

Findings from this study help to bridge the gap between research and practice by providing data that translate school-based health-promotion intervention findings into reality. There was much variability in how PS was delivered and received across time and across schools but adaptations that supported better contextual fit, including shorter activity breaks, cross-curricular games, and PA challenges, facilitated intervention delivery. These findings offer solutions that may help to address some inherent contextual barriers when designing and delivering health-promotion interventions in primary schools.

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