

A. Introduction (1 page)

1. Overview

Physical inactivity is a global pandemic and, despite Australia's reputation as a sporting nation, our children are among the least active in world. Schools are ideal venues to promote physical activity in children; however, recent reports suggest many Australian schools are failing to provide students with sufficient physical activity or equip them with the skills needed to be physically active beyond the school setting. As a result, there is an urgent need for interventions that can not only promote children's physical activity, but can also be disseminated and sustained at a population level. In a recent randomised controlled trial, we demonstrated that the "Supporting Children's Outcomes using Rewards, Exercise, and Skills" (*SCORES*) intervention increased primary school-aged children's physical activity, improved their fundamental movement skills (e.g., kicking throwing, catching) and enhanced their cardiorespiratory fitness. The next step for *SCORES* is to work with practitioners and policy makers to examine the translational capacity of this program. The aim of this project is to partner with the NSW Department of Education and Communities (DEC) and other stakeholders to scale-up and evaluate the effectiveness of this multi-level intervention.

The proposed project includes two complementary studies, involving 200 primary schools. One study will evaluate the intervention's reach (type of schools that participate), adoption (number of schools and teachers who participate), implementation (extent to which schools apply the intervention), and maintenance (degree to which schools continue to implement *SCORES*). In a second, concurrent study, we will conduct a cluster randomised controlled trial involving a sub-sample of 20 schools. We will assess the effectiveness and cost-effectiveness of *SCORES* at 12- and 24-months, with cardiorespiratory fitness as the primary outcome. Secondary outcomes will include objectively-measured physical activity, fundamental movement skills, and academic performance.

This project represents a unique and valuable opportunity to partner with the DEC and other key stakeholders to conduct translational research that has the potential to influence policy and practice. Indeed, if the *SCORES* intervention is shown to be scalable and effective, it could become embedded as part of routine best-practice physical activity promotion in primary schools throughout NSW and, potentially, across Australia.

2. Alignment with Scheme Objectives

1. *Meet the need for a more effective integration of research evidence into health policy and service delivery.* *SCORES* is an evidence-based intervention that increases children's physical activity and improves their cardiorespiratory fitness. This project will investigate the extent to which the intervention can be scaled up in order to positively influence public health at a population level.

2. *Create partnerships among policy makers, managers, service providers and researchers.* This project will strengthen relationships between the research team, the DEC, the Australian Council for Health, Physical Education and Recreation (ACHPER) and the NSW Department of Sport and Recreation. The DEC has made substantial intellectual contribution and financial commitment to this project and is the ideal partner to maximise the translational capacity of this initiative. Indeed, nearly all primary school-aged children attend school and, thus, an effective program delivered by the DEC has exceptional potential to influence the health of a large proportion of this population. ACHPER and the Department of Sport and Recreation also provide important links to key stakeholders, namely teachers and community sport organisations.

3. *Provide support to answer complex questions.* Decreases in children's physical activity and cardiorespiratory fitness over the past several decades are the result of changes in many aspects of modern life. To address this truly complex challenge, we designed *SCORES* based on a socio-ecological model that considers individual, interpersonal organisational, and community influences. Critically, the intervention itself is simple to understand and easy to implement, as it fits within the existing school curriculum and supports principals, teachers, parents, and community sport organisations in their efforts to promote physical activity in children.

4. This application is *not appropriate for the Project Grants scheme* that is designed to "support the creation of new knowledge". Rather, this project seeks to translate evidence into practice by partnering with key delivery agencies.

B. Research Proposal (8 pages)

1. Background and Aims

1.1 Physical inactivity is a global pandemic with “far-reaching health, economic, environmental and social consequences”¹. In Australia, lack of physical activity is a leading cause of death and disability that costs our economy \$13.8b per annum². Among children, the health benefits of physical activity are extensive and include reduced risk of obesity and type II diabetes as well as improved physical fitness and bone strength^{3,4}. Physical activity may also improve psychological well-being and prevent mental health disorders such as depression and anxiety⁵⁻⁷.

In 2014, the first Active Healthy Kids Australia Physical Activity Report Card was published. This document was compiled in order to inform policy changes and environmental decision making regarding physical activity promotion⁸. Australia received a grade of D minus based on prevalence data showing that just 20% of Australian children and adolescents meet the recommended physical activity guidelines of 60 minutes of moderate-to-vigorous physical activity (MVPA) each day. It is of additional concern that there has been a consistent secular decline of over 20% in young people’s cardio-respiratory fitness since the 1970s^{9,10}.

1.2 Schools are ideally placed to promote physical activity and fitness in children. The International Society for Physical Activity and Health¹¹ considers schools to be one of the seven “best investments” for evidence-based physical activity. Unfortunately, as noted in the Crawford¹² and NSW Auditor General¹³ reports, many Australian schools are failing to provide children with sufficient activity at school and do not equip them with the necessary skills to be active beyond the school setting. The US Centers for Disease Control and Prevention recommend schools deliver comprehensive school physical activity programs¹⁴ that involve coordination across five components: i) quality physical education (PE), ii) activity during the school day, iii) activity before and after school, iv) staff involvement and v) family and community involvement.

1.3 School-based physical activity interventions have had mixed success. A recent Cochrane review¹⁵ concluded that interventions can increase physical activity (5 to 45 minutes/day) and improve cardio-respiratory fitness (1.6 to 3.7 mL/kg/min); however, another review suggested that the effect of school-based interventions on objectively measured physical activity was negligible¹⁶. Collectively, members of our research team have conducted over 45 school-based physical activity interventions (>500,000 students)^{eg17-23}. From these studies, and our systematic reviews^{24,25}, we have concluded that efficacious approaches for promoting children’s physical activity require quality intervention design and strong fidelity (i.e., interventions delivered as they were intended).

While numerous systematic reviews have concluded that multi-component interventions are needed to increase young people’s physical activity, few studies have implemented and evaluated comprehensive school physical activity programs. Instead, most interventions have focused on one component of the school day (e.g., PE, recess or school sport) and failed to address the multiple opportunities for physical activity promotion that exist within and beyond the school setting¹⁵.

Poor fidelity is another factor that may explain why many previous interventions have failed to increase children’s activity levels. In CI McKay’s recent review²⁴, ‘lack of time’ emerged as the most consistently identified barrier to the implementation of school-based physical activity interventions. This is consistent with previous research that has noted the crowded school curriculum with an intense focus on academic achievement and lack of school leadership support are the biggest barriers to the successful implementation of school-based activity interventions²⁶⁻²⁸.

1.4 SCORES works because it addresses these problems. The ‘Supporting Children’s Outcomes using Rewards, Exercise and Skills’ (*SCORES*) intervention is a comprehensive, multi-component physical activity program for primary schools^{29,30}. The socio-ecological model³¹ provides a framework for the 12-month intervention, which consists of six components to promote physical activity and six strategies to support implementation. Components to promote PA include: (i) quality PE and school sport that maximises activity and learning, (ii) student leaders promoting physical activity during recess and lunch, (iii) activity breaks in the classroom, (iv) after school activity, (v) physical activity homework, and (vi) school physical activity policies. The six implementation strategies include: (i) professional learning and mentoring for teachers, (ii) feedback for teachers

based on the quality of their PE and school sport, (iii) lesson resources for teachers, (iv) teacher champions train student leaders, (v) parent engagement via newsletters and homework, and (vi) engagement with local community sport. Our efficacy study³⁰ showed significant group-by-time effects at 12 months for cardiorespiratory fitness (5.4 laps; 95% CI, 2.3 to 8.6), daily moderate-to-vigorous physical activity (12.7 mins/day; 5.0 to 20.5), and overall movement skill competency (4.9 units; -0.04 to 9.8). In addition, *SCORES* was delivered with a high degree of fidelity and schools and students reported high satisfaction with the program.

1.5 Translation is needed to influence population health³². There is a considerable gap between successful interventions and wide-spread dissemination in real world contexts^{24,33}. Indeed, there has been a proliferation of school-based physical activity intervention efficacy trials in recent years¹⁵, yet these efforts have had little impact on policy and practice³⁴. A notable exception is the Action Schools! BC project, conducted by CI McKay and colleagues, which successfully scaled up an efficacious intervention for delivery to nearly 2,000 schools, over 4,500 teachers and more than 500,000 primary school students across British Columbia, Canada²³.

Dissemination and scalability should be considered when interventions are initially designed³⁵. The proposed *SCORES* dissemination project has been designed in collaboration with the NSW Department of Education and Communities (DEC) and is guided by the RE-AIM framework³⁶. This framework is powerful as it allows for program evaluation in real-life contexts and provides evidence concerning the capacity of the intervention to be translated at a population level³⁶. In addition, a large portion of our intervention training is delivered online, as web-based delivery can support scaling-up and sustainability – recent evidence indicates that web-based professional learning for teachers can be as effective as face-to-face training³⁷.

1.6 Aims and Hypotheses. In collaboration with the NSW DEC and other stakeholder agencies, the aim of this project is to scale-up an evidence-based physical activity promotion intervention for primary school-aged children.

Primary hypotheses: H_1 – Compared with usual practice, the *SCORES* intervention will produce greater increases in cardiorespiratory fitness in the short-term (post-intervention, 12 months after baseline). These benefits will be maintained 12 months after the end of the intervention (24 months after baseline). H_2 – *SCORES* will be effectively disseminated to NSW primary schools with high levels of reach, adoption, implementation and maintenance. Specific hypotheses: *Reach* – participating schools will be representative of the NSW population (SES, location and school size). *Adoption* – >30% of NSW schools will volunteer in the first two years, with 200 schools (~ 10% of population) randomly selected to participate. At a teacher level, we expect >70% in each school to complete the training. *Implementation* – In terms of dosage, we expect that 90% of schools in the project will provide at least 150 minutes per week of planned physical activity time that is mandated in NSW primary schools. This compares with 70% of schools that the NSW Auditor general indicated met the previous guidelines in 2012 (120 minutes of weekly planned physical activity)¹³. We will also evaluate the quality of delivery of each intervention component and hypothesise that 90% of schools will meet pre-established quality criteria on at least four of the six intervention components. *Maintenance* – Implementation will be maintained 12 months after the intervention, with no significant decreases in the proportion of schools meeting implementation criteria.

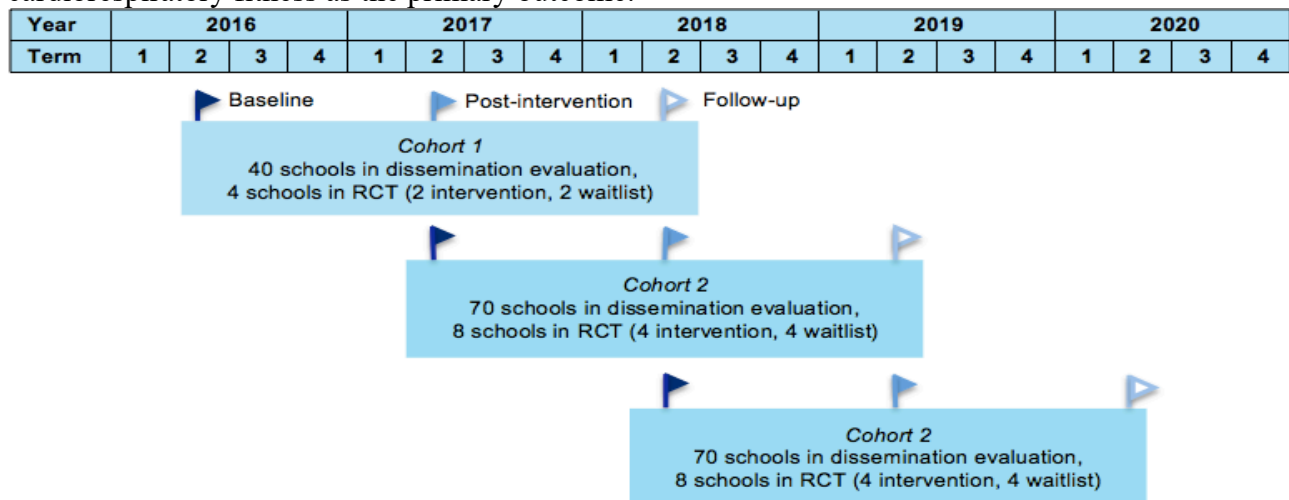
Secondary hypotheses: Compared with usual practice, the *SCORES* intervention will produce positive effects on students' moderate-to-vigorous physical activity levels, fundamental movement skills, physical health and subjective well-being, both in the short-term and 12 months after the intervention. *SCORES* will also enhance students' motivation towards physical activity, engagement with academic lessons and academic achievement on standardised tests.

2. Research Plan

2.1 Overview. In keeping with the RE-AIM framework, we will evaluate the *Reach*, *Effectiveness*, *Adoption*, *Implementation* and *Maintenance* of *SCORES* when disseminated in 200 NSW primary schools. We will conduct two complementary evaluations (see figure on next page):

1. A dissemination evaluation will examine the *Reach*, *Adoption*, *Implementation* and *Maintenance* (but not *Effectiveness*) of *SCORES*. These aspects will be measured in 180 schools.

2. A cluster RCT involving 20 schools (1:1 allocation to intervention and waitlist control) will evaluate the *Effectiveness* and incremental cost effectiveness of the *SCORES* intervention, with cardiorespiratory fitness as the primary outcome.



All government-funded NSW primary schools will be invited to participate in the project, with a recruitment target of 200 schools (~10% of the NSW population). From the schools that volunteer prior to Term 2 2016, we will randomly select 44 to form Cohort 1. Recruitment will continue through to Term 2 2017 at which point we will randomly select 78 schools to form Cohort 2. In Term 2 of 2019, we will randomly select a final cohort (Cohort 3) of 78 schools from remaining schools that have expressed an interest in participation. From within each cohort, we will use stratified random sampling to select four to eight schools that will form a sub-sample of 20 schools that is representative of the NSW school population in terms of school size, local SES and location (metro/regional/remote). These 20 schools will represent the sample for the effectiveness RCT.

In the dissemination evaluation, we will measure *Reach*, *Adoption*, *Implementation* and *Maintenance*. In the RCT, we will collect evidence regarding *Effectiveness* (and cost effectiveness).

2.2 Dissemination Evaluation

2.2.1 Design for Dissemination Evaluation will be a multiple cohort design, with all schools receiving the intervention. Measurement will occur at baseline, 12 and 24 months for each cohort.

2.2.2 Participants in Dissemination Evaluation Participants will include principals, teachers and students at government-funded primary schools in NSW (excluding schools designated as ‘Schools for Specific Purposes’). There will be no exclusion criteria for principals or teachers within these schools. All students who are able to participate in physical activity will be eligible for the study.

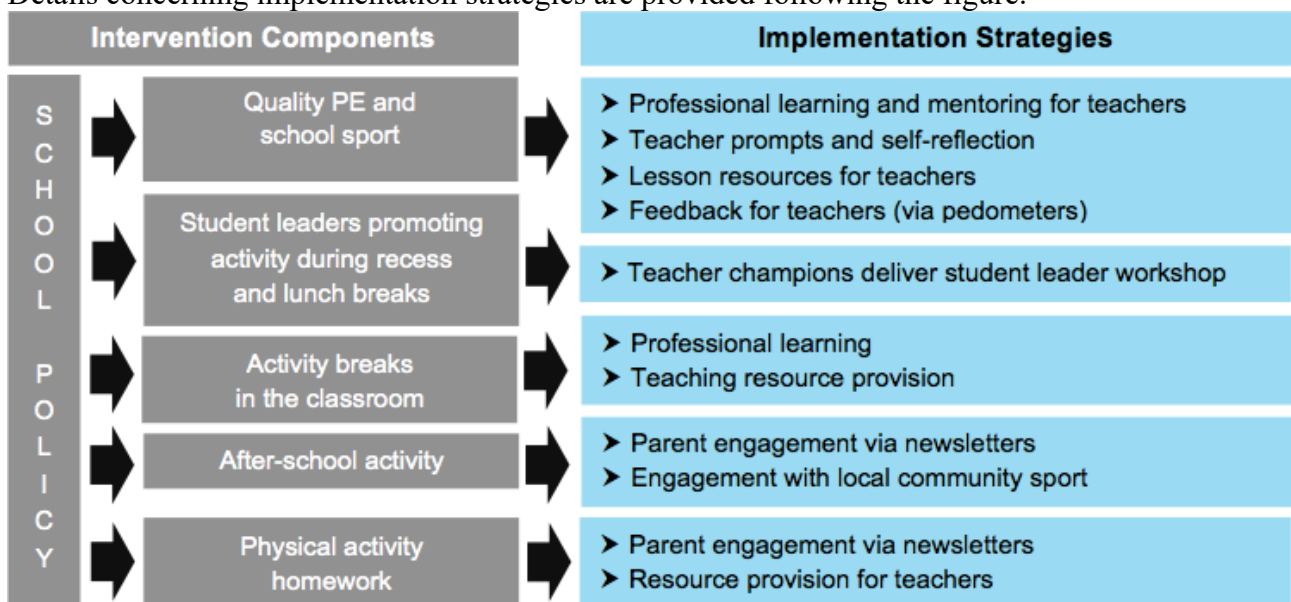
2.2.3 Procedure for Dissemination Evaluation Recruitment – All eligible primary schools in NSW (N=2,215) will be invited to express their interest to participate in the project. Schools will be recruited via presentations at conferences and meetings (e.g., Primary Principals Association Annual Conference) and advertisements sent by our partners (NSW DEC, ACPHER). We will also advertise via the NSW DEC Twitter feeds (>15,000 followers) and Facebook pages (>50,000 ‘likes’). Recruitment momentum is expected to build over the course of the project (see figure above) and our targets are achievable given the team’s success recruiting schools in NSW¹⁸⁻²².

From the 200 schools recruited into the entire project, 180 schools will be assigned to participate in the dissemination evaluation (the other 20 will have been randomly selected for the effectiveness RCT). We will invite all teachers of Years 1-6 within these 180 schools to participate in the study and provide them with complete information required (e.g., activities involved, time commitment required). A student whose classroom teacher chooses not to participate will not be exposed to the intervention components that take place during lessons (e.g., quality PE and school sport, activity breaks in the classroom), but may participate in other elements that are delivered to the entire school (e.g., student leaders promoting activity during recess and lunch breaks). Schools will send an information letter home to all parents providing them with the opportunity to have their child opt-out of data collection procedures (e.g., interviews, questionnaires, videorecording of lessons).

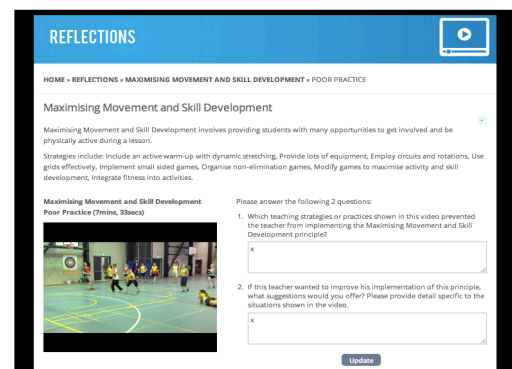
Data collection – We will collect school-level measures from principals using an online questionnaire. Teacher-level measures will include an online survey distributed via email, brief questionnaires completed at the end of each professional learning session (see intervention in 2.2.4), video-recordings of a sub-sample of PE/school sport lessons and implementation checklists that teachers can choose to complete via a smartphone app or a paper-based version. We will use Google analytics software to gather data regarding teacher participation in our online training. Students in Years 3-6 will complete a teacher-administered online questionnaire in each school’s computer lab. Our team has successfully employed all of these methods in previous studies.

2.2.4 Intervention in Dissemination Evaluation will be delivered to teachers in each school by one of eight ‘specialist mentors’. Teachers within the schools will then deliver the intervention components to their students. Specialist mentors will be secondary school teachers with NSW Board of Studies Teaching and Educational Standards (BOSTES) accreditation in Health and PE. These specialist mentors are ideally placed to deliver *SCORES* as the primary school teachers will view them as credible. Specialist mentors will be seconded from secondary schools, and their training and participation will earn them credit towards designation as a BOSTES ‘Highly Accomplished Teacher’. This sustainable delivery model capitalises on the DEC’s widespread framework and our experience in previous studies indicates it will attract quality practitioners working towards this higher-level accreditation.

SCORES includes six components to promote physical activity and movement skill competency. As outlined in the figure below, the school policy component underpins the other five components. Details concerning implementation strategies are provided following the figure.

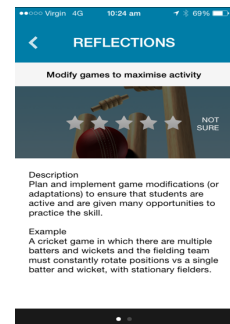


Implementation Strategy Details for All Teachers – Professional learning is designed to help teachers implement three components: (i) ‘Quality PE and school sport’, (ii) ‘Activity breaks in the classroom’, and (iii) ‘Physical activity homework’. To begin, a specialist mentor will facilitate a 2-hour face-to-face workshop at each school (e.g., 3-5pm). Approximately once per month after the initial workshop, teachers will complete one of eight 30-minute online modules that are designed to reinforce and extend knowledge and skills gained in the initial workshop. Online learning activities include brief instructional videos and engaging tasks that allow teachers to understand the rationale behind each component and make realistic plans for implementation (i.e., ‘action plans’). We have already created the online platform (see screenshot on right) and successfully employed it in a professional learning study in secondary schools (DP130104659¹⁹).



Mentoring for teachers will include three 30-minute mentoring sessions: (i) *Specialist mentoring*. Specialist mentors will spend three days in each school. They will observe PE and school sport sessions and meet individually with each teacher for 30 minutes to promote self-reflection and provide feedback. Video recordings will be the centrepiece of these discussions. In our recent project¹⁹, 100% of teachers (N=110) agreed to have their lessons recorded and teachers valued greatly the reflective activities based on these videos ($M=4.9/5$ rating on ‘usefulness’). (ii) *Peer teacher mentoring*: Recently introduced regulations in NSW mandate that teachers engage in peer lesson observation and mentoring. In this project, teachers will use a discussion guide provided by the project as the basis for a 30-minute peer mentoring activity. (iii) *Group mentoring*: Using discussion guides provided by the project, school champions will facilitate small group mentoring sessions (~10 teachers/group) during which teachers reflect on their implementation of *SCORES*.

Teacher prompts and self-reflection will take place on a smartphone app (see screenshot on right) that links automatically with data from the action plan that each teacher creates at the end of each professional learning module to ensure reminders are tailored to each teacher’s goals. In our recent project¹⁹, 109 of 110 teachers owned a smartphone. Thus, we expect teachers in the proposed study will be able to access the app.



Pedometer feedback kit: In the original *SCORES* intervention, teachers used pedometers and an Excel spreadsheet with an evidence-based algorithm to calculate the proportion of time their students spent being active during a PE lesson or school sport session. We are developing a monitoring system utilising pedometers that communicate wirelessly with a smartphone/iPod to provide this information instantaneously to teachers for a specific lesson or across the entire school day. Each school in this project will be provided with one activity monitoring system. Teachers will be trained to use the system during the face-to-face workshop and asked to use the kit during a PE lesson or school sport session once every 6 weeks. Data from this system will also be available remotely to the research team and will be used to judge implementation quality. See outcomes section 2.2.5. (*Note*: participating in professional learning and mentoring activities described above will provide each teacher with 14 hours of professional learning that will be registered with NSW BOSTES – teachers are required to accumulate 50 registered hours every five years.)

Resources for teachers: The website and smartphone app allow teachers to download resources (e.g., lesson plans, activity descriptions) that support intervention implementation.

Implementation Strategy Details for Teacher Champions in Each School – Teacher champion training: Two teacher champions per school will participate in a 1-hour video-conference (facilities available in each school) in which they will learn how to implement a student leadership program that acknowledges students’ efforts to promote physical activity during school breaks.

School policy development: In 2 x 30-minute video-conferences, teacher champions will learn how to complete a school physical activity audit and then develop and implement evidence-based policies that will increase physical activity participation across the school. These policies include: (i) establishing a school physical activity committee, (ii) 150 minutes of moderate-to-vigorous physical activity each week, (iii) annual reporting of students’ cardiorespiratory fitness and fundamental movement skills, and (iv) parental involvement in school-based physical activity.

Engagement with local community sport: The NSW Department of Sport and Recreation will provide each school with a contact list of sporting organisations in their local area. Teacher champions will invite organisations to arrange demonstration events at each school.

Parent engagement: We will provide teacher champions with pre-made monthly parent e-newsletters regarding physical activity promotion, with a particular emphasis on the after-school time period. We will also provide physical activity and fundamental movement skill homework. Documents will be provided in MS Word so teachers can modify them to suit the local context.

Implementation Timeline – Within each cohort, the *SCORES* intervention will be delivered in three phases that roughly equate to three school terms (see figure next page).

Target	Implementation Strategy	Phase 1	Phase 2	Phase 3
All teachers	Professional learning	Workshop	Online learning modules	
	Mentoring	Specialist mentoring	Peer mentoring	Group mentoring
	Prompts & self-reflection	via smartphone app		
	Teaching resource provision	via website and smartphone app		
	Feedback during PE/sport	iPod and class set of pedometers		
2 x teacher champions per school	Teacher champion training	Webinar		
	School policy development	Webinars with school champions		
	Community engagement	Demonstration events with local sport organisations		
	Parent engagement	Teacher champions distribute newsletters		
		3 months	6 months	9 months

2.2.5 Measures in Dissemination Evaluation will be guided by the *RE-AIM* framework³⁶ and will be administered at baseline, 12 and 24 months. *Reach* – We will examine the extent to which participating schools are representative of the NSW population, in terms of school size, SES and location. We will follow up to determine what attracted these schools to the program. We will also purposively sample 100 schools (according to size, SES, and location) that do not volunteer and follow-up to determine reasons for non-participation. *Adoption* – We will examine the proportion of schools from the NSW population that volunteer and participate in the program. We will assess teacher level adoption by examining the proportion of teachers who complete each aspect of the training, including attendance at face-to-face sessions and online components (via Google Analytics). We will explore teachers’ engagement with online components using algorithms designed to identify emotions (e.g., frustration, boredom). *Implementation* – Durlak and Dupree’s framework³³ will guide our implementation assessment at the school and the teacher levels. We will assess school’s implementation of physical activity policies and the student leadership components using principal/school champion self-reports and specialist mentor observations during school visits. At the teacher level, we will examine delivery dose with each teacher reporting the type and duration of structured activity provided in the past week. We will also examine the quality of delivery. For example, we will examine data from each pedometer feedback kit to determine the proportion of PE and sport lesson time that students spent in moderate-to-vigorous physical activity. For each implementation measure we will establish a pre-determined threshold of acceptability. For example, regarding the proportion of PE and school sport lesson time spent in moderate-to-vigorous physical activity we will utilise the internationally recognised recommendation of 50% of lesson time as the criterion^{38,39}. As noted, we hypothesise that schools will meet these thresholds for at least five of the six components. *Maintenance* – We will re-examine implementation 24 months after baseline. To further understand barriers and facilitators to implementation, we will conduct semi-structured interviews with purposively selected principals, teachers and students. Thematic analysis of transcripts will indicate ways to improve implementation prior to further dissemination.

2.2.6 Statistical Analyses for Dissemination Evaluation will focus on descriptive statistics concerning reach, adoption, implementation and maintenance. We will also use linear regression to explore the impact of school and community characteristics on program reach. We will use linear mixed model analysis (adjusted for clustering) to examine changes from baseline to 12-month and 24-month in implementation. These effects will be estimated for the entire sample as well as in critical sub-populations (e.g., across teacher gender, school average SES).

2.2.7 Economic Evaluation in Dissemination Evaluation will examine the costs of scaling up (roll out and implementation to 180 schools) and the maintenance phase, to assess intervention affordability and sustainability. A societal perspective and steady state operation of the intervention will be assumed (up and running to its full effectiveness potential, and excluding start-up costs).

Costs will largely relate to the time costs of specialist mentors, teachers and schools principals (using opportunity cost principles). Resource utilisation data will be tracked by the specialist mentor (no. and length of visits and phone calls) and from teacher records. Costs will be expressed as total costs, costs per child and per school, separately for the intervention and maintenance periods.

2.3 Effectiveness Trial

2.3.1 Design for Effectiveness Trial Running alongside the dissemination evaluation will be an effectiveness trial. This will be a cluster RCT with an allocation ratio of 1:1 (intervention : waitlist) that conforms with CONSORT guidelines⁴⁰. We will conduct assessments at baseline, post-intervention (12 months after baseline) and maintenance (24 months after baseline).

2.2.3 Participants in Effectiveness Trial All teachers in each school selected for the effectiveness trial will be invited to participate in the intervention, but only students in Years 3 and 4 will complete outcome assessments. These students will be available for assessment at all time-points (most Year 5 and 6 students will leave the school by 24 months), and will have the cognitive ability to complete the questionnaires (c.f., Years 1 and 2). In addition, these years represent the ideal period to develop fundamental movement skill competency⁴¹, which may help prevent the decline in physical activity typically observed during the transition from childhood to adolescence⁴².

2.3.3 Procedure for Effectiveness Trial We will stratify schools in the larger sample of 200 schools, according to SES, location and size, and then randomly select 20 schools to participate in the effectiveness trial (4-8 schools from each of the three cohorts – see figure on page 4). Trained research assistants will collect all student level outcomes in the effectiveness trial. These researchers will be blinded to study hypotheses and school allocation to treatment conditions.

2.3.4 Randomisation in Effectiveness Trial Within the effectiveness trial, schools will be stratified according to their enrolment size, SES (SEIFA), and location (metro/regional/remote). Our data analyst, CI Phillip Parker (who will not be involved in data collection or intervention delivery), will randomly assign schools from within each stratum following baseline assessments.

2.3.5 Intervention in Effectiveness Trial will be the same as the dissemination evaluation (2.2.4).

2.3.6 Usual Care (Waitlist Control Arm) in Effectiveness Trial Schools in the waitlist control arm will continue with usual practice which will likely include some schools pursuing other physical activity promotion initiatives. No restrictions will be made regarding schools' participation in such programs. In this sense, the study is a pragmatic trial as it compares the effectiveness of the *SCORES* intervention with schools' 'real-world' attempts to provide physical activity programs.

2.3.7 Primary Outcome Measure in Effectiveness Trial Cardiorespiratory fitness will be assessed using the 20-m multistage fitness test⁴³, which has demonstrated strong validity in studies worldwide⁴⁴. The number of 20-m laps completed will be used as a continuous variable for analysis.

2.3.8 Secondary Outcome Measures in Effectiveness Trial *Seven-day physical activity* - ActiGraph GT3X+ accelerometers. We will examine: (i) within school activity, (ii) after school activity, and (iii) total activity as well as times spent in different intensities of activity (e.g., moderate vs vigorous) and time spent sedentary. *Fundamental movement skill competency* - the Test of Gross Motor Development-2⁴⁵. *Physical health* – In a subsample of 15 children per school ($N=300$), field-based assessments of resting heart rate and blood pressure (via oscillometric devices), markers of bone health such as bone strength, cortical and trabecular area and density via peripheral quantitative computed tomography (pQCT) and muscular strength (via vertical jump on portable force platforms). *Motivation towards physical activity* – the Perceived Locus of Causality Scale - Children⁴⁶. *Subjective well-being* – items from WHO's Health Behaviour in School-aged Children questionnaire⁴⁷. *Student engagement with school* – items from the Longitudinal Surveys of Australian Youth⁴⁸. *Academic achievement* – For students whose parents provide permission, we will work with the NSW BOSTES to obtain Year 4 and Year 6 NAPLAN numeracy and literacy standardised test scores⁴⁹. *Anthropometry* - Height, weight and waist circumference. Body mass index (BMI) and BMI z-scores. *Demographics* - sex, age, language spoken at home, Aboriginal or Torres Strait Islander descent, ethnicity, suburb, and mother/father's occupation.

2.3.9 Sample Size Calculations and Statistical Analyses for Effectiveness Trial We will test for between arm differences in changes in outcomes using linear mixed model with standard errors

corrected for clustering. We will analyse data according to intention to treat principles (main analyses) and per-protocol principles (sensitivity analyses). We conducted a power analysis using procedures appropriate for complex nested designs⁵⁰. In this analysis the effect size for between-arm differences in cardiorespiratory fitness (primary outcome) was conservatively set to .35 (note: effect in our efficacy trial was .54) with ICCs based on our efficacy trial¹⁸ (class=.09, school=.01). Analysis indicated that 1080 students from 60 classes in 20 schools would provide power of .91.

2.3.10 Economic Evaluation in Effectiveness Trial will determine if *SCORES* represents ‘value-for-money’ measured incrementally against usual practice. We will include a ‘trial-based evaluation’ (costs and outcomes exactly as per the trial) and a ‘modelled economic evaluation’ which extends the target population, time horizon and decision context⁵¹. Detailed pathway analysis will specify all intervention activities in order to measure costs of associated resource use (2016 reference year). Costs will be combined with the behavioural and biomarker outcomes to produce a range of incremental cost effectiveness ratios. A Markov approach will be used to estimate the health impacts over the cohort’s lifetime. Simulation-modelling using the @RISK software package will calculate 95% uncertainty intervals around the epidemiological probabilities and cost estimates.

3. Timelines

Nov 2015: Ethics amendment. **Jan–March 2016:** Recruitment for Cohort 1. Note: Staff recruitment will be minimal as the project officer on current DP130104659 will transition to the proposed project in January 2016. **Apr 2016–Jun 2020:** Dissemination evaluation and effectiveness RCT (see figure on page 4). **Jul–Dec 2020:** Analysis and report writing. **Dec 2020:** Final report to NHMRC, manuscripts to journals, intervention materials to DEC for further dissemination.

4. Role of the Partner Organisations

NSW DEC: *Preliminary funding* – The DEC has been integral partner in the lead up to this application. In 2015 they provided funding (\$70,000 cash) and staff input via an in-kind contribution (\$63,138) to support preliminary work (e.g., online resource development) that will ensure the proposed project is ready to begin in 2016. *Staff time* – Anna Gonzalez (DEC) will be seconded two days per week to provide training and support to the specialist mentors. Develop resources and moderate the online discussion platform. Sue Meade (DEC) will facilitate recruitment for the project. Ross Morrison (DEC) will be a member of the project advisory board. **NSW Department of Sport and Recreation:** will provide information regarding local sport organisations near each school. Cathy Gorman-Brown (Industry Programs) will be a member of the project advisory board. **Australian Council for Health, Physical Education and Recreation:** *Recruitment* – ACHPER will facilitate school and teacher recruitment via their various media. *Staff time* – Julie Percival (ACHPER–NSW) will be a member of the project advisory board.

5. Expected Outcomes and Significance

Testing the scalability and effectiveness of health promotion programs is rare. However, understanding this process can enable successful uptake of evidence-based efficacious interventions. Our efficacy trial indicated that *SCORES* increases children’s physical activity, enhances their fundamental movement skills and improves their cardiorespiratory fitness. The critical next step for *SCORES* is to ascertain the program’s potential public health impact at a population level. Initial indications are that *SCORES* can be feasibly delivered outside of a controlled research environment. Indeed, *SCORES* is currently being delivered to 32 schools and 292 teachers in the Newcastle area and anecdotal reports from teachers and program facilitators are positive. More comprehensive real-world evaluation, however, is required. The proposed project provides a unique and valuable opportunity to partner with the DEC and other key stakeholders to conduct translational research. In the proposed project evidence gathered within the RE-AIM framework will provide important insights into the potential scalability of *SCORES*. As such, this research could inform education policy and practice and enable *SCORES* to become embedded as part of routine best-practice physical activity promotion in primary schools throughout NSW and, potentially, across Australia.