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Where to next for school playground interventions to encourage active play? An exploration of structured and unstructured school playground strategies

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Where to next for school playground interventions to encourage active play? An exploration of structured and unstructured school playground strategies

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Abstract

An emerging public health priority is to enhance children's opportunities for active play. Children spend a large proportion of weekdays in schools, making schools an influential and suitable setting to promote children's active play. Rather than continually increasing the burdens placed upon busy teaching staff, the use of school playgrounds interventions have emerged as a critical strategy within schools to facilitate and develop children's active play via an informal curriculum. This scholarly article provides a research-based commentary on a range of school playground interventions to encourage both structured and unstructured active play opportunities. Additionally, future research directions for school playground research to encourage children's active play will be discussed. Teachers, educational leaders, designers, researchers and play professionals can consider the findings from this paper for future school playground intervention and planning to facilitate children's active play within school playgrounds.

Key words: Child, Schools, Playground, Interventions, Recess, Play

Background

Active play is regarded as the diverse range of unstructured, spontaneous physical activities and behaviour that children engage in (Pellegrini, 2009). Active play is emerging as an ‘informal curriculum’ within schools (Hyndman et al. 2012) to facilitate children’s learning and development and the importance of play has been acknowledged by the United Nations High Commission for Human Rights as a basic entitlement for every child (United Nations, 1989). The promotion of regular, active play within society is a major public health objective in an effort to improve health internationally and to prevent the development of obesity and chronic diseases such as type 2 diabetes, cardiovascular disease (World Health Organisation, 2007) and mental health conditions (Sawyer et al., 2008). Childhood is a crucial period to develop health behaviors such as active play that can track into adolescence and to a lesser extent into adulthood (Telama, 2009). Establishing active play habits in children is vital, with recent International trends revealing that many children prefer sedentary activities despite active play opportunities being readily available (Biddle, Gorely, Pearson, & Bull, 2011). The need for strategies to encourage children’s active play is reinforced by physical inactivity (not meeting the recommended physical activity guidelines) contributing towards 1.5% to 3.0% of total direct healthcare costs in developed countries (Oldridge, 2008) or almost two million deaths worldwide (Hayman et al., 2007). Despite childhood being an essential stage to develop active play habits, our understanding of how to enhance and maintain the health of school children and adolescents from active play opportunities remains underdeveloped, necessitating a continuing focus for researchers (World Health Organisation, 2007).

An increase in sedentary behavior, overweight and obese youth worldwide has identified schools as a key setting to facilitate children’s active play. Schools are expected to enhance

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children's active play by providing children with essential physical skills, knowledge and attitudes (Dobbins, De Corby, Robeson, Husson, & Tirilis, 2009). Evidence has highlighted schools as the most influential setting to facilitate children's active play (Dobbins et al., 2009; Kriemler et al., 2011). Children spend the majority of their weekdays (> 30 hours per week) in schools, making schools an obvious and suitable setting to promote and implement active play interventions (Dobbins et al., 2009). The school setting provides active play opportunities for children who may have limited active opportunities within their home or community setting (Telama, 2009). Schools offer a range of physical activity programs that are either curricular (e.g. Physical Education and Sport Education programs), co-curricular (e.g. inter-school sport and school break periods) and non-curricular initiatives (e.g. after school activity programs and active transport programs; Dobbins et al., 2009). Rather than continually increasing the demands placed upon busy Physical Education staff, school break periods (e.g. morning recess, lunchtime recess) have emerged as a critical period to target children's physical activity via active play (Ridgers, Salmon, Parrish, Stanley, & Okely, 2012). Children in some schools engage in up to 4200 school breaks during their primary schooling (3-times per day, 5-days per week, 39-weeks per year, 7-years of primary school). Additionally, active play during school breaks can contribute up to 50% of children's recommended daily physical activity (Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006). Developing a greater understanding and awareness of the facilitators and barriers of children's active play during school breaks is vital in order to implement school break interventions effectively in an attempt to achieve sustainable health benefits (Hyndman, Telford, Finch, & Benson, 2012; Hyndman, Telford, Finch, Ullah, & Benson, 2013). In addition to developing children's physical skills and participation, active play experiences can have a major influence on children's development of social and cognitive skills through the 'informal' curriculum of school breaks (Hyndman, Benson, & Telford, 2014).

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Children have limited access and opportunities for active play in areas other than playgrounds during school breaks (Kriemler et al., 2011) and as research suggests active play during school breaks allow children to increase physical activity levels (Kriemler et al., 2011), interventions targeting school breaks are vital. Despite the health benefits of active play during childhood to counteract sedentary lifestyles (World Health Organisation, 2007), there have been limited interventions designed to target children's active play during school breaks (Dobbins et al., 2009; Kriemler et al., 2011).

School Playground Interventions to Promote 'Structured' Active Play during School Breaks

A structured physical activity is an organised activity characterised by specified locations, time schedules and adult supervision (Sener, Copperman, Pendyala, & Bhat, 2008). Structured physical activity can also include team sports, racquet sports and fitness classes (Salmon, Owen, Crawford, Bauman, & Sallis, 2003). There have been a number of school playground interventions that have used specified playground or activity locations (e.g. playground markings, physical structures, allocated physical activity spaces, activity zones), teacher led activities (e.g. fitness breaks, Physical Education activities in the playground) and games/sports equipment to facilitate structured activities within the school playground.

Games equipment has been trialled to promote children's active play during school breaks (Connolly & McKenzie, 1995; Verstraete, Cardon, De Clercq, & De Bourdeaudhuij, 2006). Across seven primary schools, a games equipment intervention was implemented to investigate the impact on the active play levels of children (Verstraete et al., 2006). Children's levels of active play were measured before and after the games equipment intervention. During morning and lunch school breaks, children's moderate to vigorous physical activity (MVPA) increased from the games equipment intervention. However, the researchers acknowledged that it would have been beneficial to evaluate which aspects of the intervention were most successful and

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which aspects should be modified or enhanced (Verstraete et al., 2006). A Portuguese study also examined the effects of implementing games equipment within a school playground on children's active play during school breaks (Lopes, Lopes, & Pereira, 2009). The effects of the games equipment showed significant increases in the proportion of time children spent in active play across gender, age groups and body mass index (BMI). However, this study was limited by a short intervention period, not examining the type of activities that were influencing children's active play and no long-term follow-up was implemented to determine if the positive play effects could be sustained (Lopes et al., 2009). Similarly to introducing games equipment, a United States study investigated the effects of a games intervention on children's active play levels (Connolly & McKenzie, 1995). Each day the children participated in a games-specific school break and a standard school break. Results suggested that children were more active during the games school breaks than the standard school breaks, highlighting that playground interventions have the potential to develop children's active play behaviour.

Fitness breaks have also been implemented within the school setting to encourage children's active play. A fitness break intervention to increase activity levels at schools was implemented by researchers for year five primary school children (Scruggs, Beveridge, & Watson, 2003). Fitness breaks involved children participating in their own structured circuit of locomotor and non-locomotor activities during morning and lunch breaks. The fitness breaks were monitored for three consecutive days and it was found that activity levels increased among both boys and girls. The fitness breaks encouraged the children to participate in MVPA for 50% of school break periods. However, the fitness break structure was least enjoyed by females and resulted in inconsistencies between heart rate telemetry and pedometry. Furthermore, due to the limited data collection period and solitary fifth year class, generalizability of the findings is limited. Structured fitness breaks have also been evaluated (Howe, Freedson, Alhassan, Feldman, & Osganian, 2012) where researchers introduced 30 minutes of structured games, resulting in

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increased energy expenditure. Significant increases in children's MVPA were evident in the intervention group in comparison to the control school after the structured physical activity intervention. However, researchers acknowledged that implementing unstructured active play activities during school breaks may promote greater development in children's social and emotional health. Staff training to facilitate children's play behaviour in specified activity zones have also been trialled as an intervention to develop children's active play during school breaks (Huberty et al., 2011). Each active play zone contained 10 to 15 equipment items and structured, daily school break activities within the active play zones would be planned by a Physical Education teacher, a staff leader and the researcher. Significant increases in children's MVPA were identified measured via accelerometer however, as direct observation wasn't conducted, specific activity types within physical activity zones and their influence on children's active play weren't reported.

There have been a number of short-term playground marking intervention studies designed to facilitate children's active play during school breaks (Stratton, 2000; Stratton & Leonard, 2002; Stratton & Mullan, 2005). The first study investigated the activity levels of 36 English children aged 5-7-years-old using heart rate telemetry during three school breaks (Stratton, 2000). It was discovered that the playground markings intervention increased time spent in MVPA during school breaks by 18 minutes per day (10% increase during playtime; Stratton, 2000). Findings also revealed that children's average heart rate increased by six beats per minute during the intervention phase (Stratton, 2000) and that MVPA made a significant contribution towards children's recommended national activity guidelines (Stratton & Mullan, 2005). It was implied that the time spent in MVPA may have been inflated by a novelty effect from the playground markings and the study was also limited due to a small sample size. Similarly, the energy expenditure of children during active play was also examined after the playground marking intervention (Stratton & Leonard, 2002). It was revealed that play duration, total

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energy expenditure, heart rate and rate of energy expenditure significantly increased from baseline to the post playground markings intervention. Total energy expenditure increased by 35% and rate of energy expenditure increased by 6%. However, by using heart rate as a measure of the level of active play, it failed to provide information about the mode of play children were participating in or which markings were most effective at increasing active play levels. The results of the study could also be a result of short-term novelty effects of the intervention, which could be counteracted by medium and long-term follow-up of the intervention.

Similarly, playground markings with the addition of skipping ropes (school one) and allocating different groups of children to the sports courts (school two) within school playgrounds were trialled (Loucaides, Jago, & Charalambous, 2009). The researchers measured children's accumulated step counts from the simple intervention and discovered that both the playground markings/skipping ropes and space allocation interventions significantly increased children's step counts during school breaks compared with the matched control school. Although the effects of the simple, short-term intervention on children's step counts were positive, research has identified a need to evaluate the effects of school-based active play interventions over a longer period to determine if health effects can be sustained (Kriemler et al., 2011). Although cost-effective, there are also a number of limitations to measuring children's active play levels with pedometers (Dollman et al., 2009) and there is a need to examine where possible the effects of school-based interventions on further active play dimensions (Hyndman et al., 2012) such as frequency, intensity, duration and activity type during children's participation in active play.

The long-term effects of playground markings and changes to the physical structure of playgrounds on children's active play during school breaks were assessed within deprived areas of London, United Kingdom (Ridgers, Stratton, Fairclough, & Twisk, 2007). Fifteen primary

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schools received funding to redesign their playground environments via a sporting playgrounds initiative. Accelerometer and heart rate telemetry were used to measure children's active play, with findings suggesting that MVPA and vigorous levels of active play participation significantly increased across a two-year period. This reinforces findings from the literature (Stratton, 2000; Verstraete et al., 2006) that playground redesign and intervention can positively influence children's active play during school breaks. Despite short-term intervention studies suggesting novelty effects positively influence active play levels, the long-term intervention study established that playground interventions increased active play during school breaks over a prolonged time span (Ridgers et al., 2007). The findings from the study reinforces the notion that school playground interventions can enhance children's active play levels over a prolonged period to counteract sedentary lifestyles in childhood that can track into adulthood (Telama, 2009). Further studies of school playground interventions should implement a long-term follow-up to evaluate if increases to children's active play during school breaks can be sustained over prolonged periods (Kriemler et al., 2011).

Schedules have also been created for children to participate in themed weekly activities in the United States during school breaks. School break 'activity weeks' that included no school break activities, a circuit course, an obstacle course (e.g. balancing beams, hula hoops and skipping ropes) and the introduction of 30 soft Frisbees were trialled children (Stellino, Sinclair, Partridge, & King, 2010). Children's active play levels were measured by pedometers with findings demonstrating that different features and items within the school playground can facilitate active play depending on children's gender, age and BMI (Stellino et al., 2010). The step count results revealed that children's accumulated active play levels were higher during the week with no organised activities and the week of the fitness circuit. Interestingly, males had accumulated significantly more steps than females during the obstacle course week, older children accumulated significantly more steps during the Frisbee week, younger children were

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significantly more involved in active play via the obstacle course and children with low body mass index (BMI) were significantly more involved in active play during the circuit week (Stellino et al., 2010). The findings from this study highlight that diverse equipment and activities need to be implemented within school playgrounds so that all children's active play preferences can be catered for during school breaks (Stellino et al., 2010). However, this study was limited by measuring children's levels of active play solely with pedometers, therefore dimensions of active play such as the frequency, intensity, duration and the specific play type during each activity week were not recorded. In addition, the school break activities were only introduced for a limited time (one week for each activity) to assess children's levels of active play.

School Playground Interventions to Promote 'Unstructured' Active Play during School Breaks

Unstructured active play is defined as the activities children participate in that are spontaneous and without a set regime or purpose (Sener et al., 2008) that can include digging, raking (Salmon et al., 2003), lifting/carrying, exploring, planting, chasing (Dyment & Bell, 2008), pushing objects into positions, construction, imaginative and creative play (A. Bundy et al., 2009). The importance of children's unstructured active play is reflected in the definition of school breaks by Wechsler and colleagues (2000), "as a regularly scheduled time for children to engage in 'unstructured' play" (p123, Wechsler, Devereaux, Davis, & Collins, 2000). School breaks that encourage unstructured, open-ended free play are an important opportunity to promote children's active play levels (Cardon & De Bourdeaudhuij, 2008; Dyment & Bell, 2007, 2008). Open-ended and diverse play opportunities have been identified as having a significant impact on key social-ecological levels such as intra-personal level factors (e.g. skill development, enjoyment, playability and cognitive improvements) and development of inter-

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personal skills (e.g. co-operation, reduced bullying, team-work; Bundy et al., 2011; Dymont, Bell, & Lucas, 2009; Engelen et al., 2013; Hyndman, Benson, & Telford, 2014). To address children's diverse playground interests and abilities, greening projects have been successfully introduced within school playgrounds to develop children's active play levels during school breaks (Dymont & Bell, 2007, 2008; Dymont et al., 2009). Questionnaire data was gathered from parents, teachers and administrators from Canadian primary schools (Dymont & Bell, 2007, 2008). The results from the study revealed that active play was facilitated by space, diverse play opportunities and children's interaction with natural environmental features (Dymont & Bell, 2007, 2008). The greening projects show promise as an avenue to promote non-competitive, open-ended, diverse and enjoyable play opportunities and can create a school play environment to cater for all ages, interests and abilities (Hyndman et al., 2012; Hyndman et al., 2013). With children today having increasingly structured lives, school breaks should provide diverse activities for children to engage in open-ended, unstructured play opportunities (Stellino et al., 2010).

A study of school greening in Canada and Australia showed the highest percentage of Australian children were engaged in vigorous levels of active play on manufactured equipment (Dymont et al., 2009). However, the greening projects were reported to be the school play area in which the highest percentage of Canadian and Australian boys and girls were engaged in moderate active play levels (Dymont et al., 2009). Despite the reported play benefits of children in the greening areas, the researchers acknowledge that cost, maintenance and safety issues associated with implementing the greening projects need to be accounted for. The greening projects can also restrict children's use of play spaces whilst the project is being implemented for prolonged periods (Bundy et al., 2008). The researchers identify that for schools to reach their optimum potential, school authorities and service providers should look to provide greater diversity within playground designs to engage all children's abilities and play interests

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(Dyment & Bell, 2007, 2008). The importance of providing diverse items within the school playground is underlined by the definition of play, regarded as the diverse range of unstructured activities and behaviour that children engage in (Pellegrini, 2009).

Responding to a need for playground variety and diverse play opportunities, materials with no fixed purpose (e.g. movable/recycled materials) were introduced to an Australian school playground over an 11-week period (Bundy et al., 2008; Bundy et al., 2009). Movable/recycled materials were items generally not considered to be school play materials for children, including: milk crates, wooden planks, hay bales and tyre tubes. The effects on the intensity of children's active play levels (5-7-years-old) were measured via accelerometers and revealed children were significantly more involved in active play after the movable/recycled materials were introduced (Bundy et al., 2009). Researchers also reported that the movable/recycled materials increased 5-7-year-old children's playability within the school playground (Bundy et al., 2008). Additionally, teachers perceived the intervention to have increased children's social, creative and resilient play during school breaks. However, despite minimal injuries being reported, teachers still had concerns about potential risks and duty of care of the intervention within the school playground (Bundy et al., 2009).

More recently, the effects of movable/recycled materials on children's active play levels (5-13 years old), quality of life and enjoyment (8-13 years old) were evaluated via the Lunchtime Enjoyment Activity and Play (LEAP) intervention in an Australian primary school (Hyndman, Benson, Ullah, & Telford, 2014). The LEAP intervention had significant effects on children's steps and distance accumulated (both assessed using pedometry) in the intervention school compared to a matched control school. Short-term effects from the LEAP intervention were evident for children's physical health scale quality of life and enjoyment of active play activities (Hyndman, Benson, Ullah, et al., 2014). Direct observations revealed that the children at the LEAP intervention school spent significantly higher proportions within playground areas

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in more vigorous play intensities than the control school (Hyndman, Benson, Ullah, et al., 2014). The direct observations also revealed that the major types of active play observed among children in the intervention school evolved from imaginative play with the movable/recycled materials (7-weeks after the intervention) to building and construction activities (8-months after the intervention) (Hyndman, Benson, Ullah, et al., 2014). Teachers at the intervention school reported a range of individual (e.g. problem solving, creativity) and social (e.g. negotiation, teamwork) benefits and a high level of play engagement of the children (especially non-competitive type children and females; Hyndman, Benson, Ullah, et al., 2014).

The movable/recycled materials intervention innovatively provided a low cost option for schools that do not have the necessary funding for expensive greening designs and other costly school playground projects. Moreover, as movable/recycled materials are found within the home and community environments, the play benefits from such interventions can be replicated beyond the school playground for children's continued development. Whilst there are a number of benefits of implementing a movable/recycled materials intervention, there is a need for further research to examine this concept targeting school playgrounds on a wider scale.

Evaluating the Transferability and Feasibility of School Playground Interventions Promoting Physical Activity during School Breaks

The evaluation of the translation (transferability and feasibility) of school playground interventions to other school environments is emerging as an important consideration for researchers (Kriemler et al., 2011). Despite the importance of comprehensively evaluating playground interventions, there is little evidence from process evaluations to provide guidance to other schools of how to replicate positive school playground intervention effects (Austin, Bell, Caperchione, & Mummery, 2011; Janssen, Toussaint, Van Mechelen, & Verhagen, 2011). In a recent study known as the 'PlayZone' intervention in Australia, a combination of

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intervention concepts including playground line markings, a games activity manual, games equipment (e.g. skipping ropes, balls) and an active peer leader training manual were introduced into six school playgrounds (Austin et al., 2011). The researchers applied the RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) framework to examine the transferability of the research project on a wider scale. Providing insight for other schools of the barriers and facilitators to intervention implementation, the research team noted that assigning a staff member to paint line markings and addressing staff turnover of intervention leaders were key considerations. The ease of introducing the playground intervention and low burden on the schools to maintain the intervention were seen as positives of the 'PlayZone' intervention (Austin et al., 2011). The low complexity of the line markings and activity manual intervention ensured all schools could maintain the intervention concept for over a 12-month period (Austin et al., 2011).

A RE-AIM evaluation was also conducted of the 'PLAYgrounds' intervention that provided Physical Education classes with playground activities so that children could gain ideas on how to use the school playground during school breaks (Janssen et al., 2011). Children's classes were provided with boxes of sporting equipment to stimulate playground physical activity ideas such as throw/catch equipment, balls and skipping ropes. Monthly playground active play themes were also encouraged by teachers (joined in with the children once a week) and parents (joined in with the children once a month). Researchers suggested that the success of the intervention was due to it being delivered as a complete package with funding, staff support and equipment (Janssen et al., 2011). However, not all schools can obtain this high level of support and future evaluation of the maintenance level of the PLAYgrounds intervention concept in school playgrounds should consider appointing a school employee to lead the program, especially when funding isn't available (Janssen et al., 2011).

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The LEAP intervention consisted of the first process evaluation of a school playground intervention to encourage more unstructured-type active play during school breaks. The LEAP intervention included movable/recycled materials being introduced to the school playground over a 13-week period. The movable/recycled materials were items generally not considered to be typical play materials such as milk crates, swimming boards and noodles, buckets, cardboard boxes, tyre tubes and plastic pipes. In addition to a range of positive active play outcomes, a REAIM process evaluation of the LEAP intervention revealed that movable/recycled materials could be feasibly implemented and maintained for at least a two and a half year period. The cost-effectiveness, sustainability and diversity of the movable/recycled materials were seen as major factors contributing to the success of the LEAP intervention. As this is the first process evaluation of a school playground to encourage unstructured-type physical activity opportunities, further process evaluation research is needed to ensure schools on a wider scale can implement such school playground interventions. Rather than a period for students to 'let off steam and energy' (Evans & Pellegrini, 1997), the findings from the LEAP intervention show the value of introducing cost-effective materials to a school playground as a strategy with low burden on staff to develop children's activity play levels beyond school classroom activities.

The process evaluations of school playground intervention programs highlight a need for low complexity and staff support for optimal replication. As there has been limited process evaluation of school playground interventions to encourage children's active play, further research is needed to ensure schools can replicate the benefits of such playground interventions on a wider scale.

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Designing Future School Playground Interventions to Facilitate Active Play during School Breaks

Numerous studies have highlighted that females engage in more sedentary play than their male counterparts within the school setting (Ridgers et al., 2012). As interventions that encourage open-ended and unstructured play have demonstrated positive active play outcomes in females (Dyment et al., 2009), further research exploring the active play and health effects of implementing a school playground movable/recycled materials intervention on primary school females of all ages is warranted. Supporting this finding, it has been identified that young females tend to prefer engaging in non-competitive types of active play (Telford, Salmon, Timperio, & Crawford, 2005). The introduction of diverse items within school playgrounds during school breaks can be beneficial for children's active play (Dyment et al., 2009; Engelen et al., 2013; Hyndman, Benson, Ullah, et al., 2014), therefore the variety and choice associated with implementing a movable/recycled materials interventions is an important consideration for teachers and school decision makers. Cost-effective interventions such as movable/recycled materials within the school-context are encouraging for sustainable public health outcomes that are translatable to other school settings (Kriemler et al., 2011; Hyndman, Benson, & Telford, 2014). As there are limitations to the assessment of children's active play using single measures (Telford et al., 2005; Dollman et al., 2009), there is a need to evaluate school-based active play interventions by employing a combination of subjective and objective physical activity measures. There are still a number of considerations to effectively conduct school-based active play interventions. Research continues to identify a distinct need to assess the long-term impact (i.e. from 6 months to several years) of school active play interventions (Dobbins et al., 2009; Kriemler et al., 2011). However, research suggests long-term follow-ups are difficult, as only a small percentage of the original population can be reached (Kriemler et al., 2011). To our knowledge, only three school break interventions targeting children's active play have

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implemented a long-term follow-up (Ridgers et al., 2007; Engelen et al., 2013; Hyndman, Benson, & Telford, 2014). In a major review of school-based active play intervention literature, a need for further research to examine the mediators of active play intervention effects (e.g. enjoyment) has been identified (Kriemler et al., 2011). Mediators are intervening causal variables that are necessary to complete a cause-effect pathway between an intervention and children's active play levels (Bauman, Sallis, Dzewaltowski, & Owen, 2002). There is also a need to identify the multi-level mediation effects of active play interventions such as enjoyment within a school lunchtime context (Hyndman et al., 2013; Hyndman, Telford, Finch, Ullah, & Benson, 2014). Furthermore, only one active play intervention study we are aware of targeting school break has comprehensively evaluated a school playground intervention using the social-ecological model (Hyndman, Benson, & Telford, 2014). Evaluating an intervention's potential to modify the multiple levels of influence on children's active play levels is important for long lasting health outcomes (Ridgers et al., 2012; Salmon & King, 2010). Lastly, despite research calling for comprehensive evaluations of school-based active play interventions (Kriemler et al., 2011), only three studies have applied a recognized evaluation framework to examine translatability of implementing an active play intervention targeting school breaks using structured (Austin et al., 2011; Janssen et al., 2011) and unstructured-type (Hyndman, Benson, & Telford, 2014) active play interventions. It is important to comprehensively evaluate the transferability and feasibility of school playground interventions for future implementation in schools. Comprehensively evaluating the effectiveness of school-based interventions is essential for school settings to achieve sustainable health benefits and to develop a range of physical, cognitive and social skills via the 'informal' curriculum of school lunch breaks.

Conclusion

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Evaluating a range of school playground interventions to encourage children's active play levels during school break periods is important to inform the development and evaluation of school playgrounds. This paper suggests that future interventions should evaluate children's active play levels with a combination of measures, conduct follow-up measurements, implement comprehensive evaluation frameworks and highlights the importance of implementing cost-effectiveness, variety and choice in school playground materials. Furthermore, there is scope to explore school playground interventions that promote 'unstructured' active play during school breaks. Teachers, educational leaders, designers, researchers and play professionals can consider the findings from this paper for future school playground intervention and planning to ensure children's active play can be facilitated effectively.

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