

Loughborough University
Institutional Repository

*School-based physical
activity interventions:
effectiveness, trends, issues,
implications and
recommendations for
practice*

This item was submitted to Loughborough University's Institutional Repository by the/an author.

Citation: CALE, L. and HARRIS, J., 2006. School-based physical activity interventions: effectiveness, trends, issues, implications and recommendations for practice. *Sport, Education and Society*, 11 (4), pp. 401 - 420

Additional Information:

- This article was published in the journal, *Sport, Education and Society* [© Routledge]. The definitive version is available at: <http://www.informaworld.com/smpp/contentcontent=a757741496db=allorder=page>

Metadata Record: <https://dspace.lboro.ac.uk/2134/4465>

Version: Accepted for publication

Publisher: © Routledge

Please cite the published version.

This item was submitted to Loughborough's Institutional Repository (<https://dspace.lboro.ac.uk/>) by the author and is made available under the following Creative Commons Licence conditions.



CC creative commons
COMMONS DEED

Attribution-NonCommercial-NoDerivs 2.5

You are free:

- to copy, distribute, display, and perform the work

Under the following conditions:

BY: **Attribution.** You must attribute the work in the manner specified by the author or licensor.

Noncommercial. You may not use this work for commercial purposes.

No Derivative Works. You may not alter, transform, or build upon this work.

- For any reuse or distribution, you must make clear to others the license terms of this work.
- Any of these conditions can be waived if you get permission from the copyright holder.

Your fair use and other rights are in no way affected by the above.

This is a human-readable summary of the [Legal Code \(the full license\)](#).

[Disclaimer](#) 

For the full text of this licence, please go to:
<http://creativecommons.org/licenses/by-nc-nd/2.5/>

**School based physical activity interventions – effectiveness, trends,
issues, implications and recommendations for practice**

Lorraine Cale and Jo Harris

School of Sport and Exercise Sciences

Loughborough University

Loughborough

LE 11 3TU

Tel: 01509 226302

Fax: 01509 226301

Correspondence to:

Lorraine Cale at the above address

L.A.Cale@lboro.ac.uk

Abstract

The promotion of physical activity within schools and Physical Education (PE) has attracted growing interest in recent years. Schools have been acknowledged as the primary institution with responsibility for promoting activity in young people and more specifically, school PE has been recognized as having a key role to play. Given this, and based on previous reviews of the findings of formally evaluated interventions, this paper considers the evidence for the effectiveness of school based physical activity interventions and highlights the key trends and a number of issues concerning their type, target population, design, implementation and content. Earlier reviews have provided comprehensive summaries of the effectiveness of physical activity interventions but they have not provided specific guidance for teachers' practice in schools. Thus, whilst it is acknowledged that the existing literature is not sufficiently extensive to provide definitive guidelines for schools, this paper considers the implications for practice and presents recommendations for future physical activity programmes, initiatives and interventions.

Introduction

Given the growing concerns over the physical activity levels of many young people and the possible health consequences, targeted efforts to promote physical activity would seem to be warranted. In this respect, the promotion of physical activity within schools and the physical education (PE) curriculum has attracted growing interest in recent years. Schools have been acknowledged as the primary institution with responsibility for promoting

activity in young people (Cardon and Bourdeaudhuij, 2002; McBride and Midford, 1999; Sallis and Owen, 1999). More specifically, school PE has been recognized as having a key role to play (see for example, Armstrong 2002; Cale, 2000a; Cardon and Bourdeaudhuij, 2002; McKenzie, 2001; Shephard and Trudeau, 2000). Indeed, McKenzie (2001) views PE as the most suitable vehicle for the promotion of active, healthy lifestyles among young people. According to Stone and colleagues (1998), school based physical activity interventions have an inherent advantage over interventions in other settings because programmes can become institutionalized into the regular school curriculum, staff development and other infrastructures. It is perhaps not surprising therefore, that they are the most common form of physical activity intervention with young people.

Furthermore, the role of schools and PE in promoting health and the link between health and education has increasingly been recognized by Government in the United Kingdom (UK). Harris and Penney (2000, p. 252) note how official and semi official pronouncements on behalf of Government have clearly identified PE as 'critical in educating and providing opportunities for young people to become independently active for life,' whilst Green (2004) reports that the encouragement of lifelong participation in sport and physical activity is an implicit and explicit theme in government policy towards health promotion generally and PE and sport in schools in particular. This is evidenced in a number of publications in recent years that have attested to the desirability of utilizing schools and PE in order to promote lifelong participation in sport and physical activity (e.g., Department

for Culture, Media and Sport (DCMS), 2001; Department of Health (DoH), 1999; 2005a; 2005b; DCMS London Strategy Unit, 2002). Perhaps the most recent and significant example of this was the launch of the National PE, School Sport and Club Links Strategy in October 2002, which is being delivered by the Department for Education and Skills (DfES) and DCMS and being supported by a Government investment of £459 million over three years. The aim of the strategy is to:

‘increase the percentage of school children in England who spend a minimum of two hours each week on high quality PE and school sport within and beyond the curriculum (from 25 per cent in 2002) to 75 per cent by 2006.’ (DfES, 2003, p.2).

In December 2004, a further £519 million was allocated to continue and build on the Strategy from 2006/07 to 2007/08, to extend the target to 85 per cent of children spending at least two hours a week on high quality PE and school sport by 2008 (DfES, 2004).

This interest and level of investment is perhaps being fuelled by concerns generally over young people’s health and more recently by the alleged ‘obesity epidemic’ and ‘alarming’ rise in childhood obesity, as well as by the general acceptance of a biomedical model of health as an appropriate response and means of intervention (Johns, 2005). Yet interestingly, the ‘obesity discourse,’ with its inherent uncertainties, ambiguities and conflicts of knowledge has been critiqued and contested elsewhere, as has the uncritical acceptance of PE’s role in the prevention or treatment of obesity

(see for example, Evans, 2003; Gard and Wright, 2001; Gard, 2004).

Similarly, the limitations of a biomedical approach within PE have also been acknowledged (Johns, 2005) and will be addressed briefly later within this paper.

Despite this, and mindful of the expectation and pressure upon schools and PE in particular to influence physical activity levels, this paper considers the evidence for the effectiveness of school based physical activity interventions. In this respect, the paper draws on previous reviews of the findings of formally evaluated interventions and from these, attempts to highlight the key trends and discuss a number of issues concerning their type, target population, design, implementation and content. It is also perhaps worth noting at this stage that the authors are advocates of the ecological model of physical activity promotion. Thus, where applicable, the interventions are discussed and critiqued with respect to this framework. Further, whilst earlier reviews have provided useful and comprehensive summaries of the effectiveness of physical activity interventions and recommendations for research, and to a lesser extent public health, they have not provided specific guidance for teachers' practice in schools. To conclude therefore, this paper considers the implications for practice and presents a series of recommendations for future formal and informal school based physical activity programmes, initiatives and interventions.

School based physical activity interventions

A number of studies of varying degrees of rigour have been conducted to evaluate the effectiveness of school based physical activity interventions over the past decade and more recently, reviews have been published which have summarised and/or critiqued their effectiveness (see for example, Almond and Harris, 1998; Cale and Harris, 2005a ; Harris and Cale, 1997; Kahn et al., 2002; Stone et al., 1998).

Harris and Cale (1997) and Almond and Harris (1998) conducted a review of studies of formally evaluated primary and secondary school health-related PE (HRPE) programmes, predominantly from the United States (US), UK, Canada and Australia. Stone et al., (1998) conducted a review and synthesis of physical activity interventions in youth employing stricter study inclusion criteria, whereby only studies that had used a quantitative assessment of physical activity and a comparison or control group were included. A total of 14 completed school based studies met these criteria.

More recently, Kahn et al., (2002) undertook a systematic review of the effectiveness of various approaches to increasing physical activity. Only studies considered to be of at least fair design or execution were included. Ten studies were reviewed which evaluated the effectiveness of classroom based health education programmes, three which evaluated classroom based programmes that focused on reducing television watching and video game playing, and 13 which evaluated the effectiveness of modified PE

programmes. More recently, and drawing on previous reviews, Cale and Harris (2005a) highlighted the trends, characteristics and a number of issues concerning school (and community) based interventions designed to increase young people's physical activity participation. Indeed, a number of the issues raised later were alluded to in this previous review.

Effectiveness

Studies which have evaluated the effectiveness of classroom based health education interventions have shown variable effects on physical activity. Some studies revealed increases in physical activity [(e.g., the Australia School Study (Hommel et al., 1981); The Southwest Cardiovascular (CV) Curriculum Project (Davis et al., 1995)], and others revealed decreases [(e.g., The Slice of Life Project (Perry et al., 1987)]. A few studies showed improvements in knowledge, attitude and self-efficacy about exercise (e.g., The Slice of Life Project; The Southwest CV Curriculum Project).

A few classroom based programmes focused on reducing television watching and video game playing (Gortmaker et al., 1999a; Gortmaker et al., 1999b; Robinson, 1999) and found a consistent and sizeable decrease in television viewing and video game playing. In one study, time spent in other sedentary behaviours also decreased (Robinson, 1999). However, reductions in television viewing and video game playing did not consistently correspond with increases in physical activity.

Consistent increases in time spent in physical activity at school were observed in the studies which had implemented modified PE curricula by various methods (Kahn et al., 2002). Increases in the amount or percentage of time spent in moderate to vigorous physical activity (MVPA) in PE classes were found in a number of studies [(e.g., Dwyer et al., 1983; Go for Health (Parcel et al., 1989; Simons-Morton et al., 1991); The Child and Adolescent Trial for Cardiovascular Health (CATCH) (Luepker et al., 1996; McKenzie et al., 1996); The Nebraska School Study (Donnelly et al., 1996); Sports, Play and Active Recreation for Kids (SPARK) (McKenzie et al., 1997; Sallis et al., 1997)]. Indeed, the net increase in the amount of PE class time spent in MVPA was reported to be 50.3 per cent (Kahn et al., 2002). Increases in energy expenditure were also reported in a few studies (e.g., CATCH; SPARK).

Findings however, were not so consistently positive for out of school physical activity. Whilst some studies reported significant increases in out of school activity [(e.g., CATCH; the Oslo Youth Study (Tell and Vellar, 1987); The Australia School Study; the Stanford Adolescent Heart Health Study (Killen et al., 1988)], others did not (e.g., Go for Health; SPARK). Also, whilst the Nebraska School Study reported a significant increase in physical activity during school PE, less out of school activity was reported for the intervention group.

Studies also showed increases in measures of physical fitness (e.g., Hopper et al., 1992; Shephard and Lavalley, 1993; 1994; The Oslo Youth Study; The

Path Program (Fardy et al., 1996); SPARK; Pieron et al., 1996; Manios et al., 1999). The majority of studies examined weight change but the results were inconsistent. Finally, these interventions were also associated with increased knowledge (e.g., Go for Health; The Oslo Youth Study; Hopper et al., 1992; The Cardiovascular Health in Children Study (CHIC) (Harrell et al., 1996); The Path Program; The Stanford Adolescent Heart Health Programme), and improved attitudes (e.g., Go for Health; Pieron et al., 1996), and self efficacy (CATCH; Go for Health).

Summary of the effectiveness of physical activity interventions

On the basis of these findings, it would seem that school based PE programmes can achieve a range of positive outcomes (Almond and Harris, 1998; Harris and Cale, 1997) and can be effective in increasing young people's physical activity and fitness (Cale and Harris, 2005a). Meaningful improvements in activity and fitness levels, and in knowledge and attitudes have been reported following school based studies. Kahn and colleagues (2002) concluded from their review that there is strong evidence that school based PE is effective in increasing levels of physical activity and improving physical fitness. However, they also noted that, because of inconsistent results among studies, there is currently insufficient evidence to assess the effectiveness of classroom based health education focused on information provision, and health education classes focused on reducing television viewing and video game playing in increasing physical activity (Kahn et al., 2002). Furthermore, whilst school based PE programmes appear to be

successful in increasing activity during PE, there is less evidence that they are as effective in improving out of school physical activity levels.

Trends and issues in school-based physical activity interventions

In analysing the physical activity intervention studies, Cale and Harris (2005a) identified certain trends across programmes, and a number of issues which should be of interest and relevance to PE teachers, as well as health and other practitioners, when planning, implementing, or evaluating health-related or physical activity programmes with young people. These and other issues are now highlighted.

Programme types

According to Cale and Harris (2005a), broadly the following types of school based interventions were common:

- 1) Augmented PE programmes which involved lengthening the time of existing PE lessons or adding new or additional lessons.
- 2) Non augmented or standard PE programmes which were incorporated into existing PE time. These involved increasing the amount of physical activity during lessons, for example, by changing the activities taught or modifying the rules of games.
- 3) Classroom based programmes which were based on theoretical instruction and the provision of information.

Most studies appeared to focus on augmented PE programmes involving the provision of additional PE time (Almond and Harris, 1998) which, coupled

with the non augmented programmes, have often been found to be successful. However, the difficulties schools face with this type of intervention due to pressures of curriculum time for PE have been acknowledged (Cale and Harris, 2005a; Kahn et al., 2002) and their feasibility and sustainability for more widespread implementation therefore questioned (Cale and Harris, 2005a). More recently though, with the introduction of the PE, School Sport and Club Links Strategy, and in particular following the Government's extended funding and announcement that 'by 2010 all children will be offered at least 4 hours of *sport* every week, which will comprise at least 2 hours of high quality PE and sport at school...' (DfES, 2004), such programmes may soon represent a more feasible option for schools.

By comparison, classroom based programmes have enjoyed less success. Harris and Elbourn (1992) argue that sedentary classroom based delivery of health-related concepts is limited in that it tends to focus on information transmission rather than the essential combination of understanding, experiencing, decision making and evaluating. This may in part explain why such programmes have been found to be relatively ineffective (Cale and Harris, 2005a). A practical approach meanwhile, is considered consistent with the physical context of the subject and with messages relating health benefits to frequent physical activity (Harris, 1995).

Target populations

The collection of studies to date is largely from the US and limited for several age groups, with most having been conducted with upper primary aged children (Stone et al., 1998). For example, CATCH; Go for Health; The Nebraska School Study; The Southwest CV Curriculum Project; SPARK, were all conducted with upper primary aged children. Just a minority of programmes have been conducted with older youth [(e.g., Slice of Life; The Stanford Adolescent Heart Health Program; Project Active Teens (Dale, Corbin and Cuddihy, 1988)]. Stone et al., (1998) suggest that the absence of pre-school and early primary years in interventions is partially due to the difficulty in measuring physical activity, as well as delivering interventions with these groups. Harris and Cale (1997) on the other hand, suggest that the predominance of primary school programmes may be due to the increased flexibility generally afforded by the primary curriculum and to their more generally holistic approach to health education. Given that physical activity levels decrease with age, particularly during the teenage years (Armstrong and Van Mechelen, 1998; Riddoch and Boreham, 1995), the lack of secondary based interventions is disappointing. It also seems a waste given the specialist knowledge, expertise and resources that should be available to deliver programmes in secondary schools.

Of interest was the noticeable lack of targeted interventions. This is despite recommendations that programmes should be designed to meet the specific needs of young people and differentiated on the grounds of gender, age/life-stage and socio-economic status (HEA, 1998). Indeed, the HEA (1998) recognise the need to focus specifically on the inactive, and identify girls

aged 12-18, young people of low socio-economic status and older adolescents as priority groups for interventions, whilst Stone et al., (1998) identify the need for studies on the effectiveness of interventions for diverse ethnic/racial groups, special needs populations and females, amongst others. Thus, perhaps a more focused approach in schools which tackles specific groups of youngsters may be more successful. This would not have to be at the exclusion of other students, but the programme design and content would try to address the target group's needs, interests and preferences. Indeed, in the UK, two recent initiatives, the Nike/Youth Sport Trust Girls in Sport project (O'Donovan, 2002) and the BSkyB/Youth Sport Trust 'Living for Sport' project (Sandford et al., 2004) represent good examples of targeted physical activity interventions.

The Girls in Sport project is an intervention concerned with developing 'girl-friendly' forms of PE with the aim of increasing girls' physical activity levels and producing more positive attitudes towards participation. The 'Living for Sport' project aims to support teachers (and community deliverers) to use PE and sport to reach out to disaffected or disengaged young people within schools, and to design and deliver physical activity programmes that will allow the participants to develop team-building, communication, and problem solving skills as well as a sense of personal and social responsibility. Both projects are being formally evaluated by the Institute of Youth Sport at Loughborough University (see www.lboro.ac.uk/departments/sses/institutes/iys/ for further details) and findings to date reveal some positive outcomes. For example, of the schools

implementing changes as a result of the Girls in Sport project, 83% perceived either a decrease in 'non-doers' in PE (70%) or an increase in extra-curricular participation (77%) as a direct result (O'Donovan, 2002), whilst early findings from the Living for Sport project suggest that physical activity can facilitate the positive personal and social development of young people, particularly in terms of improving confidence, developing communication and leadership skills, and encouraging behavioural improvement (Sandford et al., 2004).

Programme design and implementation

With respect to the design of the interventions, the majority used random assignment experimental designs (e.g., CATCH; CHIC; Slice of Life; The Southwest CV Curriculum Project), though some adopted quasi experimental designs (non randomized) (e.g., Active Winners; Class of 1989; Go for Health; SPARK; The Oslo Youth Study). CATCH is the first school based multi centre randomized trial ever conducted. Some researchers consider the use of random assignment and control groups a necessity in intervention research, whilst others consider such experimental examinations an impossibility (Kemper, 1990). Tinning and Kirk (1991) highlight the limitations of adopting a scientifically based experimental approach within complex social settings such as schools and identified problems with the matching of control and experimental groups and of isolating the effects of programmes from control groups. Most studies however, randomized or assigned schools rather than individuals to intervention conditions. Given the complexities involved, in depth qualitative

approaches to physical activity intervention research are considered to have merit (Cale and Harris, 2005a).

Perhaps not surprisingly, the interventions varied greatly in size and duration. Ninety-six schools and 5,106 students were involved in CATCH whereas just one school and 270 students were involved in The Slice of Life Project. Indeed, Almond and Harris's (1998) review identified a number of school based studies with under 100 students (e.g., Ignico and Mahon, 1995; Goldfine and Nahas, 1993; Maconnie et al., 1982). In terms of the duration of the interventions, programmes ranged from just a few weeks or a term or two (e.g., 11 weeks for The Southwest CV Curriculum Project; one semester for the Slice of Life Project; two semesters for Project Active Teens), to more than a year (e.g., 18 months for Active Winners; two years for The Nebraska School Study; The Oslo Youth Study; SPARK).

Further, follow up has been carried out in only a minority of studies (Stone et al., 1998) and the long term effects of programmes have had little investigation (Shephard and Trudeau, 2000). Follow up periods included two months for the Stanford Adolescent Heart Project, one and a half years for SPARK, three years for CATCH, seven years for Class of 89, 12 years for the Oslo Youth Study, and 20+ years for the Trois Rivieres study (Trudeau et al., 1998; 1999). Indeed, Shephard and Trudeau (2000) claim that the latter study represents the only experimental study examining the long term impact of enhanced PE at the primary level. Given the short nature of many of the interventions and lack of longitudinal designs, Cale and Harris (2005a)

suggest that it is perhaps not surprising that equivocal findings or no significant changes have been reported in some instances. Further, the available evidence from long term evaluations suggests that the long term effects of programmes remain rather weak (Shephard and Trudeau, 2000). Additional longitudinal studies are clearly required.

For interventions to be critically evaluated, clearly defined and measurable goals are needed that are based on the best available evidence defining valued outcomes. Physical activity interventions can influence physiological outcomes (physical fitness components such as aerobic capacity, muscular strength and endurance, flexibility), clinical outcomes (body composition, blood pressure, blood lipids), behavioural outcomes (physical activity and/or dietary behaviour), cognitive outcomes (knowledge and understanding about physical activity and/or exercise) and affective outcomes (attitudes), and programme effectiveness can be gauged in terms of changes in any of these factors (Cale and Harris, 2005a). The programmes reviewed here had varied aims and objectives and focused on a broad range of short term outcomes. According to Stone et al., (1998), most studies measured knowledge, attitudes, and physical activity behaviour, most identified increasing levels of physical activity as a primary outcome, and a number also included fitness measures (e.g., CATCH; CHIC; The Nebraska School Study; The Oslo Youth Study; SPARK).

Cale and Harris (2005a) claim that the emphasis by many studies on physiological outcomes such as the development of physical fitness is note

worthy. These studies typically involved measuring pre and post intervention fitness levels via the administration of tests such as VO_2 max tests (e.g., CHIC; The Oslo Youth Study), a one mile run (The Nebraksa School Study), or a 9 minute run (CATCH). Yet, controversy concerning fitness testing in young people has been on going in recent decades and a number of issues have been raised, concerns expressed, and limitations identified in using fitness tests with children (ACSM, 1988; Armstrong, 1987; 1989; Cale and Harris, 1998; Cale and Harris, 2005b; Fox and Biddle, 1986; Harris and Cale, 1997; Physical Education Association (PEA), 1988; Rowland, 1995; Safrit, 1990; Seefeldt and Vogel, 1989). Many factors for example, influence fitness test performance (e.g., the environment/test conditions, lifestyle (exercise/nutrition), motivation, intellectual and mechanical skill at taking the test, test practice, and in particular heredity or genetic potential and maturation) which brings into question the validity and reliability of the scores and therefore the results concerning the success or otherwise of the programmes. A number of paradoxes relating to fitness testing have also been reported (Seefeldt and Vogel, 1989) which raise further questions over the relative merits of testing. For example, fitness tests purport to assess health-related physical fitness yet do not provide any clinical measures of health status (e.g., blood pressure, blood lipids), and they emphasize safe healthy practice yet some involve children performing tests which violate healthy behaviour (Cale and Harris, 2005b).

A key factor in physical activity programmes which rely on fitness tests as a measure of success is the influence the tests themselves may have on the

youngsters. Concern has been expressed that fitness testing may be counterproductive to the promotion of active lifestyles in young people (Corbin, Pangrazi and Welk, 1995; Docherty and Bell, 1990; Rowland, 1995). Rowland (1995) for example, considers programmes of field testing children to be demeaning, embarrassing and uncomfortable for those children about which there is most concern (e.g., the least active/fit), and to reinforce the notion that exercise is competitive and unpleasant.

For these reasons, it is argued that from a public health and physical activity promotion perspective, the goal should be to influence physical activity rather than fitness (Cale and Harris, 2002; Corbin, 2002; Pangrazi, 2000; Rowland, 1995), and that interventions should focus also (or instead) on behavioural, cognitive and affective outcomes (Harris and Cale, 1997). Indeed, Shephard and Trudeau (2000) suggest that the ability of programmes to develop a habit of regular physical activity that persists throughout adult life seems more important than any short term gains in fitness. Further, because the health benefits of physical activity in youth are transitory, it has been suggested that it is most important to establish patterns of regular participation in youth that can be carried into adulthood and to evaluate programme effectiveness on short and long term behavioural changes (Pate et al., 2000; Richter et al., 2000; Sallis et al., 1992). Cale and Harris (2005a) suggest that there needs to be consensus amongst researchers and physical educators alike concerning what health-related outcomes are valued most, and what school-based physical activity interventions should be striving to achieve.

A further point made by Cale and Harris (2005a) is how on the whole the studies provided limited detail regarding the specific intervention protocols employed. They claim this makes the replication of studies difficult and provides little direction or guidance for the future development of studies, interventions and practice. Similarly, Stone et al., (1998) recommend providing more precise descriptions of interventions and measurement procedures so that the effectiveness of different components of the interventions can be identified and replicated. Furthermore, it has been suggested that where the content was outlined, it did not appear to be especially innovative or to include the type of physical activity which would appeal to many young people (Cale and Harris, 1998). For example, programmes included aerobic conditioning techniques or timed runs, and many others were based on theoretical classroom instruction (Cale and Harris, 1998). Although the former activities may positively influence short term fitness gains, they may not be so successful in promoting lifetime physical activity (Harris and Cale, 1997). How inclusive such activities were for all youngsters is also questionable. In addition, the limitations with sedentary classroom based delivery which tends to rely on information transmission rather than understanding, experiencing, decision making and evaluating and which is inconsistent with the physical context of the subject were highlighted earlier. Indeed, the importance of the perceived relevance and acceptance of health-based work within the curriculum by young people has been highlighted by others (Johns, 2005; Kirk, 2003; Tinning and Fitzclarence, 1992). Tinning and Fitzclarence (1992) for example, suggest

that the ideology of healthism within a biomedical discourse, which, as discussed later, is the ideology underpinning most physical activity interventions, is unlikely to be approved by teenagers who perceive it as irrelevant to their life projects and associate it with sickness, incapacity, toil and the drudgery of exercise.

Yet on a more positive note, significant progress has been made in the area of health-related exercise and instruction in recent years. In the UK for example, subsequent revisions of the National Curriculum for Physical Education (NCPE) (Department for Education (DfE) and the Welsh Office (WO), 1995; Department for Education and Employment (DfEE) and Qualifications and Curriculum Authority (QCA), 1999; (Qualifications, Curriculum and Assessment Authority for Wales (ACCAC), 2000) have led to a stronger focus and a more coherent and progressive coverage of health-related issues. In addition, to assist teachers in the delivery of health-based work, including the requirements of the NCPE, good practice guidelines have been published in the form of a curriculum resource (Harris, 2000). The resource provides an interpretation of the National Curriculum health and fitness requirements expressed in the form of learning outcomes for each Key Stage, as well as guidance on terminology, delivery, approaches and assessment and sample schemes and units of work. Thus, it would seem to make good sense if programme outcomes and content in the UK could be designed to meet, complement and reinforce National Curriculum requirements and the outcomes identified by Harris (2000), and that the

resource be used to inform the design, content and implementation of physical activity interventions.

Compatible with the NCPE health and fitness requirements and the interpretation offered by Harris (2000) is the notion of 'lifelong or lifetime physical activity,' which suggests that content should focus on the development of activities and skills 'that promote generalization and maintenance of physical activity during youth and adolescence and enhance the probability of carryover to adulthood' (Sallis et al., 1992, p. S255). This may require a focus on more individually oriented and unstructured activity which is more characteristic of adult physical activity. Yet, this type of activity currently does not feature strongly within the PE curriculum of most schools. In fact, given the strong emphasis of schools' PE curricula on competitive sports and team games with an emphasis on performance (Fairclough, Stratton and Baldwin, 2002; Penney and Evans, 1999) and the observations of Green (2002; 2004) and Penney and Evans (1999) that teachers and Government appear to view competitive sport, and particularly team games, as the primary vehicle for the promotion of on-going involvement in health-promoting, active lifestyles, this may present a particular challenge for school based programmes.

In addition, Green (2004) highlights not only the importance of content but also the delivery as being critical for fostering on going participation. He suggests that if PE is to appeal to young people, it must allow them degrees of choice regarding what they do and when they do it. In the same vein, it

could be argued that overly prescriptive school based programmes are unlikely to be attractive to youngsters or particularly effective in promoting lifelong participation.

Kahn et al., (2002) highlight the role of multi site, multi component interventions in successfully increasing physical activity behaviours and an encouraging theme in some studies (e.g., CATCH; SPARK), was the use of multi component interventions (Stone et al., 1998) which extended beyond the curriculum. For example, some of the components within the programmes included intervening in the PE programme, the classroom curriculum, with parents/families, as well as in out of school physical activity. Cale and Harris (2005a) note how it is logical to assume that interventions are likely to be most successful if they target the same behaviour across a number of areas. Most studies also addressed multiple health behaviours, with diet being coupled most often with physical activity (Kahn et al., 2002; Stone et al., 1998). In addition, theoretical models were commonly used as a basis for the interventions, with a number of studies using a multiple theoretical approach (e.g., CATCH; Class of 89; The Oslo Youth Study; SPARK; The Southwest CV Curriculum Project). The most common theory was the Social Cognitive Theory or Social Learning Theory, though Social Influences, Self-Monitoring, Cognitive Evaluation Theory (self-regulation) and Organizational Change Theory were also employed.

Whilst it was encouraging to see that some studies had adopted multi component interventions, a limitation was that the focus remained largely on

targeting change in the individual and potentially important environmental factors were ignored. There has been growing interest and support for environmental or ecological approaches to physical activity promotion in recent years (Sallis, Bauman and Pratt, 1998; Spence and Lee, 2003) and as noted earlier, and for the reasons which will be explained below, the authors' are also supporters of the ecological model. Ecological approaches have, at their core, the notion that behaviour, in this case physical activity, is influenced by multiple facets of the intrapersonal (e.g., psychological and biological variables, developmental history), interpersonal (e.g., family, peers), and physical and policy and legislative environments (Gorely, 2005). However, despite growing support for the ecological perspective, French, Story and Jeffrey (2001) note that environmental and policy interventions are the least studied component of school health promotion. To date, school based studies have primarily been limited to changes in the curriculum as opposed to whole school policies or to the environment (Wechsler et al., 2000; Fox and Harris 2003), with little research examining the effects of environmental factors on youth and the contribution of school environmental factors on the physical activity levels of young people (Richter et al., 2000; Wechsler et al., 2000). In this respect, Cale and Harris (2005a) suggest that generally a limited range of physical activity interventions have been applied to young people while Resnicow, Robinson and Frank (1996) highlight the need to examine how the individual and the environment interact to influence behaviour.

Indeed, the merits of the ecological model and the limitations of and the need to move beyond the curriculum in particular has been recognized by a number of researchers (e.g., Biddle, 1991; Cale, 1997; 2000a; 2000b; Cardon and De Bourdeaudhuij, 2002; Fox, 1996; Fox and Harris, 2003). Fox and Harris (2003) for example, claim that the focus on PE provides only one part of the solution - it represents much less than two per cent of the child's waking time and therefore can not in itself address activity shortfalls. Similarly Cale (1997; 2000a), claims that the curriculum is a vitally important avenue for promoting physical activity, but that this is just one of many aspects of the school that impact upon young people.

Another important reason for moving beyond the curriculum relates to the limitations of healthism and the biomedical discourse upon which curriculum based interventions are based. This discourse is concerned with promoting the need to increase young people's physical activity levels in order to alleviate the health problems that may arise as a result of inactive lifestyles and is based on the (simplistic) assumption that individuals possess the capacity to make the necessary healthy lifestyle choices and that they are responsible for their physical and mental well being (Evans and Davies, 2004). In this respect, educational or behavioural approaches to the promotion of physical activity are usually adopted in which teachers encourage pupils to make healthy choices regarding their physical activity behaviour. This might involve delivering persuasive arguments for and relevant information about physical activity, and involving pupils in learning self management and regulatory skills such as goal setting, programme

planning, self reinforcement and monitoring or time management to encourage participation in physical activity. Whilst these skills are considered critical to lifestyle change and activity independence (Corbin, 2002), Cale and Harris (2005c) note the limitations of such an approach which targets only the individual, tends to hold the individual responsible for their activity behaviour, and fails to acknowledge other factors in the physical and social environment which influence physical activity.

From an ecological perspective, many aspects of the school can either promote or inhibit the adoption of an active lifestyle, and understanding gained through the 'formal' curriculum can either be reinforced and supported or completely undermined by other influences (e.g., peers, family, and the 'hidden curriculum' in the form of policies and other practices). Thus, to increase the likelihood of physical activity interventions being successful and leading to sustainable behaviour change, an ecological framework is recommended to address the multiple levels of influence on physical activity and to explore the potential of every aspect of the school to promote physical activity.

One notable example of a project which has adopted such an approach and which may provide scope for others is the Middle School Physical Activity and Nutrition (M-Span) project (McKenzie, 2001; Sallis et al., 2003). M-Span is concerned with evaluating the effects of environmental, policy and social marketing interventions on the physical activity and eating habits of school children. Twenty four middle schools were randomly assigned to intervention

or control conditions and physical activity interventions designed to increase physical activity in PE classes and throughout the school day were carried out over two years. Environmental changes included increasing supervision, equipment and organized activities. Findings revealed that the environmental and policy interventions were effective in increasing physical activity at school amongst boys but not girls. It was concluded that such interventions have potential but that barriers to full implementation need to be better understood and overcome (Sallis et al., 2003). Priorities identified for future research included improving school physical activity interventions for girls, which concurs with the recommendations highlighted earlier concerning the need for targeted interventions, and assessing multi level school health promotion interventions. Indeed, whilst these approaches are favoured, the difficulties encountered in evaluating and teasing out the specific effects on physical activity, which strategies are most effective, and which factors or aspects of an intervention determine success have been acknowledged (Fox and Harris, 2003).

Finally, whilst it could be argued that such studies are still relatively few and far between, the indications are that progress is being made. Stone et al., (1988) for example, note how the more recent intervention studies include more randomized trials, involve multi component interventions and often address measurement of multiple behaviours and environmental changes. They furthermore recommend conducting studies on the effectiveness of environmental and policy changes to increase physical activity and

examining whether multiple component interventions are more effective than single component interventions as areas for further research.

Implications and recommendations for practice

Whilst most schools are unlikely to be involved in the large scale formal and more 'robust' research studies reviewed within this paper, they are likely to be involved in planning and implementing health-related or physical activity programmes or initiatives with young people with the aim of increasing their physical activity levels. The above issues are therefore considered to be of relevance to PE teachers and to have implications for practice. Furthermore, the evidence on the effectiveness of school based interventions suggests that teachers' efforts to plan and implement programmes can be worthwhile. On the basis of the studies to date however, Fox and Harris (2003), concluded that the existing literature is not sufficiently extensive to provide definitive guidelines for schools about which types or aspects of programmes are most effective in promoting activity. Nonetheless until such a time, and from the preceding discussion, a number of recommendations for practice concerning the future direction of formal and informal physical activity programmes, initiatives and interventions can be proposed. These are presented in table 1.

Insert Table 1 here

Conclusion

The evidence reviewed here has revealed that school based physical activity interventions can be effective and achieve a range of positive outcomes,

suggesting that teachers' efforts to promote physical activity through PE programmes can indeed be worthwhile. Further, and despite limitations in the existing literature precluding definitive guidelines for schools to be made, consideration of the key trends and issues concerning the physical activity interventions clearly has implications for practice and has been used to inform a number of recommendations for the future direction of formal and informal physical activity programmes, initiatives and interventions. Until a stronger evidence base becomes available, schools and teachers should be encouraged to plan, implement and evaluate programmes and draw on such recommendations to inform their practice.

References

ACCAC. (2000) *Physical education in the national curriculum for Wales* (Cardiff, Author).

American College of Sports Medicine. (ACSM). (1988) Opinion statement on physical fitness in children and youth, *Medicine and Science in Sport and Exercise*, 20(4), 422-3.

Almond, L. & Harris, J. (1998) Interventions to promote health-related physical education, in: S. Biddle, J. Sallis & N. Cavill (eds) *Young and Active? Young People and Health-enhancing Physical Activity – Evidence and Implications* (London, Health Education Authority), 133-149.

Armstrong, N. (1987) A critique of fitness testing, in: S. Biddle (ed) *Foundations of health related fitness in physical education* (London, Ling Publishing House), 19-27.

Armstrong, N. (1989) Is fitness testing either valid or useful? *British Journal of Physical Education*, 20, 66-67.

Armstrong, N. (2002) Promoting physical activity and health in youth: The active school and physical education, Abstract presented at the 12th Commonwealth International Sport Conference, 19-23 July, 2002. Manchester, Association of Commonwealth Universities, 37-40.

Armstrong, N. & Van Mechelen, W. (1998) Are young people fit and active?, in: S. Biddle, J. Sallis & N. Cavill (Eds) *Young and active? young people and health-enhancing physical activity – Evidence and implications* (London, Health Education Authority), 69-97.

Biddle, S. (1991) Promoting health related physical activity in schools, in N. Armstrong & A. Sparkes (Eds.) *Issues in physical education* (London, Cassell Education), 155-169.

Cale, L. (1997) Promoting physical activity through the active school, *The British Journal of Physical Education*, 28(1), 19-21.

Cale, L. (2000a) Physical activity promotion in secondary schools, *European Physical Education Review*, 6(1), 71-90.

Cale, L. (2000b) Physical activity promotion in schools – PE teachers' views, *European Journal of Physical Education*, 5(2), 158-167.

Cale, L. & Harris, J. (1998) The benefits of health-related physical education and recommendations for implementation, *The Bulletin of Physical Education*, 34(1), 27-41.

Cale, L. & Harris, J. (2002) National fitness testing for children – issues, concerns and alternatives, *The British Journal of Teaching Physical Education*, 33(1), 32-34.

Cale, L. & Harris, J. (2005a) Physical activity promotion interventions, initiatives, resources and contacts, in: L. Cale & J. Harris (Eds) *Exercise and young people. Issues, implications and initiatives* (Basingstoke, Palgrave Macmillan), 232-270.

Cale, L. & Harris, J. (2005b) Fitness testing and exercise promotion – issues and recommendations, in: L. Cale & J. Harris (Eds) *Exercise and young people. Issues, implications and initiatives* (Basingstoke, Palgrave Macmillan), 209-231.

Cale, L. & Harris, J. (2005c) Promoting physical activity within schools, in: L. Cale & J. Harris (Eds) *Exercise and young people. Issues, implications and initiatives* (Basingstoke, Palgrave Macmillan), 162-190.

Cardon, G. & De Bourdeaudhuij, I. (2002) Physical Education and physical activity in elementary schools in Flanders, *European Journal of Physical Education*, 7(1), 5-18.

Corbin, C.B. (2002) Physical activity for everyone: what every physical educator should know about promoting lifelong physical activity, *Journal of Teaching in Physical Education*, 21, 128-144.

Corbin, C.B., Pangrazi, R.P. & Welk, G.J. (1995) A response to 'the horse is dead; let's dismount,' *Pediatric Exercise Science*, 7, 347-351.

Dale, D., Corbin, C.B. & Cuddihy, T.F. (1988) Can conceptual physical education promote physically active lifestyles? *Pediatric Exercise Science*, 10, 97-109.

Davis, S.M., Lambert, L.C., Gomez, Y. & Skipper, B. (1995) Southwest cardiovascular curriculum project: study findings for American Indian elementary students, *Journal of Health Education*, 26(supplement), S72-81.

Department for Culture, Media and Sport (DCMS). (2001) *A sporting future for all. The Government's Plan for Sport* (London, DCMS).

Department for Culture, Media and Sport (DCMS) London Strategy Unit. (2002) *Game plan: a strategy for delivering Government's sport and physical activity objectives* (London, DCMS).

Department for Education and the Welsh Office (DfE and WO). (1995) *Physical Education in the National Curriculum* (London: HMSO).

Department for Education and Employment & Qualifications and Curriculum Authority (DfEE & QCA). (1999) *Physical Education. the national curriculum for England* (London, HMSO).

Department for Education and Skills (DfES). (2003) *Learning through PE and sport. A guide to the physical education, school sport and club links strategy* (London, Author).

Department for Education and Skills (DfES). (Dec, 2004) *Boost for school sport. The national physical education, school sport and club links strategy* (London, Author).

Department of Health (DoH). (1999) *Our healthier nation* (London, HMSO).

Department of Health (DoH). (2005a) *Delivering choosing health: making healthier choices easier* (London, DoH).

Department of Health (DoH). (2005b) *Choosing activity: a physical activity action plan* (London, DoH).

Docherty, D. & Bell, R. (1990) Fitness testing: counterproductive to a healthy lifestyle? *CAHPER Journal*, 56(5), 4-8.

Donnelly, J.E., Jacobsen, D.J., Whatley, J.E., et al., (1996) Nutrition and physical activity program to attenuate obesity and promote physical activity and metabolic fitness in elementary school children, *Obesity Research*, 4, 229-243.

Dwyer, T., Coonan, W.E., Leitch, D.R., Hetzel, B.S. & Baghurst, R.A. (1983)

An investigation of the effects of daily physical activity on the health of primary school students in South Australia, *International Journal of Epidemiology*, 12, 308-313.

Evans, J. (2003) Physical education and health: a polemic or 'let them eat cake', *European Physical Education Review*, 9(1), 87-101.

Evans, J. & Davies, B. (2004) Sociology, the body and health in a risk society, in: J. Evans, B. Davies & J. Wright (Eds) *Body knowledge and control: studies in the sociology of physical education and health* (London, Routledge Taylor & Francis Group), 35-51.

Fairclough, S., Stratton, G. & Baldwin, G. (2002) The contribution of secondary school physical education to lifetime physical activity, *European Physical Education Review*, 8(1), 69-84.

Fardy, P.S., White, R.E. & Haltiwanger-Schmitz, K. (1996) Coronary disease risk factor reduction and behavior modification in minority adolescents: the PATH program, *Journal of Adolescent Health*, 18, 247-253.

Fox, K. (1996) Physical activity promotion and the active school, in N. Armstrong (Ed) *New directions in physical education* (London, Cassell Education), 94-109.

Fox, K. & Biddle, S. (1986) Health related fitness testing in schools: introduction and problems of interpretation, *The Bulletin of Physical Education*, 22, 54-64.

Fox, K. & Harris, J. (2003) Promoting physical activity through schools. In: J. McKenna, J. C. Riddoch (Eds) *Perspectives on health and exercise* (Basingstoke, Palgrave Macmillan), 181-201.

French, S.A., Story, M. & Jeffery, R.W. (2001) Environmental influences on eating and physical activity, *Annual Review of Public Health*, 22, 309-335.

Gard, M. (2004) An elephant in the room and a bridge too far, or physical education and the 'obesity epidemic', in: J. Evans, B. Davies & J. Wright (Eds) *Body knowledge and control: studies in the sociology of physical education and health* (London, Routledge Taylor & Francis Group), 68-82.

Gard, M. & Wright, J. (2001) Managing uncertainty: obesity discourses and physical education in a risk society, *Studies in Philosophy and Education*, 20, 535-549.

Godfine, B.D. & Nahas, M.V. (1993) Incorporating health-fitness concepts in secondary school physical education curricula, *Journal of School Health*, 63(3), 142-146.

Gorely, T. (2005) The determinants of physical activity and inactivity in young people, in: L. Cale & J. Harris (Eds) *Exercise and young people. Issues, implications and initiatives* (Basingstoke, Palgrave Macmillan), 81-102.

Gortmaker, S.L., Peterson, K., Wiecha, J., et al., (1999a) Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health, *Arch Pediatr Adolesc Med*, 153, 409-418.

Gortmaker, S.L., Cheung, L.W., Peterson, K.E., et al., (1999b) Impact of a school-based interdisciplinary intervention on diet and physical activity among urban primary school children: eat well and keep moving, *Arch Pediatr Adolesc Med*, 153, 975-983.

Green, K. (2002) Physical Education and the 'couch potato society' – part one, *European Journal of Physical Education*, 7(2), 95-107.

Green, K. (2004) Physical Education, lifelong participation and the 'couch potato society', *Physical Education and Sport Pedagogy*, 9(1), 73-86.

Harrell, J.S., McMurray, R.G., Bangdiwala, S.I., Frauman, A.C., Gansky, S.A. & Bradley, C.B. (1996). Effects of a school-based intervention to reduce cardiovascular disease risk factors in elementary-school children: The cardiovascular Health in Children (CHIC) Study, *J Pediatr*, 128, 797-805.

Harris, J. (1995) Physical education: A picture of health? *The British Journal of Physical Education*, 26(4), 25-32.

Harris, J. (2000) *Health-related exercise in the national curriculum. Key stages 1 to 4* (Leeds, Human Kinetics).

Harris, J. & Cale, L. (1997) How healthy is school PE? A review of the effectiveness of health-related physical education programmes in schools, *Health Education Journal*, 56, 84-104.

Harris, J. & Elbourn, J. (1992) Highlighting health related exercise within the national curriculum-part two, *British Journal of Physical Education*, 23(2), 5-9.

Harris, J. & Penney, D. (2000) Gender issues in health-related exercise, *European Physical Education Review*, 6(3), 249-273.

Health Education Authority (1998) *Young and active? Policy framework for young people and health-enhancing physical activity* (London, Author).

Homel, P.J., Daniels, P., Reid, T.R. & Lawson, J.S. (1981) Results of an experimental school-based health development program in Australia, *International Journal of Health Education*, 24, 263-270.

Hopper, C.A., Gruber, M.B., Munoz, K.D. & Herb, R.A. (1992) Effect of including parents in a school-based exercise and nutrition program for children, *Research Quarterly for Exercise and Sport*, 63, 315-321.

Ignico, A.A. & Mahon, A.D. (1995) The effects of a physical fitness program on low-fit children, *Research Quarterly for Exercise and Sport*, 66(1), 85-90.

Johns, D.P. (2005) Recontextualizing and delivering the biomedical model as a physical education curriculum, *Sport, Education and Society*, 10(1), 69-84.

Kahn, E.B., Ramsey, L.T., Brownson, R.C., Heath, G.W., Howze, E.H. & Powell, K.E. (2002) The effectiveness of interventions to increase physical activity, *American Journal of Preventive Medicine*, 22(4S), 73-107.

Kemper, H.C.G. (1990) Exercise and training in childhood and adolescence, in: J. Torg, P. Welsh & R.J. Shephard (Eds) *Current therapy in sports medicine 2* (Philadelphia, B.C. Decker) 11-17.

Killen, J.D., Telch, M.J., Robinson, T.N., Maccoby, N., Taylor, C.B. & Farquhar, J.W. (1988) Cardiovascular disease risk reduction for tenth graders: a multiple-factor school-based approach, *Journal of the American Medical Association*, 260, 1728-1733.

Kirk, D. (2003) The social construction of physical education, legitimation crises and strategic intervention in educational reform, in: K. Hardman (Ed) *Physical Education: deconstruction and reconstruction-issues and directions* (Berlin, International Council of Sport Science and Physical Education).

Luepker, R.V., Perry, C.L., McKinlay, S.M, Nader, P.R., Parcel, G.S., et al. (1996) Outcomes of a field trial to improve children's dietary patterns and physical activity: The Child and Adolescent Trial for Cardiovascular Health (CATCH), *Journal of the American Medical Association*, 275(10), 768-776.

MacConnie, S.E., Gilliam, D.L., Geenen, D.L. & Pels A.E. III. (1982) Daily physical activity patterns of prepubertal children involved in a vigorous exercise program, *International Journal of Sports Medicine*, 3, 202-207.

Manios, Y., Moschandreas, J., Hatzis, C. & Kafatos, A. (1999) Evaluation of a health and nutrition education program in primary school children of Crete over a three-year period, *Preventive Medicine*, 28, 149-159.

McBride, N. & Midford, R. (1999) Encouraging schools to promote health: impact of the western Australian school health project (1992-1995), *Journal of School Health*, 69(6), 220-225.

McKenzie, T.L. (2001) Promoting physical activity in youth: Focus on middle school environments, *Quest*, 53(3), 326-334.

McKenzie, T.L., Nader, P.R., Strikmiller, P.K., Yang, M, Stone, E.J., et al. (1996) School physical education: effect of the Child and Adolescent Trial for Cardiovascular Health, *Preventive Medicine*, 25, 423-431.

McKenzie, T.L., Sallis, J.F., Kolody, B. & Faucett, F.N. (1997) Long-term effects of a physical education curriculum and staff development work: SPARK, *Research Quarterly for Exercise and Sport*, 68, 280-291.

O'Donovan, T. (2002) *The Nike/Youth Sport Trust girls in sport partnership. End of year report*, (Loughborough University, Institute of Youth Sport).

Pangrazi, R.P. (2000) Promoting physical activity for youth, *The ACHPER Healthy Lifestyles Journal*, 47(2), 18-21.

Parcel, G.S., Simons-Morton, B., O'Hara, N.M., Baranowski, T. & Wilson, B. (1989) School promotion of healthful diet and physical activity: Impact on learning outcomes and self-reported behaviour, *Health Education Quarterly*, 16, 181-199.

Pate, R., Trost, S., Mullis, R., Sallis, J., Wechsler, H. & Brown, D. (2000) Community interventions to promote proper nutrition and physical activity among youth, *Preventive Medicine*, 31(supplement), S138-S149.

Penney, D. & Evans, J. (1999) *Politics, policy and practice in physical education* (London, E & FN Spon).

Perry, C.L., Klepp, K.I., Dudovitz, B., Golden, D. & Griffin Smyth, M. (1987) Promoting healthy eating and physical activity patterns among adolescents: a pilot study of 'Slice of Life', *Health Education Quarterly*, 2, 93-103.

Physical Education Association (PEA). (1988) Health related fitness testing and monitoring in schools. A position statement on behalf of the PEA by its fitness and health advisory committee, *British Journal of Physical Education*, 19(4/5), 194-195.

Pieron, M., Cloes, M., Delfosse, C. & Ledent, M. (1996) An investigation of the effects of daily physical education in kindergarten and elementary schools, *European Physical Education Review*, 2(2), 116-132.

Resnicow, K., Robinson, T.N. & Frank, E (1996) Advances and future directions for school-based health promotion research: Commentary on the CATCH intervention trial, *Preventive Medicine*, 25, 378-383.

Richter, K., Harris, K., Paine-Andrews, A., Fawcett, S., Schmid, T., et al., (2000) Measuring the health environment of physical activity and nutrition among youth: A review of the literature and applications for community initiatives, *Preventive Medicine*, 31(supplement), S98-S111.

Riddoch, C. & Boreham, C.A.G. (1995) The health-related physical activity of children, *Sports Medicine*, 19(2), 86-102.

Robinson, T.N. (1999) Reducing children's television viewing to prevent obesity: a randomised control trial, *Journal of the American Medical Association*, 282, 1561-1567.

Rowland, T.W. (1995) The horse is dead; let's dismount, *Pediatric Exercise Science*, 7, 117-120.

Sandford, R., Armour, K. & Bowyer, S. (2004) It might be fashionable but does it work?: physical activity, behaviour management and impact. Paper presented at the British Educational Research Association Annual Conference, Manchester University, September 2004.

Safrit, M. (1990) The validity and reliability of fitness tests for children: A review, *Pediatric Exercise Science*, 2, 9-28.

Sallis, J. F. & Owen, N. (1999) *Physical activity & behavioural medicine* (London, Sage Publications).

Sallis, J., Bauman, A. & Pratt, M. (1998) Environmental and policy interventions to promote physical activity, *American Journal of Preventive Medicine*, 15, 379-397.

Sallis, J.F., Simons-Morton, B.G., Stone, E.J., Corbin, C.B., Epstein, L.H., et al., (1992) Determinants of physical activity in youth, *Medicine and Science in Sports and Exercise*, 24(6)(supplement), S248-S257.

Sallis, J.F., McKenzie, T.L., Alcaraz, J.E., Kolody, B., Faucette, N. & Hovell, M.F. (1997) The effects of a 2-year physical education programme (SPARK) on physical activity and fitness in elementary school students, *American Journal of Public Health*, 87(8), 1328-1334.

Sallis, J.F., McKenzie, T, L., Conway, T.L., Elder, J.P., Prochaska, J.J., Brown, M., Zive, M.M., Marshall, S.J. & Alcaraz, J.E. (2003) Environmental interventions for eating and physical activity. A randomized controlled trial in middle schools, *American Journal of Preventive Medicine*, 24(3), 209-217.

Seefeldt, V. & Vogel, P. (1989) Physical fitness testing of children: A 30-year history of misguided efforts, *Pediatric Exercise Science*, 1, 295-302.

Shephard, R.J. & Lavalley, H. (1993) Impact of enhanced physical education in the prepubescent child: Trois Rivieres revisited, *Pediatric Exercise Science*, 5, 177-189.

Shephard, R.J. & Lavalley, H. (1994) Impact of enhanced physical education on muscle strength of the prepubescent child, *Pediatric Exercise Science*, 6, 75-87.

Shephard, R.J., & Trudeau, F. (2000) The legacy of physical education: influences on adult lifestyle, *Pediatric Exercise Science*, 12, 34-50.

Simons-Morton, B. G., Parcel, G. S., Baranowski, T., Forthofer, R. & O'Hara, N. M. (1991) Promoting physical activity and a healthful diet among children: results of a school-based intervention study, *American Journal of Public Health*, 81, 986-991.

Spence, J. & Lee, R. (2003) Toward a comprehensive model of physical activity, *Psychology of Sport and Exercise*, 4, 7-24.

Stone, E.J., McKenzie, T.L., Welk, G.J. & Booth, M.L. (1998) Effects of physical activity interventions in youth: Review and synthesis, *American Journal of Preventive Medicine*, 15(4), 298-315.

Tell, G.S. & Vellar, O.D. (1987) Noncommunicable disease risk factor intervention in Norwegian adolescents: The Oslo youth study, in: B. Hetzel & G. Berenson (eds) *Cardiovascular risk factors in childhood: epidemiology and prevention* (Amsterdam, Elsevier Science Publishers) 203-217.

Tinning, R. & Kirk, D. (1991) *Daily physical education. Collected papers on health based physical education in Australia* (Geelong, Australia, Deakin University Press).

Tinning, R. & Fitzclarence, L (1992) Postmodern youth culture and the crisis in Australian secondary school physical education, *Quest*, 44, 287-303.

Trudeau, F. Laurencelle, L., Tremblay, J., Rajic, M. & Shephard, R.J. (1998) Follow-up of the Trois Rivieres growth and development longitudinal study, *Pediatric Exercise Science*, 10, 368-377.

Trudeau, F. Laurencelle, L., Tremblay, J., Rajic, M. & Shephard, R.J. (1999) Daily primary school physical education: effects on physical activity during adult life, *Medicine and Science in Sports and Exercise*, 31, 111-117.

Wechsler, H., Devereaux, R., Davis, M. & Collins, J. (2000) Using the school environment to promote physical activity and healthy eating, *Preventive Medicine*, 31(supplement), S121-S137.