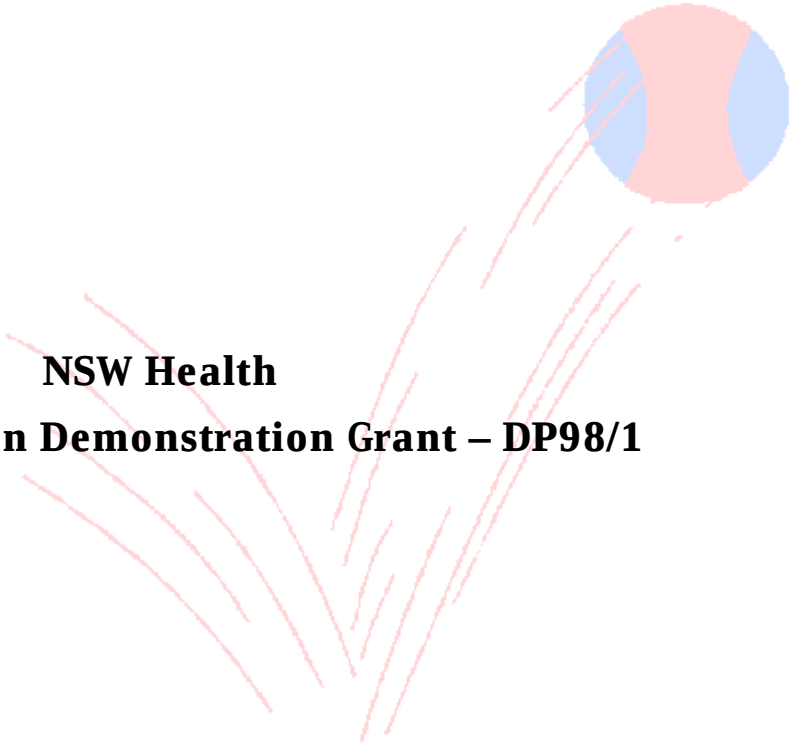
Move It Groove It

Physical Activity in Primary Schools



NSW Health

Health Promotion Demonstration Grant – DP98/1

FOREWORD

NSW Health recognises that active living constitutes one of the major components of a healthy lifestyle. There is now strong evidence that regular physical activity provides people of all ages, male and female, with substantial physical, social and mental health gains throughout life. Regular physical activity reduces the risk of premature mortality and also the development of the major non-communicable, chronic diseases such as diabetes, heart disease, osteoporosis, stroke and some cancers. It can also prevent obesity, injuries from falls and lead to increased well-being and quality of life.

In 1995 the NSW Chief Health Officer recommended that "Every adult in NSW should accumulate 30 minutes or more of moderate-intensity physical activity in most, preferably all days of the week." Population surveys estimate that only around half the people in NSW are sufficiently physically active to achieve health benefits.

The evidence linking physical activity and health is clear. However, knowledge about what actually helps people incorporate regular physical activity in their lives is not well understood. In 1996, NSW Health launched the Physical Activity Demonstration Project scheme to address the pressing need to obtain better evidence to guide the promotion of physical activity in NSW. It emphasised the importance of key settings (ie Local Government), working in partnership, rigorously designed studies, and the need to effectively disseminate the research results to guide best practice.

The Move It Groove It Project was an innovative, one-year intervention to improve children's physical activity levels and mastery of fundamental movement skills through a Health Promoting Schools (HPS) concept.

The Move It Groove It Project provides timely and useful evidence that will contribute greatly to our knowledge in the area of physical activity in schools. It also exemplifies the success of collaborative approaches to schools physical activity programs. This project was conducted jointly by the Northern Rivers Area Health Service Health Promotion Unit, Southern Cross University, and the Department of Education and Training.

I congratulate Northern Rivers Area Health Service for this excellent research study and report. It represents NSW Health's return on investment for research and development and also illustrates our commitment towards best practice in the promotion of physical activity in NSW.

Michael Reid
DIRECTOR GENERAL

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We wish to thank those members of the Department of Training and Education and of Southern Cross University who had the vision to embrace the MIGI concept and guide it to completion.

Special thanks also to the primary Principals and teachers who gave valuable time to make MIGI a success and to the many children who were the willing participants of the Fundamental Movement Skills, Physical Education and playground interventions and evaluations.

Thanks to the Southern Cross University students who were key players in the Buddy strategy and to the testers and observers who conscientiously trained and then diligently turned up for the baseline and follow-up surveys.

CHIEF INVESTIGATORS

John Beard	Executive Director, Institute of Health & Research
Uta Dietrich	Manager, Health Promotion Unit
Rob Gilfillan	Acting Head of School of Education, Southern Cross University
Carol Harris	Training & Development Curriculum Coordinator, Department of Education & Training Lismore
Avigdor Zask	Project Officer, Health Promotion Unit

PROJECT TEAM

Health Promotion Unit

Lisa Barnett	Project Officer (Sept 1998 – June 1999 & Jan 2000 – June 2001)
Eric van Beurden	Research & Evaluation Officer
Uta Dietrich	Manager
Denise Hughes	Data Entry
Lyndy McPhee	Layout and design
Elayne Mitchell	Project Officer (July/August 1999)
Erica Whisson	Web Designer
Avigdor Zask	Project Officer (Sept 1998 - Feb 2000)

Southern Cross Institute

Lyndon Brooks	Statistician

Southern Cross University, School of Education

Julia Adlington	Administration
Jo Asquith	Lecturer
Rob Gilfillan	Acting Head (1998/99)
Renata Phelps	Lecturer in Information Technology

Department of Education & Training

Vivienne Burn	FMS Trainer
Mike Cahill	Training & Development Curriculum Coordinator Coffs/Clarance,
Carol Harris	Training & Development Curriculum Coordinator Lismore
Ros Hodge	Relieving Training & Development/ Curriculum Coordinator Tweed Heads/Ballina
Kylie Nicholls	PDHPE Consultant Coffs/Clarance
Anne Riddell	Training & Development/ Curriculum Coordinator Tweed Heads/Ballina
Margaret Wilsmore	PDHPE Consultant Lismore & Tweed/Ballina

NSW Health	Health Promotion Branch
Angela Stewart	Senior Project Officer
Margaret Thomas	Manager of the Strategic and Research Development Unit
Philip Vita	Acting Manager of the Sun Exposure Nutrition and Physical Activity Unit

Contributors

'Buddies'	School of Education (SCU)
FMS Testers	School of Human Movement and Exercise Science (SCU)
Mark Thompson	Student (SCU) & relief Project Officer
Ruud Huuban	Student (MPH- Holland)
Research Assistants	Data Collection

GLOSSARY

ACHPER	Australian Council of Health Physical Education and Recreation.
CATCH	Child and Adolescent Trial for Cardiovascular Health
CAST	Children's Activity Scanning Tool
CVD	Cardiovascular Disease
DET	Department of Education and Training
FMS	Fundamental Movement Skills
HSL	Heat Stress Level
HW	Health Worker
MIGI	Move It Groove It
MNM	Mastery and Near Mastery
MVPA	Moderate to Vigorous Physical Activity
NRAHS	Northern Rivers Area Health Service
NRIHR	Northern Rivers Institute of Health and Research
PA	Physical Activity
PE	Physical Education
PDHPE	Personal Development, Health and Physical Education
PG	Playground
SCU	Southern Cross University
SOFIT	System for Observing Fitness Instruction Time
T & D Coordinator	Training and Development Coordinator
VPA	Vigorous Physical Activity

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1. EXECUTIVE SUMMARY

The NSW School Fitness and Activity Survey 1997 (11) found that many students, particularly girls, lack fundamental motor skills, and that a significant proportion have low aerobic capacity. Since skill development and pleasurable exposure to physical activity (PA) are the platform upon which lifelong PA patterns are dependent (61, 63), it is crucial that these are developed early in life.

The most successful intervention so far reported as increasing PA in school children is the American Child and Adolescent Trial for Cardiovascular Health (CATCH) Project (50) which demonstrated an increase in the level of PA in PE classes through teacher training and support. MIGI built on this model by developing, piloting and evaluating a comprehensive project that aimed to increase the motor skill and PA levels of children in primary school PE lessons and PA levels of children during recess and lunch breaks in school playgrounds.

MIGI was a collaborative effort of the Northern Rivers Area Health Service (NRAHS) Health Promotion Unit (HPU), Southern Cross University (SCU), and the Department of Education and Training (DET). Primary schools were randomly selected and stratified by size and DET district from a pool that had expressed interest. The sample covered the area from Grafton in the south to Tweed Heads in the north and as far west as Casino. Nine schools participated in the intervention and nine served as controls.

PE lessons and Fundamental Movement Skill (FMS) interventions targeted Year 3 and Year 4 children while the playground component targeted the whole school.
Interventions included:

- 'buddying' of pre-service teachers with each of the control schools for in-class work with teachers and students
- professional development of classroom teachers
- collaborative planning with the schools project team
- resource allocation in the form of a web-site and funding for equipment purchase.

As a research and demonstration project MIGI aimed to provide new evidence, instruments and intervention methods in the field of child PA. Major contributions include: (1) development and validation of the playground instrument CAST (Children Activity Scanning Tool), (2) the first Australian benchmarks on PA in PE lessons and playground through direct observation, and (3) collection of additional rural Australian data on FMS mastery.

MIGI was evaluated quantitatively by testing child FMS mastery and by observing PA of children in PE classes and in the playground both prior to and after the intervention.

MIGI exceeded the objective of increasing FMS mastery by 10%, with mastery levels increasing by a relative 11% to 60% depending on type of skill, when compared to control schools. The nature of the professional development afforded teachers through the project was such that it pinpointed explicitly the component skills of each of the identified FMS's. This allowed the teachers to concentrate on systematic teaching of those skills to effect enhanced performance. MIGI did not achieve the 10% increase in overall PA during PE lessons, however vigorous PA was increased by 3.03%. There was no evidence of a positive intervention effect on child PA in the playground or the participation rate of girls in the playground. Both the PE and playground outcomes probably reflect the brevity of the MIGI intervention in a complex inter-sectoral context rather than lack of responsiveness to change or inherent ineffectiveness of intervention strategies.

For an intervention that lasted a little over one year (with six months for pre testing and six months for post testing), MIGI achievements are considerable and the intervention contributed greatly to Australian knowledge in the area of PA in schools. Possibly the greatest outcome of MIGI was the wealth of knowledge regarding collaborative approaches to school PA programs. In particular, the buddies system proved a resounding success that will likely continue as a self-sustaining collaborative venture between Southern Cross University and DET. A range of recommendations is made for future collaborative projects with schools and for future research into PA.

2. BACKGROUND & RATIONALE

2.1. Physical Activity and Health

Physical inactivity is a major public health concern (9, 16, 61, 82). A review article from the NIH Consensus Conference Development Panel on PA and Cardio-Vascular Disease (CVD) concluded that physical inactivity is a major risk for CVD (58). A range of key reports and review articles support this finding (5, 14, 17, 90).

Physical inactivity has been linked to an increased risk of conditions such as non-insulin dependant diabetes (5, 14, 90), hypertension (5, 14, 90), stroke(5), osteoporosis (5, 91), colon cancer (5, 9, 42, 90) and depression (5, 8).

PA has purported benefits or preventative effects for, arthritis (6) and weight control (14, 66, 71). Furthermore, PA has a beneficial effect on anxiety, self-esteem and other aspects of psychological well being (6, 8, 71). Engagement in PA brings intrinsic satisfaction, which contributes to social enjoyment and participation and to the achievement of health. "Good health is a major resource for social, economic and personal development and an important dimension of quality of life" (95). Thus, the health benefits for those who engage in regular PA are many (6).

2.1.1. Physical Activity and Children's Health

The evidence for risk indicators in childhood and the prevention of CVD in later life is conflicting. A review article by Baranowski, examines the literature on PA and physical fitness in relation to CVD risk factors (blood pressure, serum total cholesterol & obesity) amongst children. The conclusion was that PA and fitness appeared to have a positive effect on the health of adults and children generally (4). However, two earlier reviews found that there was little evidence for a significant relationship between PA and risk indicators of CVD in children (55, 73). Montoye qualifies the findings by stating that there are many difficulties in the assessment of PA in children and recommends that methods for measuring habitual PA should be improved for children (55). Despite these findings, both reviews emphasise the importance of children being encouraged to remain active in later life (55, 73).

Obesity has also been linked to physical inactivity (92). Evidence shows that children who are obese tend to be less active than non-obese children are (18). However, the indicators used to categorise obesity in children vary greatly, which means it is difficult to establish a clear picture on absolute numbers of children who fall into the overweight range (56). Using the Australian Health and Fitness Survey (ACHPER) for classification - approximately 15.3% of girls and 15.1% of boys (sample age 9-15 years for both) were categorised as either overweight or at risk of being overweight. For nine year old children, 18.3% of girls and

15.6% of boys were rated as either overweight or at risk of being overweight. Overweight and obesity amongst children in Australia is therefore a concern (11).

2.1.2. 'Tracking' of Physical Activity Behaviour

In designing public health interventions, it is pertinent to know whether PA behaviour tracks from childhood to adulthood. Malina states that information on the tracking of PA habits is very limited and cites Saris 1986, as stating that there is only low inter-age correlation between PA and total energy expenditure from children aged 6-12 years (45). Telama found evidence of PA behaviour tracking from childhood to adulthood particularly if the child was involved in competitive sport and physical education (85). However Pate states that it is unclear whether PA tracks from childhood (61). Other studies have found evidence for the tracking of PA behaviours but not from childhood through to adulthood, rather from early to middle childhood (61, 94), early childhood to adolescence (39), during adolescence, and from adolescence into adulthood (45).

Additional studies have examined the question of tracking in relation to other indicators for the development of lifestyle diseases, in particular physiological risk factors. They found, on the whole, that physiological risk factors do track from childhood to adulthood. In particular, they note physiological risk factors such as atherosclerotic lesions, high blood lipids, obesity and hypertension (55, 63). Cholesterol levels have also been demonstrated to track through from childhood to adulthood (7, 41, 55). An exception was a review by Bauman who found that, like PA behaviour, physiological risk factors such as obesity, blood pressure and lipoprotein profile, track better from adolescence to early adulthood than from childhood to early adulthood (6). Marshall et al used health related components to assess tracking in children in the later years of primary school. Body Mass Index (BMI), skin fold thickness, and sit and reach flexibility tests were all indicators that showed some evidence of tracking (46).

Despite the uncertainty of whether PA behaviour tracks from childhood to adulthood, there is evidence that some physiological risk factors for CVD track from childhood to adulthood and that there is some tracking of PA behaviour. Therefore interventions that aim to promote PA amongst children that tend to be inactive are warranted (61).

2.2. Recommendations for Physical Activity Requirements

The NIH Consensus Development Panel on PA and CVD Health (1996) recommended that 30 minutes per day of PA be accumulated for both children and adults (58). Moderate levels of PA (a brisk walk of 30-60 minutes per day) are considered to provide a lowered risk of early mortality (9). The International Consensus Conference on PA Guidelines recommended that adolescents should be active every day as part of their daily life and in addition engage in another three sessions per week of moderate to vigorous activity (MVPA) lasting 20 minutes or more (71). The daily PA requirement was not quantified, as the data did not support such a

specific recommendation. The article goes on to specify the objective from 'Healthy People 2000' of 30 minutes a day PA, as a minimum PA recommendation for adolescents in the absence of more data (71).

2.3. Children's Physical Activity Levels

2.3.1. Generally

In light of the above recommendations, the evidence suggests that the PA levels of children are inadequate. Cale reviewed the evidence surrounding PA and children from a range of countries (England, Canada, Scandinavia, America, Holland, Japan, and Australia) and confirms that generally primary school children were not very active (16). The levels of PA that were reported were generally below that recommended to promote cardiovascular health. Even though three of the twenty studies reported children to be active, these were the exception. An English study (1991) that was not included in Cale's review, that investigated habitual PA in ten year old children using heart rate monitoring, also confirmed that the level of PA did not reach the level deemed to be appropriate for cardio-pulmonary fitness (2). In addition, Sallis reviewed a number of studies in order to assess the epidemiology of PA and fitness in children and found that regardless of the measure used to assess PA, the PA levels of children decline each year from 6 to 17 years. This trend was even more marked in studies that used objective measures to assess PA (67).

Gender Differences

The PA levels of boys are generally higher than that of girls in 'free play' type settings. This finding is confirmed by Sallis, who found that males between the ages of 6 and 17 years were 15% to 25% more active than females (67). Armstrong examined heart rate and PA levels in English school children 11 to 16 years old, throughout a period of three days and showed that boys had higher heart rates for a significantly higher proportion of the time than the girls both during the weekdays and on Saturday (1).

2.3.2. Fundamental Movement Skills Mastery

It has long been argued that common physical activities require competence in various basic motor skills (15, 19, 20, 29, 35, 36, 88). This has led to a systematic approach to understanding child physical activity (PA) based on the concept of Fundamental Movement (or Motor) Skills (FMS) (13, 60, 62, 86, 96).

It now appears that improved performance of FMS among children is positively correlated with participation in organised sport (60, 62). Failure to master a basic set of these skills may therefore prove to be a major barrier to participation in physical activities generally and to achieving PA levels recommended for maintenance of good health.

New education policies and training manuals increasingly reflect this viewpoint (23, 24). These documents, which are part of broader integrated initiatives targeting levels of PA among school children, have FMS as a key component. In NSW, The Department of Education and Training has now made FMS a priority area and has developed a teaching resource to this end (22).

The efficacy of such initiatives is unclear. Although there is good descriptive data concerning child FMS performance and the amount of training that may be required to bring FMS proficiency of children up to an acceptable standard, there has been no well evaluated measure used in Australia to chart change in mastery associated with a major school-based intervention (11, 13).

Gender and Age

Gender differences in mastery of FMS have been widely reported (62, 68, 87, 93, 98). Skills such as throwing kicking and striking appear to be better mastered by boys. Girls appear to perform best in skills involving fine eye-motor coordination, balance, flexibility and rhythm (11, 23, 87, 98). The reasons are still unclear but may stem from differences in activities, games and sports which boys and girls choose, or are encouraged to participate in. However reported differences in FMS mastery to date may have little bearing upon overall PA levels later in life but simply reflect a gender bias in the range of skills tested (11, 23, 98). Nevertheless by developing supportive gender-specific social environments for learning it may be possible to substantially diminish observed differences in performance of boys and girls (34)

Most studies indicate that the skill learning years are prior to adolescence (19). During these early years children are expected to improve their mastery of such skills with experience, practice and general development (47, 89). For example in a study by Booth et al, the development of FMS mastery from year 4 to year 10 among boys was as follows. Mastery plus near mastery for the run increased from 58% to 77%, for the vertical jump from 53% to 67%, for the catch from 39% to 70%, for the throw from 36% to 66% and for the kick from 22% to 56%. Among girls, levels for the run increased from 55% to 60%, for the vertical jump from 43% to 65%, for the catch from 25% to 56%, for the throw from 12% to 33% and for the kick from 3% to 7% (13). Interestingly, after age 12 the performance of boys on commonly measured FMS's rises dramatically while for girls it appears to drops off (19). This has been attributed to an array of causes. It may partially reflect a lack of motivation to perform rather than an actual decline in ability or it may reflect our society's gender bias in physical expectations and training (19).

2.3.3. Physical Education Classes

PA levels have been quantified in many studies as the proportion of time that subjects engage in moderate to vigorous physical activity (MVPA) or vigorous physical activity (VPA), (VPA in this instance is a *subset* of MVPA). MVPA has been used as a measure to assess the quality and efficiency of PE classes regardless of the activity, skill or movement objectives for the lesson (77). The American Child and Adolescent Trial for Cardiovascular Health, (CATCH), found that 37% of the average 30 minute PE lesson was spent in MVPA,

and of those 25% in VPA (43, 48). McKenzie concluded that PE classes occur infrequently and that children were relatively inactive in them (48).

Simons-Morton sampled 20 elementary schools and used an observational method to assess PA (77). An additional few schools were sampled to provide a comparison group. The comparison group of schools had all been assessed by the school as having teachers that were perceived as being "excellent PE teachers who emphasised health related PE and encouraged the children to participate in PA during substantial proportions of PE class time" (3). MVPA amongst the random group amounted to being less than 10% of the lesson time, which meant only 3 minutes of a PE lesson was spent in MVPA. Even though the comparison schools rated higher levels of MVPA than the random schools, the results were not significant. Administration and instruction time amounted to nearly one third of the lesson time (77). In an earlier study by Simons-Morton, also using an observational instrument and involving a random sample of 20 schools, the students spent 8.5% of class time involved in MVPA, 23.3% in minimal activity, and 68.1% in sedentary activity (76).

The SPARK program had a sample of fourth and fifth year children from seven elementary schools and found, using the observational method SOFIT, that MVPA in PE accounted for 17.8% in control classes (70). Sleap et al (1992) also used an observational method to assess PA levels and sampled a number of English elementary schools finding that only 32.4% of a PE lesson was spent in MVPA (78).

The above studies, despite using different instruments to assess PA, all assessed the level of MVPA in PE lessons to be between one tenth and one third of lesson time. The US Department of Health and Human Services (1994), (77), found similar results with students of all ages estimated to be physically active 27% of the class time.

There is no Australian data on MVPA in PE lessons based on behavioural observation. The little evidence which exists comes from a self-report study and suggests that the time children spend in actual vigorous activity during PE classes is low (11, 75).

These figures are far below the US National objective that children should be active at least 50% of PE lesson time (17). Whilst the US goal is considered ambitious, it is also considered to be a feasible target (17). Therefore, these figures indicate that there is considerable room for increasing MVPA in PE lessons.

Gender

In structured environments such as PE lessons, girls' activity is similar to boys. Structured PE is therefore very important for girls' PA levels (48).

Teacher gender may also have an effect on child PA in PE lessons, however the only study addressing this examined teacher time spent on varying lesson contexts within a PE lesson. The researchers found no significant differences between lessons taught by male and female teachers on any lesson contexts (48). Most other major studies on levels of PA amongst primary school children in PE lessons did not record information on teacher gender (43, 51, 52, 77, 84).

2.3.4. Playground

Importance as an Opportunity

Break times in school offer the biggest opportunities for engagement in MVPA during school, as they typically constitute more than a one sixth of the school day. In terms of preparing children for life long engagement in PA, the school playground provides an environment more similar to adult recreational environments than PE classes.

Studies of Children's Physical Activity in School Playgrounds

Little research has been conducted on children's PA levels in whole school playgrounds using direct observation (38, 49, 72). A study of four and five year old children found that they spent 60% of school break time in sedentary activities (72). An earlier study found that children aged 8-11 spent 60% of their school break time in PA (38). Both findings were limited - in the first study children were observed for a 5 minute period only, whilst in the earlier study the sample size was small (33 children). Another study of pre and elementary school children (ages 4 and 6) during recess found that 41.1% and 47.5 % of the children's time was spent in MVPA (51). This study, however, did not record PA levels throughout the playground. Rather, individual children were observed in different visits to the school for 6 months yielding data for 287 children. A large recent American study in junior high schools found that 51.7% of girls and 67.7% of boys were engaged in MVPA during lunch breaks (49). However, only 19.5% of students in participating schools were observed.

Gender

Generally, boys are reported to be more physically active than girls are (11, 16, 67). Other studies confirm that during free play in the playground, boys are significantly more active than girls in terms of MVPA (49), and PA generally (74). Sarkin used accelerometers to assess PA and found that the activity of girls in PE classes was 94.6% that of boys', whereas at recess it was only 74.2% (26). This difference is reduced when moderate activity alone is compared, which indicates that boys participate in more vigorous activity than girls do (63). Looking at PE lessons, McKenzie (1995) found that the VPA levels of boys were significantly higher than the VPA levels of girls and explained the higher PA level of boys as being due to boys being more active than girls during free play opportunities within PE lessons.

2.4. Schools as an Opportune Setting for Intervention

2.4.1. Importance of Physical Education in School

PA can be promoted amongst children in a variety of settings such as transport to and from school by bike or walking, weekend activities eg sporting clubs, other clubs involving children eg brownies/cubs and through interventions targeting parents, community leaders, or local council (82). However, school is an environment that contains most children for most of a day, for a number of years of the child's life and thus can be seen as

an opportune setting for promoting PA. Other aspects of primary schools such as trained staff, and organisational structures, policies and environments that can support healthy behaviours, mean that schools can be considered an 'ideal' setting for promoting PA (44, 64, 69). As many children do not have access to sport and Fundamental Movement Skill (FMS) lessons outside school, school PE education also has a responsibility to promote PE activity in youth (69, 83). In addition, Stone in a review article cites a number of reports and conferences held during the 1990's that recommend establishing infrastructure in schools that will enable PA to be promoted amongst children and adolescents (83). Pate also recommends that health professionals in conjunction with schools and other community organisations become involved in the promotion of PA (61).

Health professionals have been involved with schools in an Australian context using the Health Promoting Schools framework. A health promoting school in relation to PA, recognises the importance of PE and sport in the school context, the influence that policies and practises can have on limiting or encouraging children to be physically active, and the role that parents and other community members can play in promoting PA. This framework has been operating in many schools, with varied degrees of success. Many resources have been produced along with useful case studies as a result of this framework (21).

2.4.2. Benefits of Physical Activity to Academic Learning

In addition to the benefits of PA in schools for health reasons, there is a strong correlation between PA and positive academic outcomes. Wolford-Symons conducted a review on student health behaviour that included PA and the relationship with academic achievement and found that there is much evidence to support the notion that there is a relationship between improved academic outcomes and exercise. Wolford-Symons cited by (97). Kolbe 1986 concluded that school based PA programs increased concentration, improved mathematics and reading and writing scores (97). Daily PE classes were identified as being one way to improve academic outcomes and promote normal growth and development (97). Furthermore, an Australian study aiming to increase endurance fitness, found that, despite the loss of 45-60 minutes of formal teaching time each day, there was no evidence of loss of academic performance as measured by arithmetic and reading tests (27).

2.4.3. Time Allocated to Physical Education

With so much benefit to be obtained for children from PA and the opportune environment of the school setting to provide it, it remains to assess how much time at school should be spent on PA. The New South Wales Board of Studies have incorporated the broad recommendations of 1993 International Consensus Conference on Physical Activity Guidelines for Adolescents as part of the Personal Development Health and Physical Education Syllabus 1999 (10). A discussion paper addressing PA in the school curriculum, recommended a minimum of 120 minutes per week of PA within the K-6 PDHPE Syllabus (59). The NSW School Fitness and Physical Activity Survey 1997 went further by recommending specifically that 120 minutes per week be made

available for PE and sport with at least half of this time spent on FMS development (11). This recommendation was in response to the survey findings that nearly all of Australian primary schools surveyed, provided less than 60 minutes of PE per week (Yr 2 - 76% of schools, Yr 4 - 84%, Yr 6 - 94%). In terms of sport, most schools provided an hour or less per week to sport (Yr 2 – 92%, Yr 4 – 69%, Yr 6- 61%) (11). The younger years spend more time in PE and less time in sport presumably building skill levels ready for sport participation in later years. This information corresponds to another question in the survey that asked how much time was spent in PE and sport combined during the primary school week. Only a small percentage of schools responded with greater than 120 minutes per week (Yr 2 - 8%, Yr 4 – 23%, Yr 6 -37%).

2.5. Potential for Increasing Physical Activity

2.5.1. Fundamental Movement Skills Mastery

There is clear evidence that FMS mastery can be improved though individual experience and enrichment programs (36, 81). This implies that the wide range in FMS mastery levels observed within any child age/gender cohort within a school might be translated into considerable gains if interventions were to be targeted at the school level. However, well evaluated attempts to improve FMS mastery through school-based interventions are rare. Indeed only one such study could be found which involved randomisation of schools to specialist PE and control conditions (47). This study showed that children exposed to a 6 month PE curriculum taught by specially trained teachers achieved a moderate increase in aggregate outcome-based performance scores (for throw + catch + kick) of 6% to 8% higher than controls.

2.5.2. Physical Education Classes

The most successful intervention to date in terms of reported increase in PA levels during PE lessons was CATCH. CATCH had a sample size of 96 elementary schools, which makes it the largest school based field trial that has ever been implemented in the world. The CATCH study is one of the few studies in the area of PE to use random assignment of schools to treatment conditions and was also the first randomised trial over diverse geographical and cultural regions (50).

CATCH was an experiential program designed to modify and improve existing PE classes through teacher training and support and particularly aimed at increasing the levels of MVPA to 40% of the PE lesson (50, 54). CATCH recruited 3rd year students in 96 primary schools and followed the children until 5th year. Intervention schools showed a significant increase in MVPA, whereas control schools did not (50)

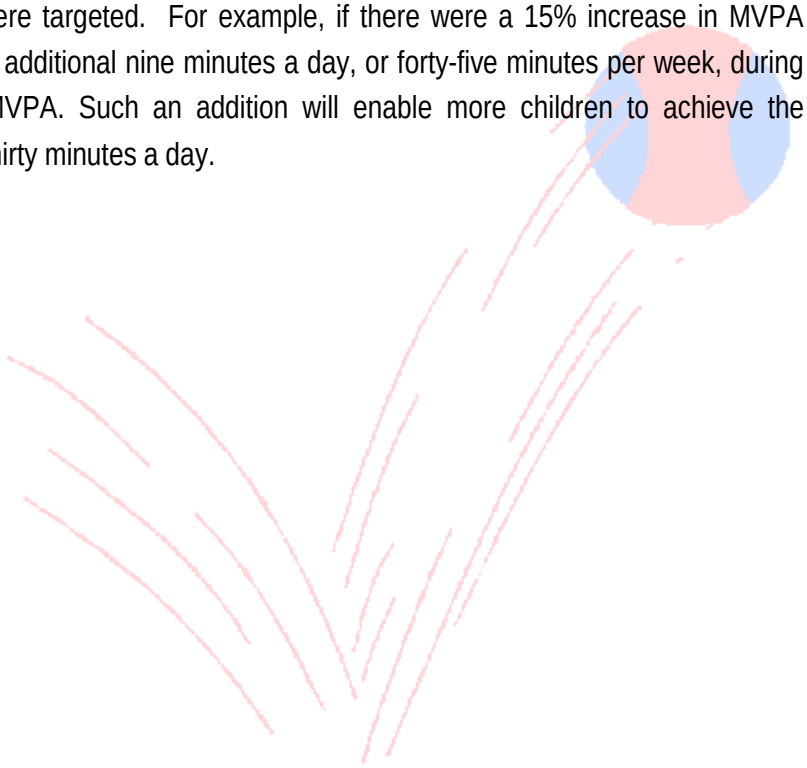
The SPARK project also demonstrated that PA could be increased during PE lessons. The study had two intervention groups and one control group. Classroom teachers led one intervention group and trained PE specialists led the other. The study aimed to improve PA both in PE class and out of school. The classes were

designed to promote high levels of PA and teach movement skills. A typical lesson lasted 30 minutes and the recommendation was for a class to be conducted three times a week. There were two parts to each lesson: health-fitness activities (15 minutes) and skill-fitness activities (15 minutes). The SOFIT system was used to observe classes during a two-week period (70).

SPARK found that the control group had PE significantly less often than intervention groups (1.8 lessons per week, versus 2.6 and 2.9 lessons respectively) and for significantly less time than both the intervention groups (38.0 minutes per lesson, versus 64.6, 79.7 minutes respectively). Specialist led students participated in twice as much MVPA each week than control students. Classroom teacher led students fell somewhere in between in terms of the range of MVPA achieved (70). Therefore, the classroom teacher can, with support and training, improve their teaching of PE (70). In the Nebraska School study the intervention school showed a significantly greater average in the SOFIT score, which represented an increase of 6% in PA compared with controls (25).

2.5.3. Playground

The limited evidence regarding PA levels of whole school playgrounds points to MVPA engagement levels between 40-60%. The same studies also report a higher level of engagement for boys. This evidence suggests that there is a potential for substantial increase of MVPA engagement levels especially if girls and possibly other less active sub-groups were targeted. For example, if there were a 15% increase in MVPA engagement, this would translate into an additional nine minutes a day, or forty-five minutes per week, during which children would be engaged in MVPA. Such an addition will enable more children to achieve the minimum daily PA recommendations of thirty minutes a day.



3. GOAL & OBJECTIVES

3.1. Goal

To develop a model aimed at enhancing knowledge, understanding and practices in order to increase PA levels in primary school children that may be applied in other schools.

3.2. Objectives

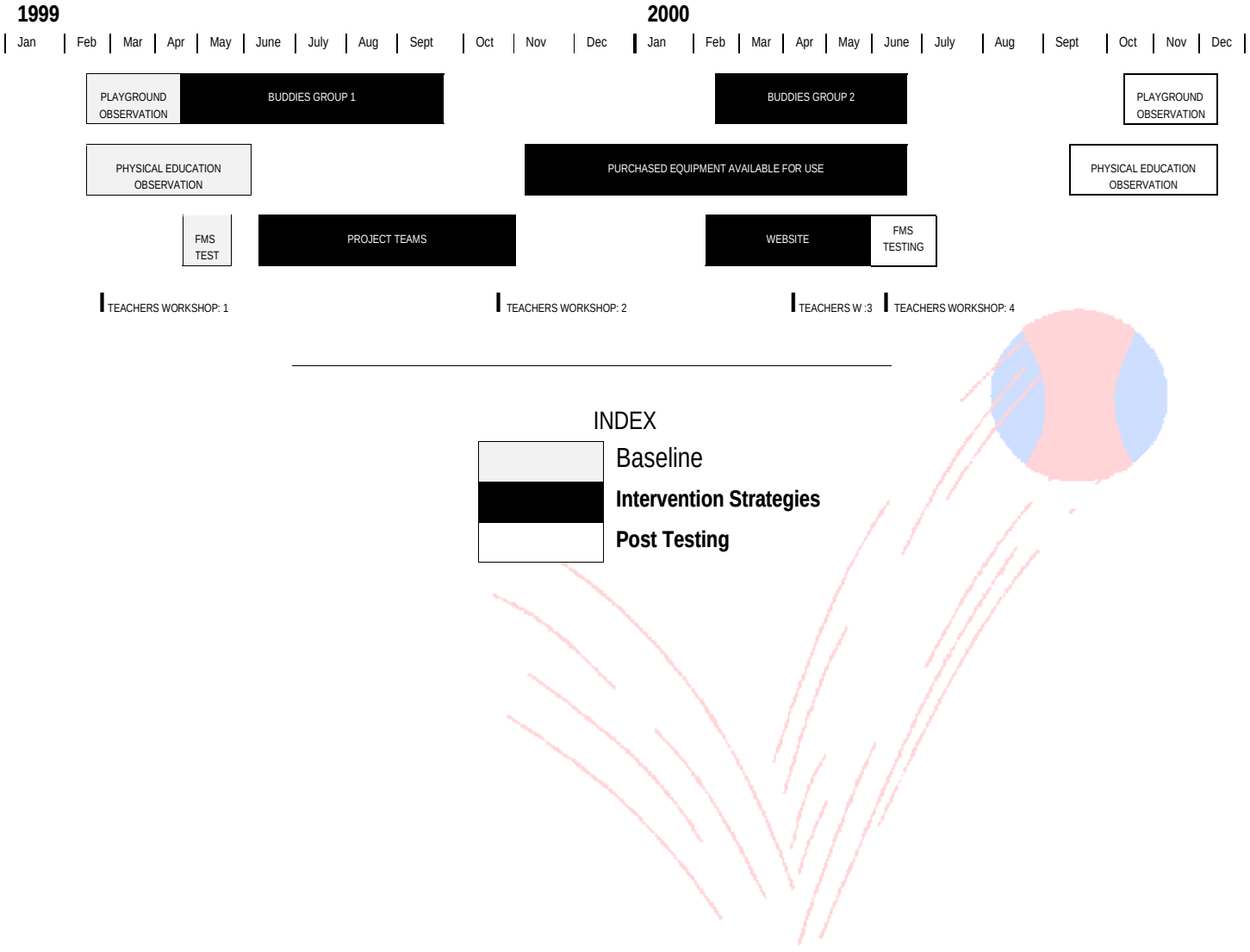
1. To develop and validate an instrument to assess children's PA levels in the playground.
2. To establish a baseline of children's overall MVPA levels in the school playground.
3. To increase children's PA levels in the school playground during lunch by 10%.
4. To increase children's PA levels in the school playground during recess by 10%.
5. To increase the participation rate of girls in school playground activities by 10%.
6. To increase by 10% the number of school students who achieve mastery or near mastery of motor skills.
7. To establish a baseline of, children's PA levels in PE lessons.
8. To increase children's PA level by 10% in PDHPE classes.
9. To identify factors that will encourage the sustainable uptake of the intervention

4. STRATEGIES & TIMEFRAME

4.1. Time-line

The MIGI project began in Feb 1999. Baseline surveys were conducted Feb to May 1999 and the intervention was concluded June 2000. Final evaluation was completed in December 2000. Refer to Figure 1.

Figure1: Timeline



4.2. Overall Plan

The five strategies undertaken to increase PA levels in intervention schools fell under two main headings: i) supporting teachers and ii) creating supportive environments & healthy school policies. The strategies in particular were teachers' professional development workshops, buddy program, web-site, funding for the purchase of equipment and school project teams.

Ethical clearance for the project was obtained from NRAHS and DET. The first step in initiating the project in schools was to visit selected intervention schools with a package that introduced the MIGI concept. Various aspects of MIGI were discussed with Principals and key teachers who would be involved. Principals subsequently informed parents by sending out the information sheet for parents/carers. This sheet had a default clause enabling parents to register any dissatisfaction they may have felt with the project. Appendix 1 includes an outline of what was in the package, answers to common questions about the project and the information sheet for parents/carers.

4.3. Teachers Professional Development

Four teachers' workshops were conducted as part of MIGI.

4.3.1. Workshop 1

Date	March 1999
Attendance	The workshop was attended by at least one teacher from each intervention school, most schools had more than one teacher.
Purpose	• An introduction to the project's goals, objectives and strategies and what it means at the school level (presented by MIGI PO). • An introduction to and explanation of the 'buddy system' (Head of School of Education, SCU). • Introduction to school based project teams. • The new PDHPE syllabus (PDHPE consultants, DET). • The expected FMS package (PDHPE consultants, DET).

4.3.2. Workshop 2

Date	November 1999
Attendance	20 teachers from 8 out of 9 intervention schools participated.
Purpose	• Revisit of MIGI goals, objectives and strategies with an emphasis on sustainability at the school level: (presented by MIGI Project Officer). • School presentation on what had happened thus far (presented by a teacher from each school). This section provided for constructive criticism and evaluation of MIGI in general and the buddy system in particular, a short time after the first buddy group had finished their session in schools. • Writing a school MIGI implementation plan with emphasis on whole school approaches and cultural change (facilitated by Training & Development Coordinator, Lismore District DET). • Practical FMS session (Lecturer School of Education, SCU).

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4.3.3. Workshop 3

Date	April 2000 in three venues (Grafton, Murwillumbah and Lismore).
Attendance	The three workshops were attended by a total of 20 teachers and 12 buddies. All schools were represented.
Purpose	• The main objective of the workshop was to demystify dance and dance teaching and provide simple dance activities that could be incorporated in a PE class. The topic was chosen based on the evaluation of Workshop 2 in which teachers requested dance as one of the areas they would most prefer for professional development. The Director of Dance at the Northern Rivers Performing Arts (NORPA) facilitated the dance teaching workshops.

4.3.4. Workshop 4

Date	June 2000 at three venues as per Workshop 3.
Attendance	All but one school were represented with the three workshops attended by 18 teachers and 9 buddies.
Purpose	• To familiarise teachers with teaching FMS. Workshop 4 was also chosen based on the evaluation of Workshop 2. The workshops were led by the School of Education Lecturer, SCU who was the Coordinator of the buddy program in 2000. • To increase teachers understanding of how to sustain MIGI strategies in schools. Teachers from the same school were asked to attempt to write a sustainability plan for their school.

4.4. Buddies Program

The buddy system was seen as a significant strategy to improve PE teaching in terms of increasing PA levels and FMS mastery. It was also hoped that the buddies would influence a whole school approach to increasing PA by incorporating PA into school planning and through environmental and policy strategies.

There were two Buddy intakes, the first group commenced June1999 and finished in December 1999 and the second group commenced in February 2000 and finished in June 2000.

4.4.1. Participants

An expression of interest to be involved in the project was sent to Bachelor of Education students in November 1998. Third year pre-service teachers were selected as they already had some practical teaching experience in schools. The exception was in the second year of MIGI, when two 2nd year students were each paired with a 3rd year student. The PO and Senior Lecturer (School of Education - SCU) presented the goals and objectives of the buddy system and students were asked to nominate for the program. Buddies were then allocated to MIGI intervention schools.

4.4.2. Expectations

The program was incorporated under a Health and Fitness elective at SCU and as such had certain Unit requirements as well as requirements from MIGI project staff. These included attendance at schools, attendance at weekly tutorials, participation in school project teams, the provision of resources to teachers, a presentation on 'their' school at the end of the unit and submission of assessments. An outline of the expectations of the buddies is shown in Appendix 2.

The buddies' role was to distribute resources to teachers and help teachers access resources, particularly the web-site. Resources in the area of PDHPE (lesson plans, support documents for dance and gymnastics, games books, safety in sport and exercise books) were therefore made available on a borrowing basis to all buddies. Buddies were also expected to attend weekly tutorials held at the University (See Section 4.4.4 Tutorials) and participate on school project teams. Participation on school project teams involved attending any meetings that were held and providing any necessary resources. (See Section 4.7 Project Teams). Buddies used a checklist to monitor progress. (See Appendix 3).

The buddies were asked to contact schools and arrange for the commencement of their service. Buddies were to clarify that their role differed from that of a normal field practice student and negotiate that their role would be to impart information to teachers as well as working with children. A contract was developed between each

buddy and the school. It took between two to four weeks for the buddies to commence. Buddies aimed to work one to one, for a day a week for a University semester (two school terms), with 'their' teacher.

As part of their assessment, buddies in the second year were required to keep a journal that was read regularly by the lecturer. They were also required to submit at least one activity or lesson plan to the web site. An oral presentation at Teachers' Workshop 2 on the 'buddy' process was also part of the assessment. (See Section 4.22: Workshop 2). Some buddies prepared folders summing up their input. One pair of buddies prepared a video that can be used by the school.

4.4.3. Training

The first 12 buddies participated in a one-week training in early February 1999. MIGI PO's, the Senior Lecturer (School of Education - SCU) and the PDHPE consultants (DET) prepared the training program. Buddies were familiarised with DET resources so that teaching strategies being modelled were aligned with DET priorities. Mandatory information such as child protection, some general PE teaching strategies, lesson planning using the new PDHPE syllabus and the new FMS package was also covered. The first group commenced their session during school Term 1 1999 and finished at the end of Term 2 1999.

The second buddy training was held during February 2000 and completed by 12 pre-service teachers. The buddies commenced in Term 1 2000 and finished at the end of Term 2 2000. A pair of buddies (a third year student with a second year student) worked with two small schools.

4.4.4. Tutorials

Tutorials were scheduled every week to update the buddies on material that could not be covered in the training and to discuss issues that arose throughout the school terms. The tutorials were facilitated by MIGI PO's, SCU staff and the DET PDHPE consultant. The first few two-hour tutorials were dedicated to completing the training as well as discussion and information on how to negotiate the contract with schools. The topics covered included: planning (scope and sequence), FMS teaching, dance teaching, reflective teaching practise, participating on school project teams, warm up and cool down activities, strategies to increase PA in the school, and child protection training.

In the second year, the SCU lecturer primarily facilitated tutorials, though the MIGI Project Officer did attend regularly. Tutorials included practical skill sections in the gym where buddies used their peer group as a simulated class and then discussed teaching strategies. Paper and other waste was used to create play equipment and buddies took the 'recycled play kit' to their schools as an example of an affordable integrated curriculum activity that can assist creating a supportive environment for increased PA engagement.

4.5. Web-Site

A MIGI web-site was produced which provided resources on PA and FMS, linking them in a contextual, comprehensive and teacher friendly way. Buddies promoted the web site to teachers at intervention schools. It was password protected so that only intervention schools had access.

The MIGI web contains resources for teachers such as lesson ideas and activities, FMS – how to test and how to teach; planning, assessment and evaluation; and links to other useful sites. It included information on ideas regarding policies, environmental changes and community involvement re PA in schools. The buddies contributed to the content of the site although most of the content came from relevant resource material. The site provided on-going feedback and information from the different research undertaken throughout the project. The MIGI web address is www.scu.edu.au/schools/edu/projects/migi

The MIGI web-site became operational two weeks after the 2000 buddies had commenced; therefore this strategy was only available for half of the intervention duration.

4.6. Equipment Purchase

Schools were offered $375.00 to purchase equipment to assist them in maximising PA. Schools had to itemise requested equipment and explain how the purchase of such equipment would contribute to the achievement of one or more of MIGI goals.

4.7. School Project Teams

4.7.1. Process and Participants

On recruitment to MIGI, schools established a PA Project Team to coordinate the project locally and to provide a 'whole school approach' to PA. MIGI project staff recommended to the school that the Project team include the School Principal, relevant teachers, parents, the school's pre-service teacher (the 'buddy'), a Health worker and any interested upper primary school students.

The expectation was that a Health worker (HW) elected for each school's Project team would ring the school after the initial Teachers Workshop (1) to make a time for the first meeting. The Project Team meeting was to be held at some point after the Teachers Workshop but before school Term 2 began.

Each HW was assigned an intervention school. All but one attended a workshop held to explain their prospective role on project teams. The Health workers consisted mainly of community school nurses (6), though there was also a Health Promotion Officer, Occupational Therapist and Physiotherapist. One intervention school had a MIGI Project Officer on its team.

Schools were notified of the HW who was assigned to their school and it was expected that schools arrange a meeting early second term 1999.

4.7.2. Aim

The individual teams aimed to select and customise policy and environmental strategies for their school by looking at the following range of strategies:

- scheduling and restructuring of PE lessons
- appropriateness of school clothing
- staff development needs and issues
- playground utilisation and layout (ie prompting, space allocation for specific groups such as girls or age cohorts)
- playground environment issues
- availability of non-competitive equipment, play space and equipment allocation, and staff monitoring
- other environmental features to support PA (eg bike paths and racks)

5. METHODOLOGY

Choice of Intervention & Study Design - General.

The intervention design of MIGI followed the Ottawa Charter for Health Promotion (95), complied with both National and State best practice guidelines on promoting health in schools (57) and built on the design employed by the CATCH program (50). These documents recommend multi-strategic, long term, whole school/integrated and inter-sectoral approaches as the best practice for health initiatives in schools.

The evaluation utilised a quasi-experimental study design involving baseline and follow-up surveys of control and intervention schools in each of the three components: FMS, PE classes and Playground. Midway testing was planned to establish trends (late in 1999) in addition to the pre and post-test.

School Sample Selection & Sample Distribution

A selection committee consisting of representatives from HPU, DET and SCU convened to select the sample of schools.

The selection process was as follows:

- Schools were invited to indicate expression of interest in the project. The request for expression of interest outlined the opportunities and benefits for participating schools as well as their obligations as participants and the possibility that their school would be selected as a control school.
- Schools posted in their expression of interest.
- Schools were then randomly selected and stratified by DET district and rurality/size of school.
- Schools were randomly divided into intervention and control groups.

Observers and Testers

'Observers' were employed to observe PE lessons and the playground, and 'testers' were employed to test children for FMS mastery levels. The first observers/testers were recruited from students in the Schools of Education and Exercise Science/Sport Management at SCU.

It would have been ideal in terms of the reliability of the study instruments to retain the same group of observer/testers for both pre and post testing, however this was not an option. Many of the original University students had moved on or were no longer interested in being observers for MIGI. Two observers were retained for the post testing but the remainder had to be re-recruited. It was decided not to recruit students for the post-testing as the first group of observers/testers had to fit observations in around their University timetables and this made planning and timetabling very challenging. The casual pool from the HPU was chosen instead to be the recruitment base for the follow-up, primarily because the individuals were more available for observations and known to be reliable.

5.1. Process Evaluation

Process evaluation of MIGI strategies and changes in teaching practice was undertaken in a number of ways.

5.1.1. Teachers Professional Development Workshops

An evaluation of Teacher Workshop 3 (See 4.23) was carried out at Teacher Workshop 4 (See 4.24). Questionnaire 1 was given to each of the teachers who attended the previous teachers' workshop. In Teachers' Workshop 4 evaluation was held directly after the workshop so it was only possible to assess intention to use the new skills. (See Appendix 4 for Questionnaire 1).

5.1.2. Buddies

One of the major sources of data for the investigation of the Buddies program was the elicitation from the Buddies of two sets of repertory grids which revealed the personal constructs that guided their behaviour through the MIGI experience, (see Buddies and Teachers' Perception (31) for a full report). Briefly, the repertory grid methodology enabled MIGI to trace the changing self-perception of a sample of buddies against perceived effective and ineffective teachers of physical education.

The evaluation of the buddies involvement in the MIGI intervention program was conducted at the end of the intervention period with an informal interview. The three questions asked of each participant were:

1. What did MIGI do for you as a pre-service teacher of physical education?
2. Did the MIGI program address the goals as determined ?
3. What role did you see the buddy playing in the MIGI program?

5.1.3. General

An evaluation of all of the MIGI strategies (except project teams) was also carried out at Teachers Workshop 4 (See 4.24). Questionnaire 2 was distributed to teachers at the workshop to be filled in jointly by the Principal and all the teachers who had been involved with MIGI in each school. (See Appendix 5 for Questionnaire 2). Some strategies that were asked about in Questionnaire 2 were not designated MIGI strategies but rather contributed to broader MIGI strategies. These were the distribution of baseline testing results to schools, and the distribution of the FMS package by DET.

5.1.4. School Project Teams

The school project teams were a strategy that was mainly concerned with whole school changes. Therefore it was evaluated by asking the schools what they had changed due to MIGI (section of Questionnaire 2) and also by conducting an audit of school management plans prior to the project (1998) and at midterm (2000).

For the audit, all references to the major strategy headings, with the exception of any policy that related to sport was recorded. Sport was not included, as the MIGI intervention focused on changing how the school addressed PA and FMS outside of the context of school sport.

Indicators were developed based on Ottawa Charter principals to help provide a clearer picture of measures that may indicate 'success' and (excluding 're-orientating health services') in order to assess the breadth of strategies chosen by school.(95) Two indicators were added that simply gave a broad indication of the impact of MIGI.

The added indicators were a mention of PE/ physical activity and/or a mention of gross motor skills/FMS. If a school simply mentioned 'skill' without specifying further, this was not included in the tally. This is because 'skill' could apply to a range of skills used in PE that are not categorised as being gross motor or fundamental movement ie 'skill playing a game' or 'skill in understanding rules'.

The first Ottawa Charter principal is 'building healthy public policy', defined as using policy to engineer change in all aspects of the environment (social, built and physical).(95) In this sense, school management plans containing any policy concerning physical activity could be seen as fulfilling the criteria of 'building healthy public policy'. In order to be able to differentiate between policy strategies more clearly 'healthy public policy' was redefined as intent to change the *social structure* of physical activity within the school, and not the built or physical aspects of the environment. Scheduling intent and time-tabling was seen as social and structural in that it is about 'how often' or 'how long' and included examples such as: 'running a daily fitness activity', and 'ensuring all children obtain a minimum of x minutes per week in PE. Structural change that related to curriculum content on a teacher/lesson level was excluded unless it concerned syllabus change at a whole school policy level.

'Creating supportive environments' as defined in the Ottawa Charter is recognising that the environment is as crucial to health and well being as actions that people take to change their own behaviour.(95) The definition of environment used in MIGI is restricted to any strategy documented in plans that concentrated on improving the *physical* or *built* environment in a way that would encourage physical activity. Using a broader definition of environment would hinder efforts to distinguish between strategies.

'Strengthening communities' as an Ottawa Charter principal, involves encouraging communities to protect and promote their own health with the aim being that such communities would have the power to define their own health issues and solutions.(95) Any change in school plans that contributes to the school taking control over its own health issues could thus be defined as 'strengthening communities'. For the purposes of MIGI, any

documented item in the plan that encouraged or facilitated the involvement of the local school community (parents, local residents) was considered to fall under this category.

'Developing personal skills' is based on the recognition that people need information and skills to encourage them to make positive health changes.(95) In MIGI, a distinction was made in this category between strategies that focused on curriculum development and strategies that focused on staff development. Strategies that focus on curriculum development impact more directly on children's personal skills than strategies that focus on staff development which impact on teachers' personal skills and may or may not transfer into the curriculum.

If a school had one or more strategies corresponding to each indicator a 'yes' was noted, otherwise 'no' was noted. Thus, the number of strategies within each indicator was not noted. If the strategy represented more than one indicator it was placed where it was considered to 'best fit'. The positive answers were then totalled to provide school tallies for each indicator at pre and midterm (Figure 5) and tallies of indicators included in plans at pre and midterm (Figure 6).

5.1.5. Changes in Teaching Practice

Questionnaire 1 also contributed to process evaluation by assessing changes in teaching practise due to MIGI and asking how well teachers' felt that the project's objectives were achieved.

5.2. Fundamental Movement Skills

5.2.1. Survey Instrument

Skill components were assessed using a written protocol in accordance with methods of the draft NSW Department of Education and Training resource on FMS (Department of Education and Training, 2000) (22). This was derived from protocols for the earlier NSW Schools Fitness and Physical Activity Survey protocols (11) and the Department of Education of Victoria A Fundamental Motor Skills: A Manual for Classroom Teachers (23).

Testing took place from March to May 1999. Eight core skills (Table 1) of a possible 11 FMS were assessed including: static balance, sprint run, vertical jump, kick, hop, catch, overhand throw and side gallop. These were selected because they are recognised as vital to development of higher skills (eg overarm throw for the overhead smash in tennis, for the volleyball or tennis serve, or for the baseball or javelin throw) and should ideally be mastered by the children in grades 3 and 4 (11, 23, 98). The specific grades in which each FMS

was tested (3 only , both 3 and 4, or 4 only) were based on general developmental patterns (28). Other skills were considered but determined outside the scope or budget of the 'Move it Groove it' project.

Groups of children were taken to each testing station in turn where a trained tester demonstrated an FMS, asked each child to perform it 5 times, and rated each component of that FMS as present or absent. This was done without the tester providing any verbal feedback. A component was deemed as present if the child performed it on at least 4 of the 5 trials (37).

Table 1: Description of Fundamental Movement Skills Tested

SKILL Year(s) tested	DESCRIPTION	COMPONENTS
Static Balance 3	Stand and balance on one leg	1. Support leg still, foot flat on ground. 2. Non support leg bent, not touching support leg. 3. Head stable eyes focussed forward. 4. Trunk stable and upright. 5. No excessive arm movements.
Sprint run 3	Run as fast as possible between two points 20 metres apart	1. Land on ball of foot. 2. Non-support foot bent at least 90^0 in recovery. 3. High knee lift thigh parallel to ground. 4. Head and trunk stable eyes forward. 5. Elbows bent at 90^0 6. Arms drive forward and back, opposite legs.
Vertical Jump 3 & 4	Jump up vertically as high as possible from knees-bent standing position	1. Eyes focussed forward or upward throughout . 2. Crouch with knees bent. Arms behind the body. 3. Forceful forward and upward swing of arms. 4. Legs straighten in air. 5. Land on balls of feet. Bend knees to absorb land 6. Controlled landing with >= 1 step any direction.
Kick 3 & 4	Run up to and kick a 20cm playground ball as far as possible with top of foot	1. Eyes focussed on the ball throughout. 2. Forward and sideways swing of opposite arm. 3. Non kicking foot placed beside ball. 4. Bend knee of kick leg 90^0 + during backswing 5. Contact ball with top of foot. 6. Kick leg follows through high towards target area.
Hop 3 & 4	Hop between two points 15 metres apart	1. Support leg bent landing then straight to push up 2. Push off and land on ball of foot. 3. Nonsupport leg bent and swings with other leg 4. Head stable and eyes focussed forward. 5. Arms bent and swing forward as support leg pushes off.
Catch 3 & 4	Catch a soft ball thrown underarm from 3-5 metres distance to 2 metres high	1. Eyes focussed on the object throughout 2. Feet move to place body in line with object. 3. Hands move to meet the object. 4. Hands and fingers relaxed and slightly cupped. 5. Catch/control object with hands only. Well timed closure. 6. Elbows bend to absorb force of object.
Overhand Throw 4	Throw a soft ball overarm as far as possible	1. Eyes focussed on target area throughout. 2. Stand side on to target. 3. Throwing arm in downward and backward arc. 4. Step towards target area with foot opposite throwing arm. 5. Hips then shoulders rotate forwards. 6.Thow arm follows through down & across body.
Side Gallop 4	Gallop sideways between two points 15 metres apart	1. Smooth rhythmical movement. 2. Brief period where both feet are on the ground. 3. Weight on the balls of the feet. 4. Hips and shoulders point to the front. 5. Head stable, eyes focussed forward or in direction of travel.

5.2.2. Study Sample

Sample Selection & Sample Distribution

Different study samples and sample sizes were used for the measurement of the three components of MIGI (FMS mastery, PA during PE lessons and PA in the playground). For FMS testing the sample of tested children in control and intervention schools consisted of all pupils in the years 3 and 4 at baseline and years 4 and 5 at follow-up. Thus, although the surveys were cross sectional, the children tested at follow-up were, with few exceptions, from the same cohort tested at baseline.

Sample Size Calculation

Sample size was calculated for a FMS mastery prevalence of 50%, (for the most conservative estimate), detection of a 10% difference between groups with one-tailed " of 5%, power of 80% and then applying a design effect inflation factor of 1.5 to account for the clustering effect of intra school student similarities (11). The required sample size was 458 per gender or per school year (3 or 4).

5.2.3. Testers, Training & Reliability

Specific training of 10 FMS testers was conducted using established protocols and an experienced tester from the NSW School Fitness and Physical Activity Survey (11) and the NSW Department of Education and Training State FMS Demonstration Project (13). Training included repetitive rating, by each prospective tester, of children performing each FMS on a video. A panel of experts had previously rated every component of each videoed FMS performance. A student was only conferred 'tester' status when they could reliably (>85% correct) score each component of each FMS in line with that of the expert panel. Inter rater reliability was subsequently determined during field observation periods in schools on sets of 48 scorings for every observer pair.

The mean kappa coefficient for paired observations of testers in the field was 0.61 representing fair to good agreement (30)

5.2.4. Data Analysis

Baseline Descriptive Analysis

Data were coded into an Epi Info database with field 'allowable entry' constraints and subsequently exported to SAS. A mastery level variable was derived for each attempted FMS from the component scores as follows: 'Mastery' if all components performed correctly, 'Near Mastery' if all but one performed correctly or 'Poor' if fewer performed correctly. Mastery and Near Mastery score frequencies were then cross-tabulated by FMS, gender and school year and 95% confidence limits calculated for resultant frequencies according to Fleiss (1981).

Follow-up Analysis for Intervention Effect

Changes in FMS performance from pre to post intervention were analysed separately for each FMS using multiple hierarchical logistic regression as described in other sections with the dependent variables 'Mastery or Not' and a separate set of analyses for 'Mastery/Near Mastery or Not'. A subsequent set of analyses explored gender and age differences in degree of intervention effect. In these analyses the dependent variable was Mastery/Near Mastery or Not' and predictors in each analysis included terms for gender or age group plus their second and third order interactions with control/intervention and pre/post.

5.3. Physical Education Lessons

5.3.1. Choice of Instrument

SOFIT (System for Observing Fitness Instruction Time) was chosen as the study instrument to assess PA and lesson context in PE lessons. It has been widely used eg CATCH (48, 50, 54), SPARK (70), and M-SPAN projects (82), and has been found to be a valid and reliable estimate of energy expenditure (53, 65).

SOFIT measures three aspects that are associated with opportunities for students to be physically active: activity, lesson context and teacher behaviour (53). A decision is firstly made by a trained observer whether the content of the PE lesson is 'general content' eg management or subject matter that is related to PA. If the lesson content is about PA, then a decision is made on whether the focus is 'knowledge content' (general knowledge or physical fitness knowledge) or 'motor content' (PA). If 'motor content', a further decision is needed to assess whether the context is 'fitness', 'skill practise', 'game play' or 'other'. Teacher behaviour is categorised into one of six categories ie 'prompting', 'demonstrates fitness', 'instructs generally', 'manages', 'observes', and 'off task'. These codes were derived from codes/definitions used in PE teacher training (53).

Briefly, five children are randomly selected prior to the start of the PE lesson. The selection is performed as follows. The children are counted as they approach the area designated for PE and every 5th child is chosen for observation until the five children have been identified. A brief note is then made as a reminder of which children have been selected. The first child is observed for 12 intervals of 20 seconds each and the PA level (1-5), lesson context (management/instruction, skill practice, game, fitness or other) and teacher activity at the moment the time interval ended is recorded. A particular context is attributed to an observation on the basis of > 50% of the children in the lesson being engaged in that context (53).

Once the 12 observations are completed on the 1st child, the 2nd child is observed for 12 intervals, followed by the 3rd and 4th child. After the 4th child is observed if any lesson time remains the 1st child is observed again and the cycle is repeated until the lesson ended (53). The 5th child is only to be used as a reserve if one of the other children leave the PE instruction area for any reason.

Modifications to SOFIT

MIGI used a modified version of SOFIT (53) to assess the mean proportion (percentage) of PE lessons that children spent in physical activity (PA). SOFIT was piloted in two ways. Firstly, answers derived from a 'gold standard' videotape provided by McKenzie, the author, (53) were compared with answers provided by a small team of observers trained from the SOFIT manual. Secondly, field piloting in local schools was conducted in which the feasibility of the instrument was assessed in terms of ease of use and practicality. The pilot resulted in the following modifications.

1. The selection process of the five children was performed slightly differently to that outlined by McKenzie (53) and was as follows:
    - All children in the class were asked to take a coloured sash prior to the start of the PE lesson, which they would subsequently wear over the shoulder. There were five sashes of each colour and six colours in total: red, blue, yellow, black, white and green.
    - Observers were instructed to select all 5 children from the yellow sash group for observation.
    - Observers were then instructed to make a re adjustment to the selected group to ensure an equitable number of boys and girls were represented (ie 3 boys and 2 girls or 2 boys and 3 girls). This was done by adding boys or girls from the blue sash group in order to redistribute the gender balance of selected children
    - Identifying characteristics about each child were then noted on the SOFIT lesson observation form so that s/he could be identified later.
    - Four children were then observed sequentially, with the fifth child a backup replacement in case one of the first four left the observation environment (as per SOFIT instrument)

2. The category of 'teacher behaviour' was excluded altogether.

3. The gender of the teacher was recorded as an additional measure.

4. The lesson contexts of 'management', 'general knowledge' and 'physical fitness knowledge' were collapsed into one category termed 'management/instruction'.

Reasons for Modifications

The sample selection proved to be difficult in an Australian context as the children all looked very similar in school uniform – the sashes provided a random means of selection and identification. Recording teacher behaviour in addition to the PA and lesson context proved to be too time consuming for the team of observers.

Creating the merged context of 'management/instruction' was necessary as in our piloting it was not possible to reach a reliability level of over 80% using the SOFIT system. The tapes that were used for piloting were of American PE classes and some of the teaching strategies used in the classes are not commonly used in PE

lessons in this area. This meant that it was difficult for observers to categorise context according to definitions provided by SOFIT (53).

5.3.2. Study Sample

The sample of observed children from control and intervention schools consisted of sets of four children selected from a number of Year 3 and 4 PE lessons in 1999 (pre) and Year 4 and 5 lessons in 2000 (post).

Sample Size Calculation

McKenzie previously reported an increase of 14% in MVPA in the CATCH program (37% increased to 51%, SD=16.3%). In order to detect a 5 % increase in MVPA (from a baseline mean of 25%), observation of 132 classes in intervention and control schools was required (given independent samples, a one-tailed test of significance "=0.05, and study power of 0.80). The study thus aimed to observe 264 classes at baseline (1998), and at follow-up. Owing to resource differences between CATCH and this program, sufficient observations were planned to ensure detection of a smaller increase in MVPA (5%).

5.3.3. Observers, Training & Reliability

Observers and Training

The same observers were used to observe PE lessons as described above. In the training programs, the modified study instrument SOFIT was outlined and observers practised by rating children's activity levels and the lesson context of the class with one of two 'gold standard' videos (One developed in USA by Thom McKenzie and the second developed by MIGI in the Australian setting). The later was developed for the second training because the quality of the original video was poor (poor sound and visuals) and the American context differed from the Australian context (different teaching strategies). Observers also practised rating children in the field (ie watching an actual PE class).

Accuracy of the 15 SOFIT observers was repeatedly measured during training until an agreement rate of 80%+ was achieved against the gold standard. This involved trainees viewing a videoed PE lesson for which expert observers had previously rated both activity and lesson context of selected students. Agreement rates were calculated as the % of recorded 20-second observations for which the score entered by the trainee was identical to that recorded by the expert observer.

Reliability

Inter observer reliability checks were conducted opportunistically on 13% (30/231) of baseline lessons and 15% (36/235) of follow-up lessons. A check consisted of two observers rating the same child for the same period from a common viewing position using a shared timer tape recorder. Checks took place at various times of the day and in 12 of the 18 schools. Percentage agreement rates were calculated separately for observer

ratings of student activity and lesson context. Cohen's kappa (k) agreement coefficient was also calculated for activity ratings.

During the baseline survey 28 pairs from among the 15 observers provided 1915 paired observations for inter-observer reliability checks. Within the check sample the agreement rate for student activity level ranged from 72.2% to 100% with a mean rate of 96.1%. Three quarters (75.0%) of the observer pairs exceeded 95% agreement and only 3.6% failed to reach 85% agreement. Kappa ranged from 0.7 to 1.0 with 17 of the 28 comparisons returning k>0.95. (See Figure 2). For the lesson context the agreement rate between the pairs ranged from 73.2% to 100% with a mean rate of 97.9%. Most (85.7%) of the observer pairs exceeded 95% agreement and only 1 (3.6%) failed to reach 90% agreement. (See Figure 3). Both these rates compare favourably with the rates reported by McKenzie (48). The Spearman correlation coefficients between the 1915 pairs of observations was 0.930 (P=0.008).

Figure 2: Inter Observer Reliability for Lesson Context

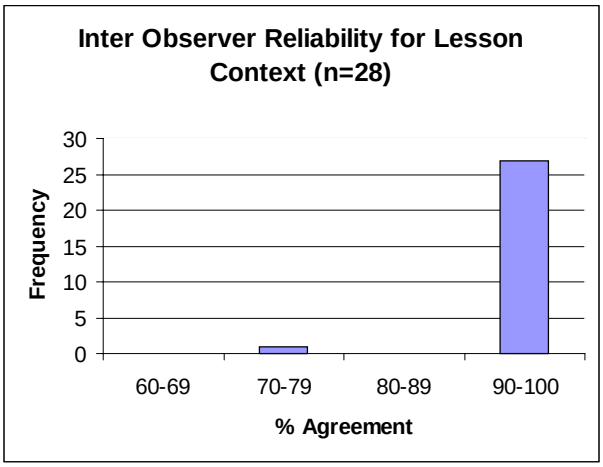
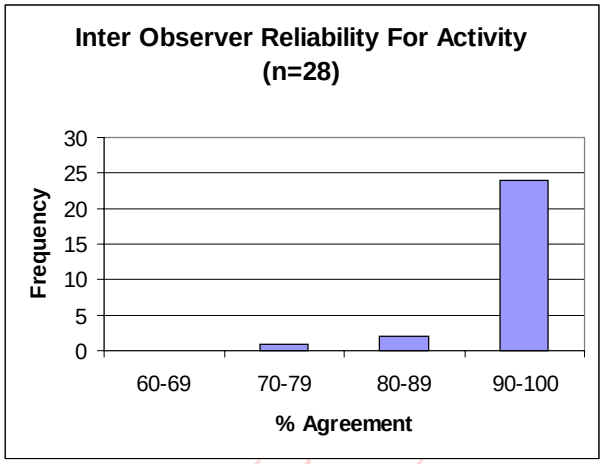


Figure 3: Inter Observer Reliability for Activity



During the follow-up survey 19 of the 22 observers had paired reliability checks. There were 36 checks in total and these included 2788 paired observations. Within the check sample (n=36) the agreement rate for student activity level ranged from 65.5% to 100% with a mean rate of 90.6%. Half of the observer pairs (52.8) exceeded 90% agreement and only 8.3% failed to reach 80% agreement. For lesson context, the agreement rate ranged from 87.5% to 100% with a mean rate of 96.0%. Most (94.4%) of the observer pairs exceeded 90% agreement and only 5.6% failed to reach 90% agreement.

5.3.4. Data Analysis

Descriptive Analysis at Baseline

Data were coded into an Epi Info database with field 'allowable entry' constraints and subsequently exported to SAS. Binary variables (0,1) were constructed from the 5-point physical activity ratings to indicate whether the child being observed was or was not rated as engaging in moderate to vigorous (MVPA) or vigorous (VPA) physical activity. These were used as dependent variables in multiple hierarchical logistic regression models (32, 79). The data were modeled as constituting a hierarchy of nested sources of variation, with observations nested within lessons and lessons nested within schools.

The models were built up from the basic variance components (intercept only) models by adding predictor variables one at a time. Dummy-coded variables for school year were added to adjust the estimates for subsequent variables regardless of whether school year was found to significantly relate to the dependent variables. Dummy-coded variables for child gender and lesson context were added in accordance with the expectations that boys would be more active than the girls and that levels of physical activity would differ among lesson contexts. A dummy-coded variable for teacher gender and the variables lesson start time (hours from 9.00 am) and lesson duration (minutes) were added although no strong expectations were held about their effects. Apart from school year, any variable found not to have a significant effect in either the MVPA or VPA models was removed, so that any variable having a significant effect in either of these models was included in both. Second order penalised quasi-likelihood (PQL2) (32, 33) estimates and standard errors were obtained.

Follow-up Analysis for Intervention Effect

To assess whether there had been a significant change in PA levels in PE, the pre and post data sets were combined and the following extra variables were added:

- Pre/Post
- Intervention: Comparing data from intervention schools at follow-up to data from all baseline schools + control schools at follow-up.
- Interaction: a variable created to compute an interaction effect between control and intervention schools data (control X intervention).

Two models were fitted to each of the MVPA and VPA data (A1 and A2 for MVPA, B1 and B2 for VPA). As with the baseline analysis, this included a variance components model (A1, B1) and then a model including only significant predictors plus the three additional terms described above (A2, B2). The interaction term and its standard error provided a measure of intervention effect and the model was used to generate estimates of the mean percentages and 95% confidence intervals for MVPA and VPA under a number of conditions represented by selected values of the predictor variables.

Further hierarchical models were generated to test for changes in the relative proportions of PE class time which teachers allocated to each context ie management, skill, fitness or game. In each model one context

dummy variable was entered as the dependent variable and predictors included control/intervention, pre/post and interaction of these two variables to detect any intervention effect. Other significant covariates were also included as predictors. Because intervention teachers had been encouraged to promote child activity within each context a final set of analyses explored whether any such changes were evident. In these analyses the dependent variable was activity (eg vigorous) and predictors in each analysis included terms for the particular context under scrutiny plus its second and third order interactions with control/intervention and pre/post.

5.4. Playground

5.4.1. Development of the CAST Instrument

Because there was no suitable instrument available to measure PA levels in the school playground a new system, the Child Activity Scanning Tool (CAST), was developed, validated and field tested for the purpose. CAST assesses PA levels, equipment availability/use and teacher presence/behaviour.

Prior to each observation, meteorological data were recorded ie: temperature and humidity using a hygrometer (for heat stress level) and 'wet' or 'dry' day ('wet' if there was evidence of rain prior to or during observation). Numbers of equipment items available in the playground such as ropes, frisbees, hoops, bats and fixed equipment were also recorded.

CAST used a team of five observers to simultaneously scan a play area. The playground was divided into discrete viewing areas and, in each break, all areas were given equal scanning time. A scan involved all observers simultaneously sweeping the area visually in the same direction twice (see below for details). All schools had a designated eating time at the start of the lunch break, which was not included in the observation. Scans started at the beginning of a break period and were repeated every 75 seconds, per audio taped signal, till the break ended. Scans alternately focused on boys and girls. The task of each observer was to first scan the designated play area for the number of boys or girls engaged in one of five allocated PA levels according to the SOFIT (System for Observing Fitness Instruction Time) instrument (53). Each observer was also allocated an equipment or teacher category to observe and record on his or her second sweep. These are summarised in Table 2. (Refer to Appendix 6 for the Playground Physical Activity Observation Training Package).

Table 2: Equipment and Teacher Behaviour Categories Observed

Equipment Variables	Teacher Behaviour/presence Variables
Number of balls in the area	Number of teachers encouraging
Number of children playing ball games[1]	Number of teachers observing
Number of children playing with non-fixed equipment other than balls	Number of teachers managing
Number of children playing on fixed equipment	No teachers present in the area

[1]A child was counted as engaged in a ball game only if focused on a ball (eye contact and body language/direction) and/or actively manipulating the ball.

5.4.2. Sample Size Calculation and Study Sample

Schools were selected as described above. Since no prior estimates were available for playground activity levels, sample size calculations were made assuming an initial MVPA and VPA prevalence of 50%, which provides the most conservative estimate. Type 1 error rate was set at "= 0.05, study power at 0.8 and a minimum detectable difference of 5%. Sample sizes were inflated by 1.5 to account for the clustering effect of intra-school student similarities (11). The resulting calculated sample size was 4,812 child observations. This was sufficient to determine a population estimate, for a parameter with 50% prevalence among the 31,000 children of primary school age in the Northern Rivers area, within 1.3%. Because of the labour intensiveness and resource requirements of the newly developed CAST system the required sample was gathered by surveying two breaks in each of the 9 intervention and 9 control schools at baseline and follow-up. For the playground component of MIGI the study sample was the whole school population.

5.4.3. Observers, Training

Observers

Two three-day training programs were conducted, one prior to the baseline, and one prior to follow-up survey.

Training

The three-day training session was conducted in two stages: 1. identifying SOFIT activity categories (53) and 2. how to scan playgrounds using CAST (both video and field experience). Observer accuracy in SOFIT was repeatedly measured during training until an acceptable agreement rate (>90%) was achieved against a gold standard. This involved trainees viewing a videoed PE lesson for which expert observers had previously rated PA levels of selected students. Agreement rates were calculated as the percentage of recorded 20-second observations for which the trainee and expert observers' scores were identical.

5.4.4. Validity and Reliability

Validity

The validity of SOFIT categories as estimates of PA has been tested and confirmed elsewhere (53). The validity of the CAST tool was tested as follows: 1. field observations were performed while the playground area was videotaped from a convenient vantage point. 2. a video gold standard was established for percentage MVPA during the period observed. 3. correlation and paired t-tests were used to compare the levels of MVPA engagement derived from CAST field observations and video analysis.

Establishing a Gold Standard

Analysing a video of the playground observation every 5 seconds was deemed to be the closest possible approximation of continuous analysis. Two pairs of observers were assigned the task of counting the number of children and analysing each child's PA level every 5 seconds for each entire video. During the training and practice period, the pairs of observers establishing the gold standard video discussed and compared their results until the agreement rate on both number of children and number of children engaged in MVPA consistently exceeded 95%. Once analysis started, a sample of the scans was analysed by both pairs independently so inter-rater reliability could be calculated. Subsequently each observer in a pair scored an interval independently and then immediately compared it with the score of the other observer. Where there was a disparity the video was replayed until both observers agreed. Results of the validation are presented under MIGI outcomes.

Inter-rater Reliability – video gold standard

A sample of the video intervals (n=100/738 or 13.55%) was analysed by both pairs of observers independently and correlation coefficients calculated for the number of children engaged in MVPA and the percentage of children engaged in MVPA respectively.

Inter-rater reliability -identifying activity categories

Inter observer reliability checks for correctly identifying SOFIT categories were conducted opportunistically on 16 pairs of observers on 28 occasions during the study period. A check consisted of two observers rating the same child for the same period of time from a common viewing position using one shared timer tape recorder. Checks took place at various times of day and in various schools. This yielded 1,915 paired observations.

Inter-rater Reliability - number of children in each activity level

Inter observer reliability of the CAST tool was measured in the field by having six observers simultaneously scan and record the number of children engaged in one SOFIT category for 120 consecutive scans. This was repeated for each category. This yielded 1,625 paired observations of the number of children in a play area in each activity level in a particular scan.

Internal Consistency

The intraclass correlation coefficients (ICC's) from the hierarchical logistic regression variance components analyses reported subsequently provide measures of the internal consistency reliabilities of the logits at the school level (79).

5.4.5. Playground Data Analysis

Baseline Descriptive Analysis

Data were coded into an Epi Info database with field 'allowable entry' constraints and subsequently exported to SAS. Binary variables were computed by recoding the five SOFIT categories to indicate whether a child was observed to be engaged in MVPA (ie: level 4 or 5), or VPA (level 5).

Multiple hierarchical logistic regression models (32, 79) were fitted to the data with the dependent variables using MLwiN (http://www.ioe.ac.uk/mlwin/). In the models the 'schools', the 'scans within schools' and the 'children within scans' were treated as random samples and defined as three levels of analysis. The non-independence among observations due to nesting within these levels is appropriately accommodated in the analyses.

Three models were fitted to each of the MVPA and VPA data (A1 to A3 for MVPA, B1 to B3 for VPA), a variance components model (A1, B1), a model including only significant predictors (A2, B2), and a model which included significant and non-significant variables (A3, B3). The variance components models partition the total variance (about the grand mean logit) among the child, scan and school levels, and yield intraclass correlation coefficients and estimates of measurement reliability. Combinations of predictor variables were fitted to arrive at the significant effects only models, which yield estimates of the proportions of variance at the school and scan levels that are explained by the set of predictors. Further predictor variables, which were considered to potentially account for significant portions of variance, were added to the model to provide tests of their significance.

Models A2 and B2 were used to generate estimates of the mean percentages and 95% confidence intervals for MVPA and VPA under a number of conditions represented by selected values of the predictor variables.

Follow-up Analysis for Intervention Effect

To assess whether there had been a significant change in PA levels in the playground, the pre and post data sets were combined and the following extra variables were added:

- Pre/Post
- Intervention: Comparing data from intervention schools at follow-up to data from all baseline schools + control schools at follow-up.

Interaction: a variable created to compute an interaction effect between control and intervention schools data (control x intervention).

Two models were fitted to each of the MVPA and VPA data (A1 and A2 for MVPA, B1 and B2 for VPA). As with the baseline analysis this included a variance components model (A1, B1) and then a model including only significant predictors plus the three additional terms described above (A2, B2). The interaction term and its standard error provided a measure of intervention effect and the model was used to generate estimates of the mean percentages and 95% confidence intervals for MVPA and VPA under a number of conditions represented by selected values of the predictor variables.

6. MOVE IT GROOVE IT OUTCOMES

6.1. Process Evaluation

6.1.1. Teachers Professional Development

Workshop 1: (See 4.3.1)

There is no evaluation of this workshop as the purpose was simply to introduce the MIGI project.

Workshop 2: (See 4.3.2)

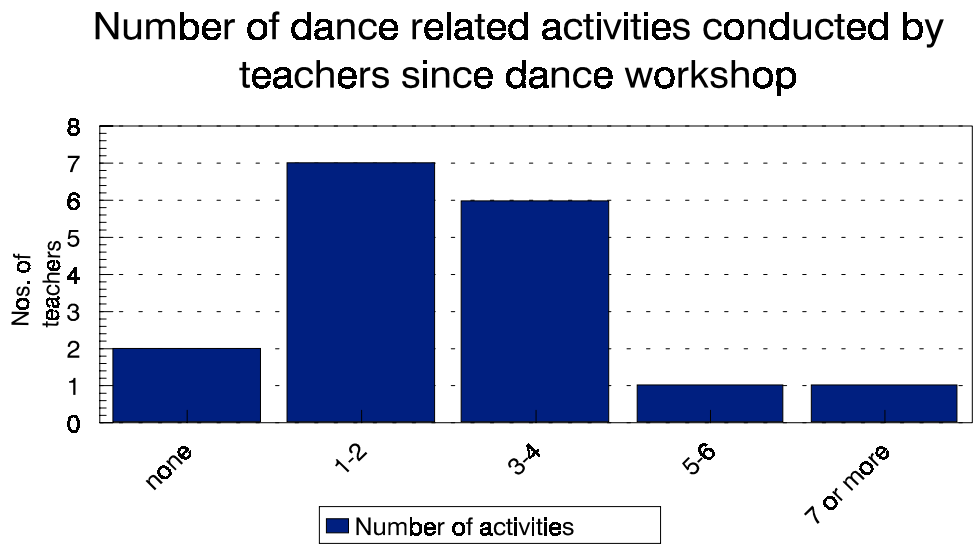
It was beneficial for the schools to hear what was happening in other schools. Two schools focussed on the difficulties they had with their buddy: school attendance and performance, and although this feedback was not positive, it provided a chance to clarify issues related to the future progress of MIGI in their school. These schools also indicated that project correspondence and materials that were sent to their school were not passed from the Principal to teachers. It was decided to send copies of all correspondence to teachers as well.

It was disappointing that one school did not send any teachers (full relief funding was available) and two teachers from another school left after lunch. The evaluation included only the teachers who stayed to the end of the workshop. (See Appendix 7 for a summary of evaluation results). Some of the feedback received from teachers in the second workshop evaluation indicated that they would prefer practical short workshops in their district rather than full day workshops in Lismore.

Workshop 3: (See 4.3.3)

Workshop 3 was a dance workshop and was attended by 17 teachers from 8 of 9 schools. All participants completed evaluation forms. Figure 4 illustrates the number of dance related activities teachers reported incorporating into their classes since the dance workshop. One teacher had not been able to use any dance-related activities due to the curriculum delivery organisation, which did not focus on dance that term. An obvious limitation of this evaluation was the lack of a pre/post design; ie teachers might have already incorporated dance activities regularly before the dance workshop. There was however anecdotal evidence to suggest that most teachers who participated in the workshop did not include dance activities in their classes prior to it.

Figure 4: Number of Dance Related Activities Conducted by Teachers Since Dance Workshop



Most teachers agreed (10) or strongly agreed (5) that the dance workshop would be useful to their teaching practice. Two teachers disagreed, one because they did not normally teach PE and the other did not specify why. However, this teacher had also specified that s/he had actually used 1-2 dance-related activities since the workshop.

Workshop 4: (4.3.4)

Workshop 4 was attended by 19 teachers with 17 of these returning evaluation forms. All teachers strongly agreed (9) or agreed (8) that the FMS workshop would be useful to their teaching practice. Teachers comments reflected learning in the following areas: being able to break down the skill being taught, more ideas for skill teaching, more motivation to teach FMS and re-evaluation of current ways of teaching skills.

6.1.2. Buddies

Schools Perception

The findings of Questionnaire 2 were that overall, the buddies visits were seen to be a useful part of the program with all schools bar except one finding them very or fairly effective. One school did not find the buddy system in 2000 effective, the main issue being that the buddy did not attend the school more than a few times. The schools that found the buddies useful also found the resources provided or recommended by buddies to be very effective. Only one school out of the nine did not find the resources provided to be useful. Obviously, this question had two parts to it, the first being the quality of resources and the second an assumption that the buddies had in fact given out resources. The evaluation took place about 3 months after the buddy program was finished, so teachers' perceptions reflect sustained/lasting impressions.

Some positive statements that were made about the buddies:

- "Buddies as links were great"
- "Buddies were great, gave us their ideas'"
- "These young professionals provided a sense of excitement and vigour to our programs.
- "Year 2000 buddy was excellent – a great help with dance"

And a negative comment:

- Our buddy was only involved at our school for a few weeks. He was great when here!!

Buddies and Teachers' Perception

The buddy system evaluation results from the Repertory Grid analysis support the hypothesis that the MIGI program did indeed have a positive influence on the buddies' perceptions of teaching physical education and the image of 'self as teacher' of physical education (31).

In the informal interviews, the buddies' reporting of attributes associated with effective teaching in physical education indicated a hierarchy of pedagogical practices in which organisational and management issues were dominant with student focussed learning as an ultimate goal. Personal attributes and knowledge of subject area and skills associated with practical aspects of physical education were also prevalent.

As evidenced by comments from each buddy there was a positive shift in how each viewed themselves as a teacher of physical education now compared to the perception they had of themselves as a teacher of physical education prior to the project.

There was a demonstrated dramatic shift for each buddy in how they perceived themselves as a teacher of physical education now in relation to the other five elements (good teachers #1 and #2, poor teachers #1 and #2, and ideal self). This shift in perception of self and the change in focus of the constructs that each buddy listed indicate that both their espoused and enacted theories of action have been altered. The shift in perceptions of self, compared to the other elements were so dramatic in most cases it may raise the question as to the length of the MIGI program and the sustainability of this shift in perception. However, given that all buddies showed less association with their two perceived 'poor' teachers than they did prior to the project they were obviously more aware of the strengths they previously had, but did not consciously realise and of the strengths they had developed over the duration of MIGI.

Upon reading each buddy's personal metaphor in response to the question, 'When I reflect upon myself as a teacher of physical education now I see...?' each of the buddies demonstrates a shift in both their espoused and enacted theories as a teacher of physical education. This change, in most cases reflects not just professional growth but also personal changes associated with how they now perceive themselves as a teacher of physical education. In each case the personal metaphors do not speak of a journey that has come to an end, rather a journey that is continuing. It is this feature of each of the buddies' personal metaphors that looks beyond the MIGI program and the sustainability of the changes to each buddy's perceptions of 'self as

teacher' as they continue their journey both through the final stages of their pre-service teacher education program and into their teaching careers.

Each buddy was very clear as to what strengths they had in their role as a buddy within the MIGI intervention program and as a pre-service teacher of physical education. From individual and group discussions it was evident that MIGI had assisted the buddies develop some strengths. However, in most cases it was through the program that all of the buddies came to realise that many of the strengths they demonstrated in the classroom during previous practicum experiences, which had previously been their comfort zones were transferable to the gym and the oval. The most obvious reason for this development is confidence. It is reflected by all buddies that as the MIGI program progressed their confidence grew, and with that came the realisation that they indeed could work competently in a physical education environment.

Although each buddy was very specific on what their strengths now were in teaching physical education, several of the buddies had shown signs of becoming very critical of their lack of content knowledge and skills. Although this fact is not reflected in the Repertory Grid elicitation it was evident in individual interviews. The concern about this feeling of lack of self-worth in teaching physical education amongst a few of the buddies is that once the support they enjoyed throughout MIGI is removed they may struggle to adapt and may look more to their lack of knowledge and skills than their professional growth. Hopefully these buddies see the opportunities throughout the remainder of their pre-service teacher education program to strive after more knowledge and to fill the remaining gap between their perceived lack of knowledge and skills.

There was unanimous support for the role of the buddy amongst the teachers. Although some minor difficulties were experienced, generally due to misunderstanding between teachers, buddy and/or the researchers or small personality clashes, the overall feeling amongst participants and buddies was one of success. There is no doubt that the buddy gained a great deal in terms of teaching strategies and organisational and management structures and viewed their involvement very differently to their previous in-school (practicum) experiences. The teachers soon adapted to having an pre-service teacher in their class as opposed to a practicum student and in most cases took only a few weeks to begin a constructive and mutually beneficial professional development experience.

One indicator of the value of the buddy will be how well the teachers adapt to not having their regular input. The buddy tutorials at the university not only focussed on knowledge and skills in teaching physical education but also looked at the sustainability of the change in each teachers' espoused and enacted theories of teaching physical education. This meant each buddy was aiming to become redundant by the end of MIGI. On many occasions several of the teachers mentioned how difficult it was going to be when the buddy left. At the conclusion of MIGI several buddies did indicate that their teachers did not appear to be ready for their departure.

6.1.3. Website

Another role of the buddies was to encourage teachers to access the web-site. Around half of the schools found the web-site to be fairly or very effective (4). However three schools found the web-site to be only somewhat effective, one school found it not at all effective and one school did not access it at all. Again, this question relied on the assumption that the buddy did indeed encourage teachers to access the web-site and that teachers had easy access to the technology.

6.1.4. Equipment Purchase

The equipment purchased from the funding provided by MIGI was found to be very effective for four of the schools, fairly effective for two schools and in two schools the order for equipment was placed late in the project due to the University bureaucracy not issuing the funding in time. One school left this question blank.

6.1.5. Additional Strategies

The baseline descriptive analysis results were given to 1999 buddies to distribute in their schools. They were also given out at the November 1999 teachers' workshops to all teachers who attended. This was perceived as very effective (1) and somewhat effective (3) by half of the schools that responded. One school found the testing results somewhat effective and one school found the testing results to be not at all effective. The remaining three schools were not aware of receiving the results.

The FMS package from DET either had not arrived at the time of the evaluation or came too late to be useful in all but one of the schools. One school found time to explore the package and found it to be very effective.

6.1.6. Summary

Evaluation at the school level is summarised in Table 3.

(Scale legend: 1=Not effective at all, 2= Somewhat effective, 3=Fairly effective, 4=Very effective). "NA to school" refers to the strategy either not being available to the school (in the case of equipment, FMS package), or the school not being aware of the strategy (distribution of testing results and web-site).

Table 3: Summary of School Level Evaluation

Strategy	NA to school	Mean score
Buddies visits		**3.5**
Resources provided/recommended by buddies		**3.0**
Teachers workshops		**3.7**
Equipment purchased by funding provided	**2**	**3.0**
Web-site	**1**	**2.5**
Distribution of testing results	**4**	**2.2**
FMS package from DET	**4**	**1.4**

6.1.7. School Project Teams

School policy was changed in six out of the nine schools as a result of MIGI. Policy changes that were identified by teachers and Principals included incorporating and strengthening PDHPE in the School Management plan for the Year 2000. In some schools, detailed outcomes and strategies were outlined. Daily PA for the whole school is one change which, in two of the schools, was timetabled and included in the policy so it would have a chance of being sustained.

The school physical environment was changed in three schools. Changes in these schools included: refill for climbing apparatus, adjustments in shade areas, plans to extend the covered area for activity during wet weather periods, soccer field marked, nets on goals, netball/basketball ring purchased and put up, and basketball posts and markings added.

Playground activities were stated as being offered in nine schools. However, only three of these schools specified that they provided lunch or recess time games that were monitored. The other schools simply specified that more equipment led to more activity during free play. The two schools that thought that these activities would be sustainable had plans to keep organising lunch time games.

Greater participation of girls in the playground was seen as a positive change due to MIGI in four of the schools. One school said that the participation of girls in the playground was never an issue as it was a small school. The schools that had seen an improvement noted girls being more interested and involved in a variety of activities with an improvement in skill level. One school noted that younger girls especially liked using the extra equipment that was now available.

Five schools stated that the class frequency had increased with one school noting that PE is now timetabled as a regular event and another noting that the attendance of buddies has ensured regular PE. Some schools included frequency of PE classes as a policy change. Of the schools that considered this change sustainable, most also mentioned that the increase of classes was timetabled and included in school policy.

The content of PE classes was changed in all schools. Changes specified were: teacher awareness of involving children in PA for a larger proportion of the lessons, skill based lessons particularly with FMS emphasis, using rotational groups/circuits as a strategy, warm ups, ideas for games, and skilled students used to lead other students. Teaching strategies are directly linked to the content of PE classes with all schools except one mentioning that their teaching strategies had changed. Additional strategies that were recorded include; skills and methods gained from the dance and FMS workshops and reduction on time for instruction generally with more time for physical involvement.

Three schools reported other changes as a result of MIGI. One school took up the offer of a PE student from Homebush and a two year plan to commit to Jump Rope for Heart due to their involvement in MIGI. One other school reiterated that MIGI had raised awareness generally in all PE activities and in school and stage planning and the other school that specified additional changes said that sport time had increased as a result of MIGI.

Following is a table of changes (Table 4) the schools made due to MIGI and the changes the school felt were sustainable.

Table 4: Changes in School Due to Move It Groove It

Area of change	Nos. of schools registering changes	Nos. of changes considered sustainable
School policy	6	3
School physical environment	3	1
Playground: equipment offered	6	4
Playground: activities offered	9	2
Playground: girls participation	5	2
PE classes: frequency	6	3
PE classes: content	8	4
PE classes: teaching strategies used	6	3
Other	3	1

In November 2000, three schools submitted information on any additional changes (since the June evaluation) that had occurred in the school that were attributed to MIGI.

Additional school changes included:

- equipment money finally received was spent on playground equipment,

- lunchtime borrowing of sports equipment implemented (two schools) and written into the management plan by one school,
- a staff development day initiated to write whole school policy on PE scope and sequence (two schools) and written into management plan by one school,
- staff meeting to revise FMS in early 2001,
- observation that teachers are spending less time organising and managing when teaching PE classes,
- observation that girls are more active in PE and the playground,
- observation that girls throwing and kicking skills and boys jumping and hopping skills are improving,
- observation that students have been motivated to enjoy a wide range of physical pursuits outside the classroom.

The management plan audit revealed a number of school wide changes. At midterm all of the nine schools mentioned PE/physical activity in the plan compared to eight of the nine schools at baseline. Of these nine schools, as well as incorporating physical activity planning in their existing management plan, four schools had an additional plan specifically concerned with MIGI strategies. One school had a separate MIGI plan to cover all references to physical activity, with physical activity not mentioned at all in the main management plan. Gross motor/FMS was mentioned in three schools at baseline and this increased to five schools at midterm.

At midterm, six schools had strategies that could be considered 'healthy public policy' compared to only two schools at baseline, examples being: project team meetings held on a mid-term basis, membership of Active Australia, daily PE, making equipment available at play time and introduction of new syllabus to all staff.

At midterm five schools compared to one at baseline had strategies that were examples of 'creating supportive environments' and included examples such as: the construction of a moveable fitness trail, improving the function & safety of the playground, purchasing equipment, and extension of the playground.

Four schools at midterm compared to one at baseline had strategies that could be seen as 'strengthening the community'. Examples included; enlisting parental feedback by using the Health Promoting schools booklet, using the school newsletter to state what was completed last year in terms of MIGI, and involving parents and the School Council in the program.

Nine schools had strategies that could be categorised as 'developing personal skills' (curriculum foci) at midterm compared to seven at baseline. Only one school had any strategies relating to personal skills in terms of staff development at baseline compared to four at midterm.

In summary, most schools at midterm had a range of strategies that was much more inclusive whereas at baseline strategies mainly focused on personal skills. Figure 6 illustrates that all schools bar one (School 8) addressed a broader range of indicators in the plan at midterm than at baseline (Figure 5 and Figure 6)

Figure 5: **Number of Intervention Schools (total=9) With at Least One Item on Their School Plan Corresponding to MIGI Indicators**

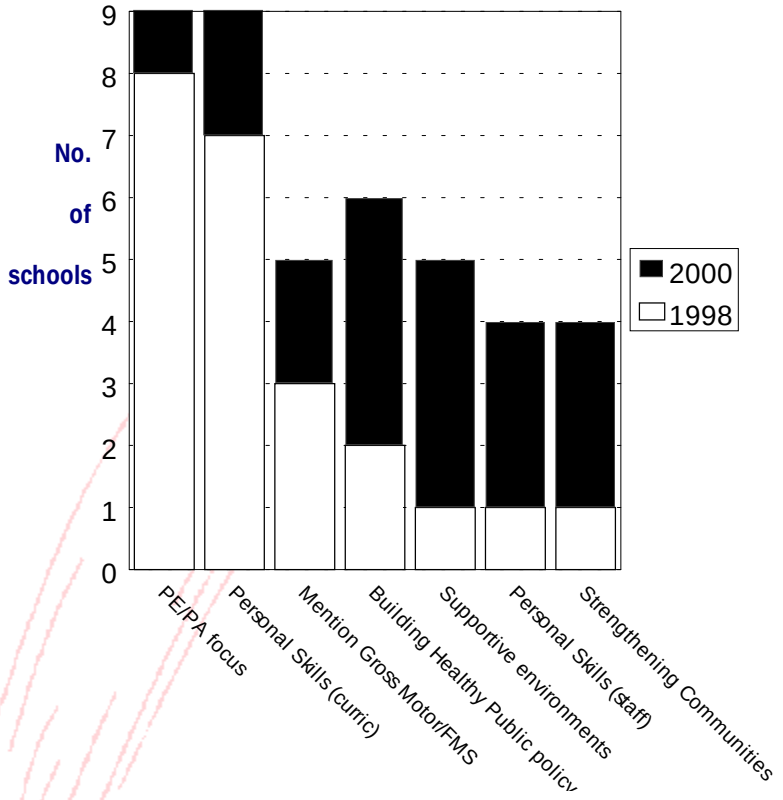
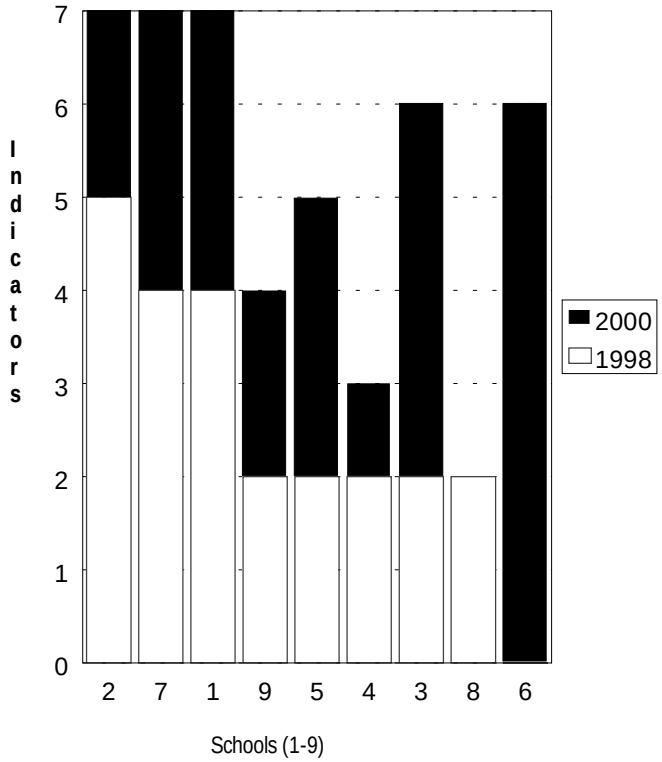


Figure 6: **Number of MIGI Indicators (total=7) That Each Intervention School Addressed in Their School Plan**



6.1.8. Changes in Teaching Practice

Every teacher, except one, thought that MIGI had positively influenced his or her teaching practice. Aside from development due to the dance and FMS workshops (reported below), the following themes emerged: lesson planning, PA focus, personal skill development and keeping informed of current thought in relation to PE.

Comments about lesson planning generally included:

- 'better structured lessons',
- 'more use of groups as a strategy',
- 'offering more specific teaching practice making the syllabus less overwhelming'
- 'helped me think about my lessons – helped with ideas'
- 'extra teaching strategies'

PA focus comments included:

- 'internalised the concept of children being active so am aware of when children are actively involved'
- 'more ideas for fitness'

In the area of personal skills, teachers noted:

- 'increased confidence in PE teaching generally, particularly in dance'
- 'mainly re-motivating teacher'
- 'I enjoy PE classes and feel more confident'

About new information, teachers said:

- 'a refresh - informed of latest information'
- 'kept me informed in current practice and was able to try out ideas'

6.1.9. Overall Comments

Most of the teachers believed that the MIGI project would have increased PA during PE classes. Eleven teachers thought that playground activity would have increased whilst six were unsure. The teachers were divided on whether girls' participation in the playground would have increased. Six of the teachers thought there would have been a demonstrated difference, nine teachers were unsure, one teacher believed there would have been no difference and one school stated that girls had been already active in their playground due to it being a small school. Around two thirds of the teachers thought that FMS skills would have improved with MIGI whereas one third were unsure. These results indicate that on the whole a majority of teachers thought that MIGI was an effective project in their school. Their comments included:

- 'Valuable program'
- 'Valuable resource for an important aspect of public health education, please give the public schools more'
- 'A most worthwhile cause that has achieved positive outcomes for students and teachers'
- 'Refreshing, I enjoyed the opportunity for new ideas and for the revitalisation of enthusiasm, I would really love to see PE interns in schools'

6.2. Fundamental Movement Skills

(Objective 6: To increase by 10% the number of school students who achieve mastery or near mastery of motor skills).

6.2.1. Sample and Testing

The FMS study sample was all year 3 and 4 children (in the 18 schools) who were able to attempt all components of each FMS. The 1045 children who took part in the FMS survey consisted of 515 from year 3 and 530 from year 4. The mean kappa coefficient for paired observations of testers in the field was 0.61 representing fair to good agreement (30). The gender distribution of tested children was 53% boys and 47% girls in both years.

6.2.2. Baseline Description

Overall, less than half (47.0%) of tests on all children for all FMS returned a score of mastery (21.3%) or near mastery (25.7%). By far the most mastered FMS was the static balance, with three in every four children achieving mastery (43.2%) or near mastery (32.2%). This was followed by the side gallop where over half achieved mastery (29.0%) or near mastery (30.0%). The poorest performance was for the jump and sprint where only 4 in 10 achieved mastery (14.5% and 16.6%) or near mastery (23.5% and 23.7%).

FMS profiles of boys and girls differed substantially (Figure 7). Although balance was the most mastered skill for both boys and girls in terms of mastery plus near mastery (75.4% and 77.1% respectively), the skills best achieved thereafter by boys (throw 62.6% and kick 59.1%) rated as the poorest for girls (throw 22.7% and kick 22.8%). Conversely the hop and side gallop which rated, after balance, as the skills best mastered by girls (67.7% and 45.7%), were among the more poorly performed skills for boys (51.2% and 41.5%).

Figure 7: Baseline Profile of FMS Mastery by Gender

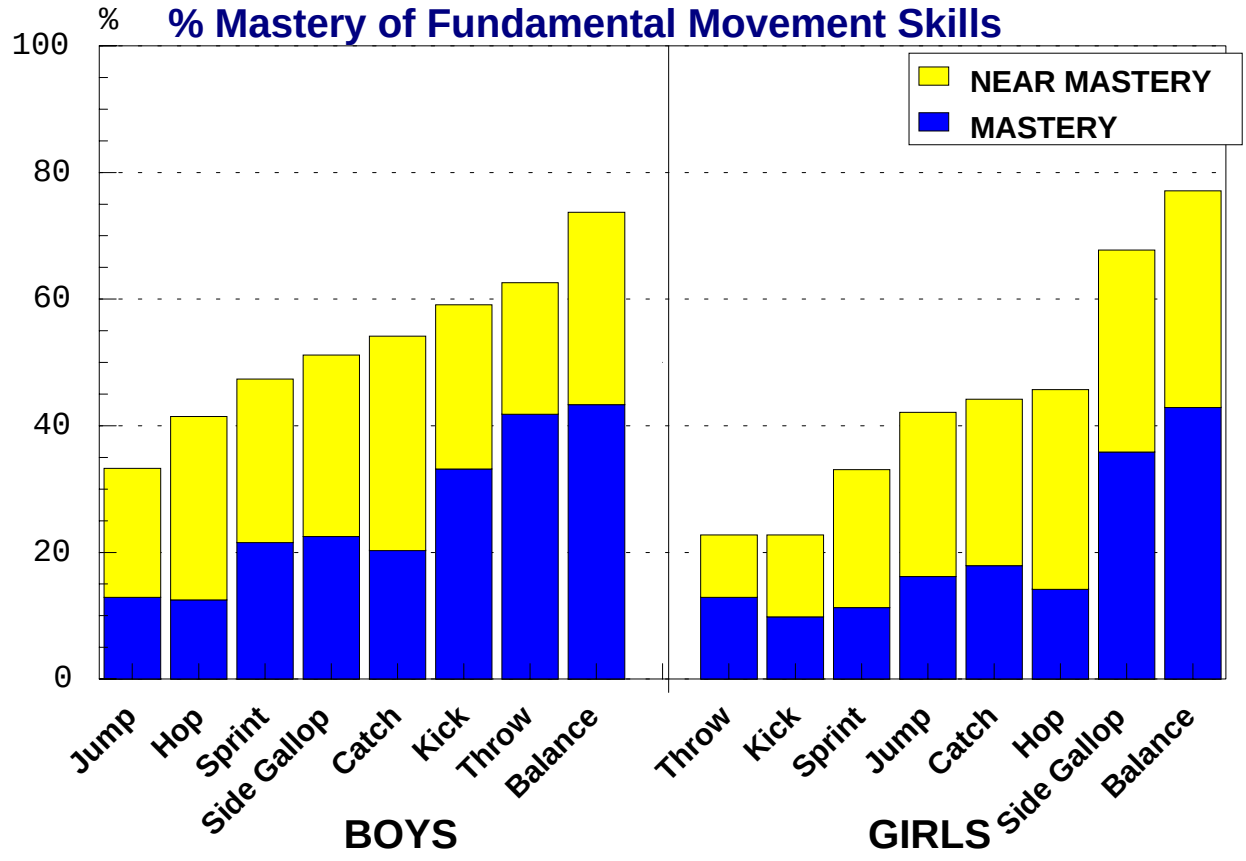
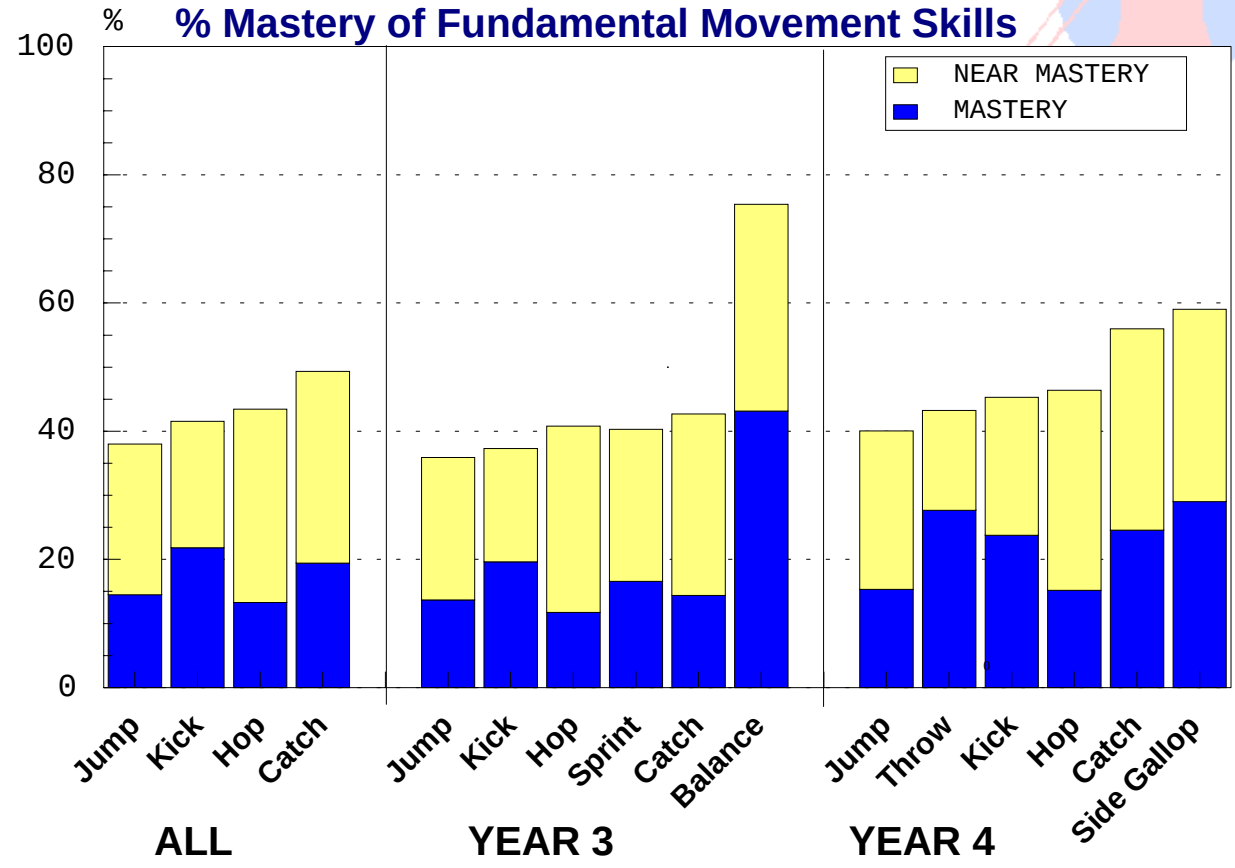


Figure 8: Baseline Profile of FMS Mastery by School Year



FMS profiles by school year provided further insight into the distribution of skills (Figure 8). Of the two skills only tested in year 3 (because they should, in theory, be mastered in year 2) the balance was mastered or near mastered by three of every four (75.4%) children tested. The sprint run however, was only mastered or near mastered by 40.3%. For all other skills tested in year 3 (catch, sprint, hop, kick and vertical jump), less than half of the children tested (<42.7%) achieved mastery or near mastery. In year 4 no FMS tested was mastered or near mastered by more than 60% of children. The throw and side gallop, tested only in year 4 on the basis that they should be mastered by the end of year 3, were mastered or near mastered by 43.3% and 59.0% respectively.

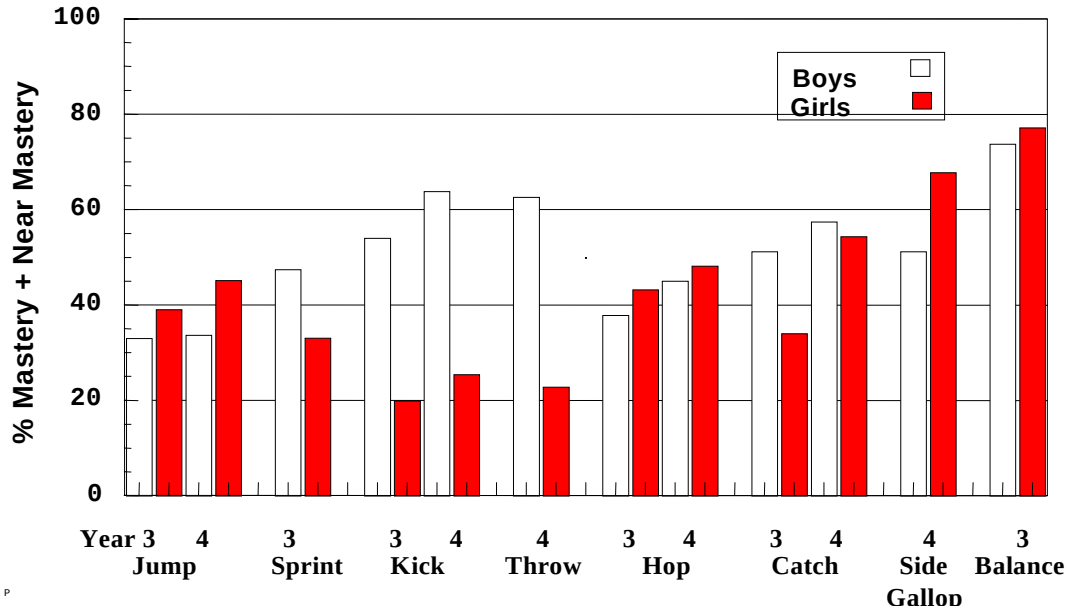
Comparison of each FMS across year 3 and 4 provided insight into the current rate of development as children progress from one year to the next (Figure 8). Although year 4 children achieved higher levels of mastery plus near mastery levels (MNM) for each of the 4 FMS tested in both years (jump, kick, hop, catch) the actual difference was small (<6%, $p>0.05$) except for the catch, which improved by 12%, ($p<0.05$). However, even in the catch the overall level of MNM at year 4 was only just over half (56.0%).

6.2.3. Development of Fundamental Movement Skills

A still finer understanding of FMS development was gained by comparing mastery levels in years 3 and 4 separately for boys and girls (Figure 9). For boys, the least development occurred in the jump. This skill was the least mastered skill in year 3 (MNM=32.9%) and there was virtually no change (0.7%, $p>0.05$) between years 3 and 4. The greatest development occurred in the kick with a 9.9% ($p>0.05$) change from an initial 53.9%.

For girls, the least change occurred in the hop with a 5.0% ($p>0.05$) change from 43.2% and the greatest change was a 20.2% ($p<0.05$) improvement for the catch.

Figure 9: Baseline Profile of Mastery and Near Mastery of FMS by Year and Gender



6.2.4. Intervention Effects – Fundamental Movement Skills Mastery

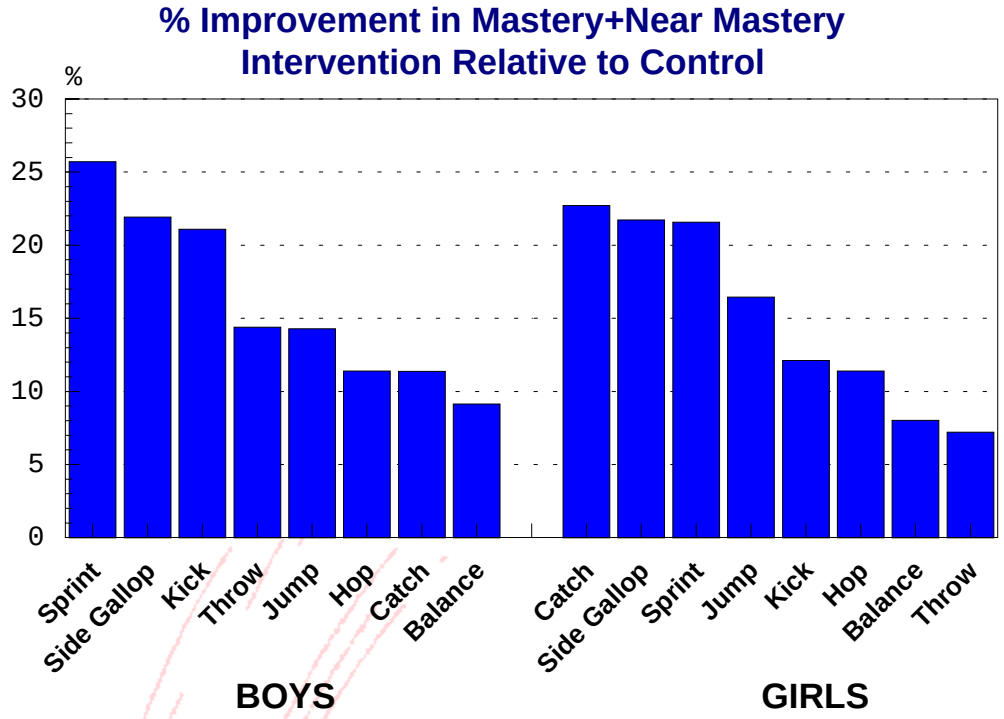
The following relative improvements were observed in the intervention group compared to controls. Overall, there was a highly significant 16.8% improvement for all skills combined, for the whole intervention group relative to controls (z=9.64, p<0.0001). The smallest change was a 7.2% improvement in throwing amongst girls and the largest was a 25.7% improvement in sprint run for boys (Table 5 Figure 10).

Table 5: Observed Relative and Derived Absolute Changes in FMS

Skill/Gender		Relative % change (compared with controls)	Z (p)
Sprint/run:	Boys	25.70	3.96 (<0.001)*
	Girls	21.56	1.04 (0.149)
Side Gallop:	Boys	21.91	3.72 (<0.001)*
	Girls	21.72	1.65 (0.049)*
Kick:	Boys	21.10	3.65 (<0.001)*
	Girls	12.11	1.99 (0.023)*
Throw:	Boys	14.38	1.82 (0.034)*
	Girls	7.22	1.73 (0.042)*
Jump:	Boys	14.28	2.661 (0.004)*
	Girls	16.44	2.79 (0.002)*
Hop:	Boys	11.39	0.94 (0.174)
	Girls	11.40	1.78 (0.037)*
Catch:	Boys	11.38	3.51 (<0.001)*
	Girls	22.72	3.64 (<0.001)*
Balance:	Boys	9.13	1.41 (0.079)
	Girls	8.08	0.85 (0.197)

* Changes significant at p<0.05.

Figure 10: Percentage Improvement in Mastery and Near Mastery - Intervention Relative to Control



6.3. Physical Education Lessons

(Objective 7: To establish a baseline of children's PA levels in PE lessons)

6.3.1. Sample Statistics

The study sample consisted of 13,080 observations on 231 lessons (mean observations per lesson = 56.9) in 18 schools (mean lessons per school = 12.8). Gender ratios of observations were 48.7% female and 51.3% male for children, and 54.7% female and 45.3% male for teachers. Lesson context breakdown of observations was management/instruction 37.4%, games 25.0%, skill 21.4%, fitness 14.7% and other 1.3%. These were 21.0% Year 3 lessons, 54.1% Years 3/4 composite lessons, and 24.9% Year 4 lessons. Lessons commenced between 9.00 am and 2.55 pm and were of between 12 and 46 minutes in duration (mean lesson duration = 21.2 minutes).

6.3.2. Overall Physical Activity Levels and Variance Components

The overall observed sample mean percentage MVPA for all observations in PE classes was 36.7%. (Derived from intercept logit for MVPA in the variance components Model A1 in Appendix 8. This table displays variance components models A1 and B1, and predictive models A2 and B2). Variance among lessons within

schools was 3.84 times greater than the variance among schools. Intraclass (intraschool) correlation was 0.21, representing similarity of lessons within schools and a measure of internal consistency reliability of a single lesson as a measure of a school. The median number of lessons within schools was 12 and internal consistency reliability of the mean of 12 lessons as a measure of a school was 0.77 (79).

The overall observed sample mean %VPA for all observations in PE classes was 12.9 (Model B1, Appendix 8). Variance among lessons within schools was 2.37 times greater than variance among schools (1.54 standard deviations), representing an intraclass (intraschool) correlation of 0.30 and a reliability of the mean of 12 lessons of 0.84.

6.3.3. Predictors of Physical Activity Levels

Among predictor variables entered into the model (Appendix 8, Models A2, B2), lesson duration was non-significant for both MVPA and VPA and was therefore excluded. School year was non-significant but included to adjust the estimates for the remaining variables. Child gender was significant for MVPA but failed to reach significance for VPA, although girls were observed to be less physically active in both the MVPA and VPA categories. In contrast, teacher gender was non-significant for MVPA but lessons taught by female teachers were found to have significantly higher levels of VPA. Lesson start time was significant for both MVPA and VPA, with activity levels declining as the day progressed. Lesson context was significant for both MVPA and VPA. Combined, the variables included in the final models explained 27% of the variance of MVPA at the lesson level and 53% at the school level. For VPA they explained 33% of the variance of VPA at the lesson level and 54% at the school level.

Mean adjusted percentage MVPA (from Model A2) was 34.7% (CI 29.8 to 39.9, Table 6). The mean for girls was 33.2% (CI 28.4 to 38.4) and for boys was 38.7% (CI 36.6 to 40.7). Mean adjusted percentage VPA (from Model B2) was 9.2% (CI 7.3 to 12.5). The mean for girls was 9.2% (CI 6.9 to 12.0) and for boys was 10.0% (CI 7.6 to 13.1).

Table 6: Estimated Mean Percentages And 95% Confidence Intervals MVPA And VPA For Each Predictor Variable Computed At The 'Average' Levels Of The Other Variables

	MVPA			VPA		
Variable [1]	Mean %	LCI %	UCI %	Mean %	LCI %	UCI %
constant	34.7	29.8	39.9	9.6	7.3	12.5
boys	36.2	31.2	41.6	10.0	7.6	13.1
girls	33.2	28.4	38.4	9.2	6.9	12.0
male teacher	34.4	28.7	40.5	8.4	6.1	11.4
female teacher	35.0	30.1	40.3	10.9	8.4	14.2
9.00 am	39.5	32.7	46.7	11.9	8.4	16.5
11.00 am	34.7	29.8	39.9	9.6	7.3	12.5
1.00 pm	30.2	25.1	35.8	7.7	5.6	10.5
manage	17.1	14.1	20.7	2.2	1.6	3.1
fitness	61.9	56.0	67.5	33.6	27.1	40.8
game	42.6	37.0	48.4	18.3	14.2	23.3
skill	46.4	40.5	52.4	19.5	15.1	24.9

[1] The mean percentages and 95% confidence intervals for each variable were computed at 'average' levels of the other variables. Specifically, except for the 'boys' and 'girls' estimates themselves, the 'average' level of child gender employed was 0.5. Similarly, except for the 'male teacher' and 'female teacher' estimates, the 'average' level of teacher gender was 0.5. Except for the lesson context estimates, the estimates were computed using the whole sample lesson context proportions. The 'average' value of lesson time was taken as 2 hours from 9.00 am (11.00 am). All estimates were computed for a year 4 class.

Mean percentage MVPA for lessons led by female teachers was 35.0 % (CI30.1 to 40.3) compared to lessons led by male teachers of 34.4% (CI 28.7 to 40.5). Mean VPA percent for lessons led by female teachers was 10.9% (CI 8.4 to 14.2) and 8.4% for lessons led by male teachers CI (6.1to 11.4).

MVPA was highest in the context of fitness at 61.9% (CI 56.0 to 67.5), followed by skill at 46.4% (CI 40.5 to 52.4), game at 42.6 (CI 37.0 to 48.4) and management at 17.1% (CI 14.1 to 20.7), (Figure 11). The lesson context 'other' was not computed (only 1.3% of sample). VPA levels followed a similar pattern, except that game and skill had more similar levels of VPA at 18.3 (CI 14.2 to 23.3) and 19.5 (CI 15.1 to 24.9) respectively.

Mean percentage MVPA varied markedly according to the time of day that the lesson began, it was highest at 9.00am being 39.5% (CI 32.7 to 46.7), by 11.00am this had dropped to 34.7% (29.8 to 39.9) and by 1.00pm to 30.2% (CI 25.1to 35.8), (Figure 12). The mean percentage VPA followed a similar pattern.

Figure 11: Average Level Of Observed %MVPA In Each PE Teaching Context

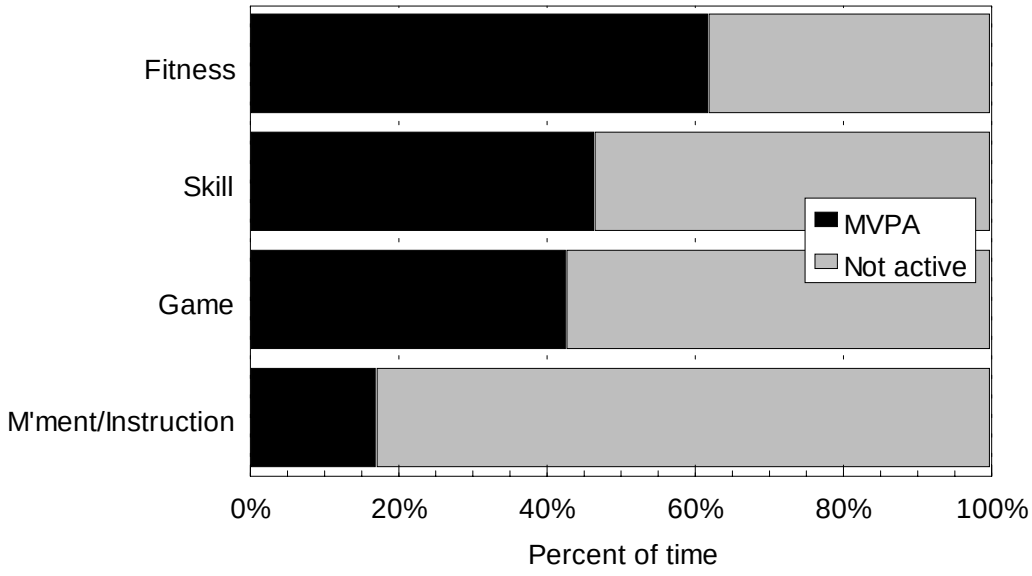
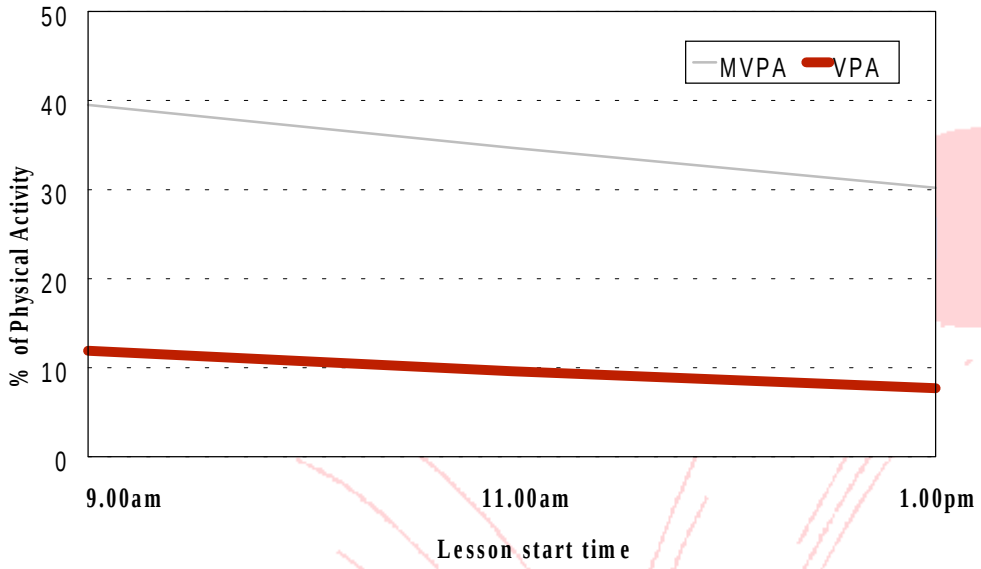


Figure 12: Average Observed %MVPA And %VPA By PE Lesson Start Time



6.3.4. Intervention Effects – PE Lessons MVPA and VPA

(Objective 8: To increase children's PA level by 10% in PDHPE lessons).

The results of hierarchical logistic regression analyses for MVPA and VPA are reported in Appendix 9. Parameter estimates are considered to be significant (two-tailed at $\alpha \leq .05$) if they are 1.96 or more times their standard errors.

The variance components models (A1 and B1) reveal considerably more variance at the 'lesson within school' than at the 'school' level (ie there is more variation *within* than *between* schools), with 86% of the variance of MVPA and 85% of the variance of VPA located at the 'lessons within schools' level.

- The results presented in Appendix 9 can be interpreted as follows:
- Compared with the baseline analysis for PE in the overall analysis, context remained a strong and significant predictor for both MVPA and VPA. Start time remained significant for VPA but no longer for MVPA. Child gender became a significant predictor for both MVPA and VPA (whereas it had not reached significance in the baseline sample).
- Teacher gender was a significant predictor of MVPA but not VPA (at baseline if was significant for VPA). In the overall analysis boys are significantly more active than girls, VPA reduces at the day progresses, and children's activity is highest during fitness then skill, then game and lowest during management/instruction context.
- The predictive model for MVPA explains more variance at the lesson (20%) than at the school level (0.18%), whilst the Model B2 (VPA) explains more variance at the school level (40%) than the lesson level (28%).

Intervention Effects - MVPA

At baseline, there was no significant difference in %MVPA engagement between intervention and control schools. At follow-up, levels of MVPA in the intervention group were higher at 44.9% (compared to a control of 38.8%, Table 7, Figure 13). Both control and intervention schools increased in MVPA. Although the rate of increase was higher for intervention schools by a relative 4.5% (or 12.5% when expressed in terms of baseline MVPA levels) the difference in slope did not reach significance ($z=1.33$, $p=0.09$).

Intervention Effects - VPA

At baseline, there was no significant difference in %VPA engagement between intervention and control schools. At follow-up, there was an overall decrease in observed levels in both control (11.7% 6.3%) and intervention groups (10.5% to 8.2%). (Table 7, Figure 14). The decrease was greater however for control schools which means that intervention schools actually showed a significant 3.3% increase in VPA by comparison. This translates to a 27.2% increase on the mean baseline level ($z=2.43$, $p=.008$).

Table 7: Adjusted Mean Percentages And 95% Confidence Intervals Of MVPA and VPA In PE Lessons Computed At The 'Average' Levels Of Predictor Variables

		Control		Intervention	
		Mean %[1]	CI	Mean %[1]	CI
MVPA	Baseline	35.4	30.1 - 41.1	37.1	31.7 - 42.8
	Follow-up	38.8	33.2 - 44.7	44.9	39.1 - 50.9
VPA	Baseline	11.7	9.4 - 14.5	10.5	8.5 - 13.1
	Follow-up	6.3	5.0 - 7.9	8.2	6.5 - 10.2

[1] The mean percentages and 95% confidence intervals were computed at 'average' levels of the other variables. Specifically, the 'average' level of child gender employed was 0.5, the 'average' level of teacher gender was 0.5. For the lesson context the estimates were computed using whole sample lesson context proportions. The 'average' value of lesson time was taken as 2 hours from 9.00 am (11.00 am). All estimates were computed for a year 4 class (ie: year 4 at baseline, year5 at follow-up).

Figure 13: Multivariate Adjusted %MVPA in PE Lessons for Pre And Post, Control and Intervention

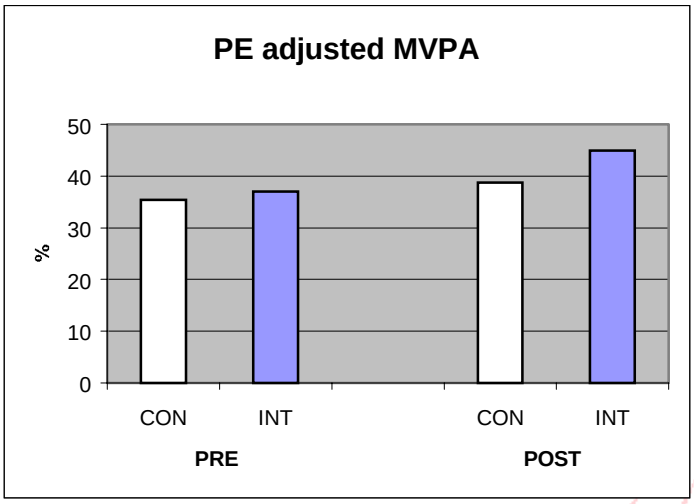
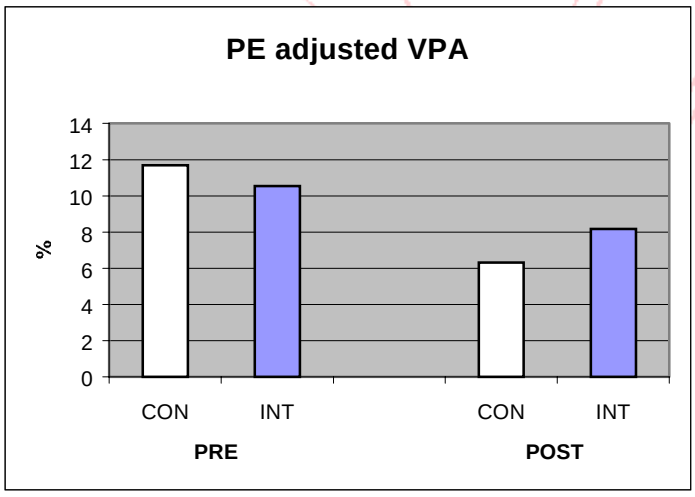
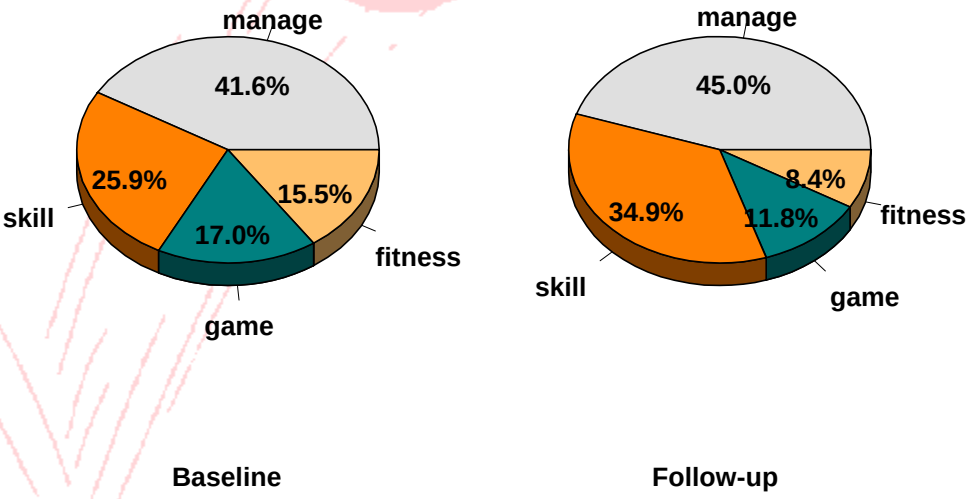


Figure 14: Multivariate Adjusted %VPA in PE Lessons for Pre And Post, Control and Intervention Teaching Context



Because the intervention promoted teachers to focus on activity and skill acquisition during PE lessons a series of logistic regression models were run to test for changes in the proportion of the lesson time spent in each context within intervention schools compared to controls. This revealed no significant change in time spent on management (β=-0.002, z=0.038, p>0.49), a decrease in time spent on fitness (β=-0.404, z=5.32, p<0.001), an increase in time spent on skill training (β=0.413, z=6.55, p<0.001) and a decrease in time spent on games (β=-0.120, z=2.14, p=0.016) relative to controls. See Figure 15. (Note: because many lessons had zero percent of one or more contexts the lesson level was removed from the logistic model to enable these estimates).

Figure 15: Changes in Intervention PE Context Proportions After Adjustment for Changes in Controls



Changes in Amount of MVPA And VPA within Teaching Contexts

Because the intervention promoted teachers to increase child activity during fitness, skill and game contexts of PE a further series of logistic regression analysis was conducted to test the hypotheses that within intervention schools, changes in %MVPA and %VPA would occur within these contexts, when compared to controls. During fitness context there was a significant increase in activity for MVPA (β=0.608, z=3.07, p<0.001) and VPA (β=0.374, z=1.86, p=0.03) relative to controls. During skill context there was no change in %MVPA (β=0.137, z=0.86 p=0.19) and a borderline non-significant increase in VPA (β=0.358, z=1.64, p=0.05). During game context there was a decrease in MVPA.

(β=-0.290, z=1.66, p=0.045) and no significant change in VPA (β=-0.192, z=0.94, p=0.17).

6.4. Playground

(Objective 1: To develop and validate an instrument to assess children's PA levels in the PG)

6.4.1. Inter-rater Reliability – Video Gold Standard

When the sample of video intervals (n=100/738 or 13.55%) was analysed by both pairs of observers independently it yielded 0.91 and 0.89 correlation for the number of children engaged in MVPA and the percentage of children engaged in MVPA respectively.

6.4.2. Validity

The validation study yielded 185 CAST scans (every 20 seconds) and 738 video scans (every 5 seconds). Every 4 video scans were averaged to enable comparison with field scans. The means percentage MVPA of the video observations was 2.7% higher than the field means (Paired t = 0.3035, df = 184, P<0.005). On a single scan level the field measurements were a valid and positive predictor of the video 'gold standard' (r=0.7, p<0.001). As CAST was used to assess the percentage MVPA engagement of a whole break period, the reliability of the field instrument as an estimate of the gold standard would increase substantially for the number of scans typically conducted during a break period (79) (see internal consistency reliability section below).

6.4.3. Inter-rater Reliability

Identifying Activity Categories

For the 1,915 paired observations agreement rate for student activity level ranged from 72.2% to 100% with a mean rate of 96.1%. Kappa ranged from 0.7 to 1, 2/3 of the comparisons returned k>.95.

Number of Children in Each Activity Level

For the 1,625 paired observations of the number of children in a play area in each activity level in a particular scan the overall r for all categories was 0.79.

Internal Consistency

The reliabilities of a single scan within a school (ICC), are 0.34 for MVPA and 0.21 for VPA. The median number of scans within schools was 29, yielding school-level composite reliabilities of 0.94 and 0.77 respectively.

6.4.4. Physical Activity in School Playgrounds

(Objective 2: To assess baseline PA levels of children in school playgrounds)

Sample and Setting

In total, 17,645 child observations were made in 524 scans in 36 break periods in the 18 schools (total enrolments = 3,912 students). School size ranged from 18 to 575 children (mean 212). Morning recess took place between 10.30am and midday with a mean observation period of 16 minutes. Lunch break took place between 12.35pm and 2.50pm with a mean observation period of 30 minutes. The gender breakdown of observations was 46.4% female and 53.6% male.

Predictors and PA Levels

The results of the six hierarchical logistic regression analyses are reported in Appendix 10 and Appendix 11. Parameter estimates are considered to be significant (two-tailed at $\alpha \leq .05$) if they are 1.96 or more times their standard errors.

The variance components models (A1 and B1) reveal considerably more variance at the 'scan within school' than at the 'school' level (ie. there is more variation *within* than *between* schools), with 74% of the variance of MVPA and 81% of the variance of VPA located at the 'scans within schools' level.

The same variables were found to be significant predictors of both MVPA and VPA (models A2 and B2), ie PA levels were significantly higher for lunch than recess periods, significantly higher for boys than girls, and decreased linearly (on the logit scale) with school size. As Table 8 shows, the percentage of children engaged in MVPA varied: 55.16 % of boys and 45.41% of girls were engaged in MVPA at lunch when a 100 students school was modeled [CI Boys 49.97 to 60.25, CI Girl 40.23 to 50.68], while only 35.14% of boys and 26.80% of girls were engaged in MVPA during recess when a 500 student school was modeled [CI Boys 27.95 to 43.06 CI Girls 20.75 to 33.87].

For MVPA, significant predictors explained 24% of the 'scan within school' and 35% of the between 'school' variance, for VPA they explained 28% of the 'scan within school' and 40% of the 'school' variance. Heat stress, equipment availability (other than balls) and teacher presence/behaviour variables were not significant. The ball to child ratio was a one-tailed significant predictor of increased VPA.

Table 8: Estimated Mean Percentages and 95% Confidence Intervals of MVPA and VPA for Each Predictor Variable Computed at Three School Sizes (N Of Students Enrolled)

School Size	Break	Child gender	%MVPA	L95%CI	U95% CI	%VPA	L95%CI	U95%CI
100	Recess	male	49.99	44.56	55.42	12.94	10.44	15.93
		female	40.33	35.12	45.77	8.17	6.44	10.30
	Lunch	male	55.16	49.97	60.25	17.18	14.21	20.62
		female	45.41	40.23	50.68	11.04	8.94	13.57
200	Recess	male	46.17	41.66	50.74	11.02	9.14	13.22
		female	36.70	32.46	41.16	6.90	5.61	8.46
	Lunch	male	51.35	47.05	55.64	14.74	12.53	17.26
		female	41.64	37.46	45.95	9.38	7.82	11.20
500	Recess	male	35.14	27.95	43.06	6.69	4.76	9.34
		female	26.80	20.75	33.87	4.12	2.88	5.84
	Lunch	male	40.00	32.44	48.07	9.10	6.57	12.47
		female	31.07	24.49	38.51	5.65	4.02	7.89

6.4.5. Follow-up Analysis of Playground Data for Effect of Intervention

(Objective 3: Increase in PA levels in playground during lunch.
Objective 4: Increase in PA levels in playground during recess
Objective 5: Increase girls participation in playground)

Although much useful information was derived from the follow-up study of playground PA, limitations in the playground study design which only became apparent during analysis prevented the derivation of meaningful conclusions relating to objectives 3,4 and 5. This is discussed further in 7.4.1 Limitations.

Predictors and Physical Activity Levels

The results of the four hierarchical logistic regression analyses are reported in Appendix 12 (MVPA) and Appendix 13 (VPA). Parameter estimates are considered to be significant (two-tailed at $\alpha \leq .05$) if they are 1.96 or more times their standard errors.

The variance components models (A1 and B1) reveal considerably more variance at the 'scan within school' than at the 'school' level (ie. there is more variation *within* than *between* schools), with 34% of the variance of MVPA and 21% of the variance of VPA located at the 'scans within schools' level.

The results presented in Appendix 12 and 13 can be interpreted as follows:

- All significant variables at baseline remained significant in the overall analysis, ie boys are significantly more active than girls, lunch breaks more active than recess and both %MVPA and %VPA decrease with increased school size. School size in VPA overall analysis was one-tailed but not quite two tailed significant. It was included in the model, as it would strengthen its explanatory power.

- In addition, 'Rainday' was a significant predictor of both MVPA and VPA in the overall analysis. Interestingly, MVPA significantly decreased in rainy days while VPA significantly increased. Furthermore, although Heat Stress Level (HSL) was a significant predictor of MVPA and a nearly significant predictor of VPA in the overall analysis, PA levels were higher in HSL 3 and 4 than in HSL2.

Intervention Effects – Playground MVPA and VPA

At baseline, MVPA engagement in intervention schools was higher than in control schools, although the difference was not significant (Table 9). At follow-up, MVPA engagement in control schools was slightly higher than in intervention schools, however the difference was still not significant. The observed difference in the changes in %MVPA engagement between control and intervention schools (interaction effect) was significant and negative, ie 'slopes' of control and intervention schools were in the opposite direction to expectation (ie no evidence of positive intervention effect). For VPA at baseline, there was no significant difference between intervention and control. There was no change between pre and post measurements for control schools and a non-significant decrease for intervention schools. This resulted in a non-significant difference at follow-up. The difference in the changes in %VPA engagement between control and intervention schools (interaction effect) was significant and negative (ie no evidence of positive intervention effect).

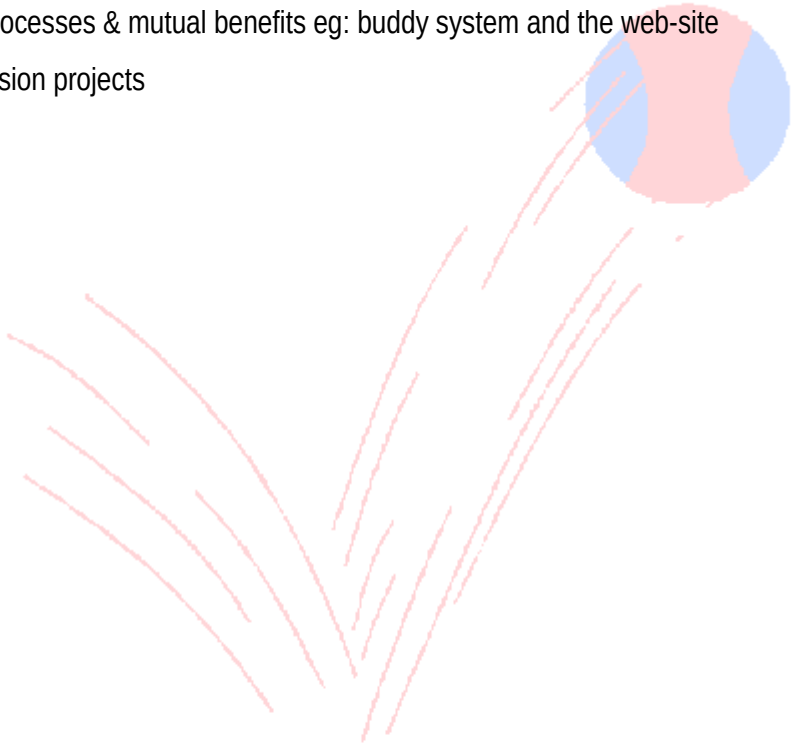
Table 9: Estimated Mean Percentages and 95% Confidence Intervals of MVPA and VPA for Intervention and Control Schools Pre and Post Implementation – Levels Computed for Boys at Lunch

Time	Treatment	%MVPA	L95%CI	U95%CI	%VPA	L95%CI	U95%CI
Pre	Control	43.66	36.15	51.47	11.42	9.17	14.12
Post	Control	47.86	41.85	53.93	11.17	8.61	14.36
Pre	Inter	53.34	45.44	61.08	13.44	10.81	16.59
Post	Inter	45.99	37.64	54.56	10.91	8.35	14.14

6.5. Other Outcomes

The collaborate nature of MIGI has led to an understanding of the three sectors involved and possible outcomes may include:

- Ongoing links between stakeholders
- Sustainability of PA enhancing processes & mutual benefits eg: buddy system and the web-site
- An existing springboard for extension projects



7. DISCUSSION

7.1. Process Evaluation

Using quantitative methods, our project showed most change in mastery of FMS's, however only five out of nine schools had a mention of FMS in their management plans at midterm. Improvements in FMS mastery could also be linked to improvement in 'personal skills' (curriculum and staff development) and 'healthy public policy' (eg incorporating FMS into the broad syllabus) in the management plans. Some quantitative change did occur in physical activity within PE lessons, and this is reflected in the improvement in 'personal skills' (curriculum and staff development), and in 'healthy public policy' within management plans. Changes in indicators relating to the MIGI playground objectives occurred under the category of supportive environments and healthy public policy but cannot be related to a quantitative result because of design limitations in playground evaluation.

For sustainable change to occur it is ideal to have strategies that simultaneously focus on the different aspects of the Ottawa Charter, so it is encouraging that schools did broaden their scope considerably in relation to physical activity.(95) Whether the changes in plans will follow through to practice and if so be sustainable, is another question. Comparing school annual reports with management plans are one way to investigate the follow through from planning to practice, as policy and planning documents in themselves do not ensure effective HPS implementation.(80)

Nevertheless, policy making and planning is one way to initiate and document intended change. Policy making in itself can be considered cyclical and incremental.(40) In this way, the development of school plans that are designed to enhance health can been seen as a first step in the cycle towards sustainable change in a school community. Furthermore, if data collected on school plans is complemented by other evaluation methods a more complete understanding of school health promotion projects can be obtained.

7.1.1. Sustainability of Changes in Buddies and Teachers

As the shift in perceptions of self for each of the buddies was so dramatic in most cases, it may raise questions as to the length of the MIGI program and the sustainability of this shift in buddies' perceptions. Was the program too short or too long? Did the program confront the participants and challenge their espoused and enacted theories to such an extent that when the support is withdrawn the pedagogical content knowledge will not be sufficient to sustain the changes? Therefore, the significant fact to consider here is what "real" changes have occurred in each participant's, both buddy and teachers, espoused and enacted theories of teaching physical education and what are the implications for the way they will teach physical education? Will they, for example have the relevant pedagogical content knowledge, skills and teaching strategies to effectively put into place their espoused theories?

7.2. Fundamental Movement Skills

7.2.1. Fundamental Movement Skills– Baseline Results

The baseline results suggest that there may be great potential to improve FMS's of primary aged children in many parts of rural Australia. Even if the aim were for children to achieve near mastery levels, the improvement could be substantial in every skill category.

That year 4 mastery levels were consistently (though not always significantly) higher than those in year 3 for all skills tested in both years was not surprising. Children are expected to improve their mastery of such skills with experience, practice and general development (47, 89). Indeed these differences between years at baseline provide an insight into the secular changes that might be expected during the course of the MIGI intervention.

Gender differences found in other studies were corroborated by our findings (62, 68, 87, 93, 98). By developing supportive gender-specific social environments for learning it may be possible to substantially diminish differences in performance of boys and girls (34).

The breakdown of skills into 5 or 6 components affords their measurement a level of objectivity beyond that of a single overall score. It provides a good foundation for measuring change over time and the possibility of tailoring interventions to focus on the particular components of a skill, which require attention. While this study did not attempt to identify the mix of skills at the individual level, scoring of skill components in this manner could provide a detailed skill profile of every child for teachers to further target their remedial efforts.

Table 10 highlights FMS deficiencies that provide the greatest opportunities for improvement by gender and year. Prime targets among girls are the 80.2% in year 3 and 74.6% in year 4 who displayed poor kicking performance and the 77.3% in year 4 who displayed poor throwing skills. Among boys, the two thirds of years 3 and 4 (67.0% and 66.4% respectively) who displayed poor jumping skills offer the greatest potential.

Table 10: Percentage of Children at Poor Level of Mastery

Skill	Year	% at ' poor' level	
		Boys	Girls
Static Balance	3	26.3	22.9
Sprint run	3	52.7	67.0.
Vertical Jump	3	67.0	61.0.
	4	66.4	54.9
Kick	3	46.1	80.2
	4	36.9	74.6
Hop	3	62.2	56.8
	4	55.0	51.8
Catch	3	48.8	66.0
	4	42.6	45.8
Overhand Throw	4	37.4	77.3
Side Gallop	4	48.9	32.3

Such inequities might readily be redressed if format, content, scope and sequence of PE programs target identified deficiencies and if social and physical environments are established to support the required changes. For example, a strategic approach to improving kicking amongst girls could potentially provide the four out of five who currently cannot kick, with enough component skills to at least achieve near mastery and possibly with it, the confidence to take part in a wide range of kicking-based activities.

7.2.2. Intervention

Limitations

A methodological issue that may have influenced all surveys requires some mention. It appears that data generated by follow-up testers were substantially more conservative than those of baseline testers to the extent that at follow-up the mean mastery and near mastery level for control schools was 29.7% compared to 49.5% at baseline.

As described in the methods section, testers at follow-up were selected from a different pool than those at baseline because the student pool was unavailable. It is also possible that training was systematically different in some way although all care was taken to precisely replicate the initial training including stringent validity and reliability checks.

That the negative shift occurred in almost all control categories of FMS and PE testing supports this explanation. Furthermore, within each sample (pre and post) the developmental patterns between school years and across child genders was the same. At both times the relative position of skills was the same in terms of overall mastery level and at both times there was the same relatively higher mastery level among the older cohort when compared to the younger (ie age or development effect). Thus the bias was systematic. Clearly children do not unlearn skills at this rate. In fact we would expect that they should all have improved by an amount equal to the year to year improvements seen within the baseline sample and again within the follow-up sample.

Unfortunately it is difficult to know which levels to use as a benchmark. The only other survey of rural children in Australia which used similar methods and surveyed some skills in common was the NSW School Fitness and Physical Activity Survey 1997 (12). The comparison is tenuous because the rural component of the NSW survey was state-wide however, for all except one of the skills tested in both surveys (run, jump, catch, throw and kick), the state-wide mastery levels were most similar to those of MIGI at baseline. The exception was the throw for which MIGI follow-up levels most closely reflected the statewide results.

Clearly this presents no problem in terms of calculating relative changes which occurred in the intervention cohort compared to the control cohort. However, we have made a further calculation of the potential absolute rates of change that might be achieved by disseminating MIGI strategies. In doing so we recognise that the assumption of zero real change in the control cohort, though supported by the foregoing arguments, is still tenuous.

Discussion of Intervention Effect

In view of the brevity of the MIGI intervention (ie 1 year), FMS outcomes were dramatic. Improvements were substantial and mostly significant (13/16) across all skills and for both genders. This degree of positive change clearly indicates that the poor mastery of basic skills identified during MIGI baseline surveys, is a prime target for collaborative intervention

It was heartening to find that overall the degree of improvement was similar for boys and girls, suggesting that at a broad level the intervention strategies suit both genders. Furthermore it was promising to find substantial improvements had been made among boys and girls in some of their less mastered skills (ie boys' jumping, sprinting and side galloping and girls' sprinting, jumping and catching).

It is unclear why some skills proved more amenable to change than others did. For example the smallest improvements for boys were in the hop, catch and balance which represent initially poor, mid and well mastered skills.

In order to estimate and rank the absolute changes in mastery for the various skills we recalculated observed changes between intervention and control groups as percentage change from baseline levels. In doing so we made the assumption that levels in control schools remained unchanged from baseline to follow-up. The choice of baseline levels as a denominator gave the most conservative estimates. This exercise revealed that

the absolute improvement was greater for girls than boys in the sprint, kick, throw and catch, all skills poorly mastered by girls at baseline. Absolute improvements ranged from a low of 10% for balance among girls to a high of 62% improvement in the sprint run among girls and the pattern of change was quite different to the relative comparison with controls (Table 11, Figures 16 & 17).

Table 11: Observed Relative and Derived Absolute Changes in FMS

Skill/Gender		Relative % change (compared with controls)	Absolute % change (% of baseline level)[1]
Sprint/run:	Boys	25.70	53.64
	Girls	21.56	62.34
Side Gallop:	Boys	21.91	42.56
	Girls	21.72	31.87
Kick:	Boys	21.10	34.42
	Girls	12.11	58.00
Throw:	Boys	14.38	22.68
	Girls	7.22	32.58
Jump:	Boys	14.28	42.99
	Girls	16.44	40.11
Hop:	Boys	11.39	26.66
	Girls	11.40	25.08
Catch:	Boys	11.38	23.95
	Girls	22.72	56.06
Balance:	Boys	9.13	12.23
	Girls	8.08	10.29

1. Made on assumption of zero real change in control cohort.

Figure 16: **Improvement in Mastery and Near Mastery as a Percentage of Baseline Level**

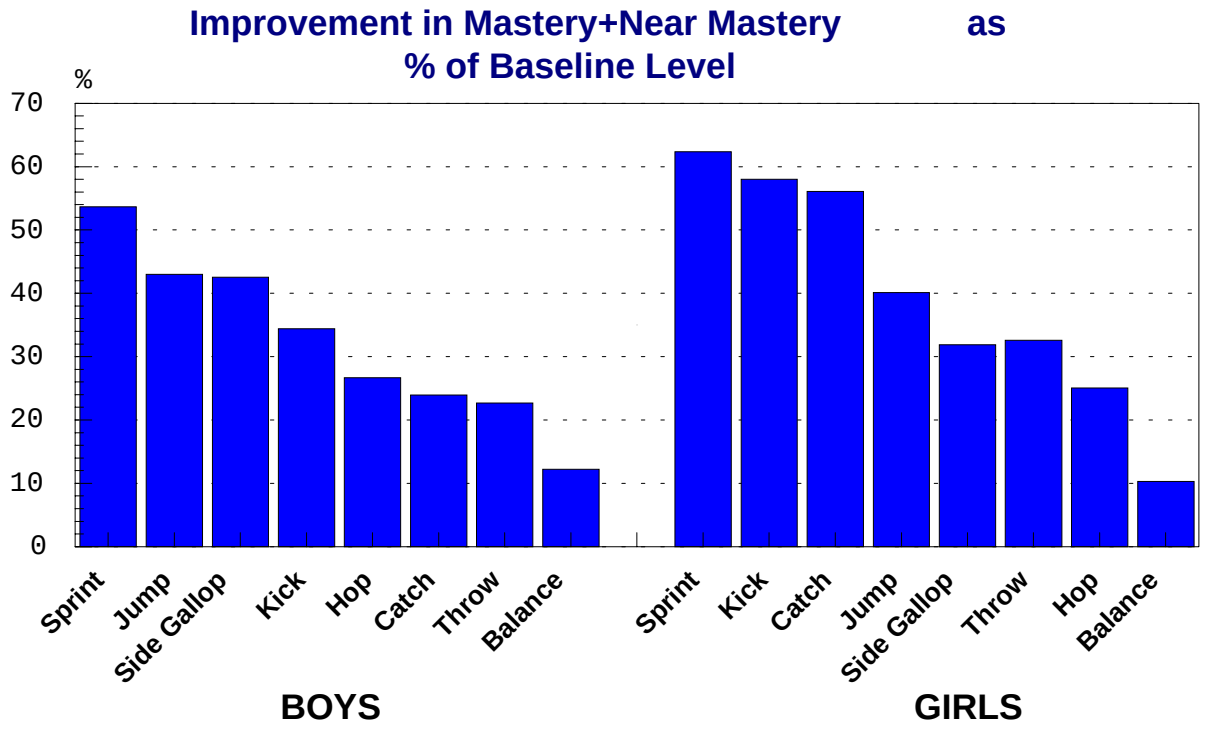
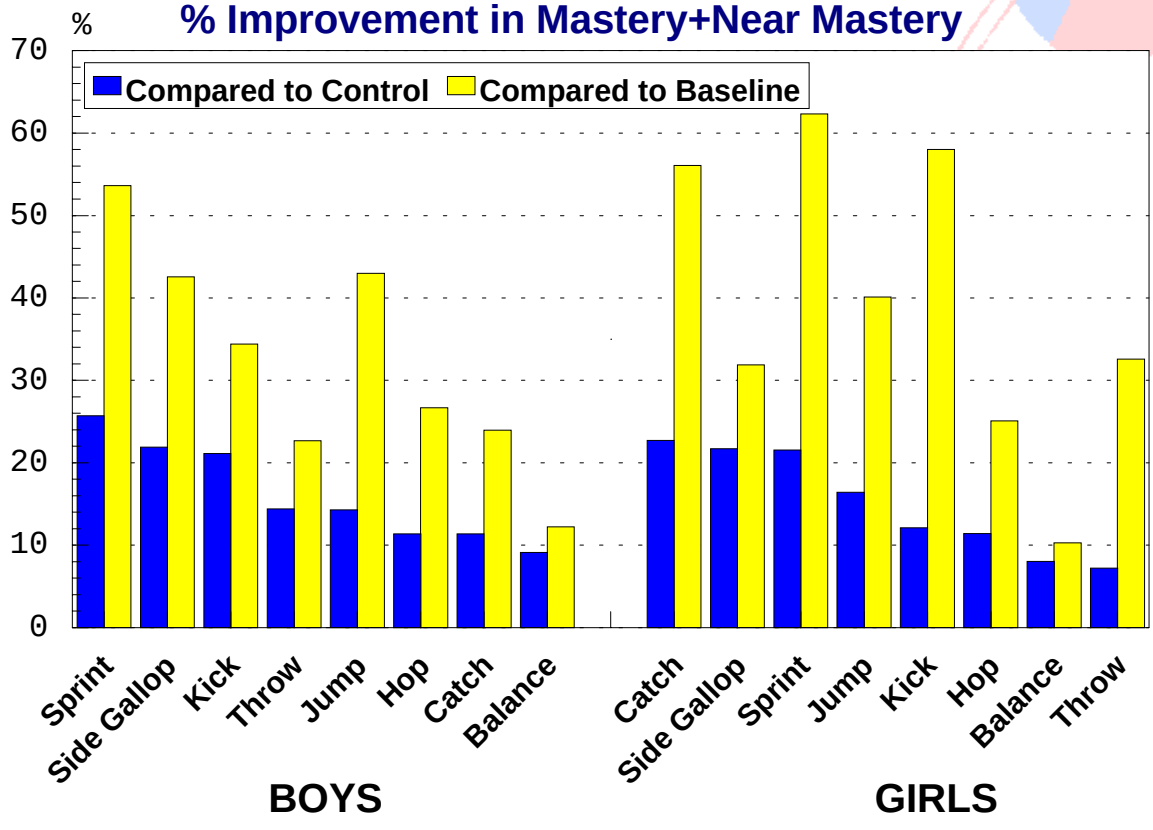


Figure 17: **Improvement in Mastery and Near Mastery**



7.2.3. Conclusions

MIGI proved highly successful in its aim to improve FMS's of primary school children. Intervention components likely to underlie observed improvements are teacher workshops, the buddy program and the web-site. Continual requests by teachers, for evaluation feedback on FMS improvement among their pupils suggests that an action research strategy may also prove effective in future interventions. MIGI strategies may have been catalysed by FMS already being an area of interest in the education sector. In fact, in the first teacher workshop DET personnel insisted on covering the upcoming FMS package as a major agenda item. It is clearly possible to substantially improve a range of child FMS mastery in a remarkably brief time frame at relatively minimal cost or inconvenience to schools. It remains to be proven conclusively that children armed with better skills actually become and remain more active into adulthood but there is evidence that they do more readily become involved in organised sport (60, 62). It also seems plausible that as other barriers to PA are removed, children equipped with high levels of FMS mastery are more likely to take advantage of opportunities for PA than their less skilled peers.

7.3. Physical Education Lessons

7.3.1. Baseline

Limitations

A potential and unavoidable limitation of the study design is that most schools required MIGI to inform them of what lessons were to be observed prior to the observation. This theoretically gave the schools a chance to structure the lesson differently to a 'typical' lesson. However, even if teachers occasionally restructured their lessons, there was little likelihood of systematic bias in measured variables. There were four main reasons, (1) the range of school type and setting, (2) the lengthy time period of observations (4 months), and (3) the fact that teachers were not aware of what we were measuring and (4) how the measurement was performed.

An improvement to the study would be to have noted primary lesson focus; MIGI only recorded broad context categories of 'fitness', 'skill', 'game', 'management/instruction' and 'other', rather than detail about the type of activity the children engaged in, eg soccer, dance, or cricket. Such information may have enabled us to discover which particular games, skill practice activities, or fitness activities have higher physical activity levels. This information would be invaluable to schools wishing to increase physical activity levels and is recommended as a focus for future research.

Discussion of Baseline

The mean percent MVPA of 34.7% is well below recommended levels and comparable to that found by McKenzie 1995 of 36.2%. The mean percent VPA level of 9.6% was even lower than McKenzie's finding of 17.5%. One factor that may explain the lower levels of VPA in our study is that one of the larger schools had a period of cross-country lessons that were excluded and these are lessons that one would expect to have high levels of VPA.

Generally boys are reported to be more physically active than girls (67). However this difference is reduced when moderate activity alone is compared, which indicates that boys participate in more vigorous activity than girls (63). In PE lessons the gender differences in terms of physical activity are unclear. Our finding that MVPA levels were significantly higher for boys than girls supports McKenzie 1995 (48). In contrast Sarkin found that in PE lessons there was no significant difference between boys and girls physical activity levels (74). However, McKenzie also found that the VPA levels of boys were significantly higher than the VPA levels of girls. In this study that is not the case.

McKenzie (1995) explained the higher physical activity level in boys as being due to boys being more active than girls during free play opportunities within PE lessons. Other studies confirm that during free play in the playground, boys are significantly more active than girls in terms of MVPA (49), and physical activity generally (74). In our study however, free playtime is almost non-existent (1.3 % of lesson time) compared to the 5.2% reported by McKenzie (1995). This may explain why VPA was not higher for boys in this study.

It is interesting that teacher gender was found to be non-significant for MVPA but lessons taught by female teachers were found to have significantly higher levels of VPA. Further research is needed to explore whether female teachers conduct lessons that contain more fitness context and less management/instruction which would raise VPA levels or whether female teachers structure lessons similarly to male teachers but simply encourage the children to be more active generally within a lesson.

A worrying result is that over a third of the lessons were spent on management/instruction. Our finding that MVPA and VPA levels were higher during the context of fitness rather than during the context of skill practice or games confirms McKenzie (1995).

The finding that physical activity levels declined as the school day progressed could reflect heat stress, children tiring due to demands of the school day, and teachers' energy declining due to teaching demands. It suggests that any restlessness that may result from being constrained in a classroom does not translate to an increase in energy expenditure.

It was thought that the lesson length might affect MVPA levels due to the students tiring with time. That this hypothesis was not supported by our data may indicate that the duration of even the longest PE lesson is insufficient to significantly tire the children. This is not hard to believe, when a lesson of average duration (21 minutes) has the equivalent of approximately 7 minutes of MVPA with only 2 minutes being spent in VPA.

Finding more variation between lessons than between schools, points to particular teaching styles making more of a difference in the delivery of PE lessons than a particular school 'culture'. Considering each lesson is likely to be conducted by a different teacher with very different aims the greater variation in lessons is understandable. However, it could also be seen as undesirable. Perhaps if lessons were more standardised in terms of achieving a minimum level of physical activity regardless of the focus of the lesson (ie dance or hockey skills), this variation between lessons would decrease and the 'school culture' would become one of greater physical activity.

7.3.2. Physical Education Intervention Effects

Limitations

It is uncertain as to why both intervention and control schools had lower VPA levels, but not MVPA levels, at follow-up than at baseline. The pattern is similar to that of FMS results and as a similar group of people were used as observers for the follow-up; it could be further evidence that the follow-up observers were 'tougher scrutineers'. Perhaps follow-up observers attributed a child with a score of '5' (very active-vigorous activity) less often than baseline observers, preferring to give a score of '4' (walking-moderate activity). As reliability for both groups of observers were high (baseline and follow-up), the reasons remain unclear.

Discussion of Effect

The change in MVPA, whilst non-significant was in the right direction and was close to reaching the original objective of a 5% increase. The fact that VPA did increase significantly is reflective of being on the 'right' track and indicates that MIGI if continued for three years may have achieved results more akin to the three year CATCH project.

What was achieved however, does not translate into a meaningful contribution towards recommended children's physical activity requirements. Since the proportion of VPA at baseline was only 2.04 mins of an average lesson of 21.2 mins, the increase of 3.3% in VPA only translates to an extra 38 seconds per lesson. Even if a child participated in three PE lessons per week, they would only partake in less than two minutes extra VPA.

In aiming to increase PA levels in PE lessons, it was thought that a decrease in the proportion of a lesson spent in management/instruction and/or an increase in the time spent in fitness would produce the desired result. What actually occurred was that the proportion of management/instruction did not change, skill context increased and fitness and games decreased. This leads to the conclusion that the increase in VPA must have occurred through the increase in time spent in skill and the reduced time spent in games.

Another possible explanation could lie in the change in each context's activity levels. We had also thought that if teachers structured each context stream in a way that promoted more activity that this would be effective in raising the PA of the lesson. At follow-up, fitness context had become more active in MVPA, skill context did not change and game became less active. Thus, it seems that the increase in VPA may have been due to a combination of the increase in activity within fitness, the increased time spent on skill and the reduced time spent in games.

The increased time spent in skill context is probably reflective of teachers putting more emphasis on teaching FMS, and may underlie the impressive results in FMS mastery. The explicit teaching skills provided through the project align with similar improvements in literacy and numeracy where systematic and explicit teaching is used. The fact that skill context did not become more active is disappointing as it suggests that the objective of improving children's skills may have countered that of increasing PA. Less time spent on games can be

considered a positive outcome in that game context was not as active as skill, and does not have the same emphasis on the learning of FMS skills.

It was interesting that while both MVPA and VPA were significantly lower later in the day at baseline, the effect was no longer significant for MVPA at follow up. It is possible that teachers in intervention schools tried to make all lessons more active regardless of the time of day but were only able to do that for MVPA.

Child gender proved to be a predictor for both MVPA and VPA at follow-up, with boys being more active. This indicates that raising the PA levels of girls within PE lessons is worthy of more focus. Likewise, the impact of teacher gender on children's activity levels is also worthy of further investigation.

7.4. Playground

7.4.1. Baseline

It is concerning that most children are not engaged in MVPA during school break times. Less than 50% of the boys observed were engaged in MVPA in most break periods and the figures for girls were much lower, reaching a low of 26.8% in a 500 children school at recess. The main other study of children's MVPA levels in school playgrounds found that children were more active with 59.3% of children being engaged in MVPA (49). However, these levels were found among students who used specialist facilities like basketball courts, gymnasiums and swimming pools. The students in this American study (49) constituted less than 20% of the students enrolled in the schools observed, whereas our study observed all playground areas and therefore included areas of very low activity.

Generally, boys are reported to be more physically active than girls (11, 16, 67). However, this difference is reduced when moderate activity alone is compared, which indicates that boys participate in more vigorous activity than girls (63). Looking at PE lessons, McKenzie (1995) found that the VPA levels of boys were significantly higher than the VPA levels of girls and explained the higher PA level of boys as being due to boys being more active than girls during free play opportunities within PE lessons. Other studies confirm that during free play in the playground, boys are significantly more active than girls in terms of MVPA (49), and PA generally (74).

The higher PA levels in lunch breaks found in this study may be due to the time of the day lunch is held or other contextual factors such as break length and availability of equipment. As there were no significant association between most equipment variables and PA levels, it may be the length of the break that contributes to increased PA engagement.

It was surprising to find no significant effect of equipment availability on PA except for the number of balls relating to VPA. Measuring the effect of increased equipment availability and usage on children's PA levels in the playground may require an experimental study design with a focus on this factor.

The differences in PA levels between boys and girls, different break periods and school sizes, the variability within large schools, and the large portion of children not currently active, even in the most active circumstances, imply that the opportunity to increase MVPA levels in the playground is substantial.

Limitations

Although the CAST tool performed well during the validation trials in terms of inter-observer reliability, internal consistency and validity of observed counts against a video gold standard, it has not been tested under the entire range of circumstances which occurred during the 3 months of the baseline study, i.e. in different size and different types of playgrounds.

Another limitation stems from the environmental complexity of school playgrounds and the chaotic nature of children's activity during unstructured breaks. Difficulties in observing PA levels under such conditions are acknowledged in other studies (49). Most school playgrounds consist of a number of areas separated by buildings. It was therefore necessary for observers to move between observation points during recess and lunch to cover the whole playground. This solves part of the problem, but there is still the difficulty of children roaming freely into, out of and between different areas and also disappearing into areas that cannot be observed such as corridors and toilets.

Finally, each school was surveyed twice on the same day. Ideally, visits on different days to every school would yield a more representative sample of break times. However, the large number of scans (524) and school breaks observed (36 break periods in 18 schools) may have compensated for the potential variation between different days.

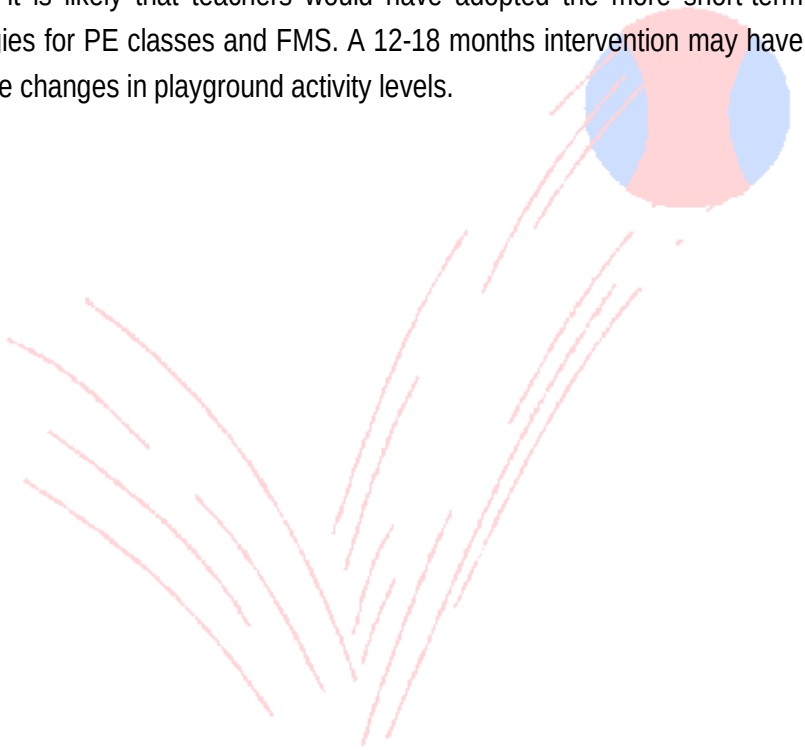
7.4.2. Intervention Effects

As mentioned above, limitations in the playground study design prevent the derivation of meaningful conclusions relating to objectives 3 and 5 as follows. While the measure of activity, within a school on any chosen day, had high precision (low error) due to a reliable instrument and a large number of child scans, there proved to be extensive variation in the level of activity between schools and also in both the direction and size of changes from pre to post within schools. Furthermore the sampling was logistically limited to only one recess and one lunch break on a single day of observation, within each school, per survey. In view of large day to day variations, the influence of random and contextual factors may have been substantial. These factors combined with the small overall sample of only 9 schools per treatment render it impossible to draw clear conclusions relating to changes in PA within playgrounds.

The change seen in MVPA engagement in the interaction between control and intervention may be due to the following:

- Secular trends: both control and intervention schools nominated to participate in the project so control schools were also intent on increasing PA. The project took place during the Sydney Olympic year, which led many NSW schools to put more emphasis on PA and sport.
- Regression to the mean effect: the change may have been within the normal variation of PA levels in schools. As every school was only measured on two occasions within the same day at base line and follow up, the negative interaction change may have been reflecting the normal fluctuation in school playground PA levels. Although there has been ample data at the child and scan level, the sample size at the school level is still quite limited. This means that the overall reliability of the instrument as a measure of children's engagement in MVPA/VPA is very high, but may not be meaningful at the school level (i.e. to compare between schools or groups of schools). A much larger number of observations in each school would have been required. This was not possible within the scope of MIGI.
- Intervention schools high PA levels at base line: as intervention schools had much higher levels of MVPA and VPA engagement at baseline, they may have been closer to the 'ceiling' of the normal range of PA engagement. Future research projects in this area may overcome this limitation by randomising after baseline observation. This option would have been impossible in the political and organisational context of the MIGI project.

The intervention had no effect or a negative one on playgrounds MVPA: as MIGI was a multi-strategic project it was left up to individual schools to choose their implementation strategies. Although policy and environmental changes were promoted, it is likely that teachers would have adopted the more short-term strategies that dealt with teaching strategies for PE classes and FMS. A 12-18 months intervention may have not been long enough to affect sustainable changes in playground activity levels.



8. RECOMMENDATIONS

8.1. Teachers/Schools

The MIGI project has highlighted the dilemma between keeping children active in PE and furthering development of FMS. It is possible to utilise strategies that work on skill development and keep physical activity levels high (i.e. circuits/tabloids). However furthering FMS development will also require a proportion of time spent on skill instruction, which will necessarily lower physical activity levels.

Therefore, concentrating on improving FMS mastery may be a better goal for schools than attempting to increase PA within PE lessons. In the long run, with the ultimate goal of improved adult health, mastery of FMS's may have a greater impact on these children's ability, desire and motivation to participate in lifelong PA than an extra few minutes per week spent in PA as children.

8.2. Fundamental Movement Skills

We recommend that mastery levels of primary aged children in performance of FMS be used to benchmark and track FMS mastery of all primary school children throughout their primary years.

We recommend that all PE teachers be trained to test FMS mastery, that their reliability be regularly reassessed and that wherever possible, the same person who tests a child initially should do so at any subsequent follow-up. One potential problem in MIGI FMS testing discussed previously stemmed from employing a different set of testers at baseline and follow-up.

8.3. Physical Education Lessons

Scheduling PE lessons in the morning will provide an additional strategy to increase MVPA, as children were more active earlier in the day. Conducting a lesson of average duration for this study (21.2 minutes) at 9am will increase MVPA from 6.4 minutes to 8.4 minutes. If a short lesson of this nature were conducted each day during the school week at 9am, 10 more minutes of MVPA would have occurred during the week.

Whilst PE lessons can be improved and restructured to become more active, schools need to consider what aspects of children's activity are more likely to *significantly* contribute to children meeting recommended levels of PA. Perhaps the number of PE lessons per week would be an appropriate target. An extra daily fitness lesson of 20 minutes would possibly achieve a greater change in terms of minutes per week/PA than improving the of PA level within the lesson.

8.4. Playground

With approximately one hour a day available for PA in school breaks, a 15% increase in MVPA engagement will translate into additional 9 minutes a day, or 45 minutes per week, during which children are engaged in MVPA. Such an addition will enable more children to achieve the minimum daily PA recommendations of 30 minutes a day.

As the PA levels of girls were consistently lower in all break types and all school sizes, future interventions could achieve a significant increase in the overall playground PA levels by increasing girls' engagement in PA. Such interventions may include policy and environmental strategies (eg allocated playground areas) as well as strategies designed to address the schools culture in regards to participation in PA.
One strategy to increase PA is to increase the numbers of balls in the playground available for children to use or encourage children to bring balls from home.

8.5. Methodology/Research

A range of recommendations for future methodology and research arises from the MIGI experience.

8.5.1. Project Timeframe

We recommend that future research/evaluation projects with a collaborative or inter-sectoral approach have a minimum one-year development phase followed by a minimum two-year intervention period. It is often cost inefficient and misleading to conduct a major evaluation of an intervention that is too brief to deliver any changes. Clearly inter-sectoral interventions require substantial formative, set up and lead in times if positive changes are to be forthcoming, measurable and sustainable. The unfortunate outcome of not allowing this time is that the evaluation may return non significant, ambiguous or negative results which might simply reflect random fluctuation during what is actually still a pre-intervention or pre response period.

MIGI also highlighted the potential dangers of exploring a new form of evaluation in such a limited timeframe. In settings which have never been systematically researched or interventions not previously evaluated it is necessary to allow sufficient development time to gather otherwise unavailable vital information to optimise evaluation design and development of new measurement instruments. In the case of MIGI, the CAST instrument proved very sensitive. However extended piloting would have revealed the typically high variance between breaks within schools. The planned sampling strategy could then have been modified to cover more breaks within each school thus maximising the likelihood of detecting any change over time. The ambiguous playground results probably reflect both of the above timeframe limitations.

8.5.2. Measurement Instruments

Fundamental Movement Skills

While there is evidence that improved FMS influence patterns of PA in later life, the picture is still unclear. We recommend research to further clarify both the immediate and longer term implications of such improvements within Australia. This is particularly important with respect to the large gender disparity evident in our results. In view of the likely cultural influence on the perceived value of varying skills it may be misleading simply to apply findings from other countries directly to Australian children (98).

We recommend that further research should be conducted to ascertain what minimum set of skills is most likely to be linked with future uptake and maintenance of an active lifestyle. This might be done via a case control research program.

Physical Education

If using an observational instrument such as SOFIT in the school context, it is important to recognise the amount of time that is needed to collect data and how this may impact on study design. Other competing school priorities and weather conditions were two factors in this study that led to many cancelled lessons contributing to the length of time involved in data collection. This led to the decision to abandon the original planned midway data collection.

Playground

More research may be needed to determine whether the significant differences in PA levels between recess and lunch breaks were due to the length of the break or its time during the day or other variables not measured or observed by this study (eg structured /unstructured activity). Possible intervention following such studies might be policy changes that would increase the length of recess breaks to allow more PA. An experimental study may be able to determine what would be the optimal length or starting time of a break in terms of maximising children's engagement in MVPA and VPA.

Further experimental research may ascertain the possible processes or structural aspects promoting higher PA levels in smaller schools which would in turn provide information on how to increase the PA of children in the larger schools' playgrounds.

CAST could be used as a valid and reliable tool for regularly monitoring child PA and environmental context in primary school playgrounds. The newly developed CAST proved highly sensitive and practical albeit labour intensive.

We also recommend continued support for development and validation of a 'cut-down' CAST instrument with a view to providing schools with an easily implemented monitoring tool for teacher use.

We recommend an experimental study design to better detect relationships between teacher behaviour and PA levels.

8.5.3. Analysis Methodology

Future research projects in schools should take into account the nested nature of various levels and the clustering that is inherent in them. Failure to do so may result in null or spurious findings, which may simply be an artefact of the hierarchical nature of the setting.

8.5.4. Further Research

Further research to address the following questions is recommended:

- How can collaboration with DET be optimised to sustainably increase child PA?
- What components of each FMS should be targeted for best training outcomes?
- What are the best strategies for teaching FMS without compromising PA levels?
- Is the maximum PA achievable within a PE lesson a significant proportion of recommended levels?
- To what degree can we increase the number and duration of PE lessons children take part in?
- How can we increase PA in school playgrounds?
- How can we increase activity of girls in school playgrounds?

Further research in the form of longitudinal studies is needed. This could take the form of tracking a cohort of MIGI participants through their adolescent years and into adulthood. Other skills not tested in MIGI may prove important in the quest to increase PA for both boys and girls. Again, further research is indicated in order to determine the optimal set. We have discussed the potential importance of more girls mastering the throw and kick and more boys mastering the jump and hop. However it may prove more productive (in terms of self confidence and involvement in sport) to enhance those skills most likely mastered by each gender rather than to strive for equality at all costs. Obviously this raises both practical and ethical questions worthy of further research.

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10. APPENDICES

10.1. School Information Package

'Move it Groove it'
Physical Activity in Primary Schools Project

School Information Package

Table of Contents

- Answers to common questions about this project (contact numbers on 2nd page)
- Time Line
- Expectations of the Project Teams
- Expectations from Pre Service teachers
- Information sheet for parents and carers
- Grant Application for your interest

MOVE IT GROOVE IT' PHYSICAL ACTIVITY IN PRIMARY SCHOOLS PROJECT

School Information Sheet

ANSWERS TO COMMON QUESTIONS ABOUT THIS PROJECT

Why are we doing this project?

The 1992 Senate Inquiry into Physical Education and Sport found that Australian children were less fit, less physically co-ordinated and skilled, more often obese, and spent less time in physical activity than children in previous times. Furthermore, the NSW School Fitness and Physical Activity Survey 1997 found that many students, particularly girls, lack fundamental motor skills, and that a significant proportion had low aerobic capacity. The same survey found that the time spent in actual vigorous activity during PDHPE classes was surprisingly low. These trends not only reflect current lack of sporting skills and reduced participation in physical activity but will impact on the health of these children during adult life.

Childhood is a critical time for developing healthy behaviour patterns. Physical Activity is one behaviour which has a significant impact on health throughout life. Research shows a clear link between physical inactivity and increased risk of conditions such as Osteoporosis, coronary heart disease, stroke, high blood pressure and diabetes. Skill development and pleasurable exposure to Physical Activity in school influence children to be more active. Physical activity is not only a health behaviour with benefits for later adulthood but also contributes to bone development, controlling obesity and improving psychological health and immune status while still a child.

What is the project?

A two year project will develop, pilot and evaluate a comprehensive and sustainable programme to increase the motor skill and physical activity levels of children in primary schools. Strategies will include training and resourcing of teachers and schools, environmental changes supportive of increased physical activity (play equipment, playground allocation, modified clothing for girls etc.), establishing a school physical activity project team (parents, teachers and health workers), and school policies that support increased physical activity.

If you are interested in more details please contact the numbers below.

Who is involved in the project?

The project will be overseen by the Northern Rivers Institute of Health & Research and will involve a collaboration of the Lismore, Tweed/Ballina and Coffs Harbour/Clarence Districts of the Department of Education and Training (DET), Catholic Education Commission, Independent Schools, the School of Education at Southern Cross University (SCU), and wider school communities.

What are the benefits?

The project will provide valuable opportunities to support teachers and parents involved in the promotion of physical activity among school children. The evaluation will provide important information on children's levels of physical activity and changes in it following the project's implementation. This will allow us to develop a model for increasing levels of physical activity that can be adopted by other schools around NSW.

What tests and measures will be used and how long will it take?
A team of two (observing PDHPE classes) or five (observing a whole school playground and conducting motor skills testing) field research officers will conduct observations at school after thorough training and practice. The observers will be supervised by personnel from the Northern Rivers Institute of Health & Research and Southern Cross University and will carry out the following tests:

- Fundamental movement skills - **Years 3 & 4 only**
- Percentage of PDHPE class time spent in actual moderate to vigorous physical activity **- Years 3 & 4 only**
- Percentage of recess time spent in actual physical activity **- whole school**
- Girls/boys ratio in the playground **- whole school**
- Percentage of students who use the playground **- whole school**
- Usage of play equipment during recess time **- whole school**

When will the project be conducted?
The project will run for two years from January 1999 to 2000.

Will results of the testing be confidential?
No individual details will be recorded. All information collected will be used to determine levels of motor skills and physical activity for participating schools as a whole and for the Northern Rivers area. The results will be published in aggregated form, from which the results of any class or school will not be identifiable. All data will be kept in locked filing systems and electronic data stored in secure and password protected databases.

If you have any questions regarding the project and its evaluation methods please call any of the following contact people:

Northern Rivers Institute of Health and Research contact:

Avigdor Zask
Ph: (02) 6620 2743

Lisa Barnett
Ph: (02) 6620 7532

Department of Education and Training contacts:

Lismore district	Tweed/Ballina district	Clarence/Coffs Harbour
Carol Harris Ph: (02) 6624 0400	Anne Riddell Ph: (02) 6672 9300	Mike Cahill (02) 6641 5040

MOVE IT GROOVE IT' PHYSICAL ACTIVITY IN PRIMARY SCHOOLS PROJECT

Information sheet for parents/carers

Dear Parent

Your child's school has nominated to participate in a project to increase physical activity among school children. Increasing children's physical activity not only prepares them for healthier adult life, but also contributes to their current physical and mental health and well being.

18 schools in the Northern Rivers area have been selected to participate in the project.
To evaluate the effects the project might have, a number of observations and tests will be conducted over the next two years. Fundamental motor skills of years 3 & 4 students will be tested in schools as part of Personal Development Health and Physical Education programs. Other observations will be held in class rooms and playgrounds. A summary of tests and observations follows:

- Fundamental Movement Skills - **Years 3 & 4 only**
- Percentage of PDHPE class time spent in actual moderate to vigorous physical activity **- Years 3 & 4 only**
- Percentage of recess time spent in actual physical activity **- whole school**
- Girls/boys ratio in the playground **- whole school**
- Percentage of students who use the playground **- whole school**
- Usage of play equipment during recess time **- whole school**

No individual details will be recorded. All information collected will be used to determine levels of motor skills and physical activity in the Northern Rivers area as a whole. All data will be kept in locked filing systems and electronic data stored in secure and password protected databases.

This project is an exciting initiative in helping us to improve the health of our students. I encourage you to support your child's involvement.

A decision to proceed with this project will be put to the next P&C meeting. If you have any concerns or comments you would like to register, please complete and return the tear-off form below. If you have no comments, you do not need to do anything.

_____
Principal

.....

'MOVE IT GROOVE IT' PHYSICAL ACTIVITY IN PRIMARY SCHOOLS PROJECT

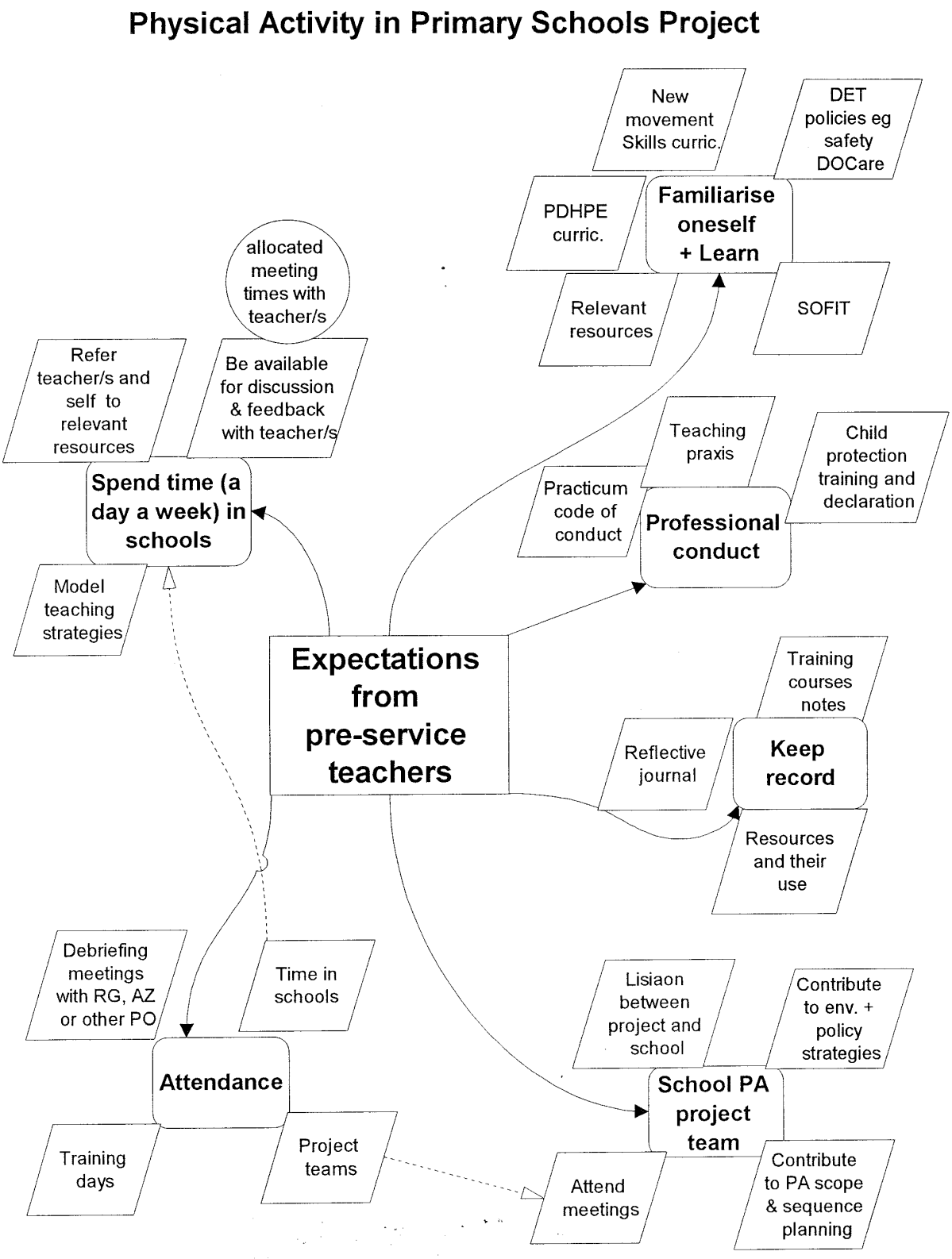
Student's Name: _____ Class:_____

My concerns/comments regarding the proposed project:

_____
_____
_____

_____ _____

10.2. Expectations



10.3. Checklist to Monitor Progress

Buddies School Visits Short Survey

27 July, 1999

Name	School	Number of visits so far

Please circle yes or no

Have you taught PE classes? **Yes** **No**

Have you done programming? (ie scope and sequence) **Yes** **No**

If yes what year?_____

Have you taught other lessons? **Yes** **No**

If yes what?_____

Have you done administration duties? **Yes** **No**

Other tasks (please describe)_____

_____

_____

_____

Buddies 1 School Visits Update: 27 July 1999

NOTE: If two buddies were allocated to a school then 1 and 2 were used to indicate.

School	Visits	PT meeting	Taught PE	Scope & Sequence	Admin	Other
1	7		Y	Y	Y	
2-1	4	Y	Y	Y	Y	Monitoring sports equipment
2-2	4	Y	Y	Y	Y	
3	3	Y	N	Y	Y	
4	?		Y	Y	N	Equipment purchased Resources updated One on one coaching provided
5	5	Y	Y	N	N	
6-1	2		Y	Y	N	2 yr plan in process Organised lunch time PA Documented PE equipment & literature resources Organising jump rope for heart
6-2	0	NA	NA	Y	NA	FMS focus Restructuring lessons- more PA Warm ups/cool down emphasis Incorporating children with special needs
7-1	1		N	Y	N	Lunch time netball games Restructuring lessons - more PA Resources updated Fitness program Soccer Competition Equipment purchased
7-2	8		Y	Y	N	Stage 1 FMS observation
8-1	5	Y	Y	N	Y	Observing lessons Starting to implement a 3 day per week fitness program
8-2	5	Y	Y	N	Y	As above
9	5		Y	N	N	

10.4. Questionnaire (1)

Teacher Evaluation

*To be filled in by **every** teacher that has been involved in 'Move it Groove It' (MIGI).*

1. SCHOOL_____

2. Has the (MIGI) project influenced your teaching practice? Yes/No

If yes, how?

_____

_____

_____

3. Do you think that MIGI might have achieved the following goals and objectives in your school (please circle appropriate answer):

⏮ increasing physical activity (PA) in PE classes? Y/N/Not sure

- increasing PA in the playground? Y/N/Not sure
- increasing the participation of girls in the playground? Y/N/Not sure
- increase mastery of Fundamental Movement Skills Y/N/Not sure

Teachers Workshops Evaluation

4. Did you attend the **dance** workshop? *Please circle* Yes/No

If you answered Yes, go to Q5. If you answered No, go to Q8

5. What time period will/has dance be taught this year?

Term 1 ⏮ Term 2 ⏮ Term 3 ⏮ Term 4 ⏮ All terms ⏮ Rarely ⏮

6. *Please tick the box which best reflects your agreement with the following statement:*
"The dance workshop was/will be useful to my teaching practice."

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

7. Since the dance workshop, how many dance related activities taught in the workshop have you used with your students? *Please tick a box*

None ⏮ 1-2 ⏮ 3-4 ⏮ 5-6 ⏮ 7 or more ⏮

8. Did you attend the **Fundamental Movement Skills (FMS)** workshop? *Please circle* Yes/No *If you answered Yes, go to Q9, if you answered No, go to Q10*

9. *Please tick the box which best reflects your agreement with the following statement:*
The FMS workshop will be useful to my teaching practice

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

10. Any other comments?

_____

_____

_____

Thank you for your time & energy for ' Move It Groove It '

10.5. Questionnaire (2)

'Move it Groove it'
Physical Activity in Primary Schools Project
Overall Evaluation

One overall evaluation to be completed per school

1. How effective have MIGI strategies been in your school in achieving the project's goals ? (ie increasing children's physical activity levels during PE lessons and break time, increasing mastery of Fundamental Movement Skills).

Please write a number next to the strategy to reflect effectiveness level according to scale below. Write NA if not applicable to your school.

Not at all	Somewhat	Fairly	Very effective
1	2	3	4

Buddies' visits _____
Resources provided/recommended by buddies _____
Web-site _____
Equipment purchased by funding provided _____
Teachers w'shops _____
FMS package from DET _____
Distribution of testing results _____
Other:

_____ _____
_____ _____

2. Have any changes occurred due to the Move It Groove It project (MIGI) in your school?
Tick in the relevant boxes and briefly describe it in the space available

⏮ School policy
_____
_____
_____

⏮ School physical environment
_____
_____

⏮ Playground: equipment offered
_____
_____

- Playground: activities offered
  _____
  _____
- Playground: Girls participation
  _____
  _____
- PE classes:
  frequency_____
  _____
- PE classes:
  content_____
  _____
- PE classes: teaching strategies used:
  _____
  _____
  _____
- Other:_____
  _____
  _____

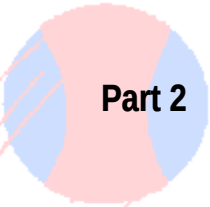
3. Put an asterix next to the changes outlined in Q2 which you think will be sustainable (ie last beyond 2000).

Thank you

10.6. Observation Training

‘Move It Groove It’

Playground Physical Activity Observation Training Package



Part 2

Team Leaders and Observers Roles and Tasks Lists

Sample Score Sheet

And

Training Guidelines for Score Sheet

Part 1 is the SOFIT Overview and Training Manual

'MOVE IT GROOVE IT' PHYSICAL ACTIVITY IN PRIMARY SCHOOLS PROJECT

Team Leader's Role + Task List

Task	Done	Not Done Comments
Make sure the principal knows about the observation by ringing the day before you leave (Friday if your visit is on Monday). If s/he is not available ask for a year 4/5 teacher. Some schools have a specified contact teacher for the project		
Get to the school at least 25/30 minutes prior to recess/lunch commencement		
Notify reception that you have arrived		
Fill in the school and observation details		
Oversee allocation of observation tasks		
Check in the school info sheet whether there is a special allocated eating time in the start of the recess/lunch period		
Ensure every observer has enough blank forms		
Oversee time keeper designation		
Ensure your team has a copy of the school site map		
Mark locations on the site map		
Final arbitrator re observation locations and movement between them		
Collect all record forms at the end of the observation and pass on to project officers		
Check and record number of children attending school on observation day (may need to be done by phone later)		
Mark locations on the site map		
Check and record whether other activities took place (eg choir practice) and estimated number of children participating		
Pick up relevant information from school database		

'MOVE IT GROOVE IT' PHYSICAL ACTIVITY IN PRIMARY SCHOOLS PROJECT

Observation Procedures - Playground Instrument

You can use this document as a reminder or as a checklist ticking once you have completed tasks.

Task	Done	Not Done Comments
Get to the school at least 25 minutes prior to recess/lunch commencement		
Allocate who observes which categories and circle them for each observer (do not use highlighter)		
Ensure you have enough blank forms		
Decide on observation positions and movement between them. Make sure you spend an even amount of time in each 'vantage point' and allow time to move between them (eg for a 23 minutes recess period with three 'vantage points' when movement between them takes a minute, allow 7 minutes per location + 1.5 minutes of moving between them).		
Designate a time keeper/announcer		
The time keeper keeps a walkman on and calls "now" when s/he hears the sound		
Decide direction of 'sweeping' the playground areas you observe. Mark it on the school site map using arrows		
Things to note		
Once you start counting children in the 'sweeping' direction, don't go back		
The number of children participating in ball games (No. play ball) is the hardest to determine		
Children that are waiting their turn to do an activity within a game are counted even if they are not currently hitting/batting etc		
Any children in the game area whose body language suggests they are part of the game (ie turning towards where ball is, eye contact) are counted even if they are currently passive. If you are at all uncertain whether they are participating in a game, **do not count them**.		

If you are asked what you are doing by a child or a teacher always give the following answers:

1. **Teachers:** Tell them you are observing physical activity in the playground. If asked further, say you are looking at what activities children are engaged in. If they want more information (which very unlikely), please give them the project officers' contact numbers.

2. **Children:** Tell them we are looking at what kids do in the playground.

SOFIT CATEGORY				
1 (Lying)	2 (Sitting)	3 (Standing)	4 (Walking)	5 (Running)
Face up	On ground/flat	Free	Straight	Straight
Face down	On seat/object	Leaning on	Side ways	Side gallop
On side	Sitting on legs w tops of feet flat on ground	Shift weight one foot to other	Sliding	Kick
Feet up		Slow shuffle	Crawl	Vigorous crawl
		Stationary in squat	Strong stretches	Tumbling
		On all fours	Going into or up from squat	Swinging from arms
		Bouncing ball while sitting	Throw frisby	Self propel on swinging
		Bent over stationary	Throw ball above shoulders	Chin ups
		Pushed on swing	Going into or up from bend	Skip
		Gentle stretches	Bouncing ball while standing	
		Sitting on legs w feet up on toes	Hang	
		Sitting on one leg other foot out front.		

SOFIT CATEGORY & EXCEPTIONS				
1 (Lying)	2 (Sitting)	3 (Standing)	4 (Walking)	5 (Running)
Rolling 4/5	Sliding 3/4/5	Into squat 4	Skip 5	
Tumbling 4/5	Bouncing 4/5	Up from squat 4	Shuffling 3	
Push ups 5	Into squat 4	On tip toes 4		
	Sit ups 4/5	Throw ball above shoulders 4/5		

Training Guidelines for Playground Scoring Sheet

Good quality data is essential to the evaluation of Move it Groove it. As part of the team you can ensure that quality is achieved and maintained.

Please don't leave any fields blank on the front page of the scoring sheet unless instructed to do so by your team leader. (Eg: If you check and can see no frisbies then enter a zero to indicate that you did check. A blank means we don't know.) Please don't leave the site until your team leader has checked that your records are complete and readable.

If you accidently enter a wrong number make sure that the correct entry is readable. (It may be clearer to put the correct value in a margin with an arrow pointing to the original spaces rather than try to squash it in where there is not enough space).

Lets go through fields which need clarification.

Page link (observer code)	If pages come apart we need to be able to identify what goes where. Enter your allocated observer code number (if you have not been allocated one then use your initial).
Page	Number each page in sequence.
Total kids enrolled	Get this information from the teacher
Total teachers employed	Include all full time, part time and casual teachers.by school
Time start (24hr time)	Check that all members of your team have recorded the same times. 24 hr time
Time end (24hr time)	means that 1pm is recorded as 1300 etc
Observer Team Indentifier	String together all first and lastname initial of all team members.
Number of teachers in playground	Record the number of supervising teachers at the beginning of the recess or lunch break
Wet or dry	If there is evidence of there having been rain earlier on the day or if it is raining at the time of observation then circle 'wet' otherwise circle 'dry'.
Temp dry bulb	These are taken from the wet/dry thermometer apparatus as described in the
Temp wet bulb	attached 'Wet Globe Thermometer Procedures'
Humidity	
Equipment in use	Record the maximum number of each item seen during the period of observation. As explained above please fill in all categories. If any item is in doubt explain in comments field
Comments	Information which may clarify anything unusual eg describe any equipment in 'Other' category
Page link	Enter your observer code (1st 2 spaces) plus page number
Number of children by SOFIT physical	Record number of boys or girls observed in each scan in the SOFIT category activity level which has been assigned to you
Equipment usage (n of participants)	
No. balls	Total number of balls in the playground on this scan
No. play ball	Number of kids of gender being scanned (boy/girl) who are engaged in a ball-based activity
No. play equipment	Number of kids of gender being scanned (boys/girl) who are engaged in an activity using non-fixed equipment.
No. play equipment	Number of kids of gender being scanned (boys/girl) who are engaged in an activity using fixed equipment.
Teacher behaviour	Enter the number of teachers engaged in each behaviour on this scan

Wet Bulb Globe Thermometer Procedures

On arrival at school place

- Completely fill the plastic container with water ensuring the wick is wet.
- Ensure the thermometer is in the shade.
- While preparing for the observation, enter the dry globe temperature and relative humidity (follow instructions below on deriving relative humidity rates using the Wet Globe thermometer).

Example

Step 1. Reading from the Dry bulb may be 29 degrees. Record this in the temperature box.

Step 2. To record the humidity record from the Wet bulb reading. Then subtract this amount from the Dry Bulb reading. The reading may be 21 degrees for the Wet bulb thus subtract 29-21 degrees. The difference is 8 degrees.

Step 3. The hygrometer reading has colums 1C to 9C which correspond to the differences between the dry and wet bulb readings. From these colums the percentage of humidity can be determined. In warm conditions a small difference between the dry and wet readings indicate that the humidity is high while larger difference will indicate that the humidity is low.

Step 4. To obtain the percentage of himidity use the colum 8 which is the difference between the dry bulb and wet bulb readings from the readings of 29-21 degrees.

Step 5. Then match up the dry bulb reading of 29 degrees and move directly in stratight line across to the 8C column.

Step 6. This will provide a reading of 48% which indicates the percentage of humidity in the playground.

Please before observing familiarise yours with this instrument.

'Move it Groove it'

Playground Physical Activity Observation Scoring Sheet

Page link (observer code) __ __ Page __

Date __ __ / __ __ / __ __ __ __ School __ __ __ __ __ __ __ __ __

Total kids enrolled __ __ __ Total teachers employed by school __

Time start (24hr time)__ __ __ __ Time end (24hr time) __ __ __ __

Observer Team Indentifier __ __ __ __ __ __ __ __ __ __

Number of teachers in playground __ __

Wet or dry (please tick one) Wet __ Dry __

Temp dry bulb __ __

Temp wet bulb __ __

Humidity __ __ __

Equipment in use (please fill in all categories)

- ropes (individual) __ __
- ropes (group) __ __
- frisbies __ __
- hoops __ __
- bats __ __
- other __ __
- fixed equipment __ __
- Comments _____

10.7. Teachers Workshop

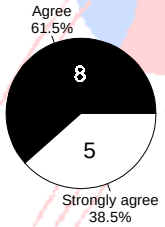
'Move it Groove it'

Physical Activity in Primary Schools Project

Teachers workshop 3/11/99 - Summary of Evaluation

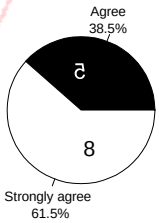
1. Attending today's workshop increased my knowledge about the Move it Groove it project:

Agree - 8, Strongly Agree - 5.



2. Today's workshop provided me with ideas, skills and strategies that I can apply in my school to achieve the project goals:

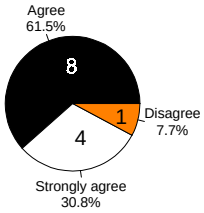
Agree - 5, Strongly Agree - 8.



Today's workshop provided me with new ideas, skills and strategies regarding:

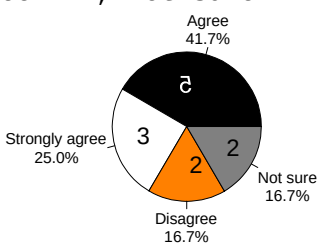
3. Increasing physical activity levels in PE classes:

Disagree - 1, Agree - 8, Strongly Agree –



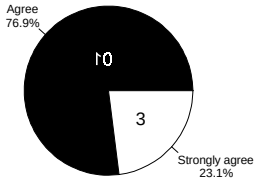
4. Increasing physical activity levels in school playground:

Disagree - 2, Not Sure - 2, Agree - 5, Strongly Agree - 3.



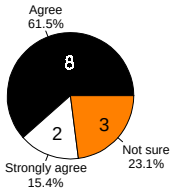
5. Improving my students' mastery of Fundamental Movement Skills:

Agree - 10, Strongly Agree - 3.



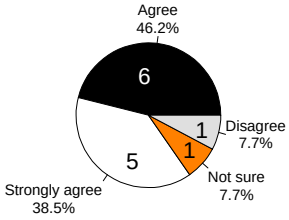
6. What my school is going to do in terms of environmental changes and supports for increasing students' physical activity:

Not Sure - 3, Agree - 8, Strongly Agree - 2.

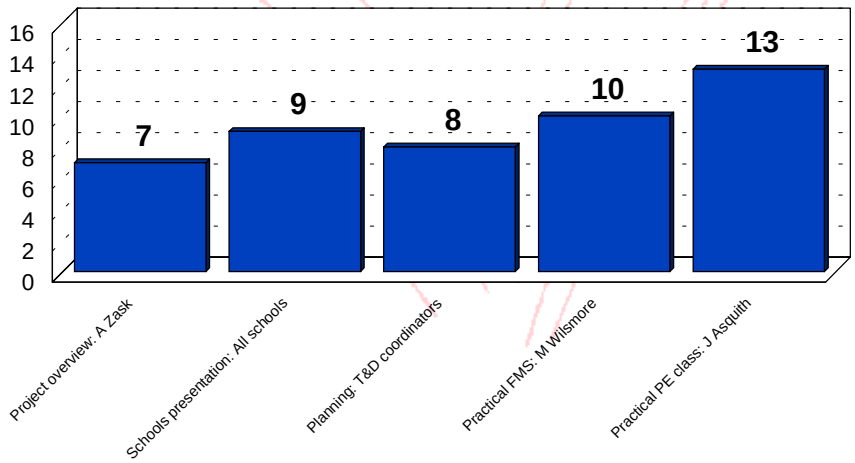


7. What my school is going to do in terms of policy changes and supports for increasing students' physical activity:

Disagree - 1, Not Sure - 1, Agree - 6, Strongly Agree - 5.



4. The session/s I found most useful to my future work on 'Move it Groove it' in my school were: (number of ticks received, people could tick more than one session):



9. What were the day's highlights for you?

- Jo's session demonstrated how the program could work well in a school situation
- Practical sessions (3)
- Sitting as a school group to plan
- Rebriefing of program,
- Clarifying aspects,
- Knowing what others are doing in their schools (3)
- The specific teaching ideas in the FMS (2)
- Activities for PE lessons
- Getting rid of frustration about the program not working within our school

10. What could have been done better?

- More guidance/examples given during the planning session. More time to look at new syllabus. (2)
- Groups to look at specific strengths and weaknesses in local school
- Plans to assist / raise level
- How to get actual lessons out of the syllabus without consuming a lot of time
- Culture section not very relevant
- A professional approach taken by buddies - I would have been sacked if I approached my job in that way
- Less time on presentations
- Nil

11. What further support/assistance would you need/want to be able to meet the project goals in your school?

- School/teacher network
- Time
- Maintain buddies
- Clarify FMS feedback
- Release time for planning (3)
- Networking seems to be a very good idea (3)
- The video from the first meeting abut the FMS and score sheets
- Ongoing teaching learning activities for FMS

10.8. Physical Education Baseline

Parameter Estimates And Standard Errors From Variance Components And Predictive Models For MVPA And VPA

	MVPA				VPA			
	Model A1 [1]		Model A2 [2]		Model B1 [1]		Model B2 [2]	
Fixed effects	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**
β_{1jk} = intercept	-0.545	0.094	-1.321	0.167	-1.910	0.134	-3.664	0.230
β_{2jk} = year 3 [3]			0.227	0.144			0.260	0.172
β_{3jk} = year 3/4 [3]			0.039	0.127			-0.072	0.160
β_{4ijk} = girl child [4]			-0.132	0.042			-0.098	0.057
β_{5jk} = female teacher [4]			0.030	0.104			0.292	0.130
β_{6ijk} = start time [5]			-0.102	0.041			-0.199	0.053
β_{8ijk} = fitness [6]			2.064	0.074			3.124	0.118
β_{9ijk} = game [6]			1.276	0.060			2.309	0.112
β_{10ijk} = skill [6]			1.432	0.063			2.387	0.115
β_{11ijk} = other [6]			0.994	0.272			0.750	0.553
Random effects [7]								
v_{1k} : school	0.108	0.052	0.039	0.027	0.245	0.107	0.103	0.056
u_{1jk} : lesson	0.415	0.050	0.343	0.045	0.581	0.077	0.451	0.066
e_{0ijk} : child [8]	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000
Statistics								
ICC = ρ_1 [9]	0.207		0.102		0.297		0.186	
ρ_2 [10]	0.770				0.835			
R_1^2 [11]			0.270				0.329	
R_2^2 [12]			0.531				0.535	

[1] Variance components model

[2] Predictive model

[3] Dummy codes to represent class year (reference category = year 4)

[4] Dummy codes to represent child and teacher gender (reference category = male)

[5] Beginning time of lesson in hours from 9.00 am

[6] Dummy codes to represent lesson context (reference category = class management)

[7] Variance components and their standard errors (SE)

[8] These values are default

[9] ρ_1 = proportion of (school & lesson within school) variance at the school level

[10] ρ_2 = reliability of mean of 12 (the median) lessons as measure of a school

[11] R_1^2 = proportion of lesson variance accounted for

[12] R_2^2 = proportion of school variance accounted for.

{Estimates for 'female teacher' without context variables: modtovig = – 0.100 (0.108); vig = 0.094 (0.133)}

10.9. Physical Education Follow-up

Parameter Estimates And Standard Errors From Variance Components And Predictive Models For MVPA And VPA

	MVPA				VPA			
	Model A1 [1]		Model A2 [2]		Model B1 [1]		Model B2 [2]	
Fixed effects	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**
β_{1jk} = intercept	-0.3970	0.0850	-1.205	0.154	-2.104	0.094	-3.300	0.163
β_{2jk} = post[3]			0.142	0.101			-0.678	0.120
β_{3k} = intrvnt[4]			0.070	0.171			-0.119	0.172
β_{4jk} = post*intrvnt[5]			0.184	0.138			0.398	0.164
β_{5ijk} = start-time [6]			-0.008	0.026			-0.071	0.030
β_{7ijk} = girl child [7]			-0.191	0.027			-0.157	0.039
β_{8jk} = female teacher [7]			-0.307	0.074			-0.043	0.088
β_{10ijk} = fitness [8]			1.841	0.053			2.901	0.085
β_{11ijk} = game [8]			1.023	0.039			2.085	0.079
β_{12ijk} = skill [8]			1.274	0.041			2.243	0.080
β_{13ijk} = other [8]			0.694	0.175			-0.674	0.359
Random effects [9]								
v_{1k} : school	0.102	0.043	0.084	0.038	0.120	0.053	0.084	0.040
u_{1jk} : lesson	0.537	0.042	0.422	0.036	0.700	0.061	0.422	0.051
e_{0ijk} : child [10]	1.000	0.000	1.000	0.000	1.000	0.000	1.000	0.000
Statistics								
ICC = ρ_1 [11]	0.160		0.166		0.146		0.116	
ρ_2 [12]	0.832		0.838		0.817		0.773	
R_1^2 [13]			0.208				0.283	
R_2^2 [14]			0.183				0.401	

[1] Variance components model
[2] Predictive model
[3] Post variable i.e. baseline or follow-up
[4] Intrvnt variable i.e. intervention or control
[5] Post*intrvnt variable i.e. interaction to determine effect of intervention
[6] Dummy codes to represent child and teacher gender (reference category = male)
[7] Beginning time of lesson in hours from 9.00 am
[8] Dummy codes to represent lesson context (reference category = class management)
[9] Variance components and their standard errors (SE)
[10] These values are default
[11] ρ_1 = proportion of (school & lesson within school) variance at the school level
[12] ρ_2 = reliability of mean of 12 (the median) lessons as measure of a school
[13] R_1^2 = proportion of lesson variance accounted for
[14] R_2^2 = proportion of school variance accounted for

10.10. Playground Baseline MVPA

Parameter Estimates and Standard Errors from Variance Components, Significant Effects Only, and Significant and Non-Significant Effects Models For *MVPA*

MVPA	**Model A1[1]**		**Model A2[2]**		**Model A3[3]**	
Fixed effects	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
β_{1jk} = intercept	-0.227	0.099	0.036	0.087	-0.360	0.491
β_{2jk} = recess[4]			-0.208	0.060	-0.149	0.076
β_{3ijk} = girl child[5]			-0.392	0.058	-0.413	0.062
β_{4jk} = enrolled[6]			-0.153	0.051	-0.121	0.053
β_{5ijk} = balls[7]					0.013	0.008
β_{6ijk} = other equip.[7]					0.000	0.005
β_{7ijk} = fixed equip.[7]					0.003	0.003
β_{8ijk} = encourage[8]					-0.008	0.034
β_{9ijk} = observe[8]					0.033	0.021
β_{10ijk} = manage[8]					0.009	0.028
β_{11ijk} = heat stress[9]					0.005	0.013
Random effects [10]						
v_{1k} : school	0.158	0.059	0.101	0.039	0.080	0.034
u_{1jk} : scan	0.301	0.030	0.246	0.026	0.230	0.027
e_{0ijk} : child [11]	1.000	0.000	1.000	0.000	1.000	0.000
Statistics:						
ICC = ρ_1 [12]	0.344		0.291			
ρ_2 [13]	0.938					
R_1^2 [14]			0.244		0.325	
R_2^2 [15]			0.350		0.478	

[1] Variance components model
[2] Model with significant variables only
[3] Model with significant and non significant variables
[4] Break period [reference category = lunch]
[5] Dummy code to represent child gender [reference category = male]
[6] School size - number of children enrolled [school deviation from mean = 212]
[7] Variables measuring equipment availability [items per 100 children]
[8] Variables measuring teacher behaviour/presence [teacher behaviours per 100 children]
[9] Variable measuring heat stress
[10] Variance components and their standard errors [SE]
[11] These values are default, given that observations on children within scans provide scan logits
[12] ICC = intraclass correlation coefficient = ρ_1 = reliability of a single scan as measure of a school
[13] ρ_2 = reliability of mean of 29 [the median] scans as measure of a school
[14] R_1^2 = proportion of scan variance accounted for
[15] R_2^2 = proportion of school variance accounted for

10.11. Playground Baseline VPA

Parameter Estimates and Standard Errors from Variance Components, Significant Effects Only, and Significant and Non-Significant Effects Models for VPA

VPA	Model B1[1]		Model B2[2]		Model B3[3]	
Fixed effects	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
β_{1jk} = intercept	-2.145	0.108	-1.777	0.095	-1.316	0.596
β_{2jk} = recess[4]			-0.334	0.081	-0.296	0.097
β_{3ijk} = girl child[5]			-0.513	0.078	-0.552	0.081
β_{4jk} = enrolled[6]			-0.182	0.054	-0.164	0.063
β_{5ijk} = balls[7]					0.019	0.010
β_{6ijk} = other equip.[7]					0.003	0.006
β_{7ijk} = fixed equip.[7]					0.000	0.004
β_{8ijk} = encourage[8]					-0.025	0.044
β_{9ijk} = observe[8]					0.044	0.026
β_{10ijk} = manage[8]					-0.019	0.036
β_{11ijk} = heat stress[9]					-0.015	0.016
Random effects[10]						
v_{1k} : school	0.179	0.070	0.104	0.044	0.112	0.049
u_{1jk} : scan	0.413	0.051	0.323	0.044	0.273	0.043
e_{0ijk} : child [11]	1.000	0.000	1.000	0.000	1.000	0.000
Statistics:						
ICC = ρ_1 [12]	0.207		0.244			
ρ_2 [13]	0.770					
R_1^2 [14]			0.279		0.350	
R_2^2 [15]			0.404		0.372	

[1] Variance components model
[2] Model with significant variables only
[3] Model with significant and non significant variables
[4] Break period [reference category = lunch]
[5] Dummy code to represent child gender [reference category = male]
[6] School size - number of children enrolled [school deviation from mean = 212]
[7] Variables measuring equipment availability [items per 100 children]
[8] Variables measuring teacher behaviour/presence [teacher behaviours per 100 children]
[9] Variable measuring heat stress
[10] Variance components and their standard errors [SE]
[11] These values are default, given that observations on children within scans provide scan logits
[12] ICC = intraclass correlation coefficient = ρ_1 = reliability of a single scan as measure of a school
[13] ρ_2 = reliability of mean of 29 [the median] scans as measure of a school
[14] R_1^2 = proportion of scan variance accounted for
[15] R_2^2 = proportion of school variance accounted for

10.12. Playground Follow-up MVPA

Parameter Estimates and Standard Errors from Variance Components and Significant Effects Models for MVPA

MVPA	Model A1[1]		Model A2[2]	
Fixed effects	Coeff.	S.E.	Coeff.	S.E.
β_{1jk} = intercept	-0.1590	0.0790	-0.2550	0.1603
β_{3ijk} = post[3]			0.1694	0.0824
β_{4ijk} = intrvnt[4]			0.3889	0.2063
β_{2ijk} = post*intrvnt[5]			-0.4642	0.1037
β_{5jk} = recess[6]			-0.3318	0.0505
β_{6ijk} = girl child[7]			-0.4520	0.0240
β_{7jk} = adjenrol[8]			-0.0011	0.0006
β_{8ijk} = heat stress[9] (Level 3 vs 2)			0.2659	0.1020
β_{8ijk} = heat stress[9] (Level 4 vs 2)			0.4491	0.1227
Random effects[10]				
v_{1k} : school	0.1010	0.0370	0.1586	0.0567
u_{1jk} : scan	0.2780	0.0220	0.2127	0.0185
e_{0ijk} : child [11]	1.0000	0.0000	1.0000	0.0000
Statistics:				
ICC = ρ_1 [12]	0.2665		0.4271	
ρ_2 [13]	0.9325		0.9660	

[1] Variance components model
[2] Model with significant variables only
[3] Post variable: baseline or follow-up
[4] Intrvnt variable: control or intervention
[5] Interaction: comparing relative changes of control and intervention groups between pre and post
[6] Break period {reference category = lunch}
[7] Dummy code to represent child gender {reference category = male}
[8] School size - number of children enrolled {deviation from mean = 212}. Note: not quite two-tailed significant, but was left in the model as an important explanatory variable.
[9] Variable measuring heat stress: dummy codes for heat stress levels 3 or 4 {reference category = level 2}.
[10] Variance components and their standard errors {SE}
[11] These values are default, given that observations on children within scans provide scan logits
[12] ICC = intraclass correlation coefficient = ρ_1 = reliability of a single scan as measure of a school
[13] ρ_2 = reliability of the mean of 38 scans {median number} as measure of a school

10.13. Playground Follow-up VPA

Parameter Estimates and Standard Errors from Variance Components and Significant Effects Models for VPA

VPA	Model B1[1]		Model B2[2]	
Fixed effects	Coeff.	S.E.	Coeff.	S.E.
β_{1jk} = intercept	-2.1553	0.0694	-2.0489	0.1244
β_{3ijk} = post[3]			-0.0251	0.1019
β_{4ijk} = intrvnt[4]			0.1861	0.1346
β_{2ijk} = post*intrvnt[5]			-0.2116	0.1254
β_{5jk} = recess[6]			-0.2629	0.0625
β_{6ijk} = girl child[7]			-0.4670	0.0384
β_{7jk} = adjenrol[8]			-0.0013	0.0004
β_{8ijk} = heat stress[9] (Level 3 vs 2)			0.1090	0.1204
β_{8ijk} = heat stress[9] (Level 4 vs 2)			0.2662	0.1427
β_{8ijk} = rainday[10]			0.4469	0.1177
Random effects[11]				
v_{1k} : school	0.0700	0.0290	0.0376	0.0179
u_{1jk} : scan	0.3116	0.0310	0.2452	0.0275
e_{0ijk} : child [12]	1.0000	0.0000	1.0000	0.0000
Statistics:				
ICC = ρ_1 [13]	0.1834		0.1330	
ρ_2 [14]	0.8951		0.8587	

[1] Variance components model
[2] Model with significant variables only
[3] Post variable: baseline or follow-up
[4] Intrvnt variable: control or intervention
[5] Interaction: comparing relative changes of control and intervention groups between pre and post. This variable was not significant, but was included
[6] Break period {reference category = lunch}
[7] Dummy code to represent child gender {reference category = male}
[8] School size - number of children enrolled {school deviation from mean = 212}
[9] Variable measuring heat stress: dummy codes for heat stress levels 3 or 4 {reference category = level 2}
[10] Rain on day during and/or prior to observation
[11] Variance components and their standard errors {SE}
[12] These values are default, given that observations on children within scans provide scan logits
[13] ICC = intraclass correlation coefficient = ρ_1 = reliability of a single scan as measure of a school
[14] ρ_2 = reliability of the mean of 38 scans {median number} as measure of a school

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