Effects of an Intervention Program on Children's Physical Activity Levels

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Abstract

In Canada, approximately 28% of 12 to 14 year old children and 66% of 15 to 19 year olds are deemed to be physically inactive (Statistics Canada, 1998). Increasing the opportunities children have to be active may be an effective strategy in increasing the activity levels of children. School-based intervention strategies are an excellent way to target the physical activity as they can reach almost all children and have been shown to be effective in increasing their physical activity levels. The school-based intervention used in this study (In Motion) was a physical activity intervention that offered 30 minutes of physical activity to every student on every school day. **PURPOSE**: To evaluate the effectiveness of an intervention strategy at increasing the activity levels of grade 4 and 5 children. **METHODS**: Participants were recruited from two Saskatoon elementary schools, which involved five classes of participants from the In Motion School (n = 81), and two from the non-In Motion School (n = 52). The classes were compared using anthropometric measures to identify if the groups were similar and to assess if maturity status affected physical activity levels. To determine the physical activity levels of the children, pedometers were worn for seven consecutive days and a seven-day recall questionnaire (PAQ-C) was completed. Data was analyzed between the schools using a One-way ANOVA and Post Hoc Least Square Differences. **RESULTS**: At the end of the evaluation, teacher logs revealed that three In Motion classes did not meet the 30-minute criteria. These classes were identified as non-compliant In Motion Classes. Amongst the In Motion, non-compliant In

Motion, and non-In Motion classes there were no maturational differences noted and the PAQ-C showed no significant differences in physical activity levels between the groups. Results from the pedometers showed between the three classes, there were no differences in the physical activity levels of children during school hours and outside of school hours. However, it was found that the In Motion classes did take significantly ($p < .05$) more steps over the weekend (855 ± 300), than the non-compliant In Motion classes (651 ± 314) and the non-In Motion classes (694 ± 378). There was no relationship found between the results of the pedometers and the PAQ-C ($r = 0.22$).

CONCLUSION: In Motion is an example of an intervention strategy that helped children to obtain 30 minutes of physical activity per day. When this program was adhered to in its entirety, children also exhibited increased physical activity levels on the weekend.

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CHAPTER 1

SCIENTIFIC FRAMEWORK

1.1. Introduction

There is an alarming trend toward physical inactivity occurring in our society (Biddle & Goudas, 1996). While children represent the most active portion of our society, there are concerns among some professionals that children may not be active enough for current or future health benefits (Biddle & Goudas, 1996). Some health benefits that have been attributed to physical activity include protection from some diseases, as well as the enhancement of muscle and bone development. Currently, the health of over half of Canadian children is threatened by physical inactivity (Canadian Fitness and Lifestyle Research Institute [CFLRI], 1999), and according to Statistics Canada (1998), approximately 28% of 12 to14 year old children, and 66% of 15 to 19 year olds are deemed to be physically inactive. By province, as many as 60% of Saskatchewan residents are insufficiently active for health benefits (CFLRI, 1999).

A report from the Surgeon General on physical activity and health (1996) indicated that about 14% of young people report no recent physical activity, and nearly half of all young people aged 12 to 21 are not vigorously active on a regular basis. These high levels of physical inactivity are alarming when one considers the numerous benefits that can be achieved through being physically active. Physical activity in children contributes positively to quality of life, functional and psychological status, as well as the ability to meet work demands and enjoy leisure activities (Sallis & Patrick, 1994). The benefits of physical activity provide significant protection from diseases such as cardiovascular disease (CVD), non-insulin dependant diabetes mellitus (NIDDM), obesity, osteoporosis, and it appears to reduce the risk of some types of cancers in adults (Casperson, Nixon, & DuRant, 1998; Pate, Pratt, & Blair, 1995; U.S. Department of Health and Human Services, 1996). There has been a substantial interest in the prevention of these adult diseases through regular physical activity during the first two decades of life (American Heart Association, 1998; Sallis & Patrick, 1994). For example, those individuals who acquire more bone mass by participating in weight bearing physical activities during the first two decades of life should be at a reduced risk for future health problems associated with skeletal fragility. Since over 90% of total adult bone mass is developed by the end of adolescence, (Bailey & Martin, 1994), the period of rapid deposition of bone during adolescence plays an important role in reducing the risk of osteoporosis later in life (Armstrong & Welsman, 1997; Sallis & Patrick, 1994).

There is growing evidence that atherosclerosis is also initiated during childhood (Shephard, 1997). This is significant, since cardiovascular disease is the number one killer of Canadians resulting in about 40% of all deaths and currently affecting over six million Canadians (Heart and Stroke Foundation, 2002). Several studies have reported the presence of fatty streaks and severe occlusive lesions in the blood vessels of adolescents and young adults (Armstrong and Simons-Morton, 1994; Enos, Beyer, Holmes, 1955). The presence of lipid deposition in the coronary arteries is associated with adult arteriosclerosis and has been observed in children as young as ten years of age (Armstrong & Simons-Morton, 1994). By being physically active, children (ages 5 and older) have been shown to exhibit higher levels of high-density lipoproteins, which have a protective effect on the heart (American Heart Association, 1998). Higher levels of lipoproteins can help to prevent lipid deposition in the coronary arteries, thus potentially also preventing the onset of arteriosclerosis.

These studies spectacle several concerning reasons as to why it is important to increase the physical activity levels of children at a young age in order to prevent some of the most common causes of disability and death in later life. There are also psychological and academic benefits related to participating in physical activity. A study done on fourth grade children in New Jersey found that students in the intervention group performed significantly better on a test of concentration after engaging in physical activity (Caterino & Polak, 1999). Increased self-esteem and self-concept are also positively affected through participation in physical activities (Calfas & Taylor, 1994). Calfas and Taylor, (1994), reviewed16 studies which involved exercise and self-esteem with adolescent participants and concluded that participants in exercise programs reported significant increases in self esteem scores when compared to control groups. Research also suggests that throughout adolescence, mastery experiences and successes with physical activity are most meaningful in improving self-esteem (Calfas & Taylor, 1994). Academically, performance in school can be maintained or even enhanced over time by an increase in a student's level of habitual physical activity. This change can occur even with 14-26% less curricular or free time for academic study (Shephard, 1997; Shephard & Lavallee, 1994). Available data also suggest that the rate of learning per section of class time is enhanced in physically active students (Shephard, 1997).

Individuals and organizations interested in the promotion of physical activity for children and youth often chose schools as intervention sites because they can reach the majority of elementary school children. Approximately 97% of elementary students in the U.S. can be reached through physical education classes (Ross & Gilbert, 1985; Simons-Morton, Parcel, Baranowski, Forthofer, & O'Hara, 1991). The Center for Disease Control (CDC) (2001), through a systematic review of published studies, has found that when properly implemented, school-based physical education programs can positively influence the physical activity levels of children. In an effort to increase the physical activity levels of children in school, the CDC also strongly recommended the implementation of programs that increase the length of, or activities in, school-based physical education classes. Schools also provide unique existing community infrastructures, facilities and equipment in order to serve large numbers of children and adolescents year round. Reaching children at a young age through school facilities and programs can affect the beliefs, habits, attitudes, and skills necessary to make exercise an enjoyable experience for the years to come (Shephard, 1997; Telama et al., 1997). By participating in daily physical activity it is hoped that children will develop healthy habits regarding physical activity, and carry these practices into adult life (Shephard, 1997; Telama et al., 1997).

The most common way of presenting physical activity to children has been through physical education classes in their schools. However, with physical education classes being cut back in frequency, duration, and quality (Telama et al., 1997), other programs must also be implemented to try to overcome the threat of physical inactivity.

Interventions involving children's physical activity levels have been measured in a variety of ways due to the sporadic nature of children's play. Therefore, there have been many different measurement tools produced to measure the activity levels of children including: questionnaires, motion sensors, heart rate monitors, direct observation, indirect calorimetry, and pedometry. Each of these measures has its benefits and limitations, and the method of measurement chosen for a study should relate directly to what the study is trying to achieve. Welk, Corbin & Dale, (2000), suggest using multiple measures for assessing the physical activity status of children in order to gather as much information as possible about their physical activity behaviors.

Sequeira et al. (1995) evaluated using a pedometer in epidemiological research along with a self-report questionnaire, and found that the pedometer did indeed provide useful information in addition to the questionnaire. Objective measures such as pedometers, reach a greater level of precision in measurement of activities mainly because they are not dependent on memory recall. (Bouchard et al., 1983). Pedometers however, do not provide any temporal information about activity patterns, as the units do not store data over a specified period of time (Freedson & Miller, 2000). This information is more readily obtained through a questionnaire.

When used in combination with objective measures, self-reports are beneficial to assess the context and type of physical activities that children perform (Sallis & Saelens, 2000).

Numerous studies have indicated that as children age, their physical activity levels decrease (Canadian Pediatric Society, 2002; Pate, Long & Heath, 1994; Sallis & Patrick, 1994; Thompson, Baxter-Jones, Mirwald, & Bailey, 2002). For example, youth aged13-17 are less active than children aged 5-12. This decline in the physical activity levels of youth may be a result of changing social demands during adolescence and career choices (Malina, & Bouchard, 1991). Prior to reaching peak height velocity (PHV), children are still growing and it is important to remember both age and maturity level can affect physical activity. Two children may be the same size at a given age, but one may have already attained a greater percentage of his/her adult size and therefore is closer to a mature state (Malina & Bouchard, 1991). This in turn will have an affect on his/her level of physical activity since going through adolescence results in changes in body composition, strength and motor performance.

In summary, children can receive a wide array of health, psychological and academic benefits by participating in physically active activities. Since the majority of children attend schools, these sites are often chosen for interventions to target children's physical activity levels. When measuring physical activity levels in children it is important to consider the age and maturational status of the participants, as well as the tools used for measurement. In order to carry out a successful intervention, it is imperative that the study is designed in such a way that the tools used for measurement can determine if the intervention achieved its desired results. The purpose of the present study is to evaluate the effectiveness of school based intervention strategy at increasing grade four and five children's physical activity levels during school hours, outside of school hours and on weekends.

1.2. Review of Literature

This review of literature is organized into four sections:

1. National recommendations for physical activity
2. The need for more physical activity in schools
3. In-school interventions and how they affect activity levels of children
4. How school environments affect the activity levels of children

1.2.1. National Recommendations for Physical Activity

Children (ages 5-12) should expend a minimum of 3 to 4 kcal/kg/day of energy, but it would be optimal to expend 6 to 8 kcal/kg/day. This optimal level would translate into 60 minutes or more of active play and would include alternating bouts of activity with rest periods as needed (Corbin, Pangrazi, & Welk, 1994). The guidelines for children (ages 5-12) are slightly different than those for adolescents (aged 13-17). The activity patterns of children tend to sporadically alternate between activity and rest, thus, the guidelines for children are based on the total volume of activity performed rather than the intensity of the activity as recommended for adolescents (Corbin, Pangrazi, & Welk, 1994). National and international groups recommend that all adolescents should participate in at least 30 minutes of moderate to vigorous physical activity on most days of the week (Sallis, et al., 1997). Optimally, 20 minutes at least 3 times a week of moderate to vigorous activity should be performed in addition to regular daily activities (Sallis, & Patrick, 1994). Moderate to vigorous activity is defined as breathing hard most of the time as the result of activity (McKenzie et al., 1996). For additional aerobic fitness benefits it is recommended to be active at least 3 times per week with a minimum 30-minute session at 75% HR reserve [resting HR+ 0.75 (max HR-resting HR)] (Sallis, & Patrick, 1994).

The physical activity guidelines are established by a group of professionals in order to portray the latest research findings regarding the volume of physical activity necessary to achieve health benefits. When looking at children in grade two, results from two Canadian studies have shown that most 8 year old children do fulfill the physical activity recommendation of 60 minutes of moderate intensity activity on most days of the week (Campagna & Maloney, 1999; Tremblay & Willms, 2000). Research has shown however, that children do become less active as they age (Canadian Pediatric Society, 2002; Pate, Long & Heath, 1994; Sallis & Patrick, 1994; Thompson, Baxter-Jones, Mirwald, & Bailey, 2002). A recent study conducted in Nova Scotia compared the physical activity levels of children in grades three, seven, and eleven, and concluded that children's physical activity levels do decline as they age. Ninety-one percent of grade three children accumulated 60 minutes or more physical activity on most days of the week, where as only 37% of grade seven students and 7% of grade eleven students reached this same goal (Campagna, et al. 2002).

In an effort to address this decreasing level of physical activity, Canada's physical activity guide for children (2002), recommends increasing the time currently spent on physical activity starting with 30 minutes or more each day, and reducing the "non-active" time spent on TV, video, and computer by 30 minutes less each day. Ideally, these behaviors will lead to an ultimate goal of 60 minutes of physical activity every day.

1.2.2. Physical Activity in Schools

There are many opportunities for activity in schools. These include: intramurals, recess, lunch, inter-school teams, physical education classes and other classes. Physical education classes alone are not able provide children with the amount of physical activity recommended by national standards (McKenzie, 1999; Sallis & McKenzie, 1991). A study conducted with 157 fifth grade students in 20 Texas schools determined that on average the students spent 8.5% of physical education class in moderate to vigorous activity, 23.3% in minimal activity, and 68.1% in sedentary activity (Simons-Morton, Taylor, Snider, & Huang, 1993). Over the school age years, a consistent decline in physical activity is seen (Sallis, 1993). In general, during grades 5-12, the activity levels of children and youth decline at a rate of about 2.7% per year in males, and 7.4% per year in females (Sallis, 1993; Telama et al. 1997). One of the factors that may be contributing to declining levels of physical activity in children is a reduction on the availability and participation in physical education classes. Limited physical education classes may be contributing to decreased physical activity levels in children. By the end of high school only half of adolescent students are enrolled in physical education classes and participation in sporting activities outside of school hours is also decreasing (Sallis, & Patrick, 1994). Opportunities to engage in activities outside of school hours are often based socioeconomic status due to the cost associated with participation (DeKnop, et al., 1996), and such a trend has decreased the likelihood of youth participation in out of school activities (Watson et al., 1999).

In Canada, (2001) only 33% of all schools had formal physical education classes, and programming varies from school to school. It is estimated that most schools in Canada offer half the recommended provincial requirement for physical education classes, and less than 4% of schools offer Quality Daily Physical Education (QDPE) programs (Canadian Pediatric Society, 2002). QDPE is a national program, which encourages schools to offer physical education classes daily for students. In Saskatchewan, the provincial requirement for physical education in grades 1 through 9 is 150 minutes per week (Sask. Education, 1987). Yet in Saskatchewan, 31% of children aged 5-17 reported receiving physical education classes 1-2 days each week, and only 38% participate 3-4 days a week (CFLRI, 2000).

In knowing the health risks that parallel sedentary behaviors it seems ironic that in parts of Canada the time and resources are not being allocated toward teaching physical activities within the elementary school system. Considering that school-based physical activity programs provide one of the only fully accessible delivery systems for children, it is particularly important to maintain school based physical activity programs (Tremblay, Shephard & Williams, 1998).

1.2.2.1. School-Based Interventions

In-school interventions have been primarily focused on physical education classes. Numerous attempts have been made to increase the frequency, duration and quality of activity within physical education classes. The Child and Adolescent Trial for Cardiovascular Health (CATCH) intervention was initiated to promote healthy eating, physical activity and tobacco non-use. A total of 5,106 students from 96 schools began the study in grade three and were followed over a period of three years. The participants, from public schools in California, Louisiana, Minnesota and Texas came from culturally, and geographically diverse states. The physical activity component of the intervention included 90 minutes of physical activity per week spread over a minimum of three sessions. Baseline data from the CATCH study revealed that third graders only engaged in moderate to vigorous physical activity (MVPA) for 36% of physical education class time (McKenzie, 1999). After the three-year intervention was finished, it was discovered that the intervention schools had a 39% increase in moderate to vigorous physical activity during physical education classes from baseline data. This increase allowed the intervention schools to surpass the year 2000 goal set by the U. S. Public Health Service of spending 50% of time in physical education classes in moderate to vigorous physical activity, where the control schools did not (McKenzie et al., 1996). This goal was accomplished through staff development in-service training, the use of 'Activity Boxes' and continual feedback from the researchers to the teachers stating possible improvements that could be made. The results of the physical activity portion of the CATCH project concluded that the amount of moderate to vigorous physical activity in physical education class was increased through the implementation of a standardized curriculum and a staff development program (Leupker et al., 1996). These results indicate that it is possible to execute an effective intervention to increase activity to moderate-vigorous levels during physical education classes that can be taught by either physical education specialists or trained classroom teachers. This particular physical education intervention emphasized physical activity participation and group activities rather than individual fitness training (McKenzie et al., 1996).

The Sports, Play, and Active Recreation for Kids (SPARK) program is a comprehensive curriculum and professional development program that was implemented in Southern California to promote physical activity both in and out of school (Sallis et al., 1999). Physical education specialists, trained classroom teachers or untrained classroom teachers (who served as controls), taught standard 30-minute lessons three times a week. The lessons included fifteen minutes of health related fitness activity and fifteen minutes of skill-fitness activity. Results indicated that classes led by physical education specialists participated in twice as much moderate to vigorous physical activity and expended twice as many calories per week in physical education class than control classes. In addition, students in the control group had physical education less frequently (1.8 vs. 2.9 lessons per week) and spent significantly fewer minutes (38 vs. 79.7 minutes) per week in physical education classes (Sallis et al., 1997). The control group in the SPARK intervention provided children with less than 25% (38 minutes) of the national recommendation of 150 minutes of physical activity per school week, where as the intervention group increased to 53 % (80 minutes) (Sallis et al., 1997). Teachers from the intervention group noticed improvements not only in physical fitness and psychomotor abilities, but also in class grades, particularly math and acuity skills (Sallis et al., 1999).

The PLAY intervention, which stands for "promoting lifetime activity for youth" is a school intervention that investigated the effects of a physical activity program on children's activity levels and attraction to physical activity. Ernst & Panagrazi (1999) looked at 28 grade 4-6 classes from a low to middle class area in the Southwestern U.S. The classes ranged from 23-27 students (fairly even number of males and females) with more than 20,000 children participating in this program during its first year. The intervention took 12 weeks to complete, with 14 intervention classrooms and 14 control classrooms. There were two steps to this intervention. During step 1, the intervention schools were allocated 15-minute activity breaks where teachers encouraged their students to be active, for a period of 4 weeks. Step 2, which was 8 weeks in duration, did away with the 15-minute activity breaks and students were asked to record all of their physical activity in student handbooks. Data was gathered through the use of two questionnaires: the Physical Activity Questionnaire for Older Children (PAQ-C) and the Children's Attraction to Physical Activity (CAPA). The PAQ-C is designed to measure physical activity levels of children, where as the CAPA is used to determine the subject's level of attraction to, or interest in physical activity. Results from the

PAQ-C showed significant increases from baseline values for both males (pre = 3.05, post = 3.37) and females (pre = 2.89, post = 3.09) in the intervention, where as the control group showed no differences in results for neither males (pre = 3.01, post = 3.02) nor females (pre = 2.77, post = 2.76). This study determined that the PLAY intervention increased physical activity levels for all participants regardless of their individual activity status.

Some school based physical activity promotion programs include classroom curricula that promote physical activity outside of school. There has been mixed results of whether this strategy is effective in altering the out of school activity of children. Some school intervention studies such as Go for Health, SPARK, and Slice of Life conducted with primary students showed no effect on out of school activity (Sallis et al., 1997). Sallis et al., (1997) explains that studies that showed no changes in out of school activity could have been a result of insensitive measurements, poorly designed curriculums, or interventions that were inadequately implemented. However, others such as CATCH, the Norwegian Oslo youth study, the Australia School study, the Stanford Adolescent heart health study did show significant increases in out of school physical activity (McKenzie et al., 1996). Stone, McKenzie, Welk, & Booth, (1998), determined that a significant difference for out of school vigorous physical activities still existed after three years of having no CATCH interventions. The students from the intervention cohort reported a mean of 30.2 minutes (SEM = 1.3) of daily vigorous activity, where control students only reported 22.1 minutes (SEM = 1.4) (Nader et al., 1999). This finding suggests that school based intervention programs such as CATCH, can indeed increase student's physical activity levels both in physical education class and outside of school time.

Ernst & Panagrazi, (1999), recommend that through school based interventions, strides can be made toward increasing activity levels in general, and decreasing the number of sedentary children. CATCH, SPARK, and PLAY were all successful in-school interventions for increasing children's physical activity levels. These interventions all concluded that classroom teachers could be trained to instruct physical education classes and activities used to promote and increase levels of moderate to vigorous physical activity.

1.2.2.2. Physical Activity Outside of Physical Education Classes

Besides required physical education classes, recess is one of the few times during the school day when all children have an opportunity to be physically active. Most schools have one to two recesses per day, which are meant to complement physical education classes and activity periods, not act as a substitute for them (Wechsler, Devereaux, Davis, & Collins, 2000). Recesses promote physical activity by simply getting children to go outdoors. This time is usually considered playtime and a break from academic content and thus remains an understudied component of schooling (McKenzie et al., 1997). Most studies of recess behavior are designed to investigate children's cognitive and social development (Hart, 1993; Pellegrini, 1995). Only a few studies have looked investigated physical health by looking at participation in recess activities. Kraft (1989) observed children at recess and concluded that children do not engage in enough aerobic activities during recess periods to increase their cardiovascular fitness. McKenzie et al. (1997), observed 287 children during two outdoor recess periods, once during preschool and once during elementary school. Each observation was six months in duration, and they found that children expended nearly twice as much energy in preschool recess than in elementary recess due to a drastic decline in recess time (25.9 vs. 14.1 minutes) and more participation in sedentary activities. They concluded that school environments could be altered to promote healthful physical activity among children (McKenzie et al., 1997). Alterations could include more teacher supervision and encouragement, longer hours to access recreation facilities or increased time to be active. By restricting recess periods and other physical activity opportunities, children are missing out on valuable activity experiences.

Opportunities are available for children to become active throughout the school day as long as there is support from the school authorities to utilize these occasions. Dale, Corbin & Dale (2000), wanted to determine if children compensated for restricted activity during the school day by increasing after school activities. Seventy-eight third and fourth grade students took part in 14 weeks of data collection. During this intervention, each child wore a Computer Science and Applications (CSA) monitor for a total of four days. During two of these days the children's physical activity was restricted during the school day. The restrictions on activity were achieved by replacing outdoor recesses and lunch periods with time to read library books and play computer games. The other two days were typical school days with outdoor recess opportunities. The results of this study indicated that there were no signs of compensation for lack of activity after a sedentary school day. Since children do not make up for indolent behaviors that occur during school hours at any other time during the day, this study therefore shows support for increased physical activity opportunities during school hours.

McKenzie, Marshall, Sallis, & Conway, (2000), studied the leisure-time physical activity of adolescents throughout the school day. Activity before school, after school and at lunch was monitored using SOPLAY (System for Observing Play and Leisure Activity in Youth) at 24 grade six to eight schools (mean = 1081 students per school) over a 20-week period. They found that there was an adequate physical environment available for physical activity (i.e. facilities were available), but school officials made a limited effort to provide equipment, supervision, or structured activities to support and encourage student physical activity. Because of a limited attempt to encourage children to participate in physical activities, relatively few students sought out opportunities to be physically active during leisure time. Only two to four percent of the daily student attendance was physically active before and after school, and twenty percent at lunchtime. McKenzie et al., (2000) suggest that it is worthwhile to examine methods of enhancing school environments to increase physical activity throughout the school day, because the majority of middle school students can be reached through such interventions.

Sallis et al., (2001), looked at increasing opportunities for physical activity at middle schools outside of physical education classes through Project M-Span. The purpose of this study was to evaluate the effect of providing more opportunities to be active before school, at lunch, and after school on total student physical activity. Opportunities were provided through increased supervision and teacher availability to facilitate activities as well as increased access to facilities. Twenty-four middle schools (grades six to eight) located in nine districts in southern California participated in this study. Trained observers watched the children using the SOPLAY observation system (System for Observing Play and Leisure Activity in Youth) for 264 days over a period of three years and found that by increasing supervision before school, at lunch and after school, student physical activity also increased.

By increasing teacher supervision, and offering encouragement to be active, children respond by increasing their activity levels. McKenzie et al., (1997) concluded that school environments can be altered to promote healthy physical activity levels in children. Since children spend significant amounts of time at school, the school should be recognized as an important means for increasing physical activity levels. Currently, children obtain only 20 to 40% of their physical activity in school (Heath, Pratt, Warren, & Kann, 1994; Simons-Morton, Taylor, Snider, & Huang, 1993). As a result of this deficit in physical activity during school time, activity needs to be made up either at home, in the community, or during extra school programs (McKenzie, 1999).

1.2.3. Measurement of Physical Activity in Children

Typically when children engage in physical activity they perform short, intermittent bouts of vigorous activity with frequent periods of rest (Welk, Corbin &

Dale, 2000). Even though there are many different methods of measuring physical activity, since children often play in random bouts, accurate measurements for these activities are difficult to obtain. Sirard & Pate, (2001), indicated some of the methods available for the measurement of physical activity in children, including:

1) Direct observation, is the most practical and appropriate criterion measure with several observational systems available to use.
2) Doubly labeled water, assesses total caloric expenditure by estimating carbon dioxide production using isotope dilution. This method is very expensive, is not suitable for large studies, and does not provide information on specific patterns of activity.
3) Questionnaires provide a subjective indication of physical activity as reported by the participant.
4) Heart rate (HR) monitoring determines the intensity of activities performed on the resulting heart rate with a HR of $\geq$140 beats per minute approximating MVPA.
5) Motion Sensors (i.e. Pedometers, accelerometers) detect body movement and provide an objective estimate of physical activity.

There are many advantages and disadvantages to using each of these methods, and for that reason researchers have suggested using multiple measures for assessing the physical activity status of children (Melanson & Freedson, 1996; Sallis & Saelens, 2000; Welk, Corbin & Dale, 2000). Sequeira et al. (1995) evaluated the use of a pedometer in epidemiological research to see if it would complement the use of a physical activity questionnaire on a sample of 493 men and woman. The results showed that the pedometer did indeed provide additional objective information to supplement the self-report questionnaire for people aged 25 and up. However, a number of studies have reported differences in levels of activity, when activity monitors were compared to self-report data (Coleman, Saelens, Wiedrich-Smith, Finn & Epstein, 1997; McMurry et al., 1998; Sallis et al., 1998; Simons-Morton, Taylor & Huang, 1994).

1.2.3.1. Pedometers

A pedometer is a mechanical motion sensor that records acceleration and deceleration of the body in one direction (Saris & Binkhorst, 1977). More specifically, it records the vertical accelerations of the body's center of gravity through the use of a spring suspended pendulum arm that moves up and down, opening and closing an electrical circuit. Each time that electrical circuit is closed, one event or step is recorded (Bassett, 2000; Sequeira, Rickenbach, Wietlisbach, Tullen, & Schultz, 1995).

Pedometers measure step counts, a marker of total volume or duration of activity (Tudor-Locke, 2002; Welk, Corbin, & Dale, 2000). They can be set to measure either distance traveled, or step rate. The preferred measure is the step rate due to the inconsistencies of pedometers measuring distance (Saris & Binkhorst, 1977; Tudor-Locke, 2002; Washburn, Chin, Montoye, 1980). The term "steps," however, may misrepresent some movements that will be detected and recorded by the pedometer. An example of this would include weight shifting without actually moving your feet. The relative importance of this error in relation to the total daily values is likely to be small (Tudor-Locke & Myers, 2001). Tudor-Locke & Myers, (2001), also mentioned that participants prefer the term steps to counts because it was more meaningful and comprehensible. In an effort to adopt a universal unit of measurement for collecting, reporting and interpreting pedometer data, Rowlands, Eston, & Ingledew (1997) and Tudor-Locke & Myers (2001) have recommended that pedometer data be reported as steps taken, or steps per day.

The pedometer is appropriate for use in population studies because it is small, lightweight, inexpensive, reusable, objective, and a field-based assessment of activity levels (Bassett et al., 1996; Eston, Rowlands, & Ingledew, 1998; Rowlands, Eston, & Ingledew, 1997; Saris, & BinkHorst, 1977; Sequeira, Rickenbach, Wietlisbach, Tullen, & Schultz, 1995; Tudor-Locke, 2002; Vincent & Pangrazi, 2002). Pedometers do not however, provide information about duration, frequency, nor intensity of physical activity (Bassett, 2000; Rowlands, Eston, & Ingledew, 1997; Welk, Corbin, & Dale, 2000). They are also incapable of picking up activities that involve no locomotion. This would include isometric exercises and activities that involve only the upper body (Melanson & Freedson, 1996).

In measuring the physical activity levels of children, pedometers have been positively correlated with a variety of measures including: oxygen uptake ($r = 0.78$, $r = 0.92$) (Eston, Rowlands, & Ingledew, 1998), heart rate monitoring ($r = 0.88$) (Freedson & Miller, 2000), energy expenditure ($r = 0.77$) (Weston, Petosa, & Pate, 1997), caltracs ($r = 0.88$) (Weston, Petosa, & Pate, 1997), and tritracs ($r = 0.85$ to 0.88) (Welk, Corbin, & Dale, 2000).

The pedometer appears to be well suited for the assessment of physical activity in children (Vincent & Pangrazi, 2002). Previous research with pedometers focuses mainly on adults and walking studies, but of the studies done with children there has been evidence of concurrent validity. Pedometers have been used to assess total physical activity of Kindergarten children during the school day. Nishikido, Kashiwazaki, & Suzuki, (1982), found when assessing children randomly running around, pedometers and observation techniques correlated highly. When tested again on four to six year old children in 1996, similar results were also found (Bassett et al., 1996). For unregulated play activities, where supposedly pedometers would be less suitable, correlations of r = 0.92 and r = 0.88 were observed when compared to oxygen uptake and heart rate respectively (Eston, Rowlands, Ingledew, 1998; Freedson & Miller, 2000).

In order to reliably assess daily activities of children with less than five-percent error on weekdays, Gretebeck & Montoye, (1992), recommended that the pedometer be worn for a minimum of four days on the waist. For a more accurate look at the ambulatory activity patterns of young individuals, pedometers should be worn for 5-6 days (including a weekend) (Gretebeck & Montoye, 1992).

When considering the number of steps taken, a review of 32 experimental studies suggested that a range of 12,000 to 16,000 steps/day could be expected for 8-10 year old children (lower for females than males). As individuals grow older, the suggested range of steps per day decreases down to 7,000 - 13,000 steps/day for relatively healthy younger adults (lower for women than men) (Tudor-Locke and Myers, 2001). The President's Council on Physical Fitness and Sports, (2001) stated that children should accumulate 11,000 steps per day at least five days a week to achieve a standard healthy base. These expected values of steps per day serve only as benchmarks for interpreting change and making comparisons of physical activity levels and they should not be misinterpreted as recommendations for appropriate activity levels (Tudor-Locke, 2002).

Research by Yamanouchi, Shinozaki, and Chikada (1995) and Hatano (1993) suggested that accumulating 10,000 steps per day is comparable to meeting the Surgeon General's (U.S. Department of Health and Human Services, 1996) activity recommendation for health. Although 10,000 steps per day appears to be readily accepted by the public (DeSa, 2001; Kosta, 2001; Krucoff, 1999; Spilner & Robertson, 2000) as a health appropriate goal, the scientific evidence is lacking (Tudor-Locke, 2002). This report was directed towards adults and to date, there are no published studies that provide step count recommendations for children in order to achieve health benefits. The pedometer however, has been found to be a useful tool in objectively measuring physical activity in both adolescents and children (Flohr, Crist, & Tudor-Locke, 2000).

1.2.3.2. Physical Activity Questionnaire for Children

The physical activity questionnaire for older children (PAQ-C) is a self reported seven-day recall questionnaire designed to assess habitual moderate to vigorous physical activity in older children (See Appendix A). Welk, Corbin & Dale, (2000) and Welk & Wood, (2000), reported that the PAQ-C provides a general indication of children's physical activity levels, and is able to discriminate between active and inactive children. This questionnaire has been shown to be both reliable and valid to use with school-aged children beyond the grade three level (Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997). After completing three studies to establish preliminary evidence for the PAQ-C it was concluded that the PAQ-C had acceptable item and test score characteristics. These characteristics include item distribution, corrected item-total correlations, internal consistency, and test retest reliability ($r = 0.75$ for males and $r = 0.82$ for females) (Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997). When compared to other measures, the PAQ-C was moderately related to a Caltrac motion sensor ($r = .39$), the Leisure Time Exercise Questionnaire ($r = .41$) and a 7-day physical activity recall interview ($r = .46$) (Kowalski, Crocker & Faulkner, 1997). Kowalski, Crocker & Faulkner, (1997), found that the strongest evidence for the validity of the PAQ-C was that it was not only related to other recall questionnaires for physical activity, but other methods as well including electronic motion sensors (Caltrac).

There are many pros and cons to using any method of physical activity measurement. The PAQ-C was developed to assess general physical activity levels of school-aged children, and does not provide an estimate of caloric expenditure. This method cannot be used to assess general physical activity levels in the summer or holiday periods and thus the PAQ-C can only be used to assess activity levels of individuals within the school system. Also, it does not discriminate between moderate and vigorous activities; it simply provides an activity score summary (Crocker, Bailey, Faulkner, Kowalski, & McGrath, 1997). Since this study is looking at physical activity levels of school aged children the first two limitations of this tool do not apply.

The PAQ-C provides a summary physical activity score derived from nine items, each scored on a 5-point scale (Appendix A). Within these nine items there are sub-items also ranging from one to five on the 5-point scale. Item ten, which asks "were you sick last week, or did anything prevent you from doing your normal activity", is not used in the calculation of the activity summary.

For item one, the mean of all activities is calculated (1 being "no" activity, 5 being "7 times or more") on the activity checklist to form a composite for item one. Items two through eight describe activity levels through physical education class, recess, lunch, right after school, evenings, and weekends. For these items the reported values are checked off, with 1 being low activity and 5 being high activity. For item nine the mean of all days of the week (with 1 being none, 5 being very often) to form a composite for item ten. Once a value is obtained (from 1 to 5) for each of the nine items in the physical activity composite, the mean of these 9 items is calculated. This final number is the PAQ-C activity summary score.

1.2.3.3. Maturational Considerations

Chronological age, growth in body size, and physiological maturation are all interrelated because as children age, they tend to grow and mature. Children enter the adolescent phase of growth at varying ages and proceed through it at different rates. So when assessing children, maturity is an important factor to consider. For example, two children may be the same size at a given age, but one may have already attained a greater percentage of his/her adult size with regards to height or muscle mass and therefore is closer to reaching a mature state (Malina & Bouchard, 1991). Throughout childhood, females tend to mature at a faster rate than males and as a group, are more biologically mature than males (Haywood & Gretchell, 2001). Females, on average reach maturation at 12 years of age, although maturation can occur at 10 years of age for females that mature early and as late as 14 years of age for females that mature late. Males have an average, reach maturation at approximately 14 years of age, and this time frame can range from 13 to 16 years of age depending on the individual (Malina & Bouchard, 1991).

As children approach maturity, physical, physiological and psychological changes are occurring. Physically, through adolescence, children develop fat mass, body weight, and stature (height) (Malina & Bouchard, 1991). with the main physical changes occurring in body size and shape. Prior to puberty, there are no noticeable differences in body shape between genders, but through growth, males develop wide shoulders and a muscular neck, and females tend to develop wider hips (Marshall & Tanner, 1986). During adolescence, the greatest height increase in female's stature is due to trunk elongation, and in males it is due to lower limb elongation (Malina & Bouchard, 1991). A decline in physical activity levels during maturation could be partially attributed to a temporary disproportion of leg and trunk lengths relative to overall body size (Wilmore & Costill, 1994).

Throughout adolescence, females gain fat mass at a rate more than twice the amount of males and as a result, males tend to have leaner bodies than females (Marshall and Tanner 1986). It has been well established that physical activity influences body weight (Haywood, 1993). Phillips, & Hill, (1998), found that nine year old overweight and obese females had significantly lower physical appearance and athletic competence self-esteem than their normal weight peers. Psychologically, self-esteem influences participation in sport and physical activity as well as skill mastery. Children who lack athletic ability or who are low in self-esteem tend to experience their sports less positively than players with high esteem do (Micheli, 1984). Children who perceive their physical activities as low are not likely to persist in physical activities and realize the associated health and psychological benefits (Weiss, 1993 in Haywood pg 273).

Lack of physical activity may lead to an increase in the prevalence of obesity and cardiovascular disease risk factors (James, 1995). In Canada, among grade school children, approximately 13.5 % of males and 11.8% of females are considered obese (Tremblay & Willms, 2000). BMI or body mass index, is a ratio of body weight (kg) to height squared (m), and is used as an indicator for achieving a healthy body weight. According to Cole, Bellizzi, Flegal & Deitz, (2000), the cutoff point for 10-12 year old children being overweight is 20-23 kg/m^2, and obesity is considered as 24-27 kg/m^2. As children grow into young adults an increase in body weight is one of the normal physiological changes that occur.

Other physiological changes that occur during puberty include improvements in motor skills and neuromuscular abilities (Wilmore & Costill, 1994). The motor skills that are developed during childhood include speed, power, coordination, agility and balance (Schroeder, 1992). Improvements to these skills and motor abilities increase a child's athletic abilities and enable them to participate in team sports such as soccer and basketball (Schroeder, 1992). The motor ability of males and females generally increases with age for the first 18 years of life, but as a result of physical inactivity, females tend to plateau around the age of puberty (Wilmore & Costill, 1994). This decreased level of physical activity could be the result of increased estrogen levels, which promote fat deposition, or social conditioning that may lead to a sedentary lifestyle (Wilmore & Costill, 1994). Males on average are more active than females at all ages, but during adolescence they too experience declines in their physical activity levels. Changing interests associated with the onset of adolescence is one factor in the decline. However, at this age many youth sports programs have also become more selective and specialized in who is allowed to play. Since early maturation is positively related to strength and motor performance, this eliminates late maturers and less skilled individuals from participating in physical activity opportunities with their peers (Armstrong & van Mechelen, 2000).

A study done by Thompson, Baxter-Jones, Mirwald, and Bailey, (2002), found that when males and females (N= 138) were aligned according to chronological age, males exhibited significantly higher PAQ-C scores than females.

However, when aligned on biological age, according to maturity, sex differences were not apparent at or after the age of peak height velocity (PHV). This study verified that maturity is a factor when looking at physical activity levels in children.

In the exercise sciences, maturity is usually assessed using one or more indicators of somatic (PHV), sexual (e.g.Tanner staging), or skeletal maturity (Armstrong & Welsman, 1997). Skeletal age assessment is the best maturational index to use, but it is costly and requires special equipment to do. Another measure of maturation, sexual maturity or the assessment of secondary sex characteristics, in a non-clinical setting is often considered personally intrusive to adolescent children and to their parents. Therefore, this method is usually only performed in controlled environments. Age at PHV is the most commonly used indicator of somatic maturity, but unfortunately this method also requires longitudinal data throughout adolescence (Malina & Bouchard, 1991).

Mirwald, Baxter-Jones, Bailey & Beunen, (2002), developed a method of assessing maturity through the use of anthropometric measurements. This method, which uses sitting height, standing height, and weight, is able to calculate "maturity offset", or the difference in time between chronological age and peak height velocity. In order to ensure that the groups being compared are of similar anthropometric status, height, sitting height and weight are often measured. These measurements are quick, easy, and non-invasive. Height and sitting height are usually measured to the nearest 0.1 mm, and body mass to the nearest 0.1 kilogram (Bailey, 1997; Mirwald, 1978). Two trials are taken for each anthropometric measure, and the average of these measurements is used. A third measurement is required if the first two differ by more than 4 mm for height and sitting height, and 0.4 kg for weight. If three measurements are taken, the median value is used (Bailey, 1997).

Maturational status is a relevant structural constraint that influences movement (Haywood & Getchell, 2001). Individuals who are more mature are likely to be stronger and more coordinated than those who are less mature, even at the same chronological age (Haywood & Getchell, 2001). Parents and educators must be aware of, and consider the maturational status of children when designing activities and interventions focused on increasing the physical activity levels of children.

1.2.4. Summary of Review of Literature

Various school-based physical activity interventions have been shown to increase the physical activity levels of children during school hours, outside of school hours, and on weekends. Since schools are able to reach the majority of children every day, they are ideal locations to implement physical activity programs. Currently, aside from recess, in most schools physical education class is one of the only times children have during the school day to participate in activities that are both organized and supervised. However, physical education classes often are not offered daily, and these classes alone are unable to provide students with enough physical activity daily to reach the recommended guideline of 60 minutes per day. Research has shown that physical activity levels of children can be increased through positive encouragement, increased teacher supervision, and by having more time available to be active. More school based intervention strategies are needed in order to try and meet the national recommendation of 60 minutes of physical activity per day for children. These intervention strategies must be implemented, tested and evaluated in order to determine which methods are effective in increasing physical activity levels of children.

1.3 Statement of the Problem

1.3.1 Purpose

The purpose of this study is to evaluate the effectiveness of an intervention strategy, In Motion, at increasing grade four and five children's physical activity levels during school hours, outside of school hours and on weekends.

1.3.2 Hypotheses

1. Students from the In Motion School will have significantly higher activity levels during school hours than students from the non-In Motion school.
2. Students from the In Motion School will have significantly higher activity levels outside of school hours than students from the non-In Motion school.
3. Students from the In Motion School will have significantly higher activity levels on weekends than students from the non-In Motion school.

1.4 Assumptions

a) Students at both the In Motion School and the non-In Motion Schools are representative of a typical Saskatoon elementary school population.

b) The In Motion School provides 30 minutes of physical activity daily to its students

c) The instruments used to measure physical activity will accurately reflect the student's physical activity levels.

d) Students will wear the pedometers during designated measurement periods.

1.5 Limitations

a) Pedometers are not able to measure physical activity counts while swimming and biking. Information on these activities will have to be obtained through the questionnaire.

b) The 7-day recall questionnaire is a self-reported retrospective questionnaire that is dependent on the memory capability and recall abilities of the students. Some activities recalled may not be totally accurate in frequency, duration or intensity levels.

c) There is no way of verifying/guaranteeing that the In Motion School is providing 30 minutes of physical activity to every student every day other than reports from teachers, which may not be completely accurate.

1.6 Delimitations

The findings from this study are delimited to school aged children of similar age and activity status as the participants.

CHAPTER 2

METHODS

2.1. Research Design

An experimental/control design was used to establish differences in physical activity levels between two schools of similar size, socio-demographic and somatic growth status. In this study the experimental component was the In Motion School intervention. Standing height, sitting height, and weight were also measured to provide maturational and anthropometric comparisons between the two groups.

2.1.1. Participants

The two schools selected for this study were located in the city of Saskatoon and were in close proximity (1.2 km) to each other. One of the schools was recognized as an In Motion school and the other was a non-In Motion school. Even though the two schools were located in similar areas of the city and are similar in size, the In Motion School had more grade four and five students (N = 81) than the non-In Motion school (N = 52). This was due to the French Immersion program offered at the In Motion School. Since separate grade four (N = 15) and five classes (N = 10) are required for the French immersion students, the In Motion school had five classrooms containing grade four and five students, with one class being a grade three/four split (N = 6). Since the non-In Motion school did not include a French Immersion program, there is only one class of grade fours (N = 21) and one class of grade fives (N = 28) in this school. See Appendix B for a flow chart of the participants.

2.1.2. Sample Size

Power calculations indicated that a sample size of 75 in each group would have 80% power to detect a difference in means of 0.32 PAQ-C total score (a difference between a control group and an intervention group of 10%) assuming that the common standard deviation is 0.78 using a t-test with a 0.05 one sided significance level. For the pedometer readings a sample size of 43 in each group would have 80% power to detect a difference on means of 1573 steps per day (a difference between a control group and an intervention group of 15%) assuming that the common standard deviation is 2896 when using a two group t-test with 0.05 one sided significance level.

2.1.3. Intervention

Children and youth are one of the targeted populations for the In Motion project and at present, schools are the main sites for intervention. The vision for an In Motion School states "An In Motion School is one that values the benefits of physical activity and ensures that it is a visible priority in the daily life at school. As an In Motion School, there is a commitment to work toward the goal of 30 minutes of physical activity every day for every student" (In Motion: School Physical

Activity Resource Guide, 2002). To achieve this, schools are encouraged to incorporate a wide variety of activities into the school day. These activities could include special school events, theme days, school walks, classroom games, or physical education classes. The physical activity opportunities that In Motion schools provide can be of any intensity and can be accumulated through bouts of activity. For example, if the entire school goes for a fifteen-minute morning walk, the teacher is then responsible to fit in the other fifteen minutes somewhere else in the day. Extending recess, or using other school classes to combine learning and activity could also fulfill the daily activity requirement. In the current study, the In Motion School, in order to be eligible to participate in this study, must have been involved in the In Motion initiative for a minimum of eight months, and the non-In Motion school must have had no intentions of becoming an In Motion School within the current school year.

2.2. Measures

The measures being used in this study include the Physical Activity Questionnaire for Older Children (PAQ-C), pedometers, teacher logs, standing height, sitting height, weight and age.

2.2.1. Teacher Activity Logs

Teachers were asked to keep a record of all organized physical activity that occurred during the school day. This record was to include the type, frequency and duration of physical activities, as well as the name of any students that were unable to participate in these activities. No information was recorded for activities done during recess or lunch hour. The purpose of these activity logs was to identify and compare the types of physical activity were being offered in each of the selected schools. For a sample teacher activity log see Appendix C.

2.3. Procedures

A pilot study was conducted in March of 2002 on a grade 4/5 classroom for seven days in an attempt to ensure that the procedures for this study would work efficiently within a classroom setting. The pilot study also provided an opportunity for the researchers to familiarize themselves with the pedometers and address any potential problems that may arise. The pilot school was an In Motion school located in a middle class socio-economic area of Saskatoon.

Data collection was scheduled to begin on April 19th, 2002. Four weeks prior to the start of the study, the researcher met with the teachers of the classes selected to participate in the study, and distributed a handout to them regarding their responsibilities, and what was expected of the students (Appendix D). Two weeks before the study was scheduled to begin, the researcher visited the classrooms selected to participate in this study and explained the study in detail. Pedometers were passed around for the children to examine and an opportunity was given for the children to ask questions about the study. The researcher then distributed the consent forms and explained that they were to be returned to the classroom teacher within one week.

Two days before data collection was to begin, pedometers were distributed to students who had returned their consent forms. This was done to provide a trial period for the participants in order to try and limit the amount of reactivity in the children. "Reactivity is defined as a change in normal activity patterns when people are aware that their activity levels are being monitored." (Vincent & Pangrazi, 2002). At this time the researcher reviewed with the students the correct way to wear a pedometer, and assisted the participants in putting the pedometers on for the first time. The students were then reminded to act as they normally would even though they were now wearing a pedometer.

On the first day of data collection researchers ensured that all participants that handed in consent forms had a pedometer, and had signed an assent form (Appendix E). The participants were instructed to wear the pedometers for seven consecutive days. The researchers explained to the children that during the seven-day period the pedometers would be sealed with cable ties to prevent them from looking at their daily step values, and inadvertently resetting them. Prior to each reading of the pedometer, the researcher clipped the cable tie off. A new cable tie was then reattached to the pedometer after the measurement was recorded (See Appendix F). Step values were recorded immediately after the morning bell and 30 minutes before dismissal at the end of each school day. The researcher and an assistant visited each classroom, read the step-count indicated on the pedometers and reset them. Daily, each participant was asked questions regarding his/her activities from the previous day (See Appendix G for a list of the questions). If the pedometer was removed for less than 1.5 hours in a day, the data was included in the analysis.

If the pedometer was removed for any reason longer than 1.5 hours in total, the pedometer value for that day was excluded from the analysis.

On weekends the pedometers were reset at the end of the school day on Friday, and the data was recorded immediately following the morning bell on Monday morning. Step counts that occurred Friday after 3:30 p.m. inclusive until Monday 9 a.m. were included in the weekend value. If a student forgot their pedometer at home in the morning, they were given an alternate pedometer to wear for that day. If they were able to retrieve their pedometer from home and bring it to school sometime during the day they put it in their desk until 3:00 p.m. At that time the researcher recorded the data required and returned the original pedometer to the participant. In the situation when the original pedometer could not be retrieved that day, an alternate pedometer was sent home with the participant and both pedometers were returned the following day.

On the morning of the 8th day, the pedometers were read for the last time and the participants were asked to complete the seven-day recall questionnaire (PAQ-C). The seven days that the pedometers were worn coincided with the seven days that were being recalled with the questionnaire. When the PAQ-C was administered, it was emphasized that it was not a test, and that the researcher was only interested in actual activity performed during the last seven days. The questionnaire took 10-20 minutes to complete with minimal guidance needed. The primary researcher remained in the room to deliver all instructions and to answer any questions that arose. The teacher also remained in the classroom for classroom management purposes only. When completing the questionnaires, the directions were clearly visible on the handout for the participants to view and were read out loud for the participants if there were any questions. When the participants completed the questionnaire, the researcher checked to ensure that it was fully completed and that the participants had no further questions. The scores resulting from the PAQ-C ranged from 1-5, with 1 meaning no activity, 2 is a low level of physical activity, 3 indicated a moderate level of activity, 4 is a moderately high physical activity level, and a 5 indicated a very active individual. Refer to the Review of Literature for how to calculate the physical activity scores for the questionnaire.

Immediately following the completion of the questionnaire the standing height, sitting height and weight of all of the participants were measured in a separate location in the school. For these measurements the participants were asked to remove their shoes. The primary researcher and two qualified assistants administered these measures.

a) Standing height was measured by having the participant stand with their heels together and against the wall in front of a stadiometer.
b) Sitting height was read by sitting on a box with the stadiometer situated behind the individual.
c) Weight was measured using a portable Toledo digital scale.

Once these measures were completed, the participants returned to the classroom to work independently at his/her desk until the researchers had completed assessing all other children in the classroom.

The above procedures were repeated for each class in both schools involved in the study. To minimize the effects of weather and the variance of activities outside of school hours, all of the grade four participants were measured during the first week of the study, and all of the grade five students were measured the second week of data collection. Refer to Appendix H for data collection schedule.

All children taking part in this study have provided verbal assent to participate as well as informed consent from their parent or guardian (See Appendix I). Ethical approval was obtained from the Saskatoon Public School Board as well as from the Advisory Committee on Ethics in Behavioral Sciences Research at the University of Saskatchewan. Permission was granted by the principals of both schools involved, as well as by the participating teachers.

2.4. Analysis

Prior to any data analysis, the level of significance was preset at $p < 0.05$. The data analysis was conducted using descriptive statistics as well as a One way ANOVA. Outliers were excluded from the data analysis, and were defined as any extreme number that was not accounted for by any reasonable explanation. Missing data was also excluded from the analysis.

Descriptive statistics on physical characteristics (i.e. age, height, weight) were expressed as means and standard deviations for each school measured, and were compared by ANOVA to determine if there were any differences in the means. Anthropometric measurements were also used to determine the maturity offset of each participant. The equations used to calculate the estimated age of PHV/maturity offset were as follows:

Males: Maturity Offset = -9.236 + 0.0002708 • Leg Length and Sitting Height interaction - 0.001663 • Age and Leg Length interaction + 0.007216 • Age and Sitting Height interaction + 0.02292 • Weight by Height Ratio, where R = 0.94, R^2 = 0.891 and SEE = 0.592

Females: Maturity Offset = -9.376 + 0.0001882 • Leg Length and Sitting Height interaction + 0.0022 • Age and Leg Length interaction + 0.005841 • Age and Sitting Height interaction – 0.002658 • Age and Weight interaction + 0.07693 • Weight by Height ratio, where R = 0.94, R^2 = 0.890 and SEE = 0.569 (Mirwald, Baxter-Jones, Bailey, & Beunen, 2002).

The values resulting from these equations indicated the approximate number of years away from PHV. Negative numbers indicated the number of years until PHV would be reached, for example, a maturity-offset value of -2 would indicate that this individual would reach their PHV in approximately two years. Whereas a positive value of +3 would indicate that PHV has already been achieved, and it would have been approximately three years ago.

The maturity offset of males and females were then compared to ensure that physical activity levels were not influenced by maturity status. Once maturity offset was calculated, based on biological age, the activity levels of the students were compared using a One way ANOVA with post hoc LSD. Activity levels were looked at outside of school hours, during the school day, and on weekends between students attending an In Motion School and Non-In Motion School.

At the end of the experimental period, teacher logs revealed that three In Motion classes did not meet the 30-minute criteria. Since there were now three experimental groups: In Motion classes, non-compliant In Motion classes, and non-In Motion classes, the data was then analyzed using a One-Way ANOVA with post hoc Least Square Difference (LSD) to detect any differences in physical activity levels.

An ANOVA was done using the pedometer data as well as the total scores resulting from the questionnaire. For the pedometers, the mean values for each day were used and broken down into the number of steps taken per hour. In this way the data gathered from during school hours, after school and on weekends could be compared. A bivariate correlation was also performed to identify any relationship between the data provided by the pedometers and the questionnaire.

CHAPTER 3

RESULTS

3.1. Adherence to the In Motion Program

As no differences in physical activity levels were found between the In Motion school and the non-In Motion School, a decision was made to review the teacher activity logs to determine if all classrooms in the In Motion School were providing 30-minutes of physical activity to each student on every school day. This review revealed that two classrooms out of five in the In Motion School met the requirements for being "In Motion", however the other three classrooms did not offer 30 minutes of physical activity to their classes on one or more days during the school week. The two classrooms that have adhered to the In Motion program in its entirety have been identified as "In Motion classes", the other three classrooms from the In Motion school that have not adhered to the In Motion protocol have been identified as "non-compliant In Motion classes". The teacher activity logs from the non-In Motion school indicated that these classrooms were very active throughout the study, and offered physical activity opportunities of at least 30 minutes in duration on four out of five school days recorded.

3.2. Descriptive Statistics

When comparing the In Motion classes (N = 26), the non-compliant In Motion classes (N = 51) to the non-In Motion classes (N = 49), it was found that there were no significant differences between the means of these groups with regards to age (Table 3.1), gender, or grade level (Table 3.2) of the participants. The average age of the three groups was 10.42 years, with the majority of the participants being 10 and 11 years old.

Over the two-week span of this study, 61% of the participants had complete data sets. Some analyses were performed using a fewer number of participants due to incomplete data sets. Most of the missing values were attributed to forgetting to wear the pedometer for extended periods of time, or being absent during the testing period.

3.2.1. Anthropometric Measurements

In order to provide a point of comparison between the participants in the In Motion classes, non-compliant In Motion classes and the non-In Motion classes, the weight, sitting height, and standing height measures were compared. Since all of the mean values for weight, sitting height, and standing height were very similar in magnitude according to the ANOVA, it was determined that there were no significant differences ($p < 0.05$) between the groups being compared, and therefore, the groups being looked at were deemed relatively homogeneous (Table 3.3).

An ANOVA was used to analyze the anthropometric data to determine if there were any differences in physical activity levels when students were aligned

Table 3.1. Age Distribution of the Participants

	Age Category	Frequency	Percent
In Motion Classes	9	1	3.8
(N = 26)	10	15	57.7
	11	10	38.5
Non-Compliant	9	3	5.9
In Motion Classes	10	21	41.2
(N = 51)	11	23	45.1
	12	3	5.9
	14	1	2.0
Non-In Motion Classes	8	1	2.0
(N = 49)	9	6	12.2
	10	20	40.8
	11	22	44.9

Table 3.2. Gender and Grade Distribution among Participants

		In Motion Classes	Non-Compliant In Motion Classes	Non-In Motion Classes
Gender				
	Male	53.6 %	47.2 %	46.2 %
	Female	46.4 %	52.8 %	53.8 %
Grade				
	Four	64.3 %	39.6 %	46.2 %
	Five	35.7 %	60.4 %	53.8 %

Table 3.3. Anthropometric Measurements of the Participants

Group	Variable	N	Mean	SD	Max	Min
In Motion	Age (Yrs)	26	10.3	0.54	11.3	9.4
Classes	Weight (kg)	26	40.0	8.53	56.0	28.0
	Height (cm)	26	143.1	6.15	156.2	131.9
	Sitting height (cm)	26	75.7	2.91	83.5	70.8
Non - Compliant	Age (Yrs)	51	10.6	0.62	11.7	9.1
In Motion	Weight (kg)	51	40.9	11.15	72.0	23.0
Classes	Height (cm)	51	143.5	8.21	160.9	122.6
	Sitting height (cm)	51	75.6	4.62	84.8	64.5
Non-In Motion	Age (Yrs)	49	10.3	0.77	11.4	8.5
Classes	Weight (kg)	49	39.0	7.71	60.3	24.9
	Height (cm)	49	144.0	6.51	156.9	126.8
	Sitting height (cm)	49	76.0	2.97	83.2	69.2

according to maturity. Since the age of maturity is different between males and females, all calculations involving maturity were broken down into genders.

When the estimated age of PHV was compared to physical activity as measured by the pedometers and the PAQ-C, it was found that there were no significant differences in physical activity levels as a result of maturity. For an indication of the estimated PHV's of males and females in the In Motion, non-compliant In Motion and non-In Motion classes, table 3.4.

Estimated PHV did however, indicate significant differences in weight between maturational groups. In males, students that were to reach their PHV at 14 years of age had a significantly lower ($t(58) = .007$, $p < .05$) average weight (33.6 kg) than males who were to reach their PHV at the age of 13 (41.1 kg) or 12 (50.0 kg). Similarly, females who were to reach their estimated age of PHV at age 11 weighed significantly more (45.4 kg) ($t(68) = .000$, $p < .05$) than the females who were to reach their PHV at age 12 (35.0 kg) or 13 (34.7 kg).

BMI was used to determine if there would be any differences in physical activity levels. A BMI of less than 20 kg/m^2 was considered in the healthy range, 20-24 kg/m^2 was considered over weight and a BMI of over 25 kg/m^2 was considered obese. It was found that for males, the amount of steps taken over seven days was significantly higher ($t(54) = .026$, $p < .05$) than the other groups for males with a BMI of 19 kg/m^2 or less. Similarly, outside of school hours on weekdays, males with a BMI of over 25 kg/m^2 took significantly less steps per hour ($t(55) = .012$, $p < .05$) than their lighter counterparts. For females, it was found that on the weekend students with a BMI of less than 19 kg/m^2 took significantly more steps per hour

Table 3.4. The Frequency (N) of the Estimated Age of PHV for Males and Females as a group, as well as for In Motion Classes, Non-Compliant In Motion Classes, and Non-In Motion Classes

	Total Group		In Motion Classes		Non-compliant In Motion Classes		Non-In Motion Classes	
Estimated Age of PHV	**Males**	**Females**	**Males**	**Females**	**Males**	**Females**	**Males**	**Females**
11		32		7		10		15
12	3	33		5	1	15	2	13
13	44	3	13	1	18	2	13	
14	11				5		6	
Missing Values	6	1	2	0	1	1	3	0
Total N	64	69	15	13	25	28	24	28

($t(59) = .009$, $p < .05$) than students with a higher BMI. However, no significant differences were noticed in physical activity levels as a result of BMI during school hours on weekdays. When assessing BMI, it was found that 64% of the students in this study had a "healthy BMI of less than 20 kg/m^2" (Cole, Bellizzi, Flegal & Dietz, 2000).

When results of the PAQ-C were divided into categories according to body mass index (BMI) and weight, using an ANOVA it was found that there were no significant differences between PAQ-C scores and the physical activity levels of the students based on body mass and BMI.

3.3. Pedometers: Step Counts

It was hypothesized that participants from the In Motion School would take more steps than participants attending the Non-In Motion School during school hours, outside of school time, and on weekends. When the schools were analyzed as In Motion classes, non-compliant In Motion classes and non-In Motion classes, there were significant differences in steps (as measured by the pedometers) between these three groups. Based on a significance level of 0.05 using a One-way ANOVA, one of the three predicted hypotheses were accepted.

The In Motion classrooms took significantly more steps over the seven measurement days than the non-compliant In Motion classrooms and the non-In Motion classrooms. On average the In Motion classes took 104,855 steps over seven days, where as the non-compliant In Motion classes and the non-In Motion classes averaged 90,771 and 84,250 steps, respectively. The difference in the total number of steps taken over seven days was significantly greater for the In Motion classrooms (Table 3.5) than the other classes. Overall, when looking at the number of steps taken per hour, again it was noticed that children took most of their steps during school hours. Followed by out of school time, and lastly, on weekends where the least amount of steps were taken per hour of time.

3.4. Tests of Hypothesis

It was hypothesized that students from the In Motion School would have higher physical activity levels during school hours (as measured by pedometers) than students from the non-In Motion school. When comparing the In Motion classes to the non-compliant In Motion classes and the non-In Motion classes by way of an ANOVA with post hoc LSD, it was found that the In Motion classes had taken more steps than the non-compliant In Motion classes ($t(53) = .18$, $p < .05$) and the non-In Motion classes ($t(52) = .06$, $p < .05$).

The In Motion classes took more steps during school hours on three out of five school days than the non-compliant In Motion classes, with one day being significant ($t(79) = .01$, $p < .05$), and took more steps than the non-In Motion classes on four out of five school days. During one of these four days, the In Motion classes took significantly ($t(77) = .03$, $p < .05$) more steps per hour (1243) than the non-In Motion classes (990 steps per hour). The second hypothesis stated that students from the In Motion School would have higher physical activity levels outside of school hours than students from the non-In Motion school.

Table 3.5. A Comparison of the number of steps taken per hour between In Motion Classes, non-compliant In Motion Classes and Non-In Motion Classes

Group	Variable	N	Mean	SD
In Motion Classes	In School	28	1159	474
	Out of School	28	880	320
	On Weekends	26	855*	300
	Total number of steps taken in 7 days	28	104,855*	23,421
Non-Compliant In Motion Classes	In School	53	1032	393
	Out of School	53	862	354
	On Weekends	43	650	314
	Total number of steps taken in 7 days	53	84,250	27,724
Non-In Motion Classes	In School	52	979	381
	Out of School	52	922	403
	On Weekends	48	694	378
	Total number of steps taken in 7 days	52	90,771	28,103

*Significant at $p < .05$

This hypothesis was rejected since there were no significant differences found between these two schools regarding the number of steps taken outside of school hours. When comparing the number of steps taken outside of school hours between the In Motion classes and the non-compliant In Motion classes, there were no differences found. Outside of school hours, the In Motion classes took more steps than the non-compliant classes on two out of four days measured averaging 880 steps per hour, where as the non-compliant In Motion classes averaged 862 steps per hour ($t\ (81) = .82,\ p < .05$). When comparing the In Motion classes to the non-In Motion classes it was found that the In Motion classes took more steps per hour outside of school time than the non-In Motion classes on only one out of four days. On average, the In Motion classes took 880 steps per hour, and the non-In Motion classes took 922 steps per hour outside of school hours ($t\ (80) = .63,\ p < .05$).

When the non-compliant In Motion classes were compared to the non-In Motion classes, there were no significant differences found between the physical activity levels of the students outside of school hours. The non-compliant In Motion classes averaged 862 steps per hour and the non-In Motion classes averaged 922 steps per hour. In fact, outside of school hours the non-In Motion school took more steps three out of four days measured. Overall, there were no significant differences found outside of school hours between the In Motion, non-compliant In Motion and non-In Motion classes.

For the third hypothesis it was expected that students from the In Motion School would have higher physical activity levels on weekends than students from the non-In Motion school. This hypothesis was accepted, and it was found that In

Motion classes took significantly more steps over the duration of a weekend than the non-compliant In Motion classes and the non-In Motion classes. The In Motion classes took 855 steps per hour, compared to the 651 steps per hour that the non-compliant classes averaged ($t\ (43) = .02,\ p < .05$), and the 694 steps per hour that the non-In Motion classes averaged ($t\ (48) = .05,\ p < .05$). These results were all found to be statistically significant.

The non-compliant In Motion classes and the non-In Motion school showed no difference in the amount of steps their students took over the weekend. The non-compliant In Motion classes averaged 651 steps per hour, where as the non-In Motion school averaged 694 steps per hour ($t\ (91) = .55,\ p < .05$).

3.4.1 PAQ-C

As a result of the data obtained from the PAQ-C questionnaire, the activity levels as reported by the participants were not significantly different between the children from the In Motion School and the non-In Motion school ($t\ (126) = .20,\ p < .05$).

When the PAQ-C scores of the In Motion classes and the non-In Motion classes were compared, it was found that the non-In Motion school had slightly higher scores ($M = 3.61$, $SD = 0.60$) than both the In Motion classes ($M = 3.44$, $SD = 0.87$), and the non-compliant In Motion classes ($M = 3.45$, $SD = 0.69$). None of these differences however, were found to be statistically significant. The majority of the PAQ-C scores were between three and four indicating that those children were participating in moderate to high levels of activity (Table 3.6). Scores below a three

<u>Table 3.6.</u> The distribution of PAQ-C scores among the In Motion, Non-Compliant In Motion and Non-In Motion Classes.

	In Motion Classes	Non-Compliant In Motion Classes	Non In Motion Classes
Below average (scores below 3)	31 %	27 %	27 %
Average (scores of 3-4)	35 %	47 %	49 %
Above average (scores above 4)	34 %	26 %	24 %

would indicate, relatively low physical activity levels or physical inactivity, and score above a four indicate high physical activity levels and highly active children.

A Pearson correlation was performed to test the relationship between the results from the questionnaire, and the pedometers. A correlation of $r = 0.22$ indicated that there was little relationship between these two variables.

3.5. Discussion

Adherence to the intervention was essential to evaluate the effectiveness of the In Motion program on the physical activity levels of children. Within an In Motion school if some classes were not compliant, any results found would not accurately represent the effectiveness of the intervention. In the present study, an examination of the teacher's activity logs, indicated that not all classes in the In Motion School were fulfilling the minimum requirement of providing 30 minutes of physical activity every day to each student in the school. Since this minimum level of activity was not being met, only two of the five classes should have been classified as "In Motion" during the weeks covered by this study. With In Motion being a voluntary program, there is little that can be done to ensure that all In Motion schools are achieving the 30 minutes of activity per day. Prior to the commencement of the study, administrators and teachers were briefed as to the purpose of the study. Teachers and administrators at the In Motion School agreed to comply with the program requirement of 30 minutes of physical activity per day.

There are several reasons why some of the classes in the In Motion School did not follow the In Motion protocol. Perhaps the teachers agreed to support the In

Motion initiative, but did not fully understand that the minimum guidelines for the program were 30 minutes of physical activity daily for every student. This lack of understanding could have occurred through insufficient communication regarding the program either at the school or administrative level. Alternatively, if the students in the classes involved were not adequately completing the required academic workload, physical education or physical activity time may have been considered a low academic priority and thereby omitted from the school day. Teachers who do not consider physical activity as an essential element of the school day are less likely to successfully deliver the required 30 minutes of physical activity daily to their class (Chad, Humbert, & Jackson, 1996). Another possible reason for not including daily physical activity opportunities is that the teachers in the In Motion School may not have felt comfortable offering physical activity opportunities due to a lack of confidence or training in this area. As a future solution, since the In Motion school chosen had been an In Motion school for over a year, maybe the teachers need an in-service or refresher course on the values and goals of the In Motion program.

3.5.1. Pedometers: Step Counts

The current study found that 60% of grade 4 and 5 children measured were within the expected range of 12 -16,000 steps per day as published by Rowlands, Eston, & Ingledew, (1997). The average number of steps taken per day was 13,005 $\pm$ 3994 steps per day in children 10 and 11 years of age. This number was slightly higher for males (13,652 $\pm$ 4335) than females (12,414 $\pm$ 3585). This was expected since numerous other scientifio studies have also shown that without considering maturational levels, in general, males to be more physically active than females (Sallis et al., 1992). These results however are difficult to interpret, as there are no pedometer guidelines available for children that indicate the recommended amount of steps per day. It was interesting to note however, that the average number of steps taken per day by the In Motion classes (14,979) was at the top end of the expected range of 12,000 to 16,000 steps per day as outlined by Rowlands, Eston, & Ingledew, (1997). This value may indicate a positive effect of the In Motion physical activity intervention. When compared to the In Motion classes, the non-compliant In Motion classes averaged 12,036 steps per day and the non-In Motion classes averaged 12,967 steps per day. These values linger closer to the bottom end of the expected range of values for children's daily physical activity.

3.5.2. Tests of Hypothesis

3.5.2.1. Hypothesis 1

The primary hypothesis of this study was that students from the In Motion School would have significantly higher physical activity levels during school hours than students from the non-In Motion School. This study found that there were no significant differences in the physical activity levels of the participants during school hours.

In this study, since teacher logs indicated that the In Motion School used physical education classes the majority of the time to fulfill the requirement of the In Motion intervention, the frequency of physical education classes in the non-In Motion school must also be considered. The non-In Motion school offered physical education classes on four out of five school days during the week and when the frequency of physical education classes was compared between the In Motion, non-compliant In Motion and non-In Motion classes it was noticed that physical education classes were offered at both schools on at least four out of five school days. Only the In Motion classes offered physical activity opportunities on all five school days. Due to the frequency in physical education classes in both schools, it was not surprising to find that there were no significant differences during school hours between the In Motion classes, non-compliant In Motion classes and the non-In Motion classes.

When comparing the In Motion intervention to other interventions that have been successful in increasing the physical activity levels of children during school hours, there were numerous differences noted in the designs of the programs. Interventions such as CATCH and SPARK were both successful in-school programs for increasing children's activity levels in physical education classes (Nader et al., 1999; Sallis et al., 1997). These interventions involved training classroom teachers and using physical education specialists to instruct predetermined curriculum and activities that promoted increased physical activity during physical education class time. If physical education class time is going to be used to meet the requirements of an In Motion school, it is suggested that trained physical education specialists or trained teachers are used to teach these classes.

The PLAY intervention used a program design similar to the format of the In Motion intervention in the current study. Untrained classroom teachers implemented the PLAY program to ensure that students received daily physical activity that complimented physical education classes. “PLAY” time was offered everyday for 15 minutes regardless if there was a physical education class that day. During this time, the teachers were provided with set activities to follow and were encouraged to act as positive role models for students by offering support and encouragement to the children to participate in the organized physical activities. As a result, the physical activity levels of the children were increased. The In Motion program also encouraged teachers to offer daily physical activity opportunities to students by providing supervised time during school hours to be active. Even though the teachers in the In Motion School were not trained to offer a specific program, it was thought that by providing children with the time and opportunity to be more active during the school day should have resulted in an increase in children’s physical activity levels. Perhaps the anticipated increase in the physical activity levels of the children in the In Motion School did not occur because unlike the PLAY intervention, In Motion did not offer a prescribed program of activities to follow. Activity guidelines would add variety to the daily In Motion activity and ensure that an array of games and movement ideas were available for teachers if they wanted to incorporate them into In Motion activities.

Sallis et al., (2001), determined that by providing children with more opportunities to be active during the school day, physical activity levels of children were increased. In the research conducted by Sallis et al, more physical activity opportunities were provided through increased supervision and teacher availability to facilitate activities as well as increased access to facilities. Through the In Motion program, teachers were required to offer children the opportunity to participate in 30 minutes of physical activity during the school day. Even though these opportunities were being offered, there was no guarantee that the teacher would facilitate activities during this time, or provide access to school resources such as balls and skipping ropes for the children to use. As a result of providing children with 30 minutes of physical activity daily during school hours, the In Motion classes did show increased physical activity levels (as measured by pedometers) during school hours over the non-compliant In Motion classes and the non-In Motion classes. These results however, did not support my hypothesis, which stated that students from the In Motion School would have significantly higher physical activity levels during school hours than students from the non-In Motion School.

When administering field-based research, the Hawthorn effect could potentially result in modified physical activity levels during the measurement period due to the presence of researchers. As the physical activity levels of the children at the non-In Motion school were going to be measured, in order to look good when compared to the other school, the teachers may have included additional physical education classes or physical activity opportunities during the measurement period of this study. These classes may not have ordinarily occurred during an average school week and therefore the physical activity levels of these students during school hours would not be representative of typical physical activity levels at this school.

3.5.2.2. Hypothesis 2

A second purpose of the present study was to determine whether students from the In Motion School would exhibit significantly higher physical activity levels outside of school hours than students from the non-In Motion school. There were no significant differences in physical activity levels outside of school hours found between the children of these two schools, and thus, this hypothesis was rejected.

Students from both the In Motion and the non-In Motion schools on average took fewer steps per hour outside of school time than during school hours. This could be the result of children coming home after school and wanting to relax and watch TV rather than playing active games and running around. A study done in Mexico City reported that children spent approximately 4.1 hours per day watching television, and only 1.8 hours per day participating in physical activities (Hernandez et al., 1999). By spending more time watching television and playing video games (in excess of 24 hours per week) (Anderson et al., 1998), children are spending less time outdoors, thus reducing their opportunities to be physically active (Kohl and Hobbs, 1998). American children have been reported to spend more time watching television and playing video games than doing anything else except sleeping (University of Pennsylvania as cited in Robinson, 1999).

Another possible reason for decreased physical activity levels after school time when compared to during school hours is that the majority of physical activities in which children participate in are organized, or supervised by an adult. After school hours, working parents are often not available to participate in physical activities with their children, and some may actually encourage their children to stay in the house (often for safety reasons) until a parent is able to supervise outside activities. Bailey, (2000) suggested that over the last few decades there has been a significant decline in the amount of time children are involved in self-generated, free time involving spontaneous play. Perhaps children have become so accustomed to playing organized sports and games that they are unable to actively "play" on their own.

There have been mixed results indicating whether or not physical activity promotion programs are effective in altering the out of school activity levels of children. Some international school intervention studies such as Go for Health, SPARK, and Slice of Life conducted with primary students showed no effect on out of school activity (Sallis et al., 1997). These studies correspond with the findings of the current study, as there were no significant differences in out of school activity levels between the control and intervention school. The studies that showed no changes in out of school activity could have been a result of insensitive measurements, poorly designed curriculums, or interventions that were inadequately implemented (Sallis et al., 1997). In the current study, even though not all classes adhered to the In Motion program of 30 minutes of physical activity per day, the results indicating that there were no increases in out of school physical activity levels were not the outcome of an inadequately implemented school-based intervention. This conclusion was based on the fact that even the classes that did adhere to the In Motion program showed no increases in the physical activity levels of children outside of school hours.

There are however, interventions that have increased physical activity levels outside of school time as a result of a school-based intervention. Three years after the CATCH intervention had terminated, Stone, McKenzie, Welk, & Booth, (1998), found that cohorts from the original CATCH intervention still participated in more moderate to vigorous physical activity per day. This finding suggests that school based intervention programs (such as CATCH) can indeed increase student's physical activity levels both in physical education class and outside of school time. The CATCH intervention provided vigorous physical activities during school physical education classes by trained teachers or physical activity specialists. The administrators of the CATCH program predetermined and monitored all activity plans so that those students involved in this program would all be participating in the same activities. The reason for the prolonged physical activity patterns exhibited by the children after the completion of the CATCH intervention could be in part due to the emphasis on moderate to vigorous physical activities. Nader et al., (1999), suggested since the activities were based on participation in group activities led by a trained physical education specialist rather than individual fitness training, that the behavioral changes for physical activity levels initiated during the elementary school years of the CATCH program persisted into early adolescence. The current study, when providing physical activity opportunities to the students during school hours also focused on keeping all participants "active" for 30 minutes every day, however the intensity of the activity was not an important feature of the In Motion intervention. Since the In Motion program did not emphasize moderate to vigorous physical activities, this may partially explain the lack of carryover to outside activity in the current study. Another limitation of the In Motion program when comparing it to the CATCH program would be the absence of feedback to the teachers regarding their adherence to the program along with the need to supply predetermined activity plans for teachers to follow.

This hypothesis was rejected since there were no significant differences in out of school physical activity levels found between the In Motion classes, non-compliant In Motion classes and the non-In Motion classes.

3.5.2.3. Hypothesis 3

The third hypothesis stated that students from the In Motion School would have significantly higher physical activity levels on weekends than students from the non-In Motion school. Results from this study showed that the students from the In Motion classes took significantly more steps per hour over the weekend than the students from the non-compliant In Motion classes and the non-In Motion classes.

One of the factors that may influence the physical activity levels of children are parents and family (Pender, 1998). In families where both parents are active, children have been found to be 5.8 times more likely to be active than those children with inactive parents (Moore et al., 1991). On weekends parents tend to have more time to spend with their children since most occupations involve working from Monday to Friday. During this quality family time, parents have the opportunity to act as role models, discuss exercise beliefs with their children, and intentionally attempt to transfer exercise beliefs to their children through instruction, shared activities and encouragement (DiLorenzo, Stucky-Ropp, Vander Wal & Gotham, 1998; Pender, 1998). Since the two schools studied were in a similar demographic area and are of similar size, any differences in familial activity levels between the two schools would probably be negligible. However, it is entirely possible that the parents of children who attended the In Motion School were more knowledgeable about the benefits of physical activity as a result of In Motion literature being sent home with their children. This information may have led to increased encouragement and involvement from parents at the In Motion School thus also influencing the physical activity levels of their children.

Another potential reason why In Motion students may have taken more steps on the weekends could have been a result of daily routine. Perhaps for the In Motion classes, if children were used to participating in physical activities for at least 30 minutes everyday at school as part of their daily routine at school, these children may have continued this routine on the weekend as well.

This hypothesis was accepted, indicating that the In Motion classes did have significantly higher physical activity levels on the weekend than the non-compliant In Motion classes and the non-In Motion classes as indicated by the amount of steps taken on a pedometer.

3.5.3. PAQ-C

The general activity levels as perceived by the participants through the use of the PAQ-C were not found to be significantly different between the In Motion classes, non-compliant In Motion classes and the non-In Motion classes. Results from the current study, showed that approximately 50% of the participants were considered to have a moderate level of physical activity, with a mean physical activity score equaling 3.51. To understand the meaning of the PAQ-C results, the score from the current study was compared to Anderson, (2002) who reported that participants in her study were considered to have low to moderate levels of activity, with an average PAQ-C score of 2.94 recorded for adolescent females in Saskatchewan. Kowalski, Crocker & Faulkner (1997), and Holowachuk (1999), found scores similar to those of the current study when collecting information on children in grades 4-8. Their PAQ-C scores averaged 3.35 (SD = 0.68) and 3.31 (SD = 0.52) respectively. These values correspond with the results of the current study, suggesting that a large percentage of the students attending the In Motion and non-In Motion schools had moderate physical activity levels (PAQ-C score of three or higher) (Table 3.6).

When the In Motion classes and non-compliant In Motion classes were compared to the non-In Motion classes, it was found that the In Motion and non-compliant In Motion classes had lower scores on the physical activity questionnaire for children than the students from the non-In Motion classes. However, there were no significant statistical differences found between these groups, as indicated by PAQ-C scores of 3.44, 3.45 and 3.61 respectively.

Table 3.7. Comparison of PAQ-C Scores

Author	N	Mean	SD
Ernst & Pangrazi (1999)			
Intervention School	~10,000	3.12	0.52
Control School	~10,000	2.89	0.56
Anderson (2002)	227	2.94	0.70
Holowachuk (1999)	44	3.31	0.52
Kowalski, Crocker & Faulkner (1997)	97	3.35	0.68
	84	3.23	0.78
Crocker et al. (1997)	215	3.24	0.72
Johnson (2002)	128	3.51	0.70
In Motion School	77	3.44	0.76
Non-In Motion School	49	3.61	0.60

Measurement problems are an issue when dealing with self-report measures. Particular items on this questionnaire ask for information about activity during physical education class, recess, lunch periods, evenings and weekends. Each statement on the PAQ-C is scored on a five-point scale. The mean score is the average of all nine of these statements, with higher scores indicating higher levels of activity. The scoring system, however, is not weighted for each question. Even though items such as weekend and evening activities assess greater durations of time, these responses are weighted the same as shorter time periods such as recess and lunch.

The objective measurements of the pedometers were expected to correspond with the subjective measurement of the PAQ-C. When comparing the results of the pedometers to those of the PAQ-C, there was a weak relationship ($r = 0.22$). The PAQ-C indicated that the non-In Motion classes were the most active with a mean activity score of 3.62, followed by the non-compliant In Motion classes ($M = 3.45$) and the In Motion classes ($M = 3.44$). The pedometers however showed that over seven days, the In Motion classes took 104,855 steps followed by the non-compliant In Motion classes at 90,771 steps, and the non-In Motion classes at 84,250 steps. A number of studies have reported differences in levels of activity when activity monitors were compared to self-report data (Coleman, Saelens, Wiedrich-Smith, Finn & Epstein, 1997; McMurry et al., 1998; Sallis et al., 1998; Simons-Morton, Taylor & Huang, 1994). As the results from both the pedometers and the physical activity questionnaire were compared, it was found that both of these measures had their advantages. Through the use of the pedometers, the researchers were able to distinguish activity levels at different times of the day. However, the PAQ-C was a quick, easy and effective way to determine an individual's general activity level.

3.5.4. Maturity

When physical activity levels were determined at estimated PHV it was found that there were no significant differences in the physical activity levels of males and females as measured by the pedometers and PAQ-C. Matching children according to biological age, it may equalize competition, but also enhances the children's opportunities for success, and possibly reduces their incidence of injury (Mirwald, Baxter-Jones, Bailey & Beunen, 2002). Many research studies compare the physical activity levels of children based on chronological age, and because of this, it is frequently reported in the physical activity literature that boys are more physically active than girls (Ernst & Pangrazi, 1999; Hovell, Sallis, Kolody & McKenzie, 1999). Given that females mature two years prior to males (Malina & Bouchard, 1991), and that during maturity, physical activity levels decrease in both males and females (Hovell, Sallis, Kolody & McKenzie, 1999), it is entirely possible that the lower level of physical activity seen in females could be attributed to an earlier age of development (Mirwald, Baxter-Jones, Bailey & Beunen, 2002). Thus it is important that prospective studies in sport and research attempt to control for maturity when assessing physical activity levels in children.

In the current study, when weight and BMI were looked at in relation to physical activity levels, it was determined that there were no significant differences in physical activity levels during school hours. However, on weekends, females with

BMI's under 20 kg/m^2 took significantly more steps than females with a BMI in the overweight (20-24 kg/m^2) and obese categories (25+ kg/m^2). It was also found that males with a BMI of less than 20 kg/m^2 took significantly more steps over the duration of the seven days, and outside of school hours on weekdays than males with BMI's over 21 kg/m^2. These results indicated that students who were heavier in weight, or who exhibited a high BMI ratio, on average, took fewer steps than students who had a BMI between 20 kg/m^2 and 27 kg/m^2. Taking fewer steps (as measured by the pedometer) and having an increased body weight/BMI seem to be related. Because of this, it is difficult to determine whether individuals with high BMI values partake in a sedentary lifestyle because they are carrying excess body weight, or as the result of a sedentary lifestyle, an increase in BMI and body weight occurred.

3.5.5. Influences on Pedometer Readings

Most of the participants in this study remembered to wear their pedometers every day. Those who forgot to put their pedometer on in the morning usually called home to get someone to bring it to school for them, or personally retrieved the pedometer from their home sometime during the school day. On the weekend however, it was difficult to determine who wore the pedometers diligently. Some weekend values were omitted after the participant admitted to forgetting to wear the pedometer for extended periods of time. Other reasons the pedometers were not worn included personal discomfort (digging into the skin), being prohibited from wearing it for certain sports (i.e. gymnastics, wrestling), aquatic activities, and physical sickness. Occurrences of pedometers not being worn seemed to be consistent between the two schools monitored.

When using the pedometers with grade four and five children it was necessary to seal the pedometers shut while they were being worn. Vincent and Pangrazi, (2002), suggested sealing the pedometers closed with cable ties to prevent the children from inadvertently resetting them, or noting their progress. Other ways of sealing the pedometers could include the use of stickers, clamps, or tape. Children of this age are curious, and even though the cable ties remained intact for most children, when the pedometers were at home in the evenings, or on the weekend some children played with the cable ties just to see if they could remove them. These individuals were given one warning, and if they tampered with the pedometer again, they were removed from the study. This warning was effective as no participants were removed from the study.

Every effort was made to ensure that no one in the study received any feedback until the data collection was completed. The participants who broke the seal/cable ties on the pedometers were able to access their current step count for that day. This feedback however, meant very little to the participants, because they did not know what average data values were. Daily, the students in this study expressed their curiosity, and often asked how many steps they had taken that day. Because of this curiosity, the researchers were careful when recording the participant's data to keep the information hidden from view.

Due to the nature of this study and the age of the participants there were times where children were wearing the pedometers unsupervised. During this time, the accuracy of the step counts could not be verified. A few participants were seen shaking their pedometer up and down on their hip, swinging their pedometer around in the air, and others were carrying their pedometer instead of wearing it. Even after explaining how the pedometers work to the students, misuse was still noticed outdoors during school hours and outside of school hours. These behaviors were to be of short duration and were occurring at both the In Motion School and non-In Motion School. Although it was confirmed that these actions were taking place, when overall daily step counts were analyzed the affects of shaking and swinging the pedometers were considered minimal.

Pedometer readings could have been influenced slightly by the checking procedure of the research assistants. For example, one morning the class with pedometers had physical education for their first class. Since there were not enough pedometers to give everyone alternatives while theirs were being read, the research assistants had to check the pedometers one by one. During this time, the students were supposed to be running and playing, but while having their pedometers checked they were standing still. This would probably have a minimal effect on the total step values taken for that school day. However, this would have had an effect on the results if it were a regular occurrence when checking the pedometers.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4.1. Summary and Conclusions

The purpose of this study was to evaluate the effectiveness of an in school intervention strategy at increasing the physical activity levels of children in grades four and five (ages 10-11) during school hours, outside of school hours and on weekends. For the purpose of this study, the physical activity intervention that was evaluated was the In Motion program. The In Motion program required teachers to offer 30 minutes of physical activity to their students daily. In order to establish the effectiveness of this intervention, a school that offered the In Motion program was compared to a school that was not involved in the In Motion initiative.

Findings from the current study indicated that during school hours there were no significant differences between the physical activity levels of children in In Motion classes, non-compliant In Motion classes and non-In Motion classes. It is possible, since the intervention school was using physical education classes to fulfill the 30-minute daily requirement for the In Motion program, that the children were not actually receiving much more physical activity than the children in the non-In Motion classes. Since the children in the non-In Motion school also participated in physical education classes, without the In Motion School taking part in any additional physical activities during the day, there would be no reason for the physical activity levels of these children to be different.

Large amounts of time in physical education classes are often spent sedentary, learning new skills and listening to directions. Thus, physical education classes are unable to provide children with sufficient amounts of physical activity during the school day. Knowing this, it was concluded that in order to increase physical activity levels of children during school time, other initiatives are necessary such as: increased physical activity opportunities outside of physical education class or leadership training by a physical education specialist. Interventions that have been successful in increasing the physical activity levels of children have typically utilized teacher encouragement and supervision, predetermined lesson plans for physical activities, and trained teachers to implement these interventions.

In addition to finding no significant differences between the physical activity levels of children in an In Motion and a non-In Motion school during school hours, no differences in physical activity levels were observed outside of school hours on weekdays. Since the In Motion program occurred during school hours, there appeared to be no carryover effects from the intervention outside of school hours on weekdays. Often children's activities are supervised by an adult, and even though it has been proven that children's activity levels do increase by having adults provide them with encouragement and supervision, outside of school hours this is not always possible. Working parents are often not accessible to participate in physical activities with their children after school, and some may encourage their children to stay in the house (to ensure their for safety) until a parent arrives home.

Findings also indicated that students from the In Motion classes had higher physical activity levels on the weekend than children from the non-compliant In Motion and the non-In Motion classes. As a result of the intervention, perhaps parents received information home from the schools indicating the importance of physical activity, and offered more support and encouragement for their children to be active during the weekend. Perhaps children from the In Motion classes chose to participate in more physical activity opportunities on the weekend since they were used to participating in physical activities daily at school.

Of the two measures used in this study, the physical activity questionnaire for children and the pedometers, there was no correlation between these measures. Since the PAQ-C only indicated the general physical activity levels of the children, this measure was not able to differentiate between activities that occurred during school time, outside of school hours or on the weekends. Overall, data from both the PAQ-C and the pedometers found that most participants did engage in moderate levels of physical activity. Since pedometers are relatively new for measuring physical activity levels of children, there are no studies to date that outline recommendations as to how many steps are required per day for children to achieve health benefits. Even though there were no differences found between the children attending the In Motion school and the children in non-In Motion school, over 60% of participants studied took over 12,000 steps per day, and rated a three or better on the physical activity questionnaire for children (rated 1-5, with 5 being most active).

Results from the current study indicated that children from the In Motion classes had physical activity levels that were significantly increased (as measured by pedometers) on the weekend over the non-compliant In Motion classes and the non-In Motion classes. However, there were no significant increases noticed during school hours or outside of school hours during the week.

4.2. Recommendations for Future Research

In order to further assess the impact of an intervention program on the activity levels of children, it may be beneficial to survey two schools of similar size, and socioeconomic status in another urban center to use as a comparison to the intervention school. This could be done to ensure that the intervention has not affected the children at the comparison school in any way (i.e. through their parents, public promotions, or additional activities). It is also recommended that in order to ensure the intervention school follows the required guidelines (30 minutes of daily physical activity) the teachers involved in the study could be asked to: provide an outline of activities for the upcoming week to the researcher, sign a contract agreeing to adhere to the guidelines of the intervention, or a school could be selected where the entire school does the "intervention activity" together (i.e. morning school walks). Another option to ensure compliance of the intervention would be to instigate an external monitoring system so that the researcher could monitor adherence to the program or initiative. It would also be interesting to see how the intervention program is affecting children of different ages, and if there is any changes in physical activity levels after several years of attending a school with a physical activity intervention.

An area that requires more study is when and where children participate in most of their physical activity during the school day (recess, lunch, physical education class, etc.). By knowing information such as this, educators can then focus their efforts on changing or implementing programs that promote physical activity at times where children are less active.

Pedometers are like a new toy to many children, and thus it is recommended that the pedometers be introduced to children during a supervised physical education class. At this time, the children would have a chance to understand how the pedometers work by actually using them thus potentially minimizing reactivity. The researchers can also ensure that everyone is wearing them properly, and that all the pedometers are counting accurately. McClung et al., (2000), also suggest that prior to monitoring, it would be good practice to evaluate the instrument's performance on each participant during a brief walking trial.

As pedometers have the potential to be great motivational tools during school hours to increase physical activity levels of children, it is recommended that they be sealed. Pedometer research that looks at habitual physical activity levels of children should use sealed pedometers in order to prevent data from being tampered with. Without being sealed, a pedometer provides immediate feedback as to how many steps are being taken in a day, or activity session. Based on previous step counts, children can challenge themselves and others to increase their step counts and thus their physical activity levels (Beighle, Pangrazi & Vincent, 2001).

Numerous authors recommend that children need to lead a more active lifestyle (Biddle & Goudas, 1996; CFLRI, 1999; Jacobson, Kohl, Donnelly, & Gibson, 2002). In an attempt to incorporate more activity into the school day, the most common solution is through school-based interventions (i.e. CATCH, PLAY, In Motion). Research suggests that some school-based programs have been triumphant in increasing the overall physical activity levels of children, while others have shown limited success. Schools offer one of the best opportunities to positively influence the physical activity levels of children both in and out of school hours. It is essential that school based interventions are monitored to determine if they can effectively increase the physical activity levels of children.

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APPENDIX A

Physical Activity Questionnaire for Children (PAQ-C)

Physical Activity Questionnaire for Older Children
May-June, 1997

Name:______________________ Age:__________

Sex: M_____ F_____ Grade:__________

Teacher:______________________

We are trying to find out about your level of physical activity from **the last 7 days** (in the last week). This includes sports or dance that make you sweat or make your legs feel tired, or games that make you breathe hard, like tag, skipping, running, climbing and other.

Remember:

A. There are no right or wrong answers- this is not a test.

B. Please answer all the questions as honestly and accurately as you can-this is very important.

1. PHYSICAL ACTIVITY IN YOUR SPARE TIME

Have you done any of the following activities in the past 7 days (last week)? If yes, how many times?

Tick Only One Circle Per Row

	No	1-2	3-4	5-6	7 or more
Skipping	O	O	O	O	O
Rowing/Canoeing	O	O	O	O	O
Roller blading	O	O	O	O	O
Tag	O	O	O	O	O
Walking for exercise	O	O	O	O	O
Bicycling	O	O	O	O	O
Jogging or running	O	O	O	O	O
Aerobics	O	O	O	O	O
Swimming	O	O	O	O	O
Baseball/softball	O	O	O	O	O
Dance	O	O	O	O	O
Football	O	O	O	O	O
Badminton	O	O	O	O	O
Skateboarding	O	O	O	O	O
Soccer	O	O	O	O	O
Street hockey	O	O	O	O	O
Volleyball	O	O	O	O	O
Floor hockey	O	O	O	O	O
Basketball	O	O	O	O	O
Ice skating	O	O	O	O	O
Cross-country skiing	O	O	O	O	O
Ice hockey/Ringette	O	O	O	O	O
Other: ______________	O	O	O	O	O

__________________ O . O . O . O . O

2. In the last 7 days, during your physical education (PE) classes, how often were you very activity (Playing hard, running, jumping, throwing)?

I don't do PE	. . . . . .	O
Hardly ever	. . . . . .	O check
Sometimes	. . . . . .	O one
Quite often	. . . . . .	O only
Always	. . . . . .	O

3. In the last 7 days what did you do most of the time at RECESS?

Sat down (talking, reading, doing school work)	. .	O
Stood around or walked around	. .	O check
Ran around or walked around	. .	O one
Ran around and played quite a bit	. .	O only
Ran and played all of the time	. .	O

4. In the last 7 days, what did you normally do AT LUNCH (besides eating lunch)?

Sat down (talking, reading, doing school work)	. . .	O
Stood around or walked around	. . .	O check
Ran around or walked around	. . .	O one
Ran around and played quite a bit	. . .	O only
Ran and played hard most of the time	. . .	O

5. In the last 7 days, on how many days RIGHT AFTER SCHOOL, did you do sports, danced, or played games in which you were very active?

None	. . . . .	O
1 time last week	. . . . .	O check
2 or 3 times last week	. . . . .	O one
4 times last week	. . . . .	O only
5 times last week	. . . . .	O

6. In the last 7 days, on how many EVENINGS did you do sports, danced, or played games in which you were very active?

None	. . . . .	O
1 time last week	. . . . .	O check
2 or 3 times last week	. . . . .	O one
4 times last week	. . . . .	O only
6 or 7 times last week	. . . . .	O

7. ON THE LAST WEEKEND, how many times did you do sports, danced, or played games in which you were very active?

None	. . . . . .	O
1 time	. . . . . .	O check
2 or 3 times	. . . . . .	O one
4 times	. . . . . .	O only
6 or 7 times	. . . . . .	O

8. Which ONE of the following describes you best for the last 7 days?
Read ALL FIVE statements before deciding on the one answer that describes you

A) All or most of my free time was spent doing things that involve little physical effort . . O

B) I sometimes (1-2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics) . . O

C) I often (3-4 times last week) did physical things in my free time . . O

D) I quite often (5-6 times last week) did physical things in my free time . . O

E) I very often (7 or more times last week) did physical things in my free time . . O

Scoring the PAQ-C

Crocker, P. R. E., Bailey, D. A., Faulkner, R. A., Kowalski, K. C., & McGrath, R. (1997). Measuring general levels of physical activity: Preliminary evidence for the Physical Activity Questionnaire for Older Children. Medicine and Science in Sports and Exercise, 29, 1344-1349.

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The PAQ-C activity summary for elementary school students consists of **9** items ranging from 1 to 5 (with sub-items on items 1 and 9 ranging from 1 to 5; item 10 ["Were you sick last week, or did anything to prevent you from doing normal activity"] is NOT used in the claculation of the activity summary).

Item 1 - take the mean of all activities (1 being "no" activity, 5 being "7 times or more") on the activity checklist to form a composite for item 1.

Item 2 to 8- (Ped, recess, lunch, right after school, evenings, weekends, describes you best) simply use the reported values that are checked off (1 being low activity and 5 being high activity).

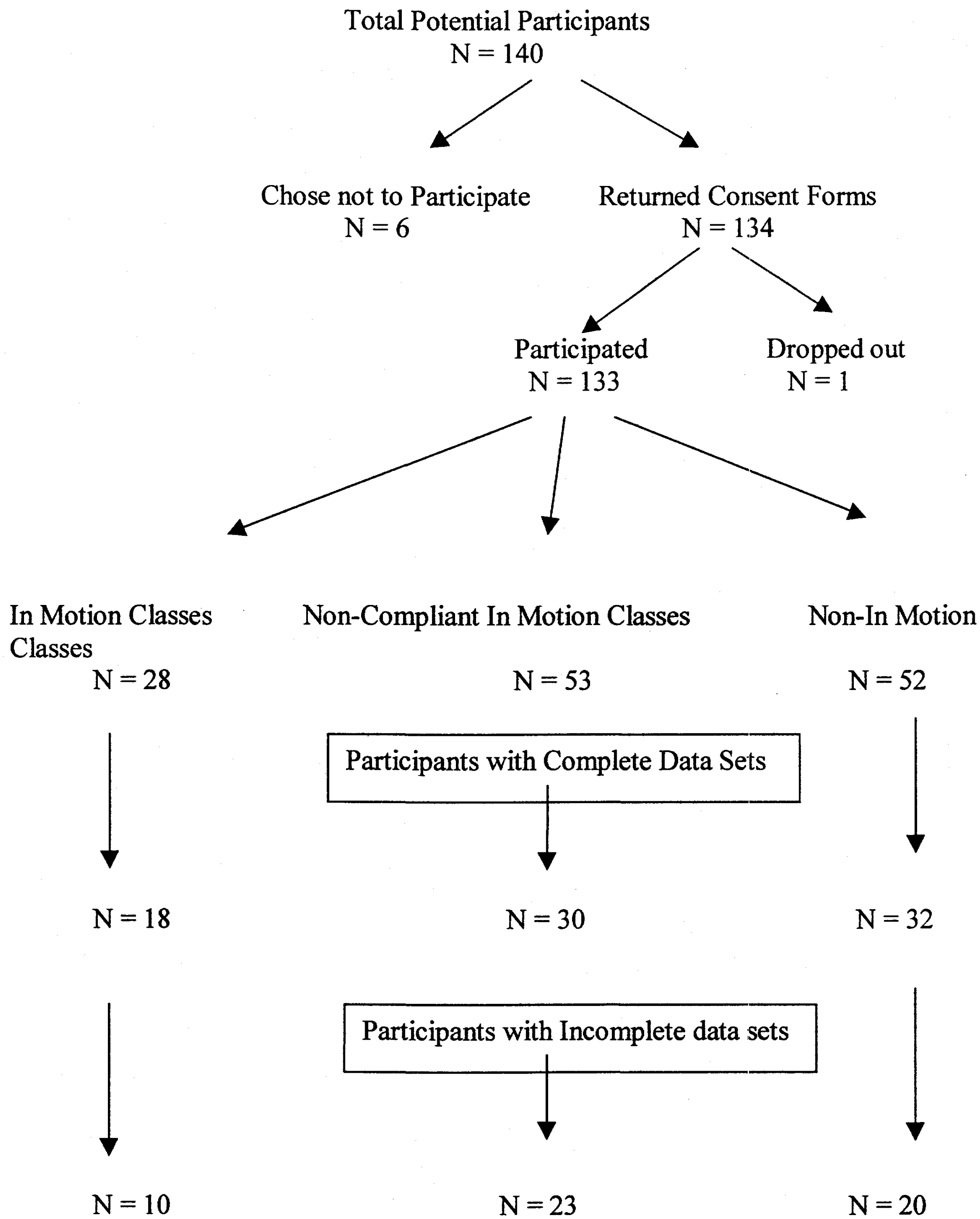
Item 9 - take the mean of all days of the week (1 being "none", 5 being "very often to form a composite for item 10.

Item 10 - can be used to identify students who had unusual activity during the previous week, but is NOT used as part of the summary activity score.

Once you have a value from 1 to 5 for each of the 9 items (items 1 to 9) used in the physical activity composite score, you simply take the mean of these items which results in the final PAQ-C activity summary score.

APPENDIX B

Flow Chart of Participant Distribution



Note: Outliers were considered as incomplete data and never entered into the database.

APPENDIX C

Sample Teacher Activity Log

SAMPLE

Daily Activity Log Sheet

Teacher: 4 Date: Friday April 19th

Please record any physical activity that occurs during the day
This could include classroom games, field trips, special events, physical education class, etc.
Please indicate if any children are unable to participate because of sickness (S) or injury (I).
Try to be as detailed as possible.

	Activities	*Details*
9:00 - 9:45	Art	Projects were done at desks and easels, but students could walk around to look at each other's work.
9:45 -10:30	Art	
10:30 - 10:45 Recess	Regular Outdoor recess	
10:45 - 11:45	Language arts	Reading and writing workshops, small groups around room, some at desks
11:45 - 12:45 Lunch		
12:45 - 1:30	Math	Measurement activities - walk around measuring things in the room
1:30 - 2:15	Gym	10 minutes of floor exercises, 35 minutes of creative dance
2:15 - 2:30 Recess	Regular Outdoor Activities	
2:30 - 3:25	Social Studies Presentations	Mainly sitting and listening, some walking around to view displays

APPENDIX D

Teacher Information Package

Pedometer Study

First Day Entering the School

- A researcher will come to your class, introduce the study to the students, show them a pedometer, read through the assent form, and hand out the consent forms to the students to take home to their parents.
- This will take about 15 minutes to do
- The classroom teacher will be asked to collect the consent forms from the students as they return them to school. You will be given a folder to put the collected forms in.
- The students will be given one week to return the consent forms

After the Consent Forms are Returned

- A researcher will come into the class to collect the consent forms.
- Each student who agreed to participate in the study will be given a pedometer
- Proper wear of the pedometers will be reviewed (will take about 10 minutes after answering their questions).
- As the pedometers are being handed out, the students will sign an assent form indicating that they understand what is going on, and the agree to participate in the study.

A couple of days will be given for the students to become accustomed to wearing the pedometers, in a hope that the novelty will wear off, and regular physical activity levels will be seen.

The study will take place for 7 days. During this time, the researcher will come into the class every morning and afternoon to reset the pedometers and reseal them with cable ties. This procedure will take approximately 20-30 minutes.

As the Pedometers are being Reset

The classroom teacher can have the children doing deskwork, assignments, reading time, book reports, essays, homework…

First day of the Study

9 A.M.

- Researcher will continue as above, resetting and resealing the pedometers.
- 2 researchers will be reading and sealing the pedometers in order to make this a time efficient process.
- The students will also be asked what time they went to bed the night before, what time they woke up in the morning, and when their birthday is.
- Again, this whole procedure will take about 30 minutes.

3 P.M.

- The pedometers will be opened, reset, and resealed, and the data will be recorded as to how many steps were taken.

Every day for the next 7 days

9 A.M.

- Researcher will continue as above, recording the number of steps taken, resetting and resealing the pedometers.
- As well as asking what time each student went to bed and got up in the morning.

3 P.M.

- The pedometers will be opened, reset, and resealed, and the data will be recorded as to how many steps were taken.

On Monday Morning

Everything will go as previously explained, but I will hand out a sheet asking what time they went to bed and got up everyday on the weekend. This way everyone can think about it for a few moments and hand back the sheet when his/her pedometer is reset.

Last Day of the Study

9 A.M.

- 7-day Physical Activity Recall Questionnaire will be administered. This will take approximately 15-20 minutes.
- Sitting height, standing height and weight will be measured at a separate location in the school by qualified research assistants. At this time, students will be asked to remove their pedometers for the final recording, and to take off their shoes for the height and weight measurements. Each student will have these growth measurements taken twice.
- These measurements will take about 45 minutes to complete.

Teacher Responsibilities

1. To fill out the daily activity log sheets to the best of your knowledge.
2. Ensure that at 9 A.M. and 3 P.M. the children are accessible to the researchers to gather the pedometer data.
   - I.e. If the children have band, art, French, p.ed… inform these teachers of the study and arrange time for data collection.
   - Children can be working on homework, reading, group work, assignments…
3. Remind the children to wear the pedometers, especially on Friday for the weekend.
4. Provide a class list to the researcher for keeping track of the pedometers, as well as for simplifying spreadsheets
5. Identify any students that may be as risk of losing the pedometers. Especially over the weekend.

Responsibilities of the Students

- Wear the pedometer everyday for 7 days as often as possible.
- Attend class regularly with the pedometers so that the researchers can read them.
- After wearing the pedometers regularly for 7 days, the students will complete the physical activity questionnaire and have their standing height, sitting height, and weight measured.

Reminder: This is a special activity for this class. When other kids ask students about their pedometer respond by saying that you are participating in a study measuring physical activity levels, or counting how many steps you take every day.

DO NOT let others touch/play with your pedometer.

If you have any questions of concerns please feel free to contact Tekla Johnson at
or email

May 3, 2002

Dear Parents,

Thank-you for allowing your son/daughter to participate in the research study that I am conducting. This study involves the measurement of physical activity levels in children thru the use of pedometers. Your son/daughter has been wearing the pedometer for several days now, and with the weekend approaching it is pertinent to remind the children of a few things.

It is important that over the weekend (Friday, Saturday, Sunday) they remember to wear their pedometer from the time they get up in the morning until they go to bed at night (and to keep it on during all activities with the exception of swimming).

I am asking that you remind your children to put the pedometers on as soon as they wake-up or get dressed every morning for the duration of the study (Until May 8^{th}).

I would like to thank you for your assistance and support in keeping this pedometer research as accurate as possible.

Sincerely,

Tekla Johnson (BSc. Kin)

If you have any questions or concerns please feel free to contact
Tekla Johnson at 3 or email

Sample Letter to Parents

Dear Parents,

Some quick personal thoughts on the pedometer study we have been presented with. I am in favor of participating in it and will be doing so myself. I encourage all of our students to do so as well. But if for some reason you wish your child not to participate I will respect your wishes.

I do ask one thing though when making your decision. If you decide to participate please make a 110% commitment to complete the study for the full 7 days. Doing the study only part time, each day or for a few days, will not help in the research.

Please return the consent forms by Wednesday March 6th, as the students will receive their pedometers that day. The actual recording of the student's movements begins on the 8th. Should you have any questions please call Ms. Tekla Johnson, the researcher, or myself. *The students are asked NOT to touch anything on the pedometer once it is set.* They just need to remember to clip it onto their pants at all times. Yes, they are to wear it when doing other activities outside of school, it is only to be unclipped when going to sleep. I am looking forward to this wonderful opportunity.

Sincerely,

Teacher's name

APPENDIX E

Assent Form

Assent Form

(The primary researcher will verbally review this form for the grade four and five students in the selected schools to participate).

Title of Study: A Comparison of the Physical Activity Levels of Children in Two Selected Schools

Investigator: Tekla Johnson, a graduate student in Kinesiology at the University of Saskatchewan.

Why are we doing this study?

The reason for doing this study is to look at the how much physical activity you are doing before school, during school and after school.

What will happen during the Study?

The study will take 7 days, and in those 7 days you will be asked to wear a pedometer as often as possible (will include one weekend). A pedometer is a scientific instrument that counts how many steps you take. It clips onto your pants at the waist and is small (about the size of a miniature Halloween chocolate bar), quiet and easy to wear. At the beginning and end of each school day a researcher will come around to your desk, read the pedometer, and ask you a few questions. These questions will include what time you woke up this morning, what time you went to bed last night, and if for any reason the pedometer was not worn. On the last day of wearing the pedometers, there will be questionnaire to fill out asking you about what activities you did in the last seven days. This will take 10 to 20 minutes to complete. After the questionnaire is done, a researcher will take you to a separate room in the school to get your standing height, sitting height and weight measured.

Are there good things and bad things about the study?

No bad things will happen to you if you take part in this study. Your school marks will not be affected and you won't be treated any differently from anyone else.

Who will know about what I did in the study?

Tekla, and her advisor Louise Humbert are the only people that will know everything about your performance in this study. All of the information gathered is confidential and will NOT be shared with other students or any teachers at your school. Any information that we get will be kept in secret and no names will be used in the research once the data is collected.

Can I decide if I want to be in the study?

You get to decide whether or not you want to take part in this study. If you do not want to take part, that is fine. If you are interested in being part of this study, you can try it and see if you like it. You have the choice to quit anytime you want to.

Assent:

"I was present when _______________________________ reviewed this form and gave his/her verbal assent."

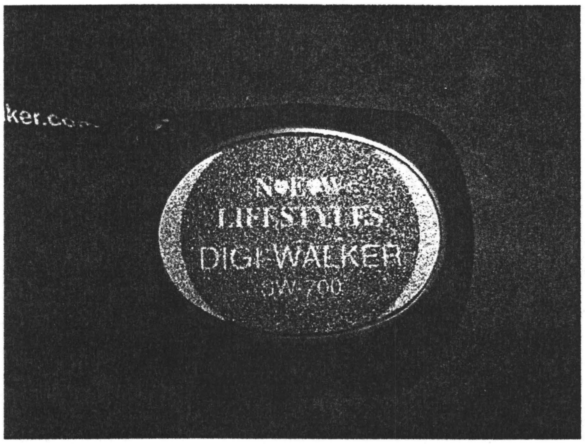
Name of Person who obtained assent _______________________________________

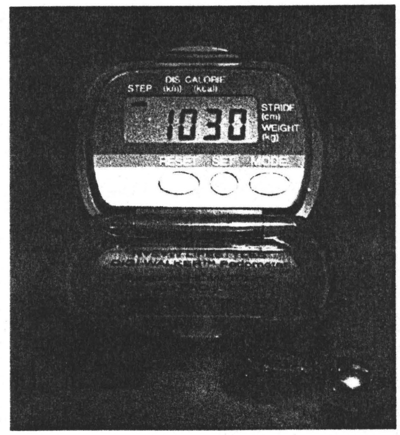
Signature: _________________________________ Date: _____________________

APPENDIX F

Pedometer Checking Procedure

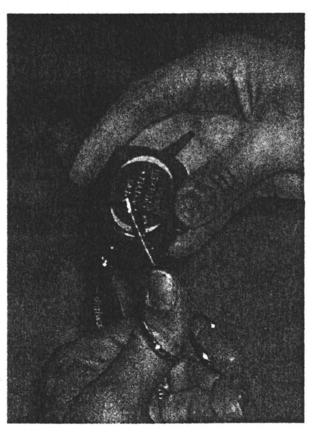
The New Lifestyles Digi-Walker SW-700





When the student's were wearing the pedometers, there was always a cable tie attached to it to keep the faceplate closed. This was to prevent the children from looking at their progress, and accidentally resetting the pedometer.

The cable ties were cut every time the pedometers were checked, and a new cable tie was attached to fasten the pedometer shut.



APPENDIX G

Questions Asked Daily

Questions Asked Daily

Each day when the research assistants checked the pedometers all participants were asked:

1. What time did you go to bed last night?
2. What time did you wake up this morning?
3. Did you take the pedometer off for any reason?

   If Yes, for how what reason, and how long was it off for?

APPENDIX H

Data Collection Schedule

Data Collection Schedule

	In Motion School	*Non-In Motion School*
Week 1	**Grade 4** 35 pedometers On the 8th day, PAQ-C and growth measurements will be taken	**Grade 4** 35 pedometers On the 8th day, PAQ-C and growth measurements will be taken
Week 2	**Grade 5** 35 pedometers On the 8th day, PAQ-C and growth measurements will be taken	**Grade 5** 35 pedometers On the 8th day, PAQ-C and growth measurements will be taken

APPENDIX I

Informed Consent Form

<u>Consent Form</u>
Students and Parents/Guardians

Title: A Comparison of the Physical Activity Levels of Children in Two Selected Schools

Tekla Johnson
Master of Science Student
College of Kinesiology
University of Saskatchewan
Saskatoon, Saskatchewan
Home: (306)

We would like to ask for your child's assistance with a study that is being carried out within the College of Kinesiology. The purpose of the study is to evaluate if the In Motion school based strategy is effective for influencing the physical activity patterns of children before, during and after school. This information will be valuable in ensuring that children receive adequate amounts of physical activity within a school day.

If your child decides to volunteer, they will be required to sign and return this consent form in order to participate. Their role as a participant in this study will be to complete a physical activity recall questionnaire for children (PAQ-C), wear a hip pedometer as often as possible for a period of 7 days, and have three growth measurements taken. These measurements include standing height, sitting height, and weight. The questionnaire will take 10-20 minutes to complete and will be administered during school hours. It is designed to provide a general indication of children's physical activity levels. The pedometer is a small objective device that counts the number of steps taken; this provides a marker of total volume or duration of activity performed. The pedometer is comfortable to wear, quiet, and hardly noticeable during daily activities. Children grow at different rates and at different ages. By measuring standing height, sitting height, and weight we can then plot the data on a growth chart and compare it to other children of similar age. The data gathered from these measurements will be the basis for my thesis project.

The decision to participate or not to participate will not affect your child's school grades in any way. There are no foreseeable risks or discomforts involved in this study and the participant can withdraw at any time with no penalty. Individual results will be kept confidential and only group results will be published. All of the information that I gather will be safely stored in a locked office when not in use. If your child wishes, they can withdraw from the study at any time. This will not in any way affect your child's school grades. This study has received approval from the Saskatoon Public School Board, and the University of Saskatchewan Advisory Committee on Ethics on Behavioral Sciences Research.

If you support your child's participation in this study, please indicate your approval with the completion of the following form. Also, please ask you child to go through this letter with you and indicate his/her consent as well. If you or your child have any questions or concerns about this study, please do not hesitate to contact either Tekla Johnson (Graduate student) of Dr. Louise Humbert (966-6473 Associate Professor and Advisor) at any time.

PARENTS/GUARDIANS PLEASE READ and SIGN YOUR CONSENT

I have read and understand the purpose of this study and my child's involvement in this study. I am aware that my child will remain anonymous throughout the study and in any written results of the data collection through participation in this project. I am aware that my child has the right to withdraw from the study at any time. I acknowledge that I have received a copy of the consent letter for my records. In signing this consent form, I am NOT waiving any legal claims, rights or remedies. If I have any questions or concerns I can contact Tekla Johnson ( ) or her research advisor, Dr. Louise Humbert (966-6473). If I wish to clarify the rights of my daughter as a research participant, I may call the Office of Research Services, University of Saskatchewan at 966-4053.

I, __________________________ give permission to allow ______________________
(parent/guardian) (student)

To participate in the study conducted by Tekla Johnson and Dr. Louise Humbert.

Signature: ____________________________________ Date: _______________

College of Kinesiology, University of Saskatchewan
105 Gymnasium Place, Saskatoon SK S7N 5C2 Canada Telephone: (306) 966-6500

APPENDIX J

Certificate of Approval

UNIVERSITY ADVISORY COMMITTEE
ON ETHICS IN BEHAVIOURAL SCIENCE RESEARCH

NAME: Louise Humbert, Kinesiology **BSC:** 2001-201
T. Johnson

DATE: 11-Jan-2002

The University Advisory Committee on Ethics in Behavioural Science Research has reviewed the Application for Ethics Approval for your study "A Comparison of the Physical Activity Levels of Children in an In Motion vs. a Non-In Motion School" (2001-201).

1. Your study has been APPROVED.

2. Any significant changes to your proposed study should be reported to the Chair for Committee consideration in advance of its implementation.

3. The term of this approval is for 5 years.

4. In order to maintain ethics approval, a status report must be submitted to the Chair for Committee consideration within one month of the current expiry date each year the study remains open, and upon study completetition. Please refer to the website for further instructions: http://www.usask.ca/research/ethics.shtml

I wish you a successful and informative study.

Valerie Thompson, Chair
University Advisory Committee
on Ethics in Behavioural Science Research

Office of Research Services, University of Saskatchewan
Kirk Hall Room 210, 117 Science Place, Saskatoon SK S7N 5C8 CANADA
Telephone: (306) 966-8576 or (306) 966-2084 Facsimile: (306) 966-8597 http://www.usask.ca/research/