The Effects of Playground Markings on Children's Physical Activity Levels

A Review of Scientifically Based Research

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Prepared for Peaceful Playgrounds, Inc.

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EXECUTIVE SUMMARY

Playground markings are currently a popular intervention strategy in the increasing epidemic of childhood obesity.

Prepared by Olivia Bissell, Bissell & Associates, P.C., to provide policy makers, school board members, administrators, teachers and parents with evidence of the effectiveness of the use of playground markings. Utilizing the Peaceful Playgrounds Program, a program developed to increase children's activity and energy expenditures as well as to decrease student bullying and confrontation, this researcher was contracted by Peaceful Playgrounds Program to conduct a study of existing research on the effects of playground markings.

Identification of 3 scientifically based research studies and 3 studies defined as model program findings. Bissell & Associates, P.C.'s staff conducted an extensive search of academic databases to locate research on the effectiveness of playground markings on the following issues: children's physical activity levels, children's energy expenditures, children's physical activity levels in primary and infant schools; playground injuries, bullying, and playground conflicts. Using the definitions set forth by Section 9101 of the No Child Left Behind Act (NCLB) of 2001, Bissell & Associates, P.C. selected 3 scientifically based research studies that applied rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs. Three other studies, while not meeting NCLB's rigorous, systematic procedures including control groups, were included as research supporting model programs (case studies) as defined by rigorous and systematic procedures but lacking control groups.

Playground Markings increase children's physical activity levels. Scientifically based research cited in the literature review demonstrates that a research base exists to support the use of playground markings for improving children's physical activity levels.

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Research conclusions from this review include:

• Increase children's phyical activity levels. Use of playground markings is effective in increasing the amount of physical activity.

• Increase children's energy expenditures. Students utilizing playground markings increased their energy expenditure significantly over the control groups.

• Increase activity levels in primary and junior schools. Use of playgrounds painted with multicolored markings increase physical activity.

- Decrease bullying. Use of playground markings, in conjunction with the Peaceful Playgrounds Program, were found to decrease playground bullying.
- Decrease playground confrontations. Use of playground markings, in conjunction with the Peaceful Playgrounds Program, were found to decrease playground confrontations.
- Decrease playground injuries. Use of playground markings, in conjunction with the Peaceful Playground program, were shown to decrease playground injuries.

SUMMARY

Peaceful Playgrounds, Inc. contracted with Bissell & Associates, P.C. to review the theoretical and/or research bases of playground markings in increasing children's physical activity levels and the effectiveness of the Peaceful Playgrounds Program on three additional areas: bullying, playground conflicts, and playground injuries.

Peaceful Playgrounds, Inc. offers stencils, activity guides (rule books), staff video training, and blueprints for use in K-8 schools to add 100 permanent painted game markings to the Preschool & K-8 playground.

Peaceful Playgrounds, Inc.'s designer, Melinda Bossenmeyer, Ed.D., developed the playground organizational system for students in preschool through grade eight. Peaceful Playgrounds offers 4 different playground designs: 1) preschool, 2) Kindergarten-grade 3, 3) Grades 3-6, and 4) K-8 grade field designs. The designs offer developmentally appropriate game activities and markings which enhance children's activity levels, energy expenditure, motor skills, social skills and academic skills. More information is available at the Peaceful Playgrounds website:

(http://www.peacefulplaygrounds.com/products.htm).

Bissell & Associates, P.C. reviewed the theoretical and/or research bases of playground markings and the Peaceful Playgrounds Program in order to inform Peaceful Playgrounds, Inc. of what scientifically based research (SBR) indicates about the effects of these strategies on children's physical activity level, children's energy expenditures, bullying, playground confrontations, and playground injuries. Peaceful Playgrounds, Inc. identified these areas as being key to its assessment of its products' effectiveness.

- To meet these purposes, five major areas of literature were reviewed:
- 1. Research that supports the use of playground markings.
- The benefits of playground markings on children's physical activity levels. Peaceful Playgrounds, Inc. further defined physical activity levels as energy expenditures, caloric burn potential through the use of observational techniques and as measured by heart rate telemetry.
- 3. The use of playground markings for engagement in game activity for the purpose of decreasing bullying behaviors. Peaceful Playgrounds, Inc. defined bullying behaviors to include name calling, physical confrontations, and perceived threat from an older or physically larger student.
- The use of playground markings in determining playground confrontations defined as resulting in adult intervention of 2 or more students requiring assistance.
- 5. Playground markings in conjunction with the Peaceful

Playgrounds Program and injury reduction.

Methodology

Research in each of the five major areas of the paper (children's physical activity levels, children's energy expenditures, bullying and playground confrontation, and playground injuries) was identified. Using academic databases such as ERIC, Bissell & Associates, P.C. conducted key word searches to locate research on playground markings and the theories supporting their use. Studies and research referenced include such reports such as the IMMPACT Project I.M. Marsh Playground Activities for Children and Teachers and the Health Promotion Wales (HPW 1997) Project. Both projects conducted simultaneously, studied a health promoting playground project in which playgrounds were painted with multicolored markings with the aim of increasing the use of and enjoyment of the school playground.

The related scientific studies in their entirety can be found at

(http://cwis.livim.ac.uk/psd/reach/immpactPlaygrounds.doc). Research referenced from other research-based studies specific to the Peaceful Playgrounds Program were also reported. A final source of review was a bibliography provided by Peaceful Playgrounds, Inc.

Research studies selected for inclusion in this review included those studies meeting criteria for SBR as defined by Section 9101 of the No Child Left Behind Act (NCLB) of 2001 and specific case studies on the Peaceful Playgrounds Program. Briefly, such research involves the application of rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs. Bissell & Associates, P.C.'s staff reviewed the research and, using the criteria from NCLB and the National Research Council's volume Scientific Research in Education (Committee on Scientific Principles for Education Research, 2002), selected only studies that aligned with these criteria to include in this review as well as case studies relating to Peaceful Playgrounds Program. NCLB's definition of SBR draws particular attention to experimental and quasi-experimental designs.

Both experimental and quasi-experimental designs employ experimental and comparison groups. An experimental group is a group in a research study that receives the treatment or intervention. While experimental or quasi-experimental designs must include at least one comparison group, they may or may not include a control group (Redfield, Sivin-Kachala, & Schneiderman, 2003).

The main difference between experiments and quasiexperiments is that in experiments, study participants are randomly selected from the population to which results of the study are to be generalized and/or randomly assigned to experimental and comparison groups, but not necessarily to both. Random selection is not haphazard or arbitrary. It follows a specified procedure using a Table of Random Numbers or a computer program for random selection. A sample either is random or it is not (Redfield, Sivin-Kachala, & Schneiderman, 2003).

Summary of Findings

Research cited in this literature review shows that a research base exists to support the use of playground markings for improving children's physical activity levels and energy expenditures, with diverse students, and in a broad range of playground activities. Peaceful Playgrounds, Inc. playground markings appear to be supported by the findings from SBR. A total of 3 SBR studies were reviewed in this paper. These 3 studies looked at physical activity levels and energy expenditures, and 2 case studies looked at bullying, decreasing playground conflicts and playground injuries.

Specific findings of the research follow. These findings are organized around the five major areas of research reviewed.

Increasing Children's Physical Activity Level and Energy Expenditures

Preschool and elementary school age children experience up to 600 minutes of recess pre year in largely peer controlled environments. These recess environments are absent of TV, computers, sedentary activities, and adult direction, all of which tend to interfere in physical activity. The results of the absence of these negative factors associated with physical activity and the insertion of playground markings resulted in happy, active children.

Use of Playground Markings for increasing children's physical activity levels

Scientifically Based Research Studies

Three SBR studies (HWP, 1997; Stratton and Leopard, 2000; and Stratton 2002) concluded that playground markings can significantly affect children's physical activity levels in playgrounds painted with multicolored playground markings.

- The first SBR study (Stratton, G. (2000), involved 47, 5 to 7 year old children before and after the school playground was painted with fluorescent markings. Children's physical activity levels were measured using heart rate telemetry during 3 recesses before and after the markings were laid down. Stratton found that moderate to vigorous physical activity increased significantly from 27 and 29 minutes to 45 and 35 minutes in the experimental and control groups respectively. These amounted to an increase of 70 percent by the intervention group and an increase of 22 percent by the control group.
- The second SBR study (Stratton,G. and Leonard, J. (2001) examined the effects of an intervention study on children's energy expenditures on the elementary school playground. The energy expenditure of the same 47 students as the Strattron, G. (2000) study also assessed before and after a school playground was painted. Total energy expenditure and the rate of energy expenditure increased significantly, as did the duration of play. Results revealed a 35% increase in total energy expenditure and a 6 percent increase in the rate of energy expenditure. Boys had a significantly higher energy expenditure than girls. These results suggest that playground markings and duration of play can have a significant and positive influence on young children's energy expenditure. This study found that children expended almost 800KJ during school recess, which is equivalent to between

15 and 20 percent of the recommended total daily energy expenditure. Recommendations: Results from this study are clearly promising and this novel, inexpensive intervention which used the children to help select game markings, has potential to improve the health of children by increasing their energy expenditure through the promotion of physically active recess games.

• The third SBR studies (Stratton, G. and Mullan, E. (2001) studied the effects of playground markings on children's health related physical activity in preschool and elementary schools (infant 4-7 years and junior 7-11 years schools). This study examined the effect of painting school playgrounds with multicolored markings, designed by children and teachers, on children's recess involvement in moderate and vigorous physical activity. Two preschools and two elementary schools from deprived areas of Northeast Wales took part in the intervention; two preschools and two elementary schools from Northwest England served as controls. Physical activity was measured using short wave heart rate telemetry, for 3 recesses before and after playgrounds were painted. Resting heart rates were used to calculate individual heart rate reserves (HRR). The percentage of playtime spent above 50% of HRR was calculated to produce percent of recess spent in moderate and vigorous physical activity (MVPA). The percent of time above 75% HRR was used as a measure of vigorous physical activity involvement (VPA). Both MVPA and VPA increased significantly as a result of playground paintings. The greatest increases were seen in VPA in experimental groups and in preschool experimental groups. Overall, the results suggest that playground painting can be a low-cost method of significantly increasing children's daily physical activity levels in the short term. If these increases can be sustained on playgrounds designed in this way, it could be a valuable contribution to health-related physical activity recommendations for young people.

Case Studies

Case study #1. (Beiswenger, Webster, Hogan & Vega (2003)) conducted a Customer Satisfaction Report of Findings in the Fall of 2003 for Peaceful Playgrounds, Inc. The Senior Research Team from California State University San Marcos methods included: school site observations, written surveys and phone interviews with 257 of Peaceful Playgrounds Program's customers. The response rate was 23%.

Overall findings by the Beiswenger 2003 study revealed that :

- All components of the Program were viewed as effective
- Most of the Program objectives were satisfied
- The Program was relatively easy to implement with staff and students
- The Program was viewed as appropriate for age groups preschools-middle school

Specific Findings related to Program outcomes are reflected in the table below. This section of the survey was designed to see if the Program is in fact accomplishing the advertised promises. The agreement mean is rated on a scale of 1-5, 1 being strongly disagree and 5 being strongly agree. Peaceful Playgrounds Program Outcomes

Program Outcomes	Agreement	
	Mean	
	(1-5)	
1. Children are more active and participating	4.09	
during recess and lunchtime.		
2. You have experienced a decrease in playground	3.78	
confrontations or fights.		
3. There has been a decrease in the amount of	3.67	
playground related injuries.		
4. There has been a reduction in playground	3.67	
bullying incidents.		
5. You have experienced a decrease in visits to	3.64	
the nurse resulting from playground injuries.		
6. In general, the students are getting along	3.54	
better throughout the school.		
7. The rules have been re-taught on an annual	3.49	
basis.		
8. The level of reported classroom disruptions	3.26	
has decreased.		
9. Your national presidential fitness levels have	2.87	
improved.		

Program outcomes 1-6 received agreement and were viewed as positively impacting the playground because each had a mean above 3.5. Statements 7-9 were not viewed to impact the playground to a significant degree. The top two rated program outcomes, increasing physical activity and decrease in violence, were the most emphasized benefits of the Program.

Playground Injuries

. • A case study by (Bossenmeyer, M. & Owens, K. 2004) examined the effects of the Peaceful Playgrounds Program on injury reduction. The six-year longitudinal study evaluated how the adoption of and operation of the Peaceful Playgrounds Program can significantly reduce playground injuries. The site for the study was a K-5 elementary school in Murrieta, CA. The Peaceful Playgrounds Program designed and implemented at Curran Elementary School in Murrieta, California significantly reduced injuries while at the same time dramatically reduced the incidences of rule infractions and misbehavior. The implementation of the Peaceful Playgrounds Program and the ongoing commitment to continued staff development in the Peaceful Playgrounds principles lead to both the significant results of the study and the school receiving the prestigious Golden Bell Award.

. To test the hypothesis that the Peaceful Playground Program reduces injury rates, a statistical test was performed on the sample data. The injury data were organized into proportions of the total number of children that were injured during three years prior to program implementation (average proportion of population injured between 1992 and 1994 = 0.05, n =1,560) and during the three years post implementation (average proportion of population of population injured between 1995 and 1997 = 0.01. m = 3,083).

Proportion of Students Injured and Average Enrollment Pre/Post Intervention		
Year	Proportion	Average
	Injured	Enrollment
1992-1994	0.05	820
1995-1997	0.01	1,027

Conclusions

The primary purpose of this literature review was to analyze the effects of playground markings on children's physical activity levels during recess, including before and after school time.

The researcher sought to determine what the findings from SBR indicated about the effects of playground markings on children's physical activity levels as well as energy expenditures. Peaceful Playgrounds, Inc. identified these areas as key to the assessment of its products' effectiveness. The conclusions in this section are drawn to align with this purpose. After reviewing 3 SBR studies, researchers drew several conclusions about the effects of playground markings on children's physical activity levels. Additionally, the researchers reviewed 2 case studies on Peaceful Playgrounds, Inc. The first case study analyzed the effects of the program on bullying, playground conflict reduction and again, physical activity. The second case study examined the use of the Peaceful Playgrounds Program as an injury reduction intervention.

Playground Markings and Physical Activity

The benefits of playground markings in increasing children's physical activity level have been documented in 3 SBR studies with both preschool and elementary school age children and with different student populations. All of the studies included in this review have shown that using playground markings resulted in demonstrated increases in children's physical activity levels as measured by heart rate telemetry.

Other documented outcomes demonstrated in these three studies were: 1) increase a child's sense of purpose while no longer wandering around the playground aimlessly looking for trouble, 2) there were fewer problems for the teacher to deal with in class in the afternoon, if children had been involved in activities at lunch time, 3) there were fewer incidences of bullying and accidents resulting from playground activities, 4) lunch time was found to be happier and less stressful for staff and students, 5) children enjoyed happy playtime, 6) the markings boosted activity levels of children, 7) the markings reduced bullying, and 8) the markings encouraged participation in traditional games and play activities.

Support for playground markings in case studies

The use of playground markings, in conjunction with the Peaceful Playgrounds Program, demonstrated a reduction in playground injuries, bullying, and playground conflicts as well as, the increase in physical activity level. All studies (SBR and Case studies) demonstrated a significant increase in children's physical activity levels. Playground markings have been found to be an effective intervention for increasing physical activity levels, increasing energy expenditures, and decreasing bullying, playground injuries and playground conflicts.

Bibliography

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