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Perceptions of Playground Safety Among Principals, Physical Education Teachers, and a Certified Playground Safety Inspector

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of Middle Tennessee State University
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Perceptions of Playground Safety Among Principals, Physical Education Teachers, and a Certified Playground Safety Inspector

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ABSTRACT

Perceptions of Playground Safety Among Principals, Physical Education Teachers, and a Certified Playground Safety Inspector

While the concern for playground safety has been extensive in recent years, the number of injuries and hazards associated with playgrounds is still very high. Studies have shown that school playgrounds are frequently associated with many safety hazards. When the school personnel who are responsible for the students cannot identify hazardous conditions on the playground, one cannot expect the playgrounds to be safe. This investigation compared a certified playground safety inspector's (CPSI) perceptions of specific playground hazards to physical education teachers' and principals' perceptions of specific playground hazards. It also compared principals' perceptions of specific playground hazards to physical education teachers' perceptions of specific playground hazards. A playground safety survey focusing on 11 specific playground hazards was administered to twenty-seven schools (principal & physical education teacher) in the Middle Tennessee area. A CPSI also evaluated each of these schools. The CPSI's mean ratings of the specific playground hazards were lower than the principals' and physical education teachers' ratings in every case except one. Significant ($p < .05$) differences were found between the CPSI's mean ratings of certain specific playground hazards and physical education teachers' and principals' mean ratings of specific playground hazards. Significant ($p < .05$) differences were also found between physical education teachers' mean ratings of specific playground hazards and principals' mean ratings of specific

playground hazards. These results indicate that the principals and physical education teachers perceive specific playground hazards as being less frequent and/or dangerous than that of a trained professional. The investigation further showed that the number of years employed in elementary education and the total number of years employed at a particular school was not related to the principals' and physical education teachers' ratings of specific playground hazards. These finding indicate that principals and physical education teachers need more comprehensive training if they are to be expected to identify and reduce playground hazards.

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CHAPTER 1
Introduction

Playgrounds were established in America to provide children with a safe place to play. Throughout the twentieth century community leaders (school administrators, recreation and park officials, physical educators, elected officials, and others) have been concerned with the children's safety when they are playing on playgrounds (American Society for Testing Material [ASTM], 1993; Butler, 1947; Christiansen, 1995; U. S. Consumer Product Safety Commission [CPSC], 1991; Curtis, 1915; Dale, Smith, Weil, and Parish, 1969; Donoghue, 1956; Frost, 1994; Mahoney, 1950; Mero, 1909; Playground, 1923; Polson, 1951; Ridenour, 1987; Scott, 1942; Wallach. 1990). While the concern is well documented, injuries are still occurring on public playgrounds.

The Consumer Product Safety Commission determined that 276 fatal injuries occurred on playgrounds between 1973 and 1988. It was also reported in 1988, that over 170,000 injuries occurred on playgrounds that required medical attention in hospital emergency rooms. About 70 percent of these injuries occurred on public playgrounds (e.g., parks, schools, daycare centers, apartment complexes, restaurants, etc.) (Tinsworth, 1992). The CPSC has recently reported that approximately 200,000 children are being treated for playground related injuries each year in emergency rooms across the United States. They determined that the number of injuries that occurred on public grounds increased from 120,000 to 148,000 (CPSC, 1996, Nov. e).

An abundant amount of information concentrated on playground safety has surfaced since the 1970's (Allen & Johnson, 1995; ASTM, 1991; ASTM, 1993; Bond & Peck, 1993; Briss, 1995; Bruya & Langendorfer, 1988; Cristiansen, 1993; Christiansen, 1995; Coppens & Gentry, 1991; Frost, 1986; Frost, 1994; Frost, 1995; Gold, 1991, Kell, 1993; Sacks, Holt, Holmgreen, Colwell & Brown, 1990; Thompson & Bowers, 1989; CPSC, 1991; Wallach, 1993; Wortham & Frost, 1990). This increased attention on

playground safety has most likely come about as a result of the high number of injuries (Briss, Frost, 1995; Tinsworth, 1992; CPSC, 1991; CPSC, 1996, Nov.e) and the deteriorating condition of playgrounds across the country (Allen & Johnson, 1995; Bond & Peck, 1993; 1995, Bruya & Langendorfer, 1988; Ridenour, 1987; Thompson & Bowers, 1989; Wortham & Frost, 1990). The CPSC, ASTM, National Recreation and Park Association (NRPA), and American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD), in cooperation with other professional associations and government agencies, have engaged in or supported numerous studies which have made large contributions to the body of knowledge over the past three decades.

In response to the high number of injuries occurring on public playgrounds, the CPSC (1991) and ASTM (1993) have developed voluntary safety guidelines and standards for public playground equipment. These guidelines and standards were formulated to reduce the chance of needless injuries to children and to "promote greater safety awareness among those who purchase, install, and maintain public playground equipment (CPSC, 1991, p. 1)." The CPSC produced their first voluntary guidelines in 1981. Two volumes of the Handbook for Public Playground Safety were published. Volume 1 (*General Guidelines for New and Existing Playgrounds*) was published for parents, individuals that supervised playgrounds, and the general public, while volume 2 (*Technical Guidelines for Equipment and Surfacing*) was intended for manufacturers, installers, and officials in charge of playgrounds (Thompson, 1992). A new revised handbook was published ten years later following studies concerning playground safety and playground injuries (Wallach, 1995; CPSC, 1991). This handbook was intended for parents, installers, supervisors, etc. The 1991 guidelines explained topics that were not clearly interpreted in the earlier guidelines and included areas that previously had not been addressed (Christiansen, 1995; Wallach, 1995; CPSC, 1991). The ASTM

developed the Standard Consumer Safety Performance Specifications for Playground Equipment for Public Use (F1487-93) in 1993. These are standards developed for manufacturers of playground equipment (ASTM, 1993; Thompson, 1992). While they are not mandatory, the standards are followed by many playground equipment manufactures.

The NRPA, specifically the National Playground Safety Institute (NPSI), and AAHPERD have conducted numerous studies and produced many publications concerning playground safety (Bruya, 1988; Bruya & Langendorfer, 1988; Christiansen, 1992; Thompson & Bowers, 1989; Wortham & Frost, 1990). While AAHPERD published several needed publications in the late 1980s, the NPSI has assembled an abundance of information since its beginning in 1991 (Cristiansen, 1992). The NPSI has been one of the leaders in playground safety and is responsible for the most significant development in the last three decades; the creation of NPSI's Playground Safety Inspector Certification program. Individuals who attend this program are educated in the safety aspects related to public playgrounds. This program "is designed to ensure that the designee has acquired the approved and standardized body of knowledge about playground safety, that the application of this knowledge has been tested, and that the goal of promoting children's safety on the playground is in the process of being furthered (Wallach, 1995, p. 66)." A certified playground safety inspector should be knowledgeable in several different playground safety topics including: testing procedures for identification of hazards, possible causes of playground accidents, support organizations, instruments and forms used during inspections, and the voluntary guidelines and standards published by the CPSC and the ASTM (Christiansen, 1994; Wallach, 1995). Individual research has also contributed to the growing body of knowledge concerning playground injuries and hazards (Allen & Johnson, 1995; Bond &

Peck, 1993; Briss, 1995; Coppens & Gentry, 1991; Ridenour, 1987; Sosin, Keller, Sacks, Kresnow & van Dyck, 1993).

The Handbook for Public Playground Safety and the Standard Consumer Safety Performance Specifications for Playground Equipment for Public Use (F1487-93) that have been produced by the CPSC (1991) and the ASTM (1993), respectively, are intended for playgrounds at parks, recreation facilities, schools, child care centers, private resorts, restaurants, multiple dwellings, and other institutions. While play areas in most of these categories have been subject to investigation, school playgrounds have been the primary focus in a large number of investigations (Boyce, Sobolewski, Sprunger, & Schaefer, 1984; Bruya & Langendorfer, 1988; Coppens & Gentry, 1991; Dale, Smith, Weil, & Parrish, 1969; Ridenour, 1987; Sosin, Keller, Sacks, Kresnow, & Van Dyck, 1993Virginia, 1992). The research concerning school playgrounds has focused on the following: the types of equipment found on the playgrounds, the injuries that occur on the playground, and the playground hazards associated with the equipment. Research has yet to be conducted that investigated the school principals' or physical education teachers' knowledge and understanding of playground safety. Bruya and Langendorfer (1988) determined that the majority of the school playgrounds they studied throughout the United States were outdated and much of the existing equipment contained known safety hazards. Frost and Sweeney (1995) determined through several case studies that more school playground injuries ended in litigation than any other type of public facility between 1981 and 1995. Poor maintenance and supervision were contributing factors in nearly all of the cases that were investigated (Frost & Sweeney, 1995).

According to Carr (1992, p. 84), Tennessee school "playgrounds and physical education facilities shall be well maintained, free from hazards, and large enough to

permit an adequate program of physical education." It is the role of the principal, faculty, and staff to ensure that the school and its grounds are free from hazards and conditions which may harm the student. This is especially true at elementary schools because the younger students cannot be expected to recognize dangerous situations in the same manner as an older student (Kimbrough & Burkett, 1990). According to Kaiser (1985), a principal is responsible for the students when the children are in the school, on the school grounds, and even when the students are off the school grounds. If the principal is not present, another employee should be delegated to supervise the students (Kaiser, 1985). During a physical education class, the physical education teacher is responsible for the students. Part of the teacher's responsibility is to provide the student with a safe environment during class participation. The teacher should be aware of potentially hazardous conditions that are present on the grounds being used for the class (Thomas & Alberts, 1982; Nygaard & Boone, 1981). Nygaard and Boone (1981) stated that "if standards and recommendations from recognized experts in various activities are available, they should be utilized (p. 63)."

A review of the literature has shown that playground safety has been a concern of many professionals. While the concern has been existent for nearly a century, the playgrounds in America are still associated with numerous hazards resulting in injury to children. School playgrounds have been the focus of many studies but the knowledge and understanding of the principal and the physical education teacher on playground safety has not been investigated. This study compared a certified playground safety inspector's perceptions of specific playground hazards to the physical education teachers' and the principals' perceptions of specific playground hazards. It also compared principals' perceptions of specific playground hazards to the physical education teachers' perceptions of specific playground hazards.

Significance of the Problem

While the concern for playground safety has been extensive, the number of injuries and hazards occurring on playgrounds is still high. An estimated 200,000 playground injuries require visits to the emergency room each year (CPSC, 1996, Nov. f). While hazards have been identified on all types of public playgrounds, a national survey of elementary school playgrounds found that over 41 percent of playgrounds contained hazardous sharp corners, edges, and protrusions. It also revealed that these playgrounds contained several other types of hazards: inappropriate surfacing, tripping hazards, entrapment, and excessive heights (Bruya & Langendorfer, 1995). Costly lawsuits have resulted from some of these accidents. Thirty-seven percent of the playground lawsuits studied between 1981 and 1995 involved schools (Frost & Sweeney, 1995). While several investigations have focused on the hazards and injuries that occur on playgrounds (Boyce, Sobolewski, Sprunger, & Schaefer, 1984; Bruya & Langendorfer, 1988; Coppens & Gentry, 1991; Dale, Smith, Weil, & Parrish, 1969; Ridenour, 1987; Sosin, Keller, Sacks, Kresnow, & van Dyck, 1993; Virginia, 1992), principals' and teachers' knowledge, understanding, and perception of playground safety have not been investigated. If the principal and the physical education teacher do not perceive the playground to be unsafe changes will probably not occur.

Research Hypotheses

The following hypotheses will be tested for the purpose of this investigation:

Hypothesis 1: There will be a significant difference between the principals' perceptions of specific playground hazards at the schools and the certified playground safety inspector's perceptions of specific playground hazards at the schools.

Hypothesis 2: There will be a significant difference between the physical education teachers' perceptions of specific playground hazards at the schools and the certified playground inspector's perceptions of specific playground hazards at the schools.

Hypothesis 3: There will be significant difference between the principals' perceptions of specific playground hazards at the schools and the physical education teachers' perceptions of specific playground hazards at the schools.

Delimitations

1. This investigation was limited to principals and physical education teachers at elementary schools (grades K - 6).
2. This investigation was limited to public schools in the Middle Tennessee area.
3. This investigation was limited to 36 principals and 36 physical education teachers.

Definitions

A variety of professional and governmental organizations are identified and several technical terms are used in describing this study. For the purpose of this investigation the following titles and terms are defined as follows:

American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD): This is an educational organization designed to support, encourage, and provide assistance to member groups and their personnel nationwide as they initiate, develop, and conduct programs in health, leisure, and movement-related programs based on individual needs, interests, and capabilities.

American Society for Testing and Material (ASTM): This is a non-profit organization that provides users, consumers, producers, and concerned individuals common ground to write standards. The standards are voluntarily written and are used on a voluntary bases.

Consumer Product Safety Commission (CPSC): This is an independent federal regulatory agency that was created to protect the public against unreasonable risk of injuries and deaths associated with consumer products. The commission develops, issues, and enforces standards, as well as conducting research and educating the public.

Entanglement: " A condition in which the user's clothes or something around the user's neck becomes caught or entwined on a component of playground equipment (ASTM, 1993, p. 2)."

Entrapment: "Any condition which impedes withdrawal of a body part that has penetrated an opening (ASTM, 1993, p. 2)"

Fall Zone: "The surface under and around a piece of equipment onto which a child falling from or exiting from the equipment would be expected to land (CPSC, 1991, p. 2)."

Footing: "A means for anchoring playground equipment to the ground (CPSC, 1991, p. 2)."

National Playground Safety Institute (NPSI): This institute promotes the right for children to play, promotes the importance of play in child development, develops and distributes current safety information and training products, provides a training program on public playground safety, and provides other services to those that are interested.

National Recreation and Park Association (NRPA): This is a nonprofit service, research, and education organization that is dedicated to improving the quality of life through effective utilization of natural and human resources.

Perception of Playground Safety: An individual's appraisal of the safety of the playground based on an individual's knowledge and experience.

Physical Education Teacher: The teacher who assists the child in the development of the knowledge, attitude, and motor skills that will prepare the child to lead an active life of participation in various physical activities (Kirchner, 1992).

Principal: "The individual with the authority to make decisions about the operation of the school (Kimbrough & Burkett, 1990)."

Protrusion: An object, connected to or part of a piece of playground equipment, that extends beyond the face of any of the three test gauges that are prescribed by the CPSC.

Public Playground: This includes playgrounds at: "parks, schools, child care centers, institutions, multiple family dwellings, restaurants, resorts and recreational developments, and other areas of public use (CPCS, 1991, p. 1)"

Resilient Surfacing: This type of surfacing absorbs some of the shock when a child falls to the surface under the playground equipment. Many different types of surfaces can be used: wood mulch, double shredded bark, wood chips, fine sand, rubber mats, etc.

CHAPTER 2
Review of Literature

Introduction

The early playgrounds in the United States were established for several reasons. One very important reason was to provide a safe place for the children to play. The playgrounds provided the children with an area, other than the streets, in which to play. The safety of children has always been a concern of professionals associated with supervision of playgrounds. This concern has been documented for over 90 years (ASTM, 1993; Butler, 1947; Christiansen, 1995; CPSC, 1991; Curtis, 1915; Dale, Smith, Weil, and Parish, 1969; Donoghue, 1956; Frost, 1994; Mahoney, 1950; Mero, 1909; Playground, 1923; Polson, 1951; Ridenour, 1987; Scott, 1942; Wallach. 1990). The National Recreation and Park Association (NRPA), (and individuals associated with this organization) and its predecessor organizations, have worked for safer playgrounds since the early 1900s.

Even though the concern has been evident, studies have shown that injuries are still common on playgrounds (CPSC, 1996, Nov.e; Tinsworth, 1992). Each year about 200,000 injuries that require emergency room attention occur each year on playgrounds and about 148,000 of these injuries occur on public playgrounds (parks, schools, restaurants, day care center, apartments, etc..) (CPSC, 1996, Nov.e).

The fact that a high number of injuries were occurring on public playgrounds (CPSC, 1981a; Frost, 1986), that lawsuits were increasing (Frost & Sweeney, 1995), and that the public playgrounds were associated with several types of hazards (CPSC, 1981a; CPSC, 1981b) led to a surge of information concerning playground safety over the last 28 years (Allen & Johnson, 1995; American, 1991; American, 1993; Bond & Peck, 1993; Briss, 1995; Bruya & Langendorfer, 1988; Christiansen, 1993; Christiansen, 1995;

Coppens & Gentry, 1991; Frost, 1986; Frost & Sweeney, 1995; Gold, 1991, Kell, 1993; Sacks, Holt, Holmgreen, Colwell & Brown, 1990; Thompson & Bowers, 1989; United, 1991; Wallach, 1993; Wortham & Frost, 1990). Some of the leaders providing this outpouring of information include organizations such as the U. S. Consumer Product Safety Commission (CPSC), the American Society of Testing and Material (ASTM), the American Alliance of Health, Physical Education, Recreation, and Dance (AAHPERD), and the National Recreation and Park Association (NRPA). With the help of these organizations and others the information concerning playground safety is very extensive. These organizations have made great contributions in the area of playground safety in the past 28 years (ASTM, 1991; ASTM,1993, Bruya & Langendorfer, 1988; Christiansen, 1993; Christiansen, 1995; CPSC, 1979, 1981a, 1981b, 1990, 1991, 1995, Herkowitz, 1986; Thompson & Bowers, 1989; Wortham & Frost, 1990). Voluntary guidelines (*The Handbook for Public Playground Safety*) and standards (*Standard Consumer Safety Performance Specifications for Playground Equipment for public Use*) have been published by the CPSC (1991) and the ASTM (1993). The NRPA has recently established an institute focused specifically on playground safety and a playground safety inspector certification program. AAHPERD has published three national studies that investigated the status of American playgrounds at schools, community parks, and day-care facilities. These guidelines, standards, training of certified inspectors, and research studies can all play a role in the prevention of some of the needless injuries that occur on playgrounds. Even though these organizations have led in the struggle to make American playgrounds safe, individual research also has contributed to this endeavor (Allen & Johnson, 1995; Bergner, Mayer, & Harris, 1971; Bond & Peck, 1993; Briss, 1995; Coppens & Gentry, 1991; Ridenour, 1987; Sosin, Keller, Sacks, Kresnow & van Dyck, 1993).

Even though the topic of playground safety has been studied extensively for many years, the public playgrounds in the United States still seem to be unsafe (Allen & Johnson, 1995; Bond & Peck, 1993; Boyce, Sobolewski, Sprunger, & Schafer, 1984; Briss, 1995; Ridenour, 1987; Sacks et al., 1990; Sosin, Keller, Sacks, Kresnow, & van Dyck, 1993). One specific type of public playground that has been the focus of several investigations has been the school playground (Boyce et al., 1984; Bruya & Langendorfer, 1988; Coppens & Gentry, 1991; Dale, Smith, Weil, & Parrish, 1969; Ridenour, 1987; Sosin et al., 1993; Virginia, 1992). These investigations have focused on injuries that occur on playgrounds and the hazards that are prevalent on playgrounds. The findings of these investigations have shown that school playgrounds are frequently associated with both injuries and hazards. The individuals that are ultimately responsible for the students are the teacher and the principal. The teacher and the principal should be aware of all hazards that are associated with school playgrounds because it is their responsibility to provide a safe place for the student during school activities (Kaiser, 1985; Kimbrough & Burkett, 1990; Nygaard & Boone, 1981; Thomas & Alberts, 1982).

The history of playground safety stretches throughout the twentieth century and can be divided into three distinct periods: 1900s - 1930s, 1940s - 1960s, and the 1970s - present. This history shows that many of the early recommendations and concerns still hold true today. While some of these early recommendations are not recommended today, many of the recommendations that we still embrace have been overlooked throughout the century.

1900-1930s

Many early professionals have documented their concerns for playgrounds that are safe for children. An early publication edited by Everett Mero (1908) dedicated one section to playground construction and equipment. Leland (1908) who authored this

section, discussed several aspects of playground safety. These aspects included: surfacing, equipment, and age separation. Leland (1908) recognized that certain types of equipment should have one foot of sand beneath them. He did not recognize the need for a resilient surface under equipment like the swing and giant stride and even went as far as to recommend a hard surface to be placed under this equipment. Despite this problem, Leland (1908) identified several pieces of equipment that he believed to be potential dangers. These included the teeter ladder, revolving see-saw, and the flying dutchman. Age separation was also a safety concern of Leland, especially when children played on swings.

Leland and Leland (1909) elaborated further on playgrounds safety aspects in "*Playground Techniques.*" They (1909) supported the information reported in Mero's (1908) publication and added that swings, giant strides, see-saws, horizontal bars, and parallel bars were the safest equipment available. This type of equipment has now been associated with many hazards and injuries.

Henry S. Curtis was another professional that wrote about playgrounds and related topics in the early twentieth century. Curtis (1913, 1914, 1915, 1917) addressed several aspects of playground safety in his writings. He (1913, 1915) believed that perimeter fencing was a necessity for playgrounds. He explained that playgrounds were first created to keep the children off the streets, and without fences children would be free to access sidewalks and streets and were likely to be in danger. Another reason for having fences was to protect the children from wondering into areas where equipment was being used (Curtis, 1915).

Different types of equipment were also discussed by Curtis (1913, 1914, 1915, 1917). He made it very clear that the swing was the most dangerous piece of equipment used on playgrounds and that it was responsible for the majority of the injuries that

occurred on playgrounds. Curtis (1914, 1915) explained that the higher swings were more dangerous and suggested that small children have swings of only eight to ten feet in height that are separated from the older children's swings. He (1915) also noted that the seat should be as light as possible and that the swing should be placed close to the fence or to the side of the playground.

Other pieces of equipment discussed by Curtis (1915) included the slide, see-saw, merry-go-round, and giant stride. He warned that wooden slides could cause injuries due to splinters and that metal slides could burn children when they get hot from the sun. While the giant stride was not considered dangerous at the time it was acknowledged by Curtis (1915) that children could get injured when exiting the apparatus as well as on see-saws that did not have a long board and a short standard.

Curtis (1915) also discussed the surfacing of a playground. He recognized that brick, cement, cinders, and gravel were all unsatisfactory surfaces. While he initially recommended grass as the most appropriate surface for most playgrounds, he later recognized that a manufactured surface might be necessary to obtain a satisfactory surface. Another safety concern of Curtis (1917) was the height of the playground equipment. He believed that standards (example: heights) for equipment were needed for city and school playgrounds.

Joseph Lee, the father of the American Playground Movement (Curtis, 1917), addressed several safety topics in the Playground and Recreation Association of America's (1925) publication, "*The Normal Course in Play.*" The topics concerning playground apparatus were very similar to Curtis' (1913, 1914, 1915, 1917) recommendations. Additional attention was added to the belief that young children's playgrounds should be separated from older children's playgrounds. The separation of gender (which is not supported today) was also believed to be a necessity. Moreover, Lee

did recognize that the care of the apparatus was very important and that improper care could lead to injury.

The National Recreation Association (NRA), formerly the Playground and Recreation Association of America, showed its commitment to playground safety in 1931 when it attempted to ban the giant strides from playgrounds. Acknowledging the fact that many children were being injured on playground equipment the NRA made a resolution to ban the giant strides from playgrounds. While the resolution was adopted by the NRA it was not adopted by the states (Thompson, 1992).

In 1932, the results of a study on surfacing conducted by a NRA committee was published in the journal *Recreation*. The committee determined that several factors could affect the type of surface that needed to be placed on a playground. Some of these factors included: climate, location, type of activity, intensity, availability, cost, etc. Several desirable qualities of playground surfaces were also listed by the committee. These qualities included: resilience, good drainage, low-dust, durability, non-abrasiveness, cleanliness, smoothness, low-cost, etc. The surfaces were classified in six groups (i.e., turf, sand-clay, crushed stone, bituminous surface, concrete, and patented material). While concrete was not widely accepted as a good playground surface, asphalt was surprisingly preferred. Specific types of surfaces in each group were discussed in detail (Surfacing, 1932a). The committee determined that the best surfaces under playground apparatus (e.g., gymnasium, flying rings, etc..) were tanbark, sawdust, shavings, and sand. While the committee suggested this surfacing for most equipment, they did not suggest that it be used around the giant stride, see-saw, traveling rings, or swings (Surfacing, 1932b). Currently, resilient surfacing is recommended under all the apparatus on the playground (CPSC, 1991; ASTM, 1993).

The NRA did not stop by just addressing surfacing. It also published standards that addressed several safety topics. The arrangement of the playground, supervision, inspection, and ground care around the equipment were some of these topics. Age separation was also addressed in these standards. It was recommended that the younger children have distinctly different playground equipment (Butler, 1950). Another recommendation includes the separation of slides and flying rings from the gymnasiums.

1940s-1960s

While several aspects of safety were addressed in the 1940s-1960s, surfacing seemed to receive the most attention. Many playgrounds were surfaced with asphalt or other non-resilient surfacing in the 1930s and 1940s. One school district, Long Beach, CA, stated that all playgrounds should be surfaced with some type of asphalt or use another type of system to cut down on dust. In 1942, Scott reported that the majority of principals, teachers, play directors, and activity leaders in this school district liked the new asphalt surfacing. He also reported that the severity and number of injuries had decreased at many of the schools. Other school systems also turned to the use of asphalt surfacing, but they did not have the same type of positive response (Playground, 1951; Experiments, 1952; Brashear, 1952; Zaun, 1952; Koehler, 1952; Butler, 1952). This type of surfacing eventually led to injuries, protest, and the removal of equipment.

One of these school systems that had a widely documented debate about playground surfacing was Los Angeles. About 60 percent of the playgrounds in Los Angeles were covered with asphalt by 1949. This included many of the areas around playground apparatus. A fatal accident that occurred on one of the playgrounds led to the public protest against asphalt surfacing under the playground apparatus in Los Angeles (Playground, 1951). Two reports were presented to the Los Angeles officials. One of these reports attempted to justify the use of asphalt surfacing while the other tried to

show the need for a resilient surfacing under certain types of equipment. The first report noted that over 50 other large cities and 29 other school systems used some type of asphalt surfacing around some of their equipment. This report also emphasized that the local principals were in favor of the blacktop surfacing and that the rate of injuries had not increased since the blacktop had been installed. The Citizen's Advisory Committee emphasized the need for resilient surfacing under playground apparatus. However, they did not believe that the blacktop must be removed from the entire playground. The committee understood that the way a person fell contributed greatly to the extent of the injury that occurred and that a resilient surface would lessen the severity of the injury. The committee recommended that several pieces of equipment have resilient surfacing under them. Some of them included the horizontal ladder, traveling rings, climbing poles, swings, giant stride, and slides (Playground, 1951).

The results of the reports were positive because the cities of Los Angeles and Pasadena began to study the use of resilient surfacing under their playground apparatus (Experiments, 1952). Another positive benefit of this publicized surfacing problem in Los Angeles was the fact that it brought attention to the fact that injuries were occurring on the asphalt surfacing, not only in Los Angeles but also in other cities (Brashear, 1952; Zaun, 1952; Koehler, 1952; Butler, 1952).

A 1956 safety education data sheet, developed by Raywid and Fox (1956), reported that 49 percent of the accidents that were reported at schools occurred on the playgrounds. Raywid and Fox (1956) realized that surfacing could not be blamed totally for the injuries that occur, but acknowledged that the resiliency of the surface may play a role in the severity of the injury. They (1956) also discussed several different types of surfacing (i.e., natural soils, tanbark, sand-clay, and turf) that could be used on playgrounds and underneath the apparatus. One type of surfacing not mentioned by

Raywid and Fox that was beginning to be used was rubber. Pellitized rubber, rubber powder, and molded rubber mats were new to playgrounds in the 50s and 60s (Butler, 1963; Moore, 1951; Polson, 1951). Frost (1986) noted that these surfaces probably did not provide adequate protection for falls from playground equipment but paved the way for "more effective manufactured surfaces (p. 12)."

Another safety education data sheet reported on the playground apparatus. The National Safety Council (NSC) determined that in the 1953-1954 school year 26 percent of the reported accidents that occurred at schools were associated with playground apparatus. The NSC (1956) listed several factors that could increase the safety on the playground in regards to the apparatus. These factors included selection, location, maintenance, and use. The NSC (1956) emphasized the need to select the apparatus for the specific group that will be using it (e.g. young vs. older children, gender). The space provided around the equipment and the need for daily inspections were other areas emphasized by the NSC (1956). Safety concerns for specific equipment (e.g., swings, slides, giant strides, and climbing structures) were also addressed (NSC,1956).

Supervision of the playground was also a popular issue during this period (Mahoney, 1950; Playground, 1951). Mahoney (1950) noted that playground leaders should supervise the playground and its activities while educating the children on how to play in a safe manner. Two safety areas that he addressed were the separation of pre-schoolers and older students, and the separation of larger children from smaller children (Mahoney, 1950).

Another major contributor to the 1940 -1960s literature was G. D. Butler. Butler (1947, 1950, 1952, 1963) addressed many aspects of safety on the playground. He believed that turf was the "most satisfactory surface (Butler, 1947, p. 9)" for many of the playgrounds. While Butler (1947) realized that resilient surfacing was needed under

some of the playground apparatus, he failed to recommend it for all the apparatus. He also believed that proper pathways and entrances would reduce the chance of accidents. Additional safety measures recommend by Butler (1947) included the placement of certain apparatus on the edges of the playground and the need for a continuous maintenance program (Butler, 1950). Butler (1950) suggested several general maintenance procedures and procedures for specific types of playground apparatus and believed that a piece of apparatus that needed to be repaired should be roped off or removed until it was in good working order.

1970s - Present

Many achievement were made in making playgrounds safe for children from the 1900s through the 1960s. These achievements however, are small when they are compared to the advancements in playground safety that have occurred since 1970. The past 28 years have brought with them many contributions to the body of knowledge that concerns the safety of public playgrounds. The contributors to this body of knowledge have been led by the ASTM, CPSC, AAHPERD, and NRPA, but have also included numerous independent researchers and other governmental and private organizations (Allen & Johnson, 1995; Bond & Peck, 1993; Boyce, et al., 1984; Briss, 1995; Coppens & Gentry, 1991; Ridenour, 1987; Sacks, et al, 1990; Sosin et al, 1993). Within the last 28 years several achievements have stood out in the playground safety field. Some of these achievements include the development of voluntary guidelines and standards, the publication of the results from three national playground surveys, and the formation of the National Playground Safety Institute (NPSI) and their inspector certification program.

In the early 1970s the National Electronic Injury Survey System (NEISS) was initiated. The NEISS reported on consumer product related injuries that were treated in

emergency rooms. Since its beginning the NEISS has played a key role in supplying injury data associated with public playgrounds (Frost, 1986).

Federal Guidelines and Standards

1981 Handbooks for Public Playground Safety

The United States Consumer Product Safety Commission (CPSC) published voluntary federal playground safety guidelines in 1981. The CPSC initially began their involvement in the production of these standards due to the petitions and letters submitted by Elayne Butwinick and Theodore Sweeney (Thompson, 1992) and due to the growing information on playground related injuries that occurred in the 1970s (Frost, 1986). The NRPA was contracted to develop playground standards by the CPSC. The NRPA submitted proposed standards in 1976 which were rejected by the CPSC (Wallach, 1995). The CPSC (1981a), with the help of the National Bureau of Standards (NBS), revised the NRPA proposed standards. The NBS also developed a technique for testing the surfacing under playground equipment. The sum of this work resulted in the publication of two volumes of the *Handbook for Public Playground Safety*. The CPSC had intended on producing standards for playground equipment. The CPSC (1981a) gave several reasons for not publishing equipment standards:

> Such factors as the diverse ways equipment is used, the varying quality of supervision on equipment, equipment placement, and equipment maintenance all play a part in playground injuries. In addition, most injuries associated with playground equipment involved falls, which would not be addressed by equipment specifications alone. (p. 2)

Even though the handbooks were not standards, the CPSC stated that the handbooks could be used as "guidelines" for public playground equipment. These guidelines were

voluntary since the CPSC (1981) did not endorse the guidelines as "the exclusive method of safe playground equipment construction (p. 2)."

Volume 1, *General Guidelines for New and Existing Playgrounds*, was intended for parents, the individual purchasing equipment, and the supervisor of the playground. The CPSC (1981a) addressed several different topic in this volume of the *Handbook for Public Playground Safety*: playground injuries, surfacing, general hazards, specific equipment guidelines, layout and design, and methods of making an existing playground safe. Volume 2, *Technical Guidelines for Equipment and Surfacing*, was developed for manufactures, installers, and officials responsible for public playgrounds (CPSC, 1981b). With this handbook the CPSC attempted to explain specific methods of determining if the playground was safe: assembly and installation, maintenance, various hazards, surfacing guidelines, etc. While these handbooks were the best source of information in the 1980s, they were not perfect and have been criticized. Frost (1992) noted that the testing section of the handbooks were too technical and that soil had not been impact tested. Frost also stated that "the most serious fault was the general orientation to conventional, outmoded equipment (p. 203)," even though the majority of the equipment found on playgrounds is conventional equipment. Wallach (1993) pointed out that these handbooks didn't fully address surfacing. The types of surfacing depths needed for particular equipment heights weren't explained. Other problems noted by Wallach included the lack of dimensions for use zones and a contradiction with the color coding of equipment between the two handbooks.

1991 Handbook For Public Playground Safety

In 1988, the CPSC began to work toward a revised Handbook for Public Playground Safety. Preston (1992) noted that several steps were taken by the CPSC staff to reach that goal. The COMSIS corporation was hired to develop a report on

playground safety. Frost (1992) praised this report acknowledging its thorough research in playground safety. Wallach (1995) on the other hand, noted that the report "only covered a portion of the available knowledge about playground safety (p. 63)." The CPSC staff conducted other studies on playground related injuries, the health hazards of Chromated Copper Arsenate treated wood, and "impact attenuation performance tests on loose-fill surfacing material (Preston, 1992, p. 108). The results of the surfacing tests resulted in the publication of the *Playground Surfacing Technical Information Guide* (CPSC, 1990). In this document the CPSC (1990) explained the need for shock absorbing surfacing under playground equipment and determined the shock absorbing properties of various loose fill materials at different depths and critical heights. All of these endeavors led to the publication of the CPSC's *1991 Handbook for Public Playground Safety.*

This handbook, like the 1981 handbooks, was a set of voluntary guidelines. The CPSC published this handbook for individuals that purchase (recreation, park, and school personnel) and install playground equipment as well as the general public. Topics included in the 1991 handbook were: layout and design, installation and maintenance, materials of manufacture and construction, general hazards, access and platforms, major types of equipment, surfacing, and use zones. The layout and design section along with the installation and maintenance section were brief while containing important information. The layout and design section contained information pertaining to the location of the equipment on the playground as well as the need for age separation. The commission emphasized the need to separate pre-schoolers from older students (e.g. using a buffer zone). The commission addressed several aspects in the installation and maintenance section. Some of these aspects included the need to follow the installation instructions provided by the manufacturer, stability, inspection before use, and the

importance of a comprehensive maintenance program. The materials that are used on playgrounds were also discussed in the handbook. This segment of the handbook contained information concerning the type of paint used on the equipment, the type of treatment used on wood, the strength of the hardware, etc.

One of the larger sections focused on general hazards that are associated with playgrounds. Six types of general hazards were explained by the CPSC. These included (1) sharp points, corners, and edges, (2) protrusions and projections, (3) pinch, crush, and shear points, (4) entrapment hazards, (5) tripping hazards, and (6) suspended hazards. None of these general hazards should be present on public playgrounds.

Examples of sharp, points, corners, and edges would include splinters, sharp slivers of metal, and non-rounded edges and corners. This type of hazard can be found on almost any type of equipment and may cause minor or serious injuries. Protrusions and projection can also be serious threats to a child's safety because they are capable of causing entanglement. If a child's clothing becomes entangled in a projection it could lead to the suffocation of the child. The CPSC stated that special attention should be given to the top of slides when looking for this type of hazard. Protrusion gauges have been developed to determine if a protrusion is hazardous (too long). The gauge is placed on a protrusion to determine if the protrusion is too long. Another type of hazard found on various pieces of equipment is head entrapment. This hazard can be very dangerous and life threatening in certain situations. "In general, an opening may present an entrapment hazard if the distance between any interior opposing surfaces is greater than 3.5 inches and less than 9 inches (CPSC, 1994)." An opening that does not meet these dimensions might allow children to insert their bodies into the opening. After entering the opening, the children may not be able to get their heads out of the opening without help, thus resulting in strangulation. Another type of hazard that is commonly associated

with equipment that has moving parts (e.g., seesaws and merry-go-round) is pinch, crush, and shear points. While tripping hazards include objects that should not be present on the playground (e.g., roots, rocks,), the footings that anchor the equipment as well as balance beams and surfacing retaining walls can also be potential tripping hazards. The balance beam and the retaining walls can be painted a bright color to draw attention to them, but the footings must be covered with resilient surfacing.

Two other areas that can contribute to the safety of a playground are the access areas and platforms. The CPSC explained several forms of access to equipment. The guidelines for access are very detailed. The commission addressed several aspects concerning access: the slope, tread depth, rung diameter, handrails, etc. The segment of the guidelines that addressed platforms was also very detailed. Specific guidelines were developed that specified when guardrails or protective barriers should be used on playground equipment. Factors that affected this decision included the type of user (pre-schooler or school-age) and the height of platform. The appropriate height of the guardrails or protective barriers were also specified for pre-schoolers and school-age children.

The largest section of this handbook is dedicated to explaining guidelines for different types of equipment. General and specific guidelines were created by the CPSC for slides, swings, climbing equipment, merry-go-rounds, seesaws, spring rocking equipment, and trampolines. (e. g. guidelines for all types of slides included the width and length of the platform, the type of access that is acceptable, the exit region of the slide, guardrails and barriers, etc.)

Surfacing and use zones were the last two sections of this handbook. Critical height is "the maximum fall height from which a life-threatening head injury would not occur (CPSC, 1991, p. 20)." The CPSC explained that all surfaces have a critical height

value (e.g., 12 inches of uncompressed wood mulch has a critical height value of 11 ft). The commission has determined the highest accessible part of different pieces of equipment so appropriate surfacing can be placed under the equipment at adequate depths.

Two types of surfacing were discussed in the handbook include unitary and loose-fill materials. Unitary materials include rubber mats and man-made materials while loose-fill materials include wood mulch, double shredded bark mulch, uniform wood chips, fine sand, coarse sand, fine gravel, and medium gravel. Critical height values for each of these loose-fill materials were determined for various uncompressed depths and compressed depths. The CPSC also emphasized the need to make the playground accessible to all children according to the American with Disabilities Act of 1990.

The CPSC divided the use zone for playground equipment into the fall zone and the no-encroachment zone. The fall zone is the area around the equipment that should be covered with protective surfacing, while the no-encroachment zone is an additional area that "should have no encroaching obstacles (p. 22)." Fall zones were developed for all stationary and moving equipment. No-encroachment zones were not developed for specific pieces of equipment but were recommended especially for moving equipment.

In 1994 the handbook was revised by the CPSC so it would resemble the ASTM standard (example: rotating swings cannot be located on a play structure). This handbook will continually be revised by the CPSC in an effort to keep up with the changes in the playground environment (Wallach, 1997).

ASTM Public Playground Equipment Standard

The American Society for Testing and Materials was petitioned in 1988 by the National School Supply Equipment Association to create safety standards. This resulted in the formation of the Public Use Playground Equipment Subcommittee (Thompson,

1992; Wallach, 1993). The committee was composed of volunteers representing a wide variety of disciplines: designers, manufactures, NRPA representatives, AALR representatives, public agencies, educators, etc. (American, 1993; Thompson 1992; Wallach, 1995). The ASTM subcommittee, who had begun to make their own playground standards, were concerned that the CPSC was coming out with guidelines at the same time. They were afraid of confusing the public with two different sets of guidelines and standards. The ASTM and the CPSC worked together to make the two documents compatible with one another. It was decided that the ASTM standard would be developed for manufactures and designers since the CPSC guidelines were developed for the public (Thompson, 1992). In 1993, the ASTM published the Standard Consumer Safety Performance Specification for Playground Equipment for Public Use (F 1487-93).

Standard F 1487-93, like the CPSC guidelines, covers a wide range of safety topics: materials and manufacture, general and performance requirements, access and egress requirements, equipment, layout, accessibility, structure integrity maintenance and labeling. There are key differences between the standard F 1487-93 and the CPSC guidelines. Standard F 1487-93 was specifically developed for playground equipment. It does not contain all of the aspects of playground safety that are covered in CPSC guidelines. Dr. Francis Wallach (1995) has developed a quick reference to the ASTM's standard F 1487-93 which compares it with the CPSC (1991) guidelines. Dr. Wallach noted that standard F 1487-93 does not address tripping hazards, environmental effects on metal and ground surfacing, age separation, electrical hazards, and some installation considerations. It should also be noted that these factors are not directly related to the playground equipment (which is the focus of standard F 1487-93). Dr. Wallach's quick reference also shows that standard F 1487-93 contained new information concerning playground safety and playground equipment. Two of the areas that stand out are

accessibility and labeling. Several aspects of accessibility were covered by standard F 1487-93. This standard addressed the access, landings, transfer points, platforms, interaction between the user and the equipment, and accessible play opportunities. Labeling was the other area where F 1487-93 is more stringent than the 1991 Handbook.

Similar to the CPSC handbook, the ASTM Standard will continually be revised. A revised standard was issued in 1995. The additions to this standard included sections on log rolls and trail rides (Wallach, 1997).

CPSC's continued work

The CPSC continues to produce numerous documents dedicated to playground safety (CPSC, 1995, 1996, Nov. a, b, c, d, e, f). On January 12, 1995, the CPSC issued an alert to remove animal swings from playgrounds (CPSC, 1995). This alert was a cooperative effort between the CPSC and seven manufactures of playground equipment (BCI Burke, Blue Valley Industries, Game Time, Miracle Recreation Equipment Company, PCA, Playworld Systems, and Quality Industries). The alert was initiated due to injuries and deaths that had occurred when children where struck by the swings.

The CPSC (1996, Nov.b) has also issued a checklist that can be used by school or community leaders so hazards can be identified and injuries can be prevented. This checklist briefly explains the guidelines that should be met to provide a safe playground for the children. The CPSC (1996, March; Nov. a, c, d, e) has also addressed topic such as lead paint on playgrounds, children being strangled by clothing strings on playgrounds, burns acquired from hot metal equipment, surfacing materials, and soft contained playgrounds in their documents and reports.

The National Playground Safety Institute

Since the establishment of the NPSI in 1991, the institute has been a leader in playground safety. The institute:

> promotes children's rights to play and promotes nationally the importance play has in a child's development, provides the most current comprehensive training program on public playground safety including the development and distribution of playground training and safety procedures, (and) provides input to help develop responsible public policy for the guaranteed safety of our children while at the same time advocates sound fiscal responsibility to provide resources for the ongoing maintenance and support of the policy. (NRPA, Jan, 29)

The most significant development in playground safety has been the playground safety inspector certification program. NPSI offers a certification course and examination for individuals who wish to become certified inspectors. Individuals who complete the course will have knowledge in accident statistics, safety guidelines, related organizations, hazard identification, maintenance procedures, audit instruments, testing instruments, procedures to eliminate hazards, etc. (Christiansen, 1994; NRPA, 1997, Jan. 29; Wallach,1995a).

NPSI, with the assistance of other playground specialists, has developed works that stand out in the field of playground safety: *Points about Playgrounds* and *Play it Safe, An Anthology of Playground Safety*. These books are also used as texts for the playground safety certification course and exam.

AAHPERD's contributions to playground safety

The American Alliance of Health, Physical Education, Recreation, and Dance (AAHPERD), especially the American Association for Leisure and Recreation (AALR), have made several contributions to the vast information concerning playground safety.

Three of the largest contributions were national studies that focused on elementary school playgrounds (Bruya & Langendorfer, 1988), community park playgrounds (Thompson & Bowers, 1989), and playgrounds for young children (Wortham & Frost, 1990). The results of the first of these studies (which focused on elementary school playgrounds) were published in 1988. The survey used in this investigation was applied to 206 elementary school playgrounds in 23 states. This investigation determined that the majority of the equipment found on the playgrounds was climbing equipment (65%), followed by swings, slides, seesaws, spring rockers, and merry-go-rounds respectively. Numerous results were identified (Bowers & Bruya, 1988) in this research. One of the results addressed by Bowers and Bruya (1988) was that the majority of the equipment that was found on the elementary school playgrounds were traditional in nature (climbers, swings, slides, seesaws, etc.). The survey also showed that the majority of the equipment found on the playgrounds were oriented to motor development. This type of equipment is often associated with a high number of playground injuries.

Bowers and Bruya (1988) also discussed several different safety problems that were discovered in this research. Some of these problems included: sharp corners, edges, and protrusions, inadequate surfacing under much of the equipment, poor maintenance, tripping hazards (exposed footings), hard metal and wood seats, excessive heights (above 12 feet), and open pipe ends on equipment. Two other problems addressed in this study were age appropriateness of the equipment and accessibility. Bowers and Bruya reported that only four percent of the playgrounds surveyed were accessible to children in wheelchairs. They also reported that only 64 percent of the playgrounds had smaller equipment for the younger children.

The second national investigation focused on community parks' playground equipment (Thompson & Bowers, 1989). One hundred and ninety-eight community

parks were surveyed in 18 states for this investigation. The types of equipment that were found were very similar to the results of the first investigation (elementary schools). The majority of the equipment found on the community playgrounds were again traditional in nature (Bowers, 1989).

The results of this study showed that about 25 percent of the playgrounds at community parks didn't have smaller equipment for younger children and that about 57 percent of the playgrounds did not have the large equipment separated from the small equipment. Sharp edges and protrusions were found to be prevalent on much of the equipment. Similar to the elementary school study, inappropriate surfacing (i.e., asphalt, concrete, clay, grass) was used under some of the equipment in the parks. Some of the other areas of concern included the use of metal and wood swing seats, finger entrapment in climbing equipment, excessive equipment heights, non-cushioned areas where a seesaw hit the surface, and non-accessible equipment for individuals in wheelchairs (Thompson & Bowers, 1989).

Another study sponsored by the AALR focused on pre-school playgrounds (Wortham & Frost, 1990). Three-hundred and forty-nine playgrounds were surveyed, in 31 states, for this investigation (Bowers, 1990). While 2,447 play structures were surveyed, 2,783 portable play materials and 2,919 other items on the playground were also surveyed in this investigation. The play structures included typical playground equipment (slides, swings, climbers, etc.). The portable equipment included bicycles, sand, water, barrels, etc. and the other items surveyed included tables, grassy areas, play houses, trucks, digging areas, etc. (Bowers, 1990).

The problems that were identified on these playgrounds were similar to the first two studies (Bowers, 1990). Most of the equipment (over 80 percent) was not accessible to wheelchairs. Over 50 percent of the playgrounds did not have smaller equipment for

younger children and 64 percent of the of the playgrounds did not have large and small playground equipment separated. The pre-school playgrounds were also determined to have inappropriate surfacing under much of their equipment as well as having other safety problems such as sharp edges, projections, and pinch and crush points.

Together, these investigations show that our children's playgrounds need attention. All of the playgrounds were shown to be suffering from similar hazards and all of these investigations proved that action needed to be taken.

AAHPERD has also published two other books that address topics concerning the playgrounds in our nation. They were *Play Spaces for Children: A New Beginning* (Bruya, 1988) and *Play for All Guidelines: Planning, Design, and Management of Outdoor Play Settings For All Children* (Moore, Goltsman, & Iacodano, 1988).

Playground Hazards and Injury Studies

Child Care Center Playgrounds

Similar to the AAHPERD investigations, research concerning playground safety is usually focused on one of three categories: child/day-care center playgrounds, public park playgrounds, and school playgrounds. The results of some of the studies that focused on child-care centers have shown that playgrounds are associated with many of the injuries that are occurring at the centers and that hazards are prevalent on these playgrounds (Sacks, Smith, Kaplan, Lambert, Sattin, & Sikes, 1989; Sacks, Holt, Holmgreen, Colwell, & Brown, 1990; Sacks, Bruntly, Holmgreen, & Rochat, 1992; Briss, Sacks, Addiss, Kresnow, & O'Neil, 1994; Briss, 1995). Several of these studies were conducted on the child-care centers in the Atlanta area. The first of these investigations concentrated on the injuries that were occurring at the child-care centers. Sacks, Smith, Kaplan, Lambert, Sattin, and Sikes (1989) determined that 143 injuries were reported at 68 child-care centers in a one year period. About half of these injuries occurred on the

playgrounds. While only 16 percent of the injuries to very young children took place on the playgrounds, about 49 percent of the injuries to children ages 2-4 occurred on the playgrounds and about 74 percent of the injuries to children five and up occurred on the playgrounds. The majority of the injuries that occurred on the playgrounds were contributed to falls. While only 29 of the injuries that occurred at the center were reported as being severe, 22 of these severe injuries occurred on the playground.

The second study conducted on the Atlanta area child-care centers focused on the hazards that were found on the playgrounds. Six hundred and eighty-four hazards were detected at the child care centers by Sacks, Holt, Holmgreen, Colwell, and Brown (1990). Eighty-four percent of the playgrounds inspected contained a hazard. While the majority of the hazards were associated with equipment, 156 of the hazards were not related to equipment. Some of these hazards included poison ivy, briars, tripping hazards, broken glass, and inadequate fencing. Five hundred and twenty-eight hazards were associated with equipment on the playgrounds. Climbing equipment (157), swings (119), and slides (69) comprised the majority of the hazards. The majority of the playground equipment did not have resilient surfacing under it and when resilient surfacing was used it was usually not deep enough. While about half of the equipment hazards were associated with the surfacing around the equipment, Sacks et al. (1990) found several different types of equipment hazards on the playgrounds which included protrusions, missing parts, loose parts, open "S" hooks, hard swing seats, broken parts, tripping hazards, and entrapment.

The child care centers that were studied in Sacks et al's (1990) investigation received an "intervention". According to Sacks, Bruntley, Holmgreen, and Rochat (1992) the intervention included an explanation of the hazards that were found at the child care centers to the director and the distribution of playground safety handbooks. The third

Atlanta child care center study investigated the effect of the intervention on the child care center playgrounds and compared their results to a control group. About two years after the initial investigation 58 of the 66 child care centers were still open. Sacks et al (1992) determined that the intervention program was not effective and that the one factor that may affect the safety of the playground could be changes in leadership.

In 1994, Briss, Sacks, Addiss, Kresnow, and O'Neil (1994) published a national study that focused on injuries at child care centers. Briss et al. (1994) interviewed 1,797 directors at child care centers across the United States. The directors reported on the injuries that occurred two months before the interview. Four hundred and forty-three centers reported injuries and the majority of the 556 injuries that were reported occurred on playgrounds. Falls from the climbing equipment were again associated with many of the injuries, especially the fractures and concussions (similar to the Atlanta study [Sacks et al., 1989]).

Public Park Playgrounds

Researchers have also been investigating the safety of public park playgrounds (Bond & Peck, 1993; Allen, and Johnson, 1995). Bond and Peck (1993) investigated the injury risk of Boston playgrounds. Forty-seven playgrounds in Boston were inspected using a 177-item checklist. Bond and Peck (1993) found 1,592 hazards on the playgrounds. While climbers (543), slides (479), and swings (346) accounted for the majority of these hazards, the hazards that were associated with the climbers and the slides were determined to be more severe than the ones associated with the swings. Bond and Peck (1993) also determined that the surfacing at all of the playgrounds were either inappropriate or inadequate (poorly maintained).

A study conducted by Allen and Johnson (1995) developed some similar results to Bond and Peck's (1993) investigation. Allen and Johnson (1995) surveyed 19

playgrounds in a Detroit suburb and identified 474 hazards. The majority of the surfacing under the playground equipment was either a non-resilient surface (58%) or the surfacing was inadequate when a resilient surfacing was used (83%). Other types of hazards reported in the this study included: maintenance problems, playground location, equipment spacing, and hazards associated with climbing equipment, swings, and slides.

School Playground

The hazards and injuries that occur on school playgrounds have been studied by many investigators. The AAHPERD study (Bruya & Langendorfer, 1988), which was mentioned earlier, is one of the largest studies that focused on school playgrounds. School playground studies have focused on the injuries that occur on the playgrounds as well as the hazards that are associated with playgrounds. In 1969, Dale, Smith, Weil, and Parrish (1969) reported that 409 accidents occurred at elementary schools in Columbia, Missouri. Seventy-seven percent of these accidents were determined to have occurred on the playgrounds. The authors determined that 143 of the injuries occurred during free play and that 59 of the injuries were the results of falls from playground equipment.

Several other researchers have continued to investigate the injuries occurring at public schools. One of these investigations that focused specifically on injuries that resulted in fractures (Johnson, Carter, Harlin, and Zoller, 1972). This investigation focused on fractures that occurred in the elementary grades as well as junior high and senior high in one school year. The number of students at the school totaled 89, 496. Johnson, Carter, Harlin, and Zoller (1972) determined that 358 fractures had occurred during the period of the investigation. Over 40 percent of the students (159) who received fractures were in elementary school. While over half of the fractures (90) were obtained on the playground, only 14 percent (22) occurred due to falls from playground apparatus. Johnson et al. (1972) recognized that while the number of fractures that

occurred due to the falls from playground apparatus seemed small, it was still an area of concern because this should be a supervised activity. They also noted that some of these injuries might have been prevented if the equipment had been surrounded with a resilient surface.

The results of a 1984 investigation were again similar to the earlier studies when Boyce, Sobolewski, Sprunger, and Shaefer (1984) investigated the playground equipment injuries at another school district. They determined that 511 injuries out of 2,193 were associated with playgrounds. Boyce et al. (1984) determined (in this two year study) that almost 25 percent of the injuries that occurred on playgrounds were severe. Injuries that were considered severe included: concussions, crush wounds, fractures, and multiple injuries. Climbing equipment was found to be the most abundant type of equipment found on the playgrounds (58%) and was also un-proportionally associated with more injuries than any other type of equipment (69%).

One of the more recent studies that focused on surface-specific fall injury rates was conducted on 157 Utah school playgrounds. Sosin et al. (1993) determined that 448 injuries occurred during the testing period. The authors also determined that gravel was found under more of the climbing equipment (60%) than any other type of surfacing. Sosin et al. (1993) concluded that they could not identify one type of surface as being better than another. The authors went on to state that the resilient surfacings have not proven to be superior over grass and turf surfaces while children are playing on the grounds.

While many of the studies performed on school playgrounds have focused on injuries, Ridenour focused on the playground hazards. After conducting a safety inspection on each of the 57 playgrounds used in this study, Ridenour (1987) determined that 99 percent of all the climbing equipment and slides were unsafe. The author

reported that the playgrounds were often supervised by aides that had not been educated specifically for playground supervision and leadership and that the child/staff ratio was ignored on the playground. The ratio did not meet the child/staff ratio that was required for the classroom. Ridenour (1987) suggested that playground supervision "be assigned to a qualified elementary physical education teacher who may be assisted by playground aides (p. 735)."

In 1992, the Virginia Department of Education (VDE) conducted a study to determine the need for statewide standards concerning the "safety of the program, the age-appropriateness of playground equipment, and the repair and replacement of broken or obsolete equipment (p. 5)." Numerous types of equipment were located on the playgrounds in the Virginia school system. Climbing equipment, slides, merry-go-rounds, swings, and see-saws were some of the major types of equipment found on the playgrounds. The VDE reported that 5,700 injuries required medical attention in the 1990-1991 school year, which was a rise from 3,697 injuries in the 1989-1990 school year. The VDE also reported that out of 12,734 injuries, the largest number of injuries resulted in abrasions, cuts or puncture wounds (53%). The severity of these injuries was not reported. Other injuries reported included eye injuries (434), sprains and strains (1,726), broken bones (661), and head injuries (1,594). Only 5,999 of the reported injuries contained complete information on what actually caused the accidents. Over 50 percent of these accidents were caused from falls from equipment (30%) and bumping into stationary equipment (23%).

While the sites where the playgrounds are located are different, the results of these studies are very similar. Traditional types of equipment were the most common types of equipment found on the playgrounds. This type of equipment was also shown to

be associated with most of the injuries occurring on playgrounds. Climbing equipment was determined to be the one type of equipment that was associated with injuries more than any other type of equipment. Many of the investigations also determined that the severe injuries to the children often occurred at the playgrounds. All of these similarities in addition to the AAHPERD studies strongly suggest that the playgrounds in America, when they are not maintained, can be hazardous places for children to play.

Playgrounds and Litigation

While many of the accidents that occur on playgrounds are soon forgotten, some of them result in lawsuits. Frost and Sweeney (1995) reported on 187 playground injury and 13 fatality lawsuits in which they had been expert witnesses. These lawsuits occurred between 1981 and 1995. Frost and Sweeney noted that the majority of the lawsuit were the results of serious injuries and that about 40 percent of these injuries occurred to the head. They also noted that 72 percent of the lawsuits involved children ages 2 - 8. While falls were the cause of the majority of the injuries (70 %), other causes included entrapment, shearing, protrusions, open "S" hooks, and being struck by a hard swing.

Traditional equipment was involved in just about all of the injuries. Slides and swings were both involved in 38 of the lawsuits, while, climbing equipment was involved in 65 of the lawsuits. Frost and Sweeney noted that 94 percent of the injuries that resulted in lawsuits involved violations of CPSC guidelines and ASTM standards and that almost all of the cases involved poor maintenance. The playgrounds where the injuries or fatalities occurred varied. They were found at schools, parks, child-care centers, fast food restaurants, backyards, and apartments. School playgrounds were involved in more lawsuits than any other location and accounted for 37 % of the lawsuits investigated. The authors noted that the number of lawsuits are escalating rapidly. Frost

and Sweeney (1995) also noted that the guidelines and standards produced by the CPSC and ASTM are "the most influential playground safety criteria in lawsuits (p. 8)", not state guidelines.

Playground Safety at the School

Who is responsible for the student's safety when they are playing on the school playground? The principal is responsible for the safety of the children when they are at school (Beebe, 1994; Kaiser, 1985). Korpela (1971a) stated that the school "owes a duty of ordinary or reasonable care with respect to the condition of its grounds, walks, and playgrounds to invitees to such premises (p. 745)." This is especially true with elementary students. Younger students can not be expected to identify hazardous conditions with the same capability of an older student (Kimbrough & Burkett, 1990). Korpela also noted that the school has a duty to maintain these premises (1971a) and that the school has a duty to supervise playground activities (Korpela, 1971b).

According to Kimbrough and Burkett (1990) the principal should be concerned with the status of the playground and make sure that the playground is free of hazards and in good condition. Zirkle and Moore (1986) suggest that the principals: conduct inspections of the playground, implement a maintenance and repair plan, establish playground safety rules and inform the student and staff, provide adequate supervision, document all actions, and become educated in the area.

While the principal may be responsible for the student, he/she can't supervise all of the students at the same time. The principal relies on responsible teachers to supervise the children. A principal may be held liable if he/she fails to provide an appropriate number of teachers to supervise the students (Korpela, 1971b). The teacher(s) that is assigned to supervise students is responsible for protecting them (Beebe, 1994) and by

watching a dangerous activity without addressing the activity the teacher may be held liable if an injury occurs to a student (Korpela, 1971b).

Physical education teachers are responsible for the students who are in their classes. The instructor is also responsible for the grounds on which the class is being taught. If the class is active on the playground the instructor should be aware of potentially dangerous conditions that could cause or lead to the injury of a student (Thomas & Alberts, 1982; Nygaard & Boone, 1981). Nygaard and Boone (1981) stated that "if standards and recommendations from recognized experts in various activities are available, they should be utilized (p. 63)." Nygaard and Boone (1981) also stated that "not only is an instructor responsible for dangerous conditions that are apparent, but also for those that should have been noticed by a reasonable and prudent professional (p. 63-64)."

The principal and the instructor are responsible for the safety of the students when they are at the school. This includes the playground. If the principal and the instructor do not perceive the playground to be unsafe, even when it is, they may put a child at risk. If the principal and the instructor can't identify hazards on the playground it is likely that these hazards will remain unchecked until a student is injured. The inability to identify hazards may be due to inexperience or lack of knowledge in playground safety. Until the principals and the instructors at the schools are able to identify hazards on the playground, the playgrounds will probably continue to be associated with needless injuries.

CHAPTER 3
Methods

Development of the Instrument

The playground safety survey (appendix A) used in this study was developed by the author and Dr. Peter Cunningham. It was based on the U. S. Consumer Product Safety Commission's (CPSC) *Ten Steps Toward a Safer Playground* (1996, Nov.b) along with other CPSC guidelines (1991) and ASTM standards (1993). The instrument was reviewed by a jury of professionals to help determine its validity. Nine prominent experts in playground safety were requested to be part of the jury to ensure that the instrument addressed the important aspects of playground safety. Five of these experts participated along with one physical education teacher and one statistician. The instrument was refined based upon the input of the jury.

The final version of the instrument was comprised of three parts. Part one was a cover letter that was addressed to the principal of the schools participating in the study. The second part of the instrument included demographic questions as well as questions pertaining to the participants' status at the school and in education in general. The third part of the survey included 11 questions that solicited principals' and physical education teachers' perceptions of specific hazards on the school playground. The specific hazards identified in the survey were as follows:

1. The depth of the playground surfacing under the playground equipment (Depth)
2. The distance the surfacing needs to be extended from the equipment (Distance)
3. The spacing needed between equipment (Spacing)
4. The condition of the hardware on the playground equipment (Hardware)
5. The accessible openings located on the playground equipment (Openings)
6. The presence of sharp points and edges on the playground equipment (Edges)

7. The accessibility of pinch and crush points on moving equipment (Crush)
8. The number of tripping hazards found on the playground (Tripping)
9. The presence of guardrails on elevated equipment (Guardrails)
10. The design of the playground in regards to supervision (Design)
11. The separation of pre-school and school age equipment (Separation)

Collection of Data

Following the approval of Middle Tennessee State University's Institutional Review Board and appropriate officials from each of the participating Middle Tennessee school systems, a list of schools was obtained. A survey packet was mailed to the principal at each school containing the following: a cover letter, a playground safety survey for the principal, a playground safety survey for the physical education teacher, instructions for the principal, instructions for the physical education teacher, and two stamped self addressed envelope (appendix B). The principal was instructed to select the playground with the most equipment on it for the study. The principal was then instructed to visit the playground and observe the surroundings. While observing the playground, the principal was to complete the survey based on his/her personal perception of the safety of the playground. The principal gave the physical education teacher at the school a copy of the survey along with the instructions. It was also the responsibility of the principal to inform the physical education teacher as to which playground should be observed for the study. When completing the survey, the physical education teacher was instructed to follow the same procedures as the principal. If a school had more than one physical education teacher the principal was informed to seiect the one with the most experience. Once the surveys were completed they were returned to be analyzed.

A certified playground safety inspector (CPSI) also completed an evaluation for each of the participating school playgrounds, using the same instrument. The CPSI was certified through the National Playground Safety Institute. The CPSI went to each school and asked the principal to point out which playground had been observed by the principal and the physical education teacher. Following the same procedures as the principals and the physical education teachers, the CPSI observed the playground and then completed the survey for each facility.

The reliability of the CPSI was determined by having a second CPSI randomly survey six of the playgrounds used in the study. The findings of the two CPSI's were then compared to determine if the inspectors' perceptions of playground safety were significantly different.

The first mailing was sent to the school principals on August 28, 1997. A postcard reminder was mailed on September 17, 1997 to all of the participants and a follow-up letter was sent to non-respondents on October 3, 1997 (appendix B). December 6, 1997 was set to be the final day that surveys would be accepted.

Subjects

After permission to conduct the study was granted by school system officials, a list of schools was obtained from the school systems. Schools with children enrolled in grades K - 6 (any combination was accepted: K-2, K-6, K-8, 1-4, 3-8, 5-6) were included in the study. Thirty-six Middle Tennessee schools were included in the sample. The principal at each of these schools was mailed the survey packet.

Data and Statistical Analysis

Mean scores and standard deviations were calculated for the descriptive variables (years employed in elementary education and years employed at the present school).

Mean scores and standard deviations were also calculated for the rating scores of principals, physical education teachers, and the CPSI.

Using the mean scores, a repeated measures analysis of variance was computed to determine if there were significant differences between the principals' and CPSI's ratings of specific playground hazards. A repeated measures analysis of variance was also computed to determine possible significant differences between the physical education teachers' and CPSI's mean ratings of specific playground hazards. A third repeated measures analysis of variance was computed to determine if there were any significant differences between the principals' and physical education teachers' mean ratings of specific playground hazards. Significance was determined using an alpha level of .05.

A Pearson Correlation was used to determine if there was a relationship between the specific playground hazard ratings and the length of time employed in elementary education for the principals and the physical education teachers. Another Pearson Correlation was used to determine if there was a relationship between the length of time employed at the present school and the ratings of specific playground hazards for principals and physical education teachers.

CHAPTER 4
Results

Thirty-six schools received playground safety surveys for the principal and the physical education teacher. While twenty-nine of the schools responded, a principal at one school and a physical education teacher at another school failed to reply. Both of these schools were eliminated from the investigation leaving a sample of 27 schools. Each of the twenty-seven school playgrounds used in this investigation were surveyed by the principal, physical education teacher, and a Certified Playground Safety Inspector (CPSI).

The N for statistical comparisons and relationships will vary because the rater had to determine if the equipment was present on the playground. (Example: Moving equipment must be present for there to be a crush and pinch point. While twenty-four physical education teachers rated crush points to be located on their playgrounds, the CPSI only reported crush points on 19 playgrounds.) The eleven specific hazards that were investigated in this study were previously described.

In addition to the specific hazards, information was gathered on:

1. The position held by the participant (principal or physical education teacher)
2. The number years employed at the present school. (present)
3. The number of years employed in elementary education. (employed)
4. The type of education one has received in playground safety. (college, in-service, workshop, other)

The reliability of the CPSI was determined by having a second CPSI randomly survey six of the playgrounds used in the study. There were no significant differences between the inspectors' ratings of specific playground hazards. Appendix B contains the

statistical data for the repeated measures analysis of variance of specific playground hazards between the two CPSI's.

The mean number of years employed at their present school and the number of years employed in elementary education are presented in Table 1 for both the principals and the physical education teachers. On average both the principals and the physical education teachers had been in their current positions for over ten years and they had both been working in elementary education for over 16 years.

Table 1

Summary of Years Employed

	Principal			Physical Education Teacher		
	M	SD	N	M	SD	N
Present School	10.5	8.81	27	12.4	8.68	26
Elementary Education	19.9	8.68	26	16.3	8.73	26

Eleven of the principals and sixteen of the physical education teachers reported that they had received some type of education in playground safety. While most of these individuals received their education in college, some of them obtained education in workshops, in-service, and other settings. Table 2 summarizes the information concerning the education of the principals and physical education teachers.

Table 2

Summary of Education

	Principal	Physical Education Teacher
	N	N
Education	11	16
College	9	14
Workshop	4	4
In-service	3	6
Other	0	2
No Education	16	11

Comparison of Principals' and CPSI's Ratings of Specific Playground Hazards

When comparing the principals' and the CPSI's mean ratings of the eleven specific playground hazards, ten of the hazards were rated lower by the CPSI. A significant difference ($p < .05$) was found between the principals' mean ratings and CPSI's mean ratings for seven of the specific playground hazards. The CPSI rated the depth of the playground surfacing under the playground equipment (depth), the distance the surfacing needs to be extended from the equipment (distance), the condition of the hardware on the playground equipment (hardware), the accessible openings located on the playground equipment (openings), the presence of sharp points and edges on the playground equipment (edges), the number of tripping hazards found on the playground (tripping), and the design of the playground in regards to supervision (design) significantly ($p < 0.05$) lower (more dangerous) than the principals' ratings. While the CPSI's mean ratings were lower than the principals' mean ratings, there were no significant differences ($p > 0.05$) between the following hazards: the spacing needed between equipment (spacing), the accessibility of pinch and crush points on moving equipment (crush), and the presence of guardrails on elevated equipment (guardrails). The CPSI's mean rating for the separation of pre-school and school age equipment (separation) was the only hazards that was not lower than the principals' mean rating, these ratings were identical. Table 3 presents the data comparing both the principals' and CPSI's mean ratings of the specific playground hazards. Appendix D presents the statistical data for the repeated measures analysis of variance for the ratings of specific playground hazards between principals and the CPSI.

Table 3

Comparison of Principals' and CPSI's Ratings of Specific Playground Hazards

Hazard	N	Principal		CPSI		F	P
		M	SD	M	SD		
Depth	25	3.08	1.382	2.04	1.37	11.01	.0029*
Distance	24	3.25	1.59	2.25	1.48	6.57	.0174*
Spacing	24	4.08	0.97	3.54	1.50	2.38	.1363
Hardware	24	3.50	0.98	1.83	0.96	31.08	.0001*
Openings	24	4.63	0.58	4.17	0.82	5.28	.031*
Edges	24	4.54	0.59	3.83	0.82	14.61	.0009*
Crush	19	4.37	0.60	4.21	1.13	0.30	.5913
Tripping	26	4.15	0.88	3.31	1.12	8.40	.0077*
Guardrails	21	4.24	0.94	3.57	1.43	3.41	.0795
Design	26	4.92	0.27	4.46	0.65	13.24	.0012*
Separation	19	3.63	1.74	3.63	1.86	0.01	1.0000

* significant < 0.05

Comparison of Physical Education Teachers' and CPSI's Ratings of Specific Playground Hazards

When comparing the physical education teachers' and CPSI's mean ratings of the eleven specific playground hazards, the CPSI's ratings were always lower than the physical education teachers' ratings. A significant difference was found between the physical education teachers' mean ratings and the CPSI's mean ratings for five of these playground safety hazards. The CPSI rated the depth of the playground surfacing under the playground equipment (depth), the distance the surfacing needs to be extended from the equipment (distance), the condition of the hardware on the playground equipment (hardware), the number of tripping hazards found on the playground (tripping), and the design of the playground in regards to supervision (design) significantly lower (more dangerous) than the physical education teachers ($p < 0.05$). While the CPSI's mean ratings were lower, there were no significant ($p > 0.05$) differences between the physical education teachers' and CPSI's mean ratings of the spacing needed between the equipment (spacing), the accessible openings located on the playground equipment (openings), the presence of sharp points and edges on the playground (edges), the accessibility of pinch and crush points on moving equipment (crush), the presence of guardrails on elevated equipment (guardrails), and the separation of pre-school and school age equipment (separation). Table 4 presents the data comparing the physical education teachers' and CPSI's mean ratings of specific playground hazards. Appendix E presents the statistical data for the repeated measures analysis of variance for the ratings of specific playground hazards for the physical education teachers and the CPSI.

Table 4

Comparison of P. E. Teachers' and CPSI's Ratings of Specific Playground Hazards

Hazard	N	P. E. Teacher		CPSI		F	P
		M	SD	M	SD		
Depth	25	2.72	1.37	2.04	1.37	4.52	.0441*
Distance	25	2.96	1.54	2.20	1.47	5.92	.0228*
Spacing	24	4.25	0.94	3.54	1.50	3.69	.0671
Hardware	24	3.04	1.04	1.83	0.96	17.54	.0004*
Openings	23	4.57	0.90	4.17	0.83	3.30	.0829
Edges	24	4.13	0.85	3.83	0.82	3.14	.0897
Crush	18	4.33	0.97	4.17	1.15	0.25	.6260
Tripping	26	4.19	0.69	3.31	1.12	11.93	.002*
Guardrails	18	3.67	1.33	3.61	1.33	0.03	.8675
Design	26	4.77	0.51	4.46	0.65	5.33	.0295*
Separation	16	3.75	1.69	3.38	1.93	0.39	.5399

* significant < 0.05

Comparison of Principal and Physical Education Teachers' Ratings of Specific Playground Hazards

When comparing the principals' and physical education teachers' mean ratings of the eleven specific playground hazards, the physical education teachers rated seven of the specific playground hazards lower than the principals with the principals rating the remaining four hazards lower than the physical education teachers. A significant difference ($p < .05$) was found between the principals' mean rating and the physical education teachers mean ratings for two of the playground hazards. The physical education teachers rated the condition of the hardware on the playground equipment (hardware) and the presence of sharp points and edges on the playground equipment (edges) significantly lower (more dangerous) than the principals ($p < 0.05$). There was no significant ($p > 0.05$) difference between the principals' and physical education teachers' mean playground hazard ratings of the depth of the playground surfacing under the playground equipment (depth), the distance the surfacing needs to be extended from the equipment (distance), the spacing needed between equipment (spacing), the accessible openings located on the playground equipment (openings), the accessibility of pinch and crush points on moving equipment (crush), the number of tripping hazards found on the playground (tripping), the presence of guardrails on elevated equipment (guardrails), the design of the playground in regards to supervision (design), and the separation of pre-school and school age equipment (separation). Table 5 presents the data comparing the principals' and physical education teachers' mean ratings of the specific playground hazards. Appendix F presents the statistical data for the repeated measures analysis of variance for the ratings of specific playground hazards between principals and physical education teachers.

Table 5

Comparison of Principals' and P. E. Teachers' Ratings of Playground Hazards

Hazard	N	Principal		P. E. Teacher		F	P
		M	SD	M	SD		
Depth	25	3.08	1.38	2.72	1.37	1.70	.2047
Distance	24	3.25	1.59	3.00	1.56	0.66	.4259
Spacing	24	4.08	0.97	4.25	0.94	0.79	.3824
Hardware	24	3.50	0.97	3.04	1.04	6.46	.0183*
Openings	23	4.65	0.57	4.57	0.90	0.21	.6477
Edges	24	4.54	0.59	4.13	0.85	4.39	.0474*
Crush	23	4.39	0.58	4.43	0.90	0.06	.8027
Tripping	26	4.15	0.88	4.19	0.69	0.46	.8321
Guardrails	17	3.94	1.09	3.76	1.30	0.23	.6364
Design	26	4.92	0.27	4.77	0.51	2.86	.1034
Separation	20	3.55	1.73	3.80	1.70	0.40	.5359

*significant < 0.05

Relationship Between Specific Playground Ratings and Length of the Time Employed at an Elementary School

A Pearson Correlation was computed to determine if there was a relationship between the length of time physical education teachers and principals had been employed at their present elementary school (present school) and their specific playground hazard ratings. There was a significant ($p < 0.01$) correlation between the length of time employed at their present school (present school) and the physical education teachers' mean rating of the hazard tripping. There was no significant ($p > 0.05$) correlation between the length of time employed at their present school and any of the other mean ratings for the physical education teachers or the principals. Table 6 presents the data from the correlations between the length of time employed at their present school and the principals' and physical education teachers' mean ratings of specific playground hazards.

Table 6

Correlation between the number of years employed at present school and mean ratings of specific playground hazards for principals and physical education teachers.

	Principal		P.E. Teacher	
Hazard	N	r	N	r
Depth	24	-.73	24	-.062
Distance	23	-.022	23	-.032
Spacing	23	.304	24	-.354
Hardware	23	-.024	24	-.253
Openings	23	.055	23	-.124
Edges	23	-.282	24	-.270
Crush	23	-.395	23	-.352
Tripping	25	.036	25	-.535**
Guardrails	22	-.231	18	-.058
Design	25	-.192	25	-.063
Separation	22	-.171	21	-.360

$p < 0.01$**

Relationship Between Specific Playground Hazard Ratings and The Number of Years Employed in Elementary Education

A Pearson Correlation was used to determine if there was a relationship between the number of years principals or physical education teachers have been employed in elementary education and the rating of playground hazards. There was a significant ($p < 0.05$) negative correlation between the number of years employed in elementary education and the principals' mean ratings of the presence of sharp points and edges on the playground (edges), the design of the playground in regards to supervision (design), and the separation of pre-school and school age equipment (separation). There was also a significant ($p < 0.01$) negative correlation between the number of years employed in elementary education and the principals' mean rating of the accessibility of pinch and crush points on moving equipment (crush). There were no significant ($p > 0.05$) correlations between the number of years employed in elementary education and the principals mean ratings of the depth of the playground surfacing under the playground equipment (depth), the distance the surfacing needs to be extended from the equipment (distance), the spacing needed between equipment (spacing), the condition of the hardware on the playground equipment (hardware), the accessibility of openings located on the playground equipment (openings), the number of tripping hazards located on the equipment (tripping), and the presence of guardrails on elevated equipment (guardrails).

A significant ($p < 0.05$) negative correlation was found between the years employed in elementary education and the physical education teachers' mean rating of the spacing needed between equipment (spacing) and the condition of the hardware on the playground equipment (hardware). There were no significant ($p > 0.05$) correlations between the years employed in elementary education and the physical education teachers' mean ratings of the depth of the playground surfacing under the playground equipment

(depth), the distance the surfacing needs to be extended from the equipment (distance), the accessible openings located on the playground equipment (openings), the presence of sharp points and edges on the playground equipment (edges), the accessibility of pinch and crush points on the playground equipment (crush), the number of tripping hazards found on the playground (tripping), the presence of guardrails on elevated equipment (guardrails), the design of the playground in regards to supervision (design), and the separation of pre-school and school age equipment (supervision). Table 7 presents the data from all the correlations between years employed in elementary education and the principals' and physical education teachers' mean ratings of specific playground hazards.

Table 7

Correlation between years employed in elementary education and mean ratings of specific playground hazards for principals and physical education teachers.

	Principal		P.E. Teacher	
Hazard	N	r	N	r
Depth	25	.096	24	-.255
Distance	24	.296	24	-.275
Spacing	24	.055	24	-.503*
Hardware	24	-.055	24	-.413*
Openings	24	.149	23	-.113
Edges	24	-.463*	24	.094
Crush	24	-.618**	23	-.397
Tripping	26	-.110	25	-.243
Guardrails	23	-.235	18	.488
Design	26	-.449*	25	-.162
Separation	23	-.478*	21	-.314

$p < 0.05$ * $p < 0.01$ **

Chapter 5
Discussion

The purpose of this investigation was to compare a certified playground safety inspector's ratings of specific playground hazards to principals' and physical education teachers' ratings of specific playground hazards. A comparison of principals' ratings of specific playground hazards and physical education teachers' ratings of specific playground hazards was also investigated.

Playground safety has been addressed and discussed by city, school and other professionals since the early 1900s. Over the last thirty years the concern placed on playground safety has become even more evident with the publication of guidelines, standards, and other studies. If the individuals that are responsible for the playgrounds (including principals and physical education teachers) are not educated in regards to the playground design and safety standards and guidelines, changes are likely to occur very slowly if they change at all.

The Principal and the Physical Education Teacher vs. the CPSI

A CPSI is a trained professional in playground safety. The education, which leads to certification, includes accident statistics, safety guidelines, related organizations, hazard identification, maintenance procedures, audit instruments, and the procedures necessary to eliminate hazards. If an individual wishes to become a CPSI, he/she must also successfully pass a written exam. (Christiansen, 1994; NRPA, 1997, Jan. 29; Wallach, 1995a). The principals' and physical education teachers' ratings of playground hazards were compared to the CPSI's ratings of playground hazards to determine if significant differences existed between the ratings of school personnel responsible for the playground and an individual educated specifically in playground safety.

The results of this investigation indicate that the CPSI rates playground hazards as being more frequent and/or more dangerous than the principals' ratings. The CPSI rated

ten of the eleven specific playground hazards lower (more frequent/dangerous) than the principals, and the eleventh was identical. Seven of the hazards (the depth of the playground surfacing under the playground equipment [depth], the distance the surfacing needs to be extended from the equipment [distance], the condition of the hardware on the playground equipment [hardware], the accessible openings located on the playground equipment [openings], the presence of sharp points and edges on the playground equipment [edges], the number of tripping hazards on the playground [tripping], and the design of the playground in regards to supervision [design]) rated lower (more frequent and/or dangerous) by the CPSI were statistically significant at the .05 level. These findings support the first research hypothesis.

The results also indicate that the CPSI rates specific playground hazards as being more frequent and/or dangerous than the physical education teachers' ratings. The CPSI rated all of the specific playgrounds hazards lower than the physical education teachers' ratings. Five of the hazards (the depth of the playground surfacing under the playground equipment [depth], the distance the surfacing needs to be extended from the equipment [distance], the condition of the hardware on the playground equipment [hardware], the number of tripping hazards on the playground [tripping], and the design of the playground in regards to the supervision [design]) rated more frequent and/or dangerous by the CPSI than the physical education teachers' ratings were statistically significant ($p < .05$). These findings support the second research hypothesis.

The principal of each school should be concerned with the status of the playground, making sure that it is free of hazards and in a condition that is safe for children (Kimbrough & Burkett, 1990). The results of this study indicate that the principals did not perceive certain hazards as being as frequent and/or dangerous as they actually are, as based upon the judgment of an educated professional. While the physical

education teachers are not directly responsible for the playground, they are however, responsible for the safety of their students. When the class is participating on the playground the physical education teacher should be aware of potentially dangerous conditions that could cause or lead to injury of a student (Thomas & Alberts, 1982; Nygaard & Boone, 1981). Additionally, physical education teachers are often considered to be the individuals who are the most knowledgeable regarding children's activity. When compared to the judgment of a professional, the physical education teachers, similarly to the principals, did not perceive certain playground hazards as being as dangerous as they are.

Five of the playground hazards were rated significantly ($p < .05$) lower (less frequent and/or dangerous) than the CPSI's rating by both the principals and the physical education teachers. These hazard ratings included the depth of the playground surfacing under the playground equipment (depth), the distance the surfacing needs to be extended from the equipment (distance), the condition of the hardware on the playground equipment (hardware), the number of tripping hazards on the playground (tripping), and the design of the playground in regards to the supervision (design). These finding are even more interesting when compared to the playground hazards that have been identified in previous research as being prevalent on school playgrounds.

Investigators (Bowers & Bruya, 1988; Ridenour, 1987) reported several different types of hazards prevalent on school playgrounds. These hazards were similar to the hazards that were perceived to be less dangerous (statistically at $p < .005$) by the principals and physical education teachers. These hazards included inappropriate surfacing, tripping hazards, and broken and missing equipment. Ridenour (1987), who also investigated school playgrounds, determined that 99% of the playground equipment did not have appropriate surfacing. It is evident that these identified hazards are similar

to the hazards that were perceived by the principals and physical education teachers as being less frequent and/or dangerous than a CPSI's perception.

The correlations that were computed show that the number of years employed at a particular school and the number of years in elementary education did not seem to be related to overall hazard ratings of the principals and physical education teachers. While some of the correlations for specific hazards were found to be significant, their coefficients were low (all below .618). The number of correlations that were found to be significant was also too low to conclude that the years employed in elementary education and the number of years employed at a particular school are related to the principals and physical education teachers hazard ratings (Table 6 and 7).

Principal vs. Physical Education Teacher

The physical education teachers rated seven of the specific playground hazards lower than the principals with the principals rating the remaining four specific playground hazards lower than the physical education teachers. Only two of these differences were found to be statistically significant ($p < .05$), edges and hardware. The physical education teachers rated the presence of sharp points and edges on the playground equipment (edges) and the condition of the hardware on the playground equipment (hardware) as being significantly more frequent and/or dangerous than the principals' ratings of these hazards. Since only two of the hazards were rated significantly ($p < .05$) different and no true pattern between the two groups of subjects was found, the third research hypothesis is not supported. These findings do not indicate if one group of raters has a superior knowledge in regards to hazard identification. The slight differences that were observed may be due to physical education teachers' increased exposure to the playground and knowledge of how the children use the playground. The physical education teacher is also directly involved with children and is

responsible for the student's safety when they are on the playground. This may lead them to be more focused on safety. The principal's time with the children on the playground would be expected to be less frequent than that of the physical education teacher. The principal must deal with the administrative functions including playground safety and the identification and removal of playground hazards to other individuals.

Conclusions

It is not surprising to the author to find that the principals and physical education teachers rate the playground hazards as less frequent and/or dangerous than the CPSI. The CPSI has received special training to identify playground hazards. Yet, research has shown that hazards are present on our school playgrounds and can place students at risk. While it may seem extreme to some, *comprehensive training* for the principal and the physical education teacher is needed so playground hazards can be identified. Half (27) of the principals and physical education teachers stated that they had received some type of education (i.e., college, in-service, workshop, etc.) in playground safety. Even with this education, all but one of the playground hazard ratings were lower than the CPSI's and certain playground hazards were significantly ($p < .05$) different from the CPSIs' ratings. Sacks et.al. (1992) found that explaining each hazard, distributing the results of a study, and providing playground safety handbooks to child care center directors did not reduce hazards. This same type procedure would most likely fail if implemented in elementary schools. In view of this it appears as if principals and physical education teachers need comprehensive training in playground safety if real changes are to take place. When the principals and physical education teachers are not going to receive the training, then auxiliary personnel at the school (e.g., maintenance, assistant principal, etc.) should receive training so the playgrounds can be properly maintained.

While it was expected that the principals may not be as well informed about playground hazards as a CPSI, it does not excuse the fact that they cannot identify certain hazards on the playground. Even if someone else in the school is in charge of the playground, the principals must have enough knowledge to determine hazardous conditions. The most important concern to all of the individuals involved should be the safety of the children.

The comprehensive training that is needed by school principals and physical education teachers should be based on the CPSC's *Handbook for Public Playground Safety*. This handbook is very thorough and quite easy to read and understand. Additional materials for the workshop can be obtained from the National Program for Playground Safety and the National Playground Safety Institute. Simply distributing the handbooks and other playground safety information to school personnel is not adequate. A detailed workshop with a hands on approach is necessary. This hands on approach would actually involve a CPSI or another individual educated in playground safety who can take the class to a playground and show principals and physical education teachers how to identify hazards. Workshops could possibly be offered in the future by professional organizations, such as the National Playground Safety Institute, the National Program for Playground Safety, AAHPERD, etc. An example of a workshop schedule / program is found in appendix H.

Future Research

While this investigation focused on the principals and the physical education teachers, other school personnel may affect the safety of school playgrounds. Examples of other personnel include the classroom teachers and maintenance personnel. Research comparing the perceptions of these individuals to that of a CPSI would be very interesting. In many cases, the individuals who bring about changes on the playground

are the parents of the students. Perceptions of parents regarding playground hazards is another population that deserves investigation in the future.

While schools are of the utmost importance, it has also been shown that park playgrounds are plagued with the same problems and hazards that are present on many school playgrounds. An investigation of the perceptions of park administrators may also reveal that many of the hazards at the facilities are not perceived as being dangerous.

Playground injuries cannot be completely eliminated. School and park personnel cannot completely prevent children from falling, tripping, and getting bumps and bruises. They can however, strive to reduce or eliminate hidden hazards that cause injury to children. As long as playgrounds remain vital to activity needs of children, safety research must continue to be conducted which targets methods and programs central to injury prevention.

APPENDICES

Appendix A

Playground Safety Survey

Perceptions of Playground Safety Survey

While the concern for playground safety has been present for nearly a century, the number of injuries and hazards occurring on public playgrounds is still high. It has been estimated that over 200,000 injuries occur on playgrounds each year that require visits to emergency rooms. Costly lawsuits have ensued after some of these accidents. Playground consultants have determined that a large number of these lawsuits involved *school playgrounds*. While several investigations have focused on the hazards and injuries that occur on school playgrounds, the principals' and physical educators' perceptions of playground safety have not been researched. The purpose of this instrument is to assess your perception of playground safety at your school. *The information obtained from this instrument will be anonymous. Your identity and the identity of your school will be kept strictly confidential by the investigator.*

Instructions:

1. You may use a pencil or pen to complete this survey.
2. While observing your playground, carefully answer the questions in this survey.
3. Answers should be based on your **personal perceptions** of playground safety at your school.
4. The survey is not as long as it looks; your promptness in completing this survey is appreciated.
5. A pre-stamped return envelope is enclosed for your use in returning the questionnaire.

Return Address:
Daniel N. McMasters
HPERS Department
P. O. Box 96
Middle Tennessee State University
Murfreesboro, TN 37132

Thanks in advance for your help!

1. How many years have you been employed at your school in your current position? _____

2. How many years have you been working in an elementary school (as a teacher or in an administrative position)? _____

Questions 3,4,5: Place an x in the appropriate space.

3. What position do you hold at your school?

   _____ Principal

   _____ Physical Education Teacher

4. Do you have any type of training in playground safety? Yes _____ No _____

   If yes, Check all that apply.

   _____ college class _____ workshop

   _____ in-service _____ other (describe)

5. How is the playground equipment utilized by the children at your school?
   Check all that apply.

   _____ during school recess hours

   _____ during physical education class

   _____ during recreational use after school

   _____ during recreational use before school

   _____ other (describe)

Questions 6-16 Circle the number that best describes your perception of the playground.

6. The surfacing under and around playground equipment should be soft **(deep)** enough to cushion falls. In general, how would you rate the cushioning of the surfacing under the equipment on your playground?

0	1	2	3	4	5
No equipment is located on the playground.	The surfacing under the equipment would not be adequate to cushion falls.	The surfacing under the equipment would probably not be adequate to cushion falls.	The surfacing under the equipment might be adequate to cushion falls.	The surfacing under the equipment would probably be adequate to cushion falls.	The surfacing under the equipment would be adequate to cushion falls.

7. To cushion a fall, the shock absorbing material (surfacing) should be extended a safe distance around the equipment on the playground. In general, how would you rate the surfacing that extends around the equipment on your playground?

0	1	2	3	4	5
No equipment is located on the playground.	The surfacing is not extended to a distance that will provide protection from falls.	The surfacing is probably not extended to a distance that will provide protection from falls.	The surfacing might be extended to a distance that will provide protection from falls.	The surfacing is probably extended to a distance that will provide protection from falls.	The surfacing is extended to a distance that will provide protection from falls.

8. Play structures (swings, slides, etc..) should be spaced a safe distance apart allowing children the space to circulate or fall without striking another structure. In general, how would you rate the spacing of the play structures on your playground?

0	1	2	3	4	5
No play structures are located on the playground.	The play structures are not spaced a safe distance apart.	The play structures are probably not spaced a safe distance apart.	The play structures might be spaced a safe distance apart.	The play structures are probably spaced a safe distance apart.	The play structures are spaced a safe distance apart.

9. There should be no dangerous pieces of hardware, such as protruding bolt ends and narrow gaps in metal connections, open "S" hooks at the top or bottom of swings, loose hardware, or missing hardware, on playground equipment. In general how would you rate the condition of the hardware on the equipment located on your playground?

0	1	2	3	4	5
No equipment is located on the playground.	The hardware is in very poor condition.	The hardware is in poor condition.	The hardware is in good condition.	The hardware is in very good condition.	The hardware is in excellent condition.

10. Children can get trapped and strangle in openings where they can fit their bodies but not their heads through the space. Openings in guardrails and spaces between platforms and openings between ladder rungs, should not be large enough for a child's body to enter if a child's head can not enter and exit the opening. In general, how would you rate the openings on the equipment located on your playground?

0	1	2	3	4	5
No equipment is located on the playground.	All of the openings would allow a child to become trapped.	Most of the openings would allow a child to become trapped.	About half of the openings would allow a child to become trapped.	A few of the openings would allow a child to become trapped.	None of the openings would allow a child to become trapped.

11. Playground equipment should not have sharp points or edges that could cut skin. In general, how would you rate the equipment located on your playground in regards to sharp points and edges?

0	1	2	3	4	5
No equipment is located on the playground.	All of the equipment contains sharp points or edges.	Most of the equipment contains sharp points or edges.	About half of the equipment contains sharp points or edges.	A few pieces of equipment contain sharp points or edges.	None of the equipment contains sharp points or edges.

12. Moving pieces of equipment should not have accessible moving parts because of the potential for crushing or pinching a child's finger. In general, how would you rate the moving equipment located on your playground in regards to crush and pinch points?

0	1	2	3	4	5
No moving pieces of equipment are located on the playground.	All of the moving equipment has accessible moving parts.	Most of the moving equipment has accessible moving parts.	About half of the moving equipment has accessible moving parts.	A few pieces of the moving equipment has accessible moving parts.	None of the moving equipment has accessible moving parts.

13. There should be no natural or man made obstacles projecting from the ground that could cause a tripping hazard. How would you rate the tripping hazards on your playground?

1	2	3	4	5
There are more than 15 tripping hazards on the playground.	There are 11-15 tripping hazards on the playground.	There are 6-10 tripping hazards on the playground.	There are 1-5 tripping hazards on the playground.	There are no tripping hazards on the playground.

14. Elevated surfaces should have guardrails to prevent falls. In general, how would you rate the guardrails on the elevated surfaces located on your playground?

0	1	2	3	4	5
There are no elevated surfaces located on the playground.	None of the elevated equipment has adequate guardrails.	A few pieces of the elevated equipment have adequate guardrails.	About half of the elevated equipment has adequate guardrails.	Most of the elevated equipment has adequate guardrails.	All of the elevated equipment has adequate guardrails.

15. The playground should be designed so that adults can observe the children at play. How would you rate the design of your playground in regards to adult observation of the children at play?

1	2	3	4	5
None of the playground can be observed by an adult while the children are at play.	A few areas of the playgrounds can be observed by an adult while the children are at play.	About half of the playground can be observed by an adult while the children are at play.	Most of the playground can be observed by an adult while the children are at play.	The entire playground can be observed by an adult when the children are at play.

16. The playground equipment for pre-school children (2-5 years) and school age children (6-12) should be separated from one another. How would you rate the playground at your school in regards to the separation of pre-school and school age equipment.

0	1	2	3	4	5
No equipment is located on the playground.	None of the pre-school equipment is separated from the school age equipment.	A few pieces of pre-school equipment are separated from the school age equipment.	About half of the pre-school equipment is separated from the school age equipment.	Most of the pre-school equipment is separated from the school age equipment.	All of the pre-school equipment is separated from the school age equipment.

Thanks again for your help!

Return Address:
Daniel N. McMasters
HPERS Department, P. O. Box 96
Middle Tennessee State University
Murfreesboro, TN 37132

Appendix B

Letters and Instructions

for

Principals and Physical Education Teachers

August 28, 1997

Dear XXX:

I am currently completing my doctoral dissertation at Middle Tennessee State University. The focus of my research is playground safety at public elementary schools. In particular, I am studying the playground safety perceptions of principals, physical education teachers, and a certified playground inspector at pubic schools. The "XXX" County Board of Education has been informed of the research and agreed to participate in the study. Your voluntary participation in my study would be greatly appreciated.

Your participation is entirely voluntary. All information will be kept confidential. Your (i.e., you, your school, and your school system) anonymity will be maintained because at no time will you ever identify yourself on the survey. Additionally, your results will never be listed in a manner that would divulge your identity.

Enclosed is an instructional page for completion of the survey and the survey itself. A packet for the senior physical education teacher at your school is also enclosed. Please be sure to read the instructional page before giving the packet to the physical education teacher.

If you have any question about this study please call me or superintendent "XXX". Your time and attention in completing this survey are appreciated.

Very truly yours,

Daniel N. McMasters, Jr.

Principal's Instructions

Please read these instructions and follow them as closely as possible.

- If you have more than one playground on your campus, please choose the one that has the most equipment.
- After selecting the playground to be surveyed, please deliver the enclosed physical education teacher's packet and instruct the senior physical education teacher as to which playground has been chosen if you have more than one playground.
- A Certified Playground Safety Inspector will also be completing a survey at your school and will inquire as to which playground needs to be surveyed.
- While you observe the playground, please complete the Perceptions of Playground Safety Survey by following the directions printed on the survey.
- Please remember that all answers should be based solely on *your* perceptions of the playground.
- Please return the survey in the self-addressed stamped envelope provided in your packet.

Dear Senior Physical Education Teacher:

I am currently completing my doctoral dissertation at Middle Tennessee State University. The focus of my research is playground safety at public elementary schools. In particular, I am studying the playground safety perceptions of principals, physical education teachers, and a certified playground inspector at pubic schools. The "XXX" County Board of Education has been informed of the research and agreed to participate in the study. Your voluntary participation in my study would be greatly appreciated.

Your participation is entirely voluntary. All information will be kept confidential. Your (i.e., you, your school, and your school system) anonymity will be maintained because at no time will you ever identify yourself on the survey. Additionally, your results will never be listed in a manner that would divulge your identity.

Enclosed is an instructional page for completion of the survey. Please be sure to read the instructional page before completing the survey.

If you have any question about this study please call me or superintendent "XXX". Your time and attention in completing this survey are appreciated.

Very truly yours,

Daniel N. McMasters, Jr.

Senior Physical Education Teacher's Instructions

Please read these instructions and follow them as closely as possible.

- The principal should have informed you of the playground that you should observe to complete the enclosed survey. If this has not occurred, please contact the principal.
- While you observe the playground, please complete the Perceptions of Playground Safety Survey by following the directions printed on the survey.
- Please remember that all answers should be based solely on *your* perceptions of the playground.
- Please return the survey in the self-addressed stamped envelope provided in your packet.

Health, Physical Education, Recreation and Safety MTSU

P. O. Box 96
Middle Tennessee State University
Murfreesboro, Tennessee 37132
(615) 898-2811

Dear Principal,

This is a reminder concerning the recent playground safety survey that I mailed you and your senior physical education teacher. I would appreciate your assistance in completing the survey and relaying the needed information to your senior physical education teacher.

If you have already returned the survey, please accept my thanks and gratitude.

If you did not receive a survey packet, please contact me at the following address:

Daniel N. McMasters, Jr.
Doctoral Candidate
Middle Tennessee State University
P. O. Box 96
Murfreesboro, TN 37132
Home:
Work:

Health, Physical Education, Recreation and Safety MTSU

P. O. Box 96
Middle Tennessee State University
Murfreesboro, Tennessee 37132
(615) 898-2811

Dear Senior Physical Educator,

This is a reminder concerning the recent playground safety survey that I mailed you and the principal. I would appreciate your assistance in completing the survey.

If you have already returned the survey, please accept my thanks and gratitude.

If you did not receive a survey packet, please contact me at the following address:

Daniel N. McMasters, Jr.
Doctoral Candidate
Middle Tennessee State University
P. O. Box 96
Murfreesboro, TN 37132
Home:
Work:

Health, Physical Education, Recreation, and Safety MTSU
P.O. Box 96
Middle Tennessee State University
Murfreesboro, Tennessee 37132
(615) 896-2811

October 3, 1997

Dear Principal,

This is another reminder concerning the recent playground safety survey that I mailed you and your senior physical education teacher. While I have received many surveys from principals and physical education teachers, I need additional surveys to make my results reliable. I have received your physical education teachers survey and would appreciate your assistance in completing the survey so I can include your school in my dissertation research.

If you have already returned the survey, please accept my thanks and gratitude. I have enclosed another playground survey packet (cover letter, instructions, survey, and self addressed stamped envelope) in case you didn't receive the first one. If you have any questions or need any additional information, I can be reached at 898-5545. If I'm not in my office, please leave a message on my voice mail.

Your help would be greatly appreciated!

Daniel N. McMasters, Jr.
Doctoral Candidate
Middle Tennessee State University
P. O. Box 96
Murfreesboro, TN 37132
Home:
Work:

Health, Physical Education, Recreation, and Safety MTSU
P.O. Box 96
Middle Tennessee State University
Murfreesboro, Tennessee 37132
(615) 896-2811

October 3, 1997

Dear Principal,

This is another reminder concerning the recent playground safety survey that I mailed you and your senior physical education teacher. While I have received your survey, I haven't heard from your physical education teacher. I would appreciate your assistance in reminding your physical education teacher about my dissertation.

If your physical education teacher has already returned the survey, please relay my thanks and gratitude. I have enclosed another playground survey packet (cover letter, instructions, survey, and self addressed stamped envelope) in case the physical education teacher needs it. If you have any questions or need any additional information, I can be reached at 898-5545. If I'm not in my office, please leave a message on my voice mail.

Your help, and the help of your physical education teacher would be greatly appreciated!

Daniel N. McMasters, Jr.
Doctoral Candidate
Middle Tennessee State University
P. O. Box 96
Murfreesboro, TN 37132
Home:
Work:

Appendix C

Statistical Data

for

Repeated Measures Analysis of Variance for Playground Safety Hazards

Comparisons Between Certified Playground Safety Inspectors

Table C1

Comparison of CPSI's and second CPSI's Ratings of Specific Playground Hazards

Hazard	N	CPSI		Second CPSI		F	P
		M	SD	M	SD		
Depth	6	1.17	.41	1.000**	.00		
Distance	6	1.83	.60	1.83	1.33	.0001	1.0000
Spacing	6	4.00	1.10	4.17	1.17	1.0000	.3632
Hardware	6	2.17	.98	2.17	.75	.0001	1.0000
Openings	6	3.83	.41	4.00	.63	1.0000	.3632
Edges	6	3.50	.84	3.50	.84	.0001	1.0000
Crush	6	4.50	.55	4.50	.55	.0001	1.0000
Tripping	6	3.17	.75	3.00	.63	1.0000	.3632
Guardrails	6	3.33	1.21	3.00	1.41	.6250	.4650
Design	6	4.33	.52	4.67	.52	2.5000	.1747
Separation	6	4.33	1.63	4.17	1.60	1.0000	.3632

* significant < 0.05 ** zero variance

Table C2

Repeated Measures ANOVA summary for Depth

The second CPSI had zero variance. The repeated measures ANOVA could not be computed.

Table C3

Repeated Measures ANOVA summary for Distance

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	20.6667	4.1333		
Within Subjects	6	1.0000			
Between Measures	1	-1.4806	.0001	.0001	1.000
Residual	5	1.0000	.2000		
Total	11	21.6667	1.9697		

Table C4

Repeated Measures ANOVA summary for Spacing

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	12.4167	2.4833		
Within Subjects	6	.5000	.08333		
Between Measures	1	.08333	.08333	1.0000	.3632
Residual	5	.4167	.0833		
Total	11	12.9167	1.1742		

Table C5

Repeated Measures ANOVA summary for Hardware

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	6.6667	1.3333		
Within Subjects	6	1.0000	.1667		
Between Measures	1	-5.9328	.0001	.0001	1.0000
Residual	5	1.0000	.2000		
Total	11	7.6667	.6970		

Table C6

Repeated Measures ANOVA summary for Openings

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	2.4167	.4833		
Within Subjects	6	.5000	.0833		
Between Measures	1	.0833	.0833	1.0000	.3632
Residual	5	.4167	.0833		
Total	11	2.9167	.2652		

Table C7

Repeated Measures ANOVA summary for Edges

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	7.0000	1.4000		
Within Subjects	6	.0001	.0001		
Between Measures	1	.0001	.0001	.0001	1.0000
Residual	5	.0001	.0001		
Total	11	7.0000	.6364		

Table C8

Repeated Measures ANOVA summary for Crush

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	3.0000	.6000		
Within Subjects	6	.0001	.0001		
Between Measures	1	.0001	.0001	.0001	1.0000
Residual	5	.0001	.0001		
Total	11	3.0000	.2727		

Table C9

Repeated Measures ANOVA summary for Tripping

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	4.4167	.8833		
Within Subjects	6	.5000	.0833		
Between Measures	1	.0833	.0833	1.0000	.3632
Residual	5	.4167	.0833		
Total	11	4.9167	.4470		

Table C10

Repeated Measures ANOVA summary for Guardrails

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	14.6667	2.9333		
Within Subjects	6	3.0000	.5000		
Between Measures	1	.3333	.3333	.6250	.4650
Residual	5	2.6667	.5333		
Total	11	17.6667	1.6061		

Table C11

Repeated Measures ANOVA summary for Design

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	2.0000	.4000		
Within Subjects	6	1.0000	.1667		
Between Measures	1	.3333	.3333	2.5000	.1747
Residual	5	.6667	.1333		
Total	11	3.6667	.2727		

Table C12

Repeated Measures ANOVA summary for Separation

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	5	25.7500	2.1500		
Within Subjects	6	.5000	.0833		
Between Measures	1	.0833	.0833	1.0000	.3632
Residual	5	.4167	.0833		
Total	11	26.2500	2.3864		

Appendix D

Statistical Data

for

Repeated Measures Analysis of Variance for Specific Playground Hazard Rating Comparisons Between Principals and the CPSI.

Table D1

Repeated Measures ANOVA summary for Depth.

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	24	61.3200	2.5550		
Within Subjects	25	43.0000	1.7200		
Between Measures	1	13.5200	13.5200	11.0068	.0029
Residual	24	1.2283	1.2283		
Total	49	104.3200	2.1290		

Table D2

Repeated Measures ANOVA summary for Distance

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	67.0000	2.9130		
Within Subjects	24	54.0000	2.2500		
Between Measures	1	12.0000	12.0000	6.5714	.0174
Residual	23	42.0000	1.8261		
Total	47	121.0000	2.5745		

Table D3

Repeated Measures ANOVA summary for Spacing

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	39.8125	1.7310		
Within Subjects	24	37.5000	1.5625		
Between Measures	1	3.5208	3.5208	2.3832	.1363
Residual	23	33.9792	1.4774		
Total	47	77.3125	1.6449		

Table D4

Repeated Measures ANOVA summary for Hardware

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	18.6667	.8116		
Within Subjects	24	58.0000	2.4167		
Between Measures	1	33.3333	33.3333	31.0811	.0001
Residual	23	24.6667	1.0725		
Total	47	76.6667	1.6312		

Table D5

Repeated Measures ANOVA summary for Openings

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	11.9792	.5208		
Within Subjects	24	13.5000	.5625		
Between Measures	1	2.5208	2.5208	5.2808	.0310
Residual	23	10.9792	.4774		
Total	47	25.4792	.5421		

Table D6

Repeated Measures ANOVA summary for Edges

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	13.8125	.6005		
Within Subjects	24	15.5000	.6458		
Between Measures	1	6.0208	6.0208	14.6088	.0009
Residual	23	9.4792	.4121		
Total	47	29.3125	.6237		

Table D7

Repeated Measures ANOVA summary for Crush

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	18	15.3158	.8509		
Within Subjects	19	14.5000	.7632		
Between Measures	1	.2368	.2368	.2989	.5913
Residual	18	14.2632	.7924		
Total	37	29.8158	.8058		

Table D8

Repeated Measures ANOVA summary for Tripping

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	25	23.2308	.9292		
Within Subjects	26	37.0000	1.4321		
Between Measures	1	9.3077	9.3077	8.4028	.0077
Residual	25	27.6923	1.1077		
Total	51	60.2308	1.1810		

Table D9

Repeated Measures ANOVA summary for Guardrails

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	20	31.6190	1.5810		
Within Subjects	21	32.0000	1.5238		
Between Measures	1	4.6667	4.6667	3.4146	.0795
Residual	20	27.3333	1.3667		
Total	41	63.6190	1.5517		

Table D10

Repeated Measures ANOVA summary for Design

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	25	7.0769	.2831		
Within Subjects	26	8.0000	.3077		
Between Measures	1	2.7692	2.7692	13.2353	.0012
Residual	25	5.2308	.2092		
Total	51	15.0769	.2956		

Table D11

Repeated Measures ANOVA summary for Separation

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	18	92.8421	5.1579		
Within Subjects	19	24.0000	1.2632		
Between Measures	1	- 1.8688	.0001	.0001	1.000
Residual	18	24.0000	1.3333		
Total	37	116.8421	3.1579		

Appendix E

Statistical Data

for

Analysis of Variance for Playground Safety Rating Comparisons Between Physical Education Teachers and the CPSI.

Table E1

Repeated Measures ANOVA summary for Depth

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	24	59.2800	2.4700		
Within Subjects	25	36.5000	1.4600		
Between Measures	1	5.7800	5.7800	4.5156	.0441
Residual	24	30.7200	1.2800		
Total	49	95.7800	1.9547		

Table E2

Repeated Measures ANOVA summary for Distance

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	24	79.6800	3.3200		
Within Subjects	25	36.5000	1.4600		
Between Measures	1	7.2200	7.2200	5.9180	.0228
Residual	24	29.2800	1.2200		
Total	49	116.1800	2.3710		

Table E3

Repeated Measures ANOVA summary for Spacing

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	34.9792	1.5208		
Within Subjects	24	43.5000	1.8125		
Between Measures	1	6.0208	6.0208	3.6948	.0671
Residual	23	37.4792	1.6295		
Total	47	78.4792	1.6698		

Table E4

Repeated Measures ANOVA summary for Hardware

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	23.3125	1.0136		
Within Subjects	24	40.5000	1.6875		
Between Measures	1	17.5208	17.5208	17.5367	.0004
Residual	23	22.9792	.9991		
Total	47	63.8125	1.3577		

Table E5

Repeated Measures ANOVA summary for Opening

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	22	21.2174	.9644		
Within Subjects	23	13.5000	.5870		
Between Measures	1	1.7609	1.7609	3.3000	.0829
Residual	22	11.7391	.5336		
Total	45	34.7174	.7715		

Table E6

Repeated Measures ANOVA summary for Edges

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	24.4792	1.0643		
Within Subjects	24	8.5000	.3542		
Between Measures	1	1.0208	1.0208	3.1393	.0897
Residual	23	7.4792	.3252		
Total	47	32.9792	.7017		

Table E7

Repeated Measures ANOVA summary for Crush

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	17	21.2500	1.2500		
Within Subjects	18	17.5000	.9722		
Between Measures	1	.2500	.2500	.2464	.6260
Residual	17	17.2500	1.0147		
Total	35	38.7500	1.1071		

Table E8

Repeated Measures ANOVA summary for Tripping

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	25	22.2500	.8900		
Within Subjects	26	31.5000	1.2115		
Between Measures	1	10.1731	10.1731	11.9252	.0020
Residual	25	21.3269	.8531		
Total	51	53.7500	1.0539		

Table E9

Repeated Measures ANOVA summary for Guardrails

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	17	43.8056	2.5768		
Within Subjects	18	16.5000	.9167		
Between Measures	1	.0278	.0278	.0287	.8675
Residual	17	16.4722	.9690		
Total	35	60.3056	1.7230		

Table E10

Repeated Measures ANOVA summary for Design

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	25	11.3077	.4523		
Within Subjects	26	7.0000	.2692		
Between Measures	1	1.2308	1.2308	5.3333	.0295
Residual	25	5.7692	.2308		
Total	51	18.3077	.3590		

Table E11

Repeated Measures ANOVA summary for Separate

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	15	55.8750	3.7250		
Within Subjects	16	44.0000	2.7500		
Between Measures	1	1.1250	1.1250	.3936	.5399
Residual	15	42.8750	2.8583		
Total	31	99.8750	3.2218		

Appendix F

Analysis of Variance for Playground Safety Rating Comparisons Between Principals and Physical Education Teachers.

Table F1

Repeated Measures ANOVA summary for Depth

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	24	68.0000	2.8333		
Within Subjects	25	24.5000	.9800		
Between Measures	1	1.6200	1.6200	1.6993	.2047
Residual	24	22.8800	.9533		
Total	49	92.5000	1.8878		

Table F2

Repeated Measures ANOVA summary for Distance

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	88.2500	3.8370		
Within Subjects	24	27.0000	1.1250		
Between Measures	1	.7500	.7500	.6571	.4259
Residual	23	26.2500	1.1413		
Total	47	115.2500	2.4521		

Table F3

Repeated Measures ANOVA summary for Spacing

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	32.6667	1.4203		
Within Subjects	24	10.0000	.4167		
Between Measures	1	.3333	.3333	.7931	.3824
Residual	23	9.6667	.4203		
Total	47	42.6667	.9078		

Table F4

Repeated Measures ANOVA summary for Hardware

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	37.9792	1.6513		
Within Subjects	24	11.5000	.4792		
Between Measures	1	2.5208	2.5208	6.4571	.0183
Residual	23	8.9792	.3904		
Total	47	49.4792	1.0527		

Table F5

Repeated Measures ANOVA summary for Openings

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	22	15.9565	.7253		
Within Subjects	23	9.0000	.3913		
Between Measures	1	.0870	.0870	.2146	.6477
Residual	22	8.9130	.4051		
Total	45	24.9565	.5546		

Table F6

Repeated Measures ANOVA summary for Edges

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	23	13.6667	.5942		
Within Subjects	24	13.0000	.5417		
Between Measures	1	2.0833	2.0833	4.3893	.0474
Residual	23	10.9167	.4746		
Total	47	26.6667	.5674		

Table F7

Repeated Measures ANOVA summary for Crush

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	22	17.6522	.8024		
Within Subjects	23	7.5000	.3261		
Between Measures	1	.0217	.0217	.0640	.8027
Residual	22	7.4783	.3399		
Total	45	25.1522	.5589		

Table F8

Repeated Measures ANOVA summary for Tripping

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	25	20.9423	.8377		
Within Subjects	26	10.5000	.4038		
Between Measures	1	.0192	.0192	.0459	.8321
Residual	25	10.4808	.4192		
Total	51	31.4423	.6165		

Table F9

Repeated Measures ANOVA summary for Guardrails

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	16	27.7647	1.7353		
Within Subjects	17	18.5000	1.0882		
Between Measures	1	.2647	.2647	.2323	.6364
Residual	16	18.2353	1.1397		
Total	33	46.2647	1.4020		

Table F10

Repeated Measures ANOVA summary for Design

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	25	5.7692	.2308		
Within Subjects	26	3.0000	.1154		
Between Measures	1	.3077	.3077	2.8571	.1034
Residual	25	2.6923	.1077		
Total	51	8.7692	.1719		

Table F11

Repeated Measures ANOVA summary for Separate

Source	df	Sum Squares	Mean Squares	F-test	P value
Between Subjects	19	82.2750	4.3303		
Within Subjects	20	30.5000	1.5250		
Between Measures	1	.6250	.6250	.3975	.5359
Residual	19	29.8750	1.5724		
Total	39	112.7750	2.8917		

Appendix G

Middle Tennessee State University

Institutional Review Board Approval

Health, Physical Education, Recreation, and Safety

P.O. Box 96
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Murfreesboro, Tennessee 37132
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To: Daniel McMasters and Dr. Peter Cunningham
Department of HPERS
Box 96, MTSU

From: Timothy J. Michael
College of Education Representative,
Institutional Review Board- Chair

Re: "A Comparison of Playground Safety Perceptions beteween Principals, Physical Educators and a Certified Playground Inspector"
(IRB Protocol Number: 97-219)

Date: August 25, 1997

The above named human subjects research proposal has been reviewed and approved. This approval is for one year only. Should the project extend beyond one year or should you decide to change the research protocol in any way you must submit a memo describing the proposed changes or reasons for extension to your college's IRB representative for review. Best of luck in the successful completion of your research.

APPENDIX H

Recommended Program
for a
Playground Safety Workshop

PLAYGROUND SAFETY WORKSHOP

I. Introduction

II. Playground Statistics

- A. Injuries
- B. Hazards

III. Layout / Design / Installation / Maintenance

IV. General Hazards

- A. Sharp points, corners, and edges
- B. Protrusions and projections
- C. Pinch, crush, and shear
- D. Entrapment
- E. Tripping hazards
- F. Suspended hazards

V. Access & Platforms

VI. Types of Equipment

- A. Slides
- B. Swings
- C. Climbing equipment
- D. Merry-go-rounds
- E. Seesaws
- F. Spring rocking equipment
- G. Trampolines

VII. Surfacing & Use Zones

VIII. Site Visit

IX. Question & Answer

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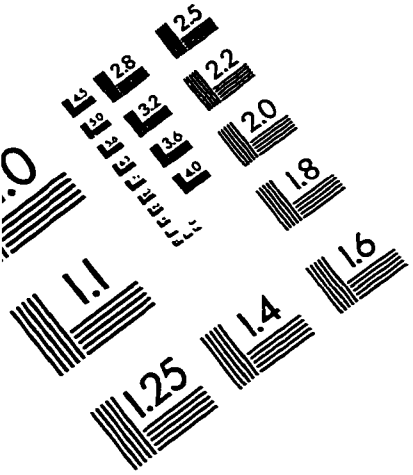

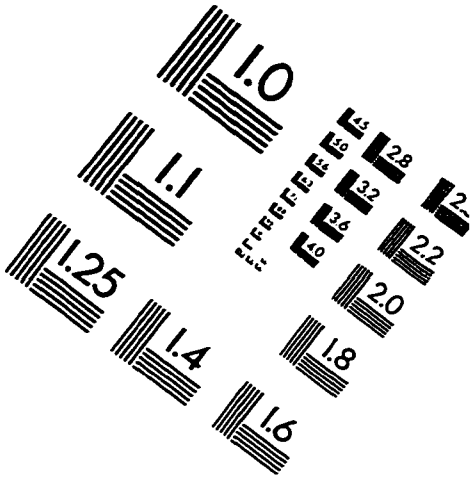

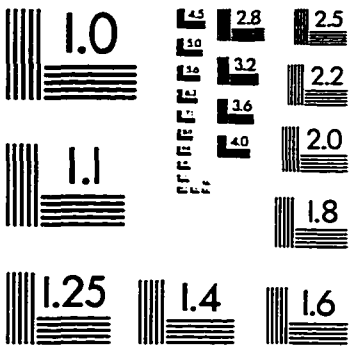

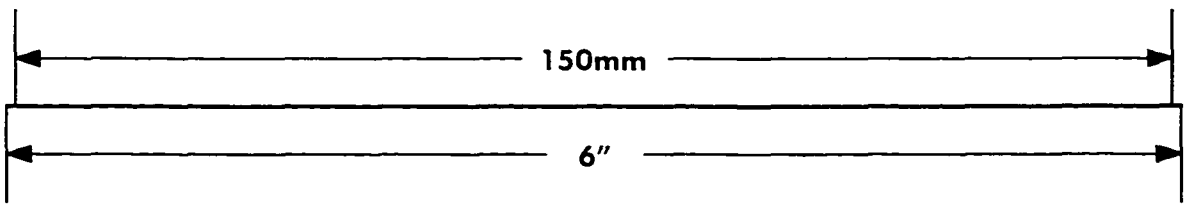

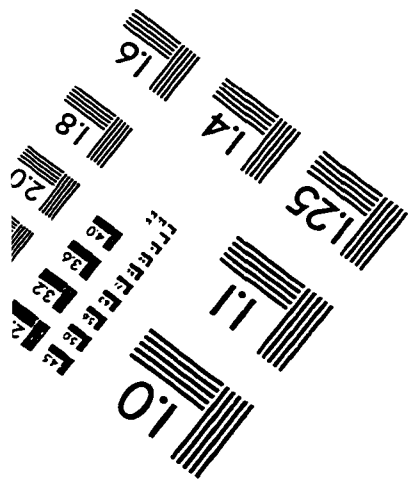

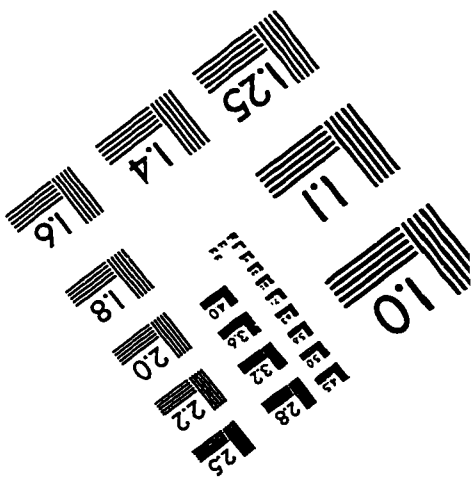

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