RUNNING HEAD: WEB-BASED INSTRUCTIONAL UNIT – HEALTHY HEARTS

The Effects of the Web-Based Instructional Unit Healthy Hearts on Fifth Grade Children's Physical Activity Knowledge, Attitudes, and Behavior.

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Abstract

Substantial resources are being directed towards use of the Internet in K-12 Education with over $2.25 billion annually distributed to K-12 schools from the Federal government alone (Maiden & Beckham, 1999). In 1998, 90% of schools had Internet access while only 2% of funds spent on software in K-12 schools were directed towards Web-based courseware (Jerald & Orlofsky, 1999). The Web-based instructional module *Healthy Hearts* was developed as a self-contained instructional unit delivered over the Internet, popularly referred to as "e-Learning", for fifth grade students to use as part of the classroom curriculum. *Healthy Hearts* teaches children about risk factors associated with heart disease, including physical activity, tobacco, and nutrition. After piloting and formatively evaluating *Healthy Hearts* in two fifth grade classrooms, Elliott (1997) made recommendations for future modification and implementation. No research regarding effects the Web-based instructional unit *Healthy Hearts* has on fifth grade children exists. The purpose of this study is to evaluate the impact *Healthy Hearts* has on fifth grade children's physical activity knowledge, attitudes, and behavior.

Participants included 233 fifth grade boys and girls and 11 teachers who implemented *Healthy Hearts* during Spring 2001. A repeated measures experimental-control design was employed to measure *Healthy Hearts* effects on physical activity knowledge, attitudes, and behavior. The questionnaire used for this study included three attitude items adapted from Sport, Play, and Active Recreation for Kids (SPARK) (Sallis, Alcaraz, McKenzie, & Hovell, 1999a), six criterion referenced knowledge items developed from *Healthy Hearts* objectives, and a Weekly Activity Checklist to assess physical activity behavior, which was developed and validated for SPARK (Sallis et. al., 1993a). Classroom teachers administered the baseline test before students began using the module. For five weeks following the baseline test, the group 1 engaged in *Healthy Hearts* lessons by going to a computer lab for 45 minutes twice a week while group 2 participated in regularly scheduled classroom activities. After group 1 finished *Healthy Hearts*, both groups completed test 1 and then teachers from group 2 implemented Healthy Hearts with their classes. When group 2 finished using Healthy Hearts, both groups completed test 2. Dependent variables were physical activity knowledge, attitude, and behavior with group as independent variables. Other independent variables included school socioeconomic status,

time allocated to *Healthy Hearts*, non-*Healthy Hearts* instruction time for related objectives, and speed of Internet connection.

Repeated measures ANOVA revealed significant effects of Healthy Hearts on physical activity knowledge and attitude, however *Healthy Hearts* had no significant effects on behavior. Results of this study indicate *Healthy Hearts* could be an effective means of using the Internet to deliver health and physical activity instruction to fifth grade children, and suggest a need for further design, development, and evaluation of *Healthy Hearts.*

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CHAPTER 1
INTRODUCTION

Since the inception of the Internet and subsequent development of the World Wide Web (WWW) in 1990, use of computer technology has exploded in popularity and use around the United States and the World (AGRIPPA Enterprises, 2000). As of September 2000, an estimated 378 million people utilize Web–based resources (Sallis, 1991; Sallis et al., 1993a). The Internet continues to have an increasingly profound effect on the economy and education as more people around the world "get connected". Initially envisioned as a means of sharing papers and data, the Web has evolved far beyond its original intent and now includes such diverse capabilities as graphics, video, audio, and real-time interaction (Dick & Carey, 1996). These, and the promise of many more capabilities, have created an enormous amount of excitement within government and education communities regarding the use of the Internet for instruction, while adding to concern with the influence of computer use on sedentary lifestyles. This chapter describes how teachers are being encouraged to use the Internet in schools, how the Internet is being employed by teachers for instructional purposes, and introduces the Web-based health instructional unit, *Healthy Hearts*. The statement of the purpose of this study is presented followed by limitations, delimitations, and definition of terms. This chapter begins with a brief description of how the government is encouraging the use of computer and Internet technology in schools.

The Internet

A substantial influence for the use of Internet technology in K-12 schools has come directly from the Federal government. Government programs such as Education rate (E-rate) were created to provide all schools with access to the Internet and are part of President Clinton's Call to Action (1997) for connecting every school in the Nation to the Internet. In 1997, the U.S. Department of Education's Office of Technology outlined four "Pillars" of the technology literacy challenge. The four pillars outlined in 1997 were to ensure; (a) modern computers and learning devices are accessible to every student, (b) classrooms are connected to one another and to the outside world, (c) educational software is an integral part of the curriculum - and as engaging as the best video game, and (d) teachers are ready to use and teach with technology (Graham, 1992). The technology challenge goals were created to ensure that "all children are technologically literate by the dawn of the 21st century, equipped with the communication, math,

science, reading, and critical thinking skills essential for enhancing learning and improving productivity and performance" (Graham, 1992). These goals have recently been updated to meet the changing needs of schools, teachers, and students (Schmidt, 1991).

As a result of the strategic review and revision of the national educational technology plan, the U.S. Department of Education outlined five new goals for technology (McNabb, Hawkes, & Rouk, 1999) that reinforce the demands on teachers to use the Internet in schools. These are;

Goal 1: All students and teachers will have access to information technology in their classrooms, schools, communities and homes.

Goal 2: All teachers will use technology effectively to help students achieve high academic standards.

Goal 3: All students will have technology and information literacy skills.

Goal 4: Research and evaluation will improve the next generation of technology applications for teaching and learning.

Goal 5: Digital content and networked applications will transform teaching and learning.

(See http://www.ed.gov/Technology/elearning/index.html)

The government has pledged to help attain these goals by contributing significant funding to ensure technology literacy of the Nation. As a result of financial incentives and programs such as E-Rate, K-12 schools are becoming more connected and use of the Internet by teachers is increasing. Since 1998, more than five billion dollars has been committed to public school districts through E-rate subsidies for connecting schools to the Internet (U.S. Department of Education, 2000). By 1999, 95 percent of K-12 schools had access to the Internet, an increase from thirty-five percent in 1994. In 1999, one-third of public K-12 school teachers reported feeling well, or very-well, prepared to use computers and the Internet for instructional purposes, up from only fourteen percent in 1993-1994 (U.S. Department of Education, 2000). Some data has been published describing how teachers use the Internet.

Teachers use of the Internet

In 1999, 95 percent of schools and 68 percent of classrooms were connected to the Internet, up from 89 percent of schools and 51 percent of classrooms in 1998. A survey of 15,000 teachers nationwide indicates that 97 percent use a computer at home and/or at school for professional activities and 61 percent use the Internet for instructional purposes (Coley, Cradler, & Engel, 1997a). Other than government surveys, empirical research on use of the Internet in schools is rare. The majority of what is known today comes from survey research, not experimental studies. The most extensive reports regarding the status of the Internet and schools include Internet use by Teachers (Becker, 1999) and Internet Access in U.S. Public Schools and Classrooms: 1994-1999 (NCES, 2000). This is probably due to the relative youth of the WWW. One means to identifying the extent of use is from existing survey data and projects that are WWW based.

The most common use of the WWW among teachers is to find and retrieve information, primarily lesson plans and ideas. Sixty eight percent of teachers in one survey stated they used the WWW for finding information and resources for their lessons, and one quarter of these indicated doing so weekly (Gortmaker et al., 1999a; Gortmaker et al., 1999b). In a survey of PreK-12 educators, Small et. al. (1998) recently found the most common types of information on the Internet for teachers are curriculum guides, including lesson plans.

In a follow-up survey to determine what sources of information teachers used in lesson preparation, Small et. al. (1998) found journals/newsletters were the most frequently cited sources, followed by textbooks, books/magazines, and workshops (Small, Sutton, Eisenberg, Miwa, & Urfels, 1998). The fifth of these sources was the Internet (Dorman, 1997). Becker (1999) found that 68 percent of teachers surveyed regularly use information from the Internet in lessons . K-12 teachers frequently use the Internet and Web for lesson preparation, communication, and for professional development than ever before, however there is still limited use of the Internet for Web-based and Web-assisted instruction.

Use of the Internet for Instructional Purposes

In addition to using the Internet for lesson planning, teachers are also being encouraged to use computers for Web-based or Web-assisted instruction with their students. There is evidence that teachers are using the World Wide Web (WWW) as part of the curriculum by providing students opportunities to use Web-based resources (Pate et al., 1997). U.S. spending on educational content such as textbooks, software, and instructional technology amounts to approximately $4 billion a year. However, online educational content represents only a fraction of this spending (Trost, Pate, Ward, Saunders, & Riner, 1999). Much of online content consists of raw information and data, Web pages, and other information teachers use to supplement their curriculum.

One such strategy for students to use Web resources is with WebQuests (Soloway et al., 2000). WebQuests are questions created by teachers for students to answer from a designated website (Kimiecik, Horn, & Shurin, 1996). Using WebQuests requires a significant amount of teacher time to find and create assignments, and Soloway et. al. (2000) compares WebQuests to "questions at the end of the textbook chapter," alluding to teacher directed lessons.

Many project based and self-contained Web-based modules have been developed and used in classrooms across a variety of subject areas. Such Web-based projects include an interactive frog dissection site called Net-frog (Brustad, 1996), a search for the largest volcano in the solar system entitled the Olympus Mons Project (Biddle & Goudas, 1996), virtual trips such as Trip to the Pyramids (Biddle & Goudas, 1996; Brustad, 1996; Pate et al., 1997; Trost et al., 1997; Trost et al., 1999), and Global Perspectives (Pate et al., 1997; Trost et al., 1996; Trost et al., 1997; Walton et al., 1999), and a health curriculum called *Healthy Hearts* (Elliott, 1997). When reliable computers and Internet connections are available, teachers are able to use the Web to provide opportunities for student learning. In light of the progress in training and access to computers, barriers remain in place for teachers to use the WWW in schools such as a lack of training and technical support, and insufficient software integrated with school curriculum (Pate et al., 1997; Trost et al., 1996; Trost et al., 1997; Walton et al., 1999). One specific barrier is the immediate access to material inappropriate for schools.

The Web is inundated with sites that provide poor examples of writing, sites that attempt to identify and market products to children, sexually explicit material, and language inappropriate for children. The widespread concern for children on the Internet, not only

regarding easy access to inappropriate materials but identification of children, is being addressed through website policy statements and schools' Internet policies . Parents must consent to students using Web-based resources at school. Websites are required to post Internet policies that spell out what information is collected from visitors, and how this information is going to be used. Furthermore, it is illegal for websites to contact children without parental consent (see the Children's Online Privacy Protection Act of 1998, http://www.cdt.org/legislation/105th/privacy/coppa.html). Guidelines for contacting children are a major concern for those involved with the Internet.

Once students are online, filters can be used to block access to any website. However, students conducting searches on health topics may be denied access to legitimate information. One project intended to provide an alternative to filtering websites is called the Gateway to Educational Materials (GEM) project (Pan, 1998). GEM teams a variety of public and private information providers, educators, and state departments of education to develop a Web search for schools by specifying the content that is accessible to teacher and student searches, instead of filtering information (Pan, 1998). Other websites, such as Yahooligans (http://www.yahooligans.com) provide students relatively safe access to reviewed Web materials. Unfortunately, teachers still have difficulty using the Web in their classes even if connections are available.

A second barrier to using the World Wide Web (WWW) is the amount of time necessary for teachers to identify appropriate content and resources and to design projects to use these resources, such as creating WebQuests (Pate et al., 1997; Trost et al., 1996; Trost et al., 1997; Walton et al., 1999). Early models of educational change implied that if teachers had access to enough equipment, use of the equipment in the classroom would follow (Ertmer, 1999). This has not been the case with the WWW because more extensive use of technology challenges traditional classroom culture (Ertmer, 1999) and requires additional time for planning. Some question whether the time spent learning how to use new technologies would be better served preparing lessons (Oppenheimer, 1997) and that districts should provide additional time for teachers to take on new training if they want teachers to actually create Web-based lessons for their children (Karvonen, 1996). In addition to time, a third barrier to utilizing the WWW in schools is that teachers continue to have problems locating resources and gaining the necessary support and skills to utilize these resources (Blair & Connelly, 1996).

Teachers who have attended workshops and training sessions were more likely to believe the Internet to be an essential classroom resource and are more likely to use the Web than teachers with no training (Sallis, McKenzie, & Alcaraz, 1993b). Unfortunately, researchers have found that only three out of ten teachers attend formal staff development with computer technology (Sallis & Patrick, 1994) and new teachers are still inadequately prepared to teach with technology (Bailey & Martin, 1994). Successful staff development requires much more than exposure. Learning to use technology takes time, and it is essential that staff have access to equipment at school and home that works (Bar-Or & Baranowski, 1994). It is frustrating for teachers to use technology when requests to repair equipment in school districts are not filled for at least fourteen hours, and as many as seven days, on average (Calfas & Taylor, 1994). Even with working equipment, teachers frequently do not have a clear understanding of what instructional technology can be and they often have a general misunderstanding of instructional design.

This fourth barrier, a misunderstanding of the purpose of instruction and how technology fits in the classroom, supersedes all other barriers. Access to resources, support, and equipment are worthless without adequate understanding of how to use computers and the Internet in the classroom. Many argue today that children learn more, faster, and/or more efficiently with computers than traditional instruction (Alpert & Wilmore, 1994). Studies comparing computer based instruction with traditional instruction, or media comparison research, have been inconclusive suggesting other approaches to evaluate impact of media on learning is necessary (Corbin & Pangrazi, 1998).

Media comparison studies typically identify independent variables as the delivery of instruction, such as computer vs. instructor, and a dependent variable as student learning (Lockee, Burton, & Cross, 1999). However, many studies about online learning are uninformed, posing questions such as “can children learn with Web-based instruction (WBI)” or “is WBI better than traditional instruction” (Corbin & Pangrazi, 1998). Many variables are related to student learning such as socioeconomic status and allocated instruction time (Corbin & Pangrazi, 1998). Questions pertaining to effectiveness of a medium for learning are inappropriate because answers to these questions depend on instruction, how different attributes of the medium are arranged, and whether these media attributes are appropriate for the desired outcomes. For example, comparing WBI to video instruction is essentially comparing media attributes such as

motion video, quality of audio, types of color and text, as well as how the learner interacts with the medium. Much of the excitement over the WWW in schools is the capability to display and utilize many media attributes.

The WWW is capable of a variety of media attributes such as text, video, varieties of color, audio, and other features including synchronous or asynchronous communication, interactivity, flexible learning contexts, accessibility, and learner control and pacing (Khan, 1997). The WWW can use these attributes to deliver instruction regardless of time and distance, however the important consideration for using the WWW is when, and how, to choose and apply different media attributes in instruction. Research has contributed to the effective application of media attributes, such as video, color, and learner control in instructional design (Clark, 1994; Shyu, 1999).

One understanding from media attribute research is that the medium selected must be capable of providing attributes closely related to the desired outcome (Clark, 1994; Clark & Salomon, 1986; Dillon, 1996; Dillon & Gabbard, 1998; Levie & Dickie, 1973; Wager & Gagne, 1988). For example, if the desired outcome is for physical education students to critique their own running technique, then motion video is more appropriate than text. This is in agreement with the systematic design of instruction, in which desired outcomes are constructed based on a need, whether attitude, knowledge, or behavior. The medium capable of many attributes related to the desired outcome is selected to provide instruction (Dick & Carey, 1996). In physical education, one well-known need is for children to become and remain physically active.

Physical Activity Patterns of Children

Data on the health status of Americans continue to reveal that many of our Nation's children lead inactive and unhealthy lifestyles (USDHHS, 1996; Biddle & Goudas, 1996; Grunbaum & et al., 1995; CDC, 1997; Welk, 1999). Experts recommend that children should accumulate at least sixty minutes of physical activity a minimum of five, preferably seven, days of the week (Corbin & Pangrazi, 1998). The National physical education standards outline outcomes from K-12 education that include knowledge, attitudes, and behaviors (see Table 1).

To impact behavior, instructional designers must first address attitudes and factors relating to changing attitudes and behavior (Dick & Carey, 1996; Moallem & Earle, 1998; Simonson & Maushak, 1996). A significant body of literature regarding determinants and correlates of physical activity in children exists helping guide design of instruction. Research

indicates that intention to be physically active (Kolbe et al., 1995; Sallis, Prochaska, & Taylor, 1999b), and to some degree perceived benefits (Garcia et al., 1995; Sallis et al., 1999b) correlate with physical activity behavior.

Influencing attitudes and behavior in school necessitates designing instruction for attitudinal outcomes (Dick & Carey, 1996; Gagne, Briggs, & Wager, 1992). Designing lessons for attitudinal outcomes requires implementing strategies for the learner to recall information relevant to the desired attitude, and to provide feedback or a reward for the desired personal action (Gagne et al., 1992). Few teachers have the time, expertise, or resources to design Web-based instruction for attitudinal outcomes. For teachers to effectively use the Internet in the classroom, there is a need for online self-contained instructional units that meet National and State educational goals and objectives, similar to Kinzie's (1996) Net-Frog. These Web-based units must apply sound principles of instructional design. In order to meet teacher's needs for Web-based instruction matching National standards, as well as to address unhealthy lifestyles in many children, Elliott (1997) designed and developed a Web-based instructional module entitled *Healthy Hearts* (Elliott, 1997).

Table 1

Predominant Learning Outcome Types for the National Physical Education Standards

Standard	Learning Outcome
Demonstrates competency in many movement forms and proficiency in a few movement forms.	Motor Skill
Applies movement concepts and principles to the learning and development of motor skills.	Intellectual skill
Exhibits a physically active lifestyle.	Attitude/Motor Skill
Achieves and maintains a health-enhancing level of physical fitness.	Motor/Intellectual Skill
Demonstrates responsible personal and social behavior in physical activity settings.	Attitude/Intellectual Skill
Demonstrates understanding and respect for differences among people in physical activity settings.	Intellectual Skill/Attitude
Understands that physical activity provides opportunities for enjoyment, challenge, self-expression, and social interaction.	Intellectual Skill

Note. National Association for Sport and Physical Education (NASPE), 1995

Healthy Hearts

Healthy Hearts is a five week Web-based instructional unit designed to influence fifth grade children's health related knowledge, attitudes, and behaviors. Fifth grade teachers use *Healthy Hearts* as part of the regular classroom curriculum over a period of five weeks (CDC, 1997). In order to access *Healthy Hearts*, teachers take their students to a computer lab for one hour twice a week, during which the students log in to the *Healthy Hearts* website with their own usernames and passwords and engage in Web-based instruction (WBI). Elliott (1997) designed *Healthy Hearts* to meet the needs of teachers and students, creating interdisciplinary instruction regarding cardiovascular health corresponding with National health and physical education standards. Each week, a new content theme is presented and students interact with questions, quizzes, and activities related to the content theme.

Elliott (1997) piloted and conducted a formative evaluation of *Healthy Hearts* in two Virginia fifth grade classrooms and claimed that instructional modules such as *Healthy Hearts* have the potential to be effective instructional tools. During the initial pilot, Elliott (1997) concluded that the Internet could be successfully used in fifth grade classrooms and may be an important medium of instruction for addressing health behaviors. She made further recommendations for improving *Healthy Hearts* based on interviews and surveys of teachers and students. However, the impact *Healthy Hearts* has on student learning, if any, has not been investigated.

Although a significant amount of funding has been directed towards computers and the Internet in schools, to date there have been no studies regarding effects of a Web-based instructional units effects on fifth grade students physical activity knowledge, attitudes, and behaviors. In order to guide further development and distribution of *Healthy Hearts*, it is necessary to conduct a summative evaluation of the effects *Healthy Hearts* has on students' physical activity knowledge, attitudes and behaviors.

Statement of the Purpose

The purpose of this study is to measure the impact *Healthy Hearts* has on fifth grade students' physical activity knowledge, attitudes, and behaviors. Three research questions guide this study:

1. Does *Healthy Hearts* have any influence on fifth grade children's physical activity knowledge following completion of the module?
2. Does *Healthy Hearts* have any influence on fifth grade children's intention to be physically active (attitude) following completion of the module?
3. Does *Healthy Hearts* have any influence on fifth grade children's participation in physical activity following completion of the module?
4. Are there other variables that influence students' responses on the *Healthy Hearts* tests?

Significance of the Study

Over the past decade, activity levels in American children have declined, overweight and obesity levels have risen, and an alarming proportion of adolescents have exhibited a sedentary lifestyle in spite of the well-published health benefits of physical activity (USDHHS, 1990; USDHHS, 1996; USDHHS, 2000; Blair, 1993; Blair & Connelly, 1996; Ignico, 1997; Pate et al., 1995). Data from the 1999 Youth Risk Behavior Surveillance System (YRBSS), a government instrument used to collect data on child physical activity, reveal little to no progress towards the Healthy People 2000 goals for youth and adolescent activity. Vigorous physical activity in adolescents moderately increased from 59 percent in 1984 to 64.7 percent in 1999 (CDC, 2001), but is well below the 75 percent Healthy People 2010 target. Younger students remained more physically active with 26 percent of 9th grade students participating in regular moderate physical activity compared to only 15 percent of 12th grade students. Within these groups, boys are significantly more active than girls and a significant proportion of their weekly physical activity comes during physical education (CDC, 1999). Furthermore, the percentage of students enrolled in high school physical education classes has decreased.

In 1991, 42 percent of high school students enrolled in physical education. This decreased to 34 percent in 1993, and the most recent survey indicated only 29 percent of high school students attended physical education (CDC, 2001). Active time during physical education

also decreased from 24 percent in 1991 to 21 percent in 1997. This is well below the recommended minimum 50 percent activity time (USDHHS, 1990) and 51 percent of active learning time in physical education (Graham, 1992). For many children, physical education provides a majority of their daily physical activity. Incredibly, the amount of children's activity time has decreased both in and outside of physical education in spite of National recognition, specific physical education objectives in Healthy People 2010, and the published benefits of physical activity.

The benefits of regular physical activity, and the need for quality health and physical education programs promoting physical activity, are well documented (USDHHS, 1996; USDHHS, 2000; (USDHHS, 1990). The health benefits of regular physical activity include increasing bone density and muscle strength and contributing to weight control. Moderate physical activity also reduces the risk of death from heart disease, diabetes, colon cancer, and high blood pressure, which can increase the length and quality of life (USDHHS, 1996). Increasing the weekly amount of moderate to vigorous physical activity is an important goal for improving the health of individuals and communities. The 1996 release of the Surgeon General's Report on physical activity and health (USDHHS, 1996), Healthy People 2000 (USDHHS, 1990), and the more recent publication of Healthy People 2010 (Dick & Carey, 1996) clearly state the importance of exhibiting healthy lifestyle behaviors.

Some progress has been made within specific regions with interventions such as the Child and Adolescent Trial for Cardiovascular Health (CATCH) (Mckenzie, Alcaraz, & Sallis, 1994; Mckenzie, Alcaraz, & Sallis, 1998), Sport, Physical Activity, and Recreation for Kids (SPARK) (Sherman, 1998), and Project Active (Dick & Carey, 1996). These interventions address children’s physical activity during the physical education class, through encouraging lifestyle physical activity, and also by establishing collaboration between schools, communities, and parents. These studies also reveal many determinants of physical activity in children, one of which is the negative correlation between computer game playing /television viewing and physical activity (Howell, 1997; Silverman & Subramaniam, 1999; Simonson & Maushak, 1996).

Teachers, students, parents and administrators receive a mixed message as goals and resources for implementing computer and Internet technology overshadow the need to improve our Nation's health (Simonson & Maushak, 1996), thus potentially compounding the problem by

encouraging sedentary behavior. Teachers are being encouraged to use computer technologies and the Internet as part of the classroom curriculum, while also having to provide instruction to students meeting National and State Standards of Learning that address student health. There is a need for designing new avenues of interventions to promote physical activity in children and for evaluating the effects these programs have on children's physical activity levels.

Healthy Hearts was designed to meet teachers' needs for self-contained Web-based instructional modules while addressing the health and physical activity needs of fifth grade children. No research measuring the effects of the Web-based instructional unit *Healthy Hearts* on physical activity knowledge, attitudes, and behavior currently exists. Measuring the influence *Healthy Hearts* has on children's physical activity knowledge, attitudes, and behaviors is a necessary step towards further design and development of Web-based health and physical activity interventions. It is important to consider that this study does not compare Web-based instruction with traditional instruction, but is an evaluation of the Web-based curriculum itself..

Limitations of the Study

1. The results of this study are limited to participating fifth grade students in West Virginia schools. Therefore, generalizations can only be made about students participating in the study.
2. Other factors beyond the control of this study may influence children's knowledge, behaviors, and attitudes towards physical activity such as parental encouragement and modeling, environmental barriers and opportunities, education, and perceived competence.
3. The classroom activities and curriculum of the experimental and control groups cannot be controlled.
4. Control and experimental group participants were not randomly selected from West Virginia schools, or assigned to Group 1 or Group 2. Therefore, these groups may not be considered statistically identical, resulting in limited application to populations outside those involved in the study.

Delimitations of the Study

1. The selection of participants was delimited to children and teachers from schools in five West Virginia counties who agreed to implement *Healthy Hearts*.
2. All participating schools had the necessary computer hardware, software, and Internet connections to use *Healthy Hearts*.
3. Data collected was restricted to self-report scales and a questionnaire designed to assess children's knowledge and attitude about physical activity.

Assumptions

1. Participating classroom teachers clearly explained to students how to use *Healthy Hearts*.
2. Participating classroom teachers explained the purpose of *Healthy Hearts*, the study, and the test questionnaires to students.
3. Participating students exhibited reasonable effort to learn content presented during *Healthy Hearts* lessons.
4. Computers, the Internet connection, and all related technologies functioned as expected.
5. Participating teachers provided students the opportunity to use *Healthy Hearts* for 45 minutes twice a week over at least four consecutive weeks.

Definition of Terms

Baseline Test – One of two 57-item questionnaires administered to participating fifth grade children prior to using *Healthy Hearts*.

Broadband – The transmission of large amounts of data electronically, whether through wire or wirelessly (U.S. Department of Education, 2000)

Construct Validity – Refers to a trait or attribute such as an attitude, mental ability, or motivation and whether the independent and dependent variables measure the intended construct (Simonson & Maushak, 1996).

Content Validity – Refers to a domain of content, such as social studies, vocabulary, or physical activity knowledge and whether the independent and dependent variables measure the intended content (Sallis, 1991).

External Validity – Refers to the extent to which scores obtained are representative of the entire population (Howell, 1997).

Healthy Hearts – A five-week Web-based health instructional module for fifth grade children delivered via the Internet and used during school. Classroom teachers implement *Healthy Hearts* as part of regular classroom activities. *Healthy Hearts* meets health and technology curriculum objectives.

Internal Validity – Fundamental to integrity of experiments, suggests that results mean what they are intended to mean (Bell, 1997).

Internet – A series of computer networks connected together (Khan, 1997).

Keller's ARCS – An instructional strategy addressing learner motivation. Includes strategies for gaining the learners attention, making the information relevant, promoting confidence and success (Keller & Suzuki, 1988).

Media – A physical element within an environment that is capable of communicating messages (Sherman, 1998).

Media Attributes – Properties of stimulus materials which are manifest in the physical parameters of media. The attributes of a medium are the capabilities of the medium (Levie & Dickie, 1973).

Media comparison research – Describes research comparing two or more media, such as television and computers, without identifying the specific attributes the media are capable of.

Test 1 – One of two 57-item questionnaires administered to all participating fifth grade children after Group 1 and before Group 2 classes used *Healthy Hearts.*

Test 2 – A 73-item questionnaire administered to all participating fifth grade children after both Group 1 and Group 2 completed using *Healthy Hearts*.

Validity – Refers to inferences made on the basis of scores obtained in experimental study and whether scores measure the intended independent or dependent variable (Sallis & Saelens, 2000).

Web-based Instruction (WBI) – An innovative approach for delivering instruction to a remote audience, using the Web as the medium (Khan, 1997).

World Wide Web (WWW) – One means of using the Internet to deliver information. A dynamic, increasingly powerful, global, interactive means of sharing information (Khan, 1997).

Summary

As we learn more about sedentary choices of children and adults, including the negative relationship between physical activity and computer and television use, instructional designers must take advantage of new media to combat the plague of inactivity. There is tremendous influence from the government and communities for teachers and students to use the Internet and World Wide Web (WWW) in schools (Butler, 2000; U.S. Office of Technology, 1997; U.S. Office of Technology, 2001), which seems to overshadow the need for physical activity interventions.

There are few self-contained Web-based instructional units available that meet state and national Standards of Learning for teachers to use as part of the classroom curriculum. *Healthy Hearts* uses media attributes of the Internet and computer technology for delivery and instruction, provides a self contained instructional unit for classroom teachers and fifth grade children and combines the need to address physical activity in children.

Healthy Hearts is a five-week instructional unit delivered via the Internet for fifth grade students addressing risk factors associated with cardiovascular disease. A few interventions have successfully influenced children's in school physical activity (Gortmaker et al., 1999a; Gortmaker et al., 1999b). These have been extremely expensive to conduct, and costly to disseminate. Additionally, the effects of school based curricula on out of school physical activity behavior has not been significant.

Using the WWW as the medium of health behavior curriculum delivery can potentially reach millions of children and adults around the World for a fraction of the cost of other existing curricula. Quite possibly, using such a medium could encourage children to engage in the instruction because of accessibility, media display capabilities, and interactivity to mention three attributes. *Healthy Hearts* is the first self-contained Web-based health curriculum. In addition to ongoing formative evaluation, it is necessary to conduct summative evaluations to measure the impact this curriculum has on fifth grade children's behavior, attitudes, and knowledge of content presented in the curriculum. This study examines summative effects *Healthy Hearts* has on fifth grade children's physical activity knowledge, attitudes, and behaviors following five weeks of *Healthy Hearts* instruction. The next chapter provides a review of literature pertinent, and leading, to the design and development of *Healthy Hearts*. The literature further explains the need for this study.

CHAPTER 2
REVIEW OF THE LITERATURE

Two prevailing topics in the U.S. today are; 1) the use of technology and the WWW for instruction and 2) widespread concern regarding high incidence of sedentary lifestyles in children and adults. This literature review begins with a brief overview of the status of Internet use in the U.S., including data describing recent computer use and Internet connectivity in schools. Learning with Web-based instruction (WBI) is discussed from a media attribute perspective, leading to a description of the systematic design of instruction for attitudinal outcomes, specifically health behaviors. Using a computer is a sedentary behavior, and the effects of sedentary behaviors such as computer use and television viewing on health are presented within a discussion of correlates and determinants of physical activity in children. These include social, biological, and environmental determinants of physical activity.

There is no denying the enthusiasm with which children flock to computers and the WWW, which logically leads to an increase in sedentary behaviors. Many interventions have been developed to improve children's physical activity levels. Such interventions have been successful in changing in-school behavior by modifying the environment, however they have not influenced out-of-school physical activity levels. In addition to unsuccessfully modifying children's out of school behavior, most interventions have been extremely expensive to implement.

The WWW is a potentially powerful medium for delivering an intervention at a fraction of the cost of other school health programs. *Healthy Hearts* is a WBI module designed to influence the health lifestyle choices of children, however no summative evaluation of this curriculum has been conducted. This chapter provides a review of the literature related to design, evaluation, and implementation of *Healthy Hearts*, beginning with a brief overview of data regarding the status of Internet connectivity in U.S. schools.

The Internet and Education

The Internet and the World Wide Web are having an increasingly profound effect on the economy and education as more people around the world "get connected". As of April 2001, an estimated 407.1 million people were online (Sallis & McKenzie, 1991). From December 1998 to August 2000, the number of households with Internet access doubled from 26.2 percent to 41.5

percent (USDOE, 2000). About one third of the U.S. population uses the Internet at home and 10.7 percent of American households have broadband access (Corbin & Pangrazi, 1998). A survey of 15,000 teachers nationwide indicate that 97 percent use a computer at home and/or at school for professional activities and 61 percent use the Internet for instructional purposes (Coley, Cradler, & Engel, 1997b).

Substantial funding has been directed towards implementing Internet technology in schools (Maiden & Beckham, 1999). States fund approximately 44 percent and localities fund close to 40 percent of overall spending on technology in K-12 schools. Although in 1998 federal funding in public education fell to 6.1 percent of overall education spending, a large investment has been made in technology at the elementary and secondary level with federal monies funding 20 to 35 percent of technology (USDOE, 2000). The result is that schools have become significantly more connected to the Internet over the past five years.

Elementary and Secondary Schools' Access to the Internet

A goal outlined in the 1997 Technology Literacy Challenge (TLC) was to connect every American classroom to the Internet (Fitz-Gibbon & Morris, 1987). A survey conducted during spring 1998 of 2,250 public school teachers provides evidence of the improvement in connectivity to the Internet (Sallis et al., 1997; Sallis & Saelens, 2000). Becker (1999) reported that the percent of public schools with any Internet access has increased from 35 percent in 1994 to 90 percent in 1998. The percentage of classrooms with connections to the Internet has increased to 65 percent in 1999, up from 14 percent in 1996 (Howell, 1997). In addition to information regarding connectivity, survey data reveals types of connections in classrooms.

Speed of connection is one limiting factor in the use of the WWW in schools. The current benchmark is a T1 connection, however many schools still connect with a 56K line. Broadband technology refers to the transmission of large amounts of data electronically, whether through wire or wirelessly (Pedhazur & Schmelkin, 1991). For example, the amount of data transferred in ten minutes with a Gbps C-48 Internet 2 connection would take over one year of time with a 56 kbps connection. A T1 line would download this same amount of data in only 11 days (Gokhale, 1996).

The NCES (1999) reported that 65 percent of public schools have dedicated connections to the Internet such as ISDN (128 kbps) or T1 lines, and 22 percent connect via 56 kbps or 33.6 kbps dial-up modem. Of the classrooms with connections to the Internet in 1998, 61 percent had

no connection in the classroom, 21 percent had a modem connection, and 18 percent had a direct connection through a local area network (LAN) (Becker, 1999). Between schools, more high school teachers had direct connections (20%), while middle school (21%) and elementary school (23%) teachers more frequently had dial-up modem connections. This is a critical consideration for Web developers because sites designed for Web-based instruction (WBI) would only have access to 39 percent of U.S. classrooms, only 18 percent of which have connections fast enough to handle more advanced Web delivered resources. A significant portion (approximately 38%) of computers in schools are incapable of connecting to the Internet (Ballard, Kirk, & Smith, 1999), and teachers indicate there are not enough computers, software, or time to implement the Internet into the classroom (Pedhazur & Schmelkin, 1991). Classrooms may have wires running to them, but teachers are frequently unable to use them because of inadequate computers, training and the amount of time necessary to implement technology.

Teacher Preparation and Training

Simply providing access to computers connected to the WWW does not provide teachers all necessary tools to use the WWW for instruction. Becker (1999) reports that teachers with high self-reported computer skills are more likely to use WWW searches as part of their lessons, however "a school can have the best software ever made and access to the Web on every computer…but it won't see much difference in student learning…unless its teachers know how to use the digital content in their classrooms" (Dick & Carey, 1996). There have been gains in teacher training, however these are insufficient to rely on teachers consistently developing instructional WBI modules for their use.

Forty-two of the fifty states (all but Arkansas, Illinois, Indiana, Minnesota, Nevada, New Jersey, Oregon, and Pennsylvania) mandate teacher preparation to include technology, and only four states (Connecticut, New Hampshire, North Carolina, and South Carolina) require technology training for teacher recertification (Pedhazur & Schmelkin, 1991). During preparation programs, teachers receive inconsistent formal training with computers (Pate et al., 1995; Sallis et al., 1999a; Sallis et al., 1999b; Silverman & Subramaniam, 1999; Slattery, 1996). University teacher preparation programs often include stand-alone courses, or attempt to integrate technology within methods courses. Of the small percentage of teachers who feel prepared to use technology, one study showed that 58 percent had at least one methods course where an instructor modeled the use of the computer. Only 27 percent of teachers who feel

unprepared to use computers had such a course (Lytle et al., 1996; Perry et al., 1990; Perry et al., 1998; Resnicow, Robinson, & Frank, 1996). A study of teachers from schools in two Virginia counties indicated learning to use computers from peers was the most common way teachers learned to use computers and being self taught was second (Corbin & Pangrazi, 1998). Teachers do not have the time or training to design and develop their own WBI, and are not receiving compensation for time or opportunities for training.

Only 6 percent of $4.2 billion spent on technology for K-12 schools in 1996 went to teacher training. In 1995, the Office of Technology Assessment urged schools and districts devote at least 30 percent of their technology budget for training. In 1999, more funds were used for training (17%), however remain far below the recommended amount. Today, the National Education Association recommends devoting forty percent of technology budgets to teacher training. Deficiencies in training highlight the need for intuitive programming, for example programs for teachers and students that require little or no technical background.

Technology funds are spent primarily on hardware such as computers and networks, with minimal used for training, software, service and support (Blair & Connelly, 1996; Sallis et al., 1993a; Sallis & Saelens, 2000). E-Rate provides government subsidies to schools depending on need, however E-Rate only provides subsidies for hardware and Internet lines, not computers, training, or support. State and Federal funding is used primarily for hardware, resulting in added pressure on teachers to use the new tools with inadequate training and insufficient instructional courseware. In the push for technology in schools, teachers are still in need of training, intuitive software, and programs meeting local and national objectives that can be readily implemented as part of the regular classroom curriculum (Corbin & Pangrazi, 1998).

Educational Software

An abundance of software has been developed over the past few years. Teachers, however, report having difficulty finding quality software for their classrooms. In 1998, schools spent $571 million on software, up from $519 million in 1997. Of this, only two percent was spent on online courseware, while stand-alone modular software (60%) and comprehensive courseware (38%) accounted for 98 percent (Ainsworth, Haskell, & Leon, 1993).

The most commonly reported reason teachers do not use instructional software is expense. Currently, only 13 percent of K-12 schools subscribe to online curriculum (Bar-Or & Baranowski, 1994; Epstein, 1992; Epstein, L. H., Kilanowski, C. K., Consalvi, A. R. & Paluch,

R. A. (1999). Eighty two percent of teachers indicate the cost of software is either a moderate or big problem (Howell, 1997; Pedhazur & Schmelkin, 1991). Other moderate or big problems are amount of class time necessary to use materials (54%), the amount of preparation time (49%), materials not matching district or state curriculum (46%), poor overall quality (36%), and difficulty of use (33%). In 1998, 44 percent of teachers with more than 20 years experience said overall software quality is a "big" or "moderate" problem while 43 percent of teachers with less than five years of experience said the same thing (Faucette et al., 1995; Mckenzie, Alcaraz, & Sallis, 1994; Sallis et al., 1997). Although teachers generally have a difficult time obtaining and using quality software, annual sales of software and online materials increased 21% from $473 million in 1996 to $571 million in 1998 (Sallis et al., 1999a; Sallis et al., 1999b). Teachers would more likely purchase software meeting their specific needs as opposed to general content. Between subject matter specialists, science teachers most frequently report having a somewhat or very difficult time finding products for their specific needs. Multiple subject teachers have the least trouble finding software for their needs (Pedhazur & Schmelkin, 1991).

Part of the difficulty teachers have finding and using online courseware are that businesses producing WBI for schools must provide general, as opposed to specific, subject matter. For example, Aries produces a self-contained character education module meeting general national objectives, but does not market programs meeting specific state objectives.

Standards differ from state to state, although at times these differences are subtle. Companies find it expensive to create instruction for specific states (Sallis & Saelens, 2000). For example, one set of Virginia fifth grade health Standards of Learning state:

The student will analyze the risks of dependence and addiction associated with the use of alcohol, tobacco, inhalants, and other drugs on the systems of the body. Key concepts/skills include

a. The effects on the integrated functioning of the body systems;
b. The effects on academic performance;
c. The effects on relationships with family, peers, and other individuals.

(Sallis, 1991; Sallis et al., 1993a; Sallis & Saelens, 2000)

A similar set of West Virginia fifth grade health objectives state that students should be able to:

a. Explain the difference between illegal and legal drugs; examine short and long term physical and social effects of drug use on the body.

b. Explain the difference between over-the-counter drugs and prescription drugs; define "side-effect" and give examples; differentiate between drug misuse and abuse.

c. Examine the influence of peers, family and the media on the decision to be drug-free; identify the benefits of being drug-free; demonstrate peer pressure resistance to drug use.

d. Identify resources for substance using/abusing persons, their families and friends (e.g., AA, Al-Anon).

(Brustad, 1996; Erbe, 2000)

These objectives are similar, however would necessitate different instruction for fifth grade students in both states. The market is exclusive, necessitating curriculum designed for specific students in certain regions. Such online content meeting state and national academic standards is of limited quality and quantity (Chidolue, 1996; Erbe, 2000). Designing online courseware meeting individual state objectives is time consuming and not very profitable to secure private sector businesses interest. This is not unlike traditional textbook development. It may soon prove to be more cost effective using the WWW compared to paper media. To meet demand, some states are beginning to develop Web-based content for teachers.

Massachusetts, Washington State, New York, Oregon, Wisconsin, and New Jersey are discussing a collaboration to develop online portfolios for students as a way to individualize instruction. Students would log in to a website with their personal password to access assignments, content linked to specific learning objectives, and portfolios of completed work (Chidolue, 1996; Erbe, 2000). Considering the difficulty teachers generally have finding online courseware, there is plenty of evidence that teachers have been using the WWW for instruction, but most of the projects used have been designed and created by the teachers themselves.

Teachers do not have the time or expertise to develop instructional modules to use in the classroom. Much of the online content consists of data, Web pages, and other information that teachers use to supplement their teaching, as opposed to online units of instruction for children (Faucette et al., 1995; Sallis et al., 1999a; Sallis et al., 1999b).

Cummings (1995) suggests a number of barriers to using educational technology exist. One barrier is a legitimate reason for using computers, or as Cummings states, "What's in it for me?". Teachers are concerned with the amount of time spent learning and designing computer based or assisted instruction and question whether time spent learning how to use the new technology wouldn't be better used preparing lessons (Sallis & Saelens, 2000). Software that requires minimal teacher time to learn and implement in classes is critical if teachers are going actually use them with students.

Teachers frequently are not sure what instructional technology truly is and have a general misunderstanding of instructional design. Cummings recommends faculty development and exposure through seminars to get the word out, however this takes time and resources (Chidolue, 1996). Other barriers are a lack of resources and support (Gilmer & et al., 1996; Grunbaum & et al., 1995; Nash, 1998), which further reveal the importance of intuitive programming readily implemented into the classroom curriculum. In spite of these barriers to using technology, many teachers are using the Internet and WWW for instructional purposes. The next section of this literature review examines how teachers have used the Internet for instruction.

Teacher's use of the Internet for Instruction

As previously described, an abundance of educational software has been developed over the past few years, however only two percent of this software is on the World Wide Web. In 1998, 29 percent of teachers encouraged their students to use the WWW during lessons. The most common student use of computers was word processing (50%), followed by CD-ROM use (36%), the WWW, games and drills (28%), simulations (23%), graphics (21%), spreadsheets and database (16%), multimedia authoring (9%), and email (7%). Of teachers including use of the WWW in their lessons, those with faster connections (direct connection) more often engage their students in projects with the Internet (Sallis et al., 1997). There are a number of ways teachers use the Internet in the classroom, from email, including listserv subscription (Edmundson et al., 1996; Trost et al., 1997), the WWW for gathering information when preparing lessons (68%) (Sallis, 1991; Sallis et al., 1993a; Sallis & Saelens, 2000), and to find and retrieve lesson plans (Edmundson et al., 1996; Trost et al., 1997). Sixty eight percent of teachers in one survey stated they used the Internet to find information for their lessons, and one quarter of these indicated doing so weekly (Edmundson et al., 1996; Gordon-Larsen, McMurray, & Popkin, 2000; Pate et al., 1997; Sallis et al., 1999b; Trost et al., 1996; Trost et al., 1997; Trost et al., 1999). Becker

(1999) found that 68 percent of teachers surveyed use information from the Internet in lessons occasionally, weekly, or more often. Many of the lessons teachers are frequently developing and using are WWW based projects.

Online projects have been used in classrooms for motivating students and for creating more effective learning experiences. One example of a Web-based project was designed by a fifth grade teacher from Florida (Gordon-Larsen et al., 2000; Pate et al., 1997; Sallis et al., 1999b; Trost et al., 1996; Trost et al., 1997; Trost et al., 1999). While engaged in a unit on volcanoes, she asked her students what the largest volcano in the solar system is, and sent them to look for answers. The class used a variety of media, including a library card catalog, a CD-ROM version of Grolier's Encyclopedia, and the WWW to identify Olympus Mons, the largest volcano in the solar system. Math and geometry concepts were integrated until every student was able to calculate the size of Olympus Mons and compare it to the size of Florida (Edmundson et al., 1996; Sallis et al., 1997; Sallis et al., 1993b).

In another example, children at a school in New Jersey participated in a project called dream vacation. Classes were separated into five groups with each assigned a continent or region (Edmundson et al., 1996; Sallis et al., 1997; Sallis et al., 1993b). The groups were all given a budget and instructed to plan a trip to anywhere in that region. Their tasks included finding flights, places to stay, exchanging money, and identifying the sights they would see. Other information included weather, language, and customs. The final product was a "virtual tour" the students created to present to the class (Sallis & Saelens, 2000).

A similar project assumes a virtual field trip to the pyramids (Sallis et al., 1996). The primary goal of this project is for students to estimate how much it would cost to build a pyramid. Students use Web browsers, email, and search engines to find information. The sixth grade math students who participate learn about applying simple machines, integrating social studies lessons, as well as applying knowledge of triangles and area to estimate the cost of building a pyramid. Student’s submitted bids for building the pyramid based on their calculations of area and cost for the final project. Other projects rely on collaboration with teachers, students, and professionals.

A teacher in Pittsburgh, PA developed online course materials to use "information technologies to increase students' sense of global awareness and understanding" (Sallis, 1991; Sallis & Saelens, 2000). Students in Stone’s class collaborated with students from North

America, South America, Europe, Africa, the Middle East, Asia, and Australia to create informational Web pages about the cultures and people. All communication is conducted through school representatives using email.

Another project called Journey North encourages student collaboration with professionals. Scientists tracking eagles send raw data to the students in the class via email. The students then plot where each eagle is, and make an educated guess where it is going (Gortmaker et al., 1999a; Gortmaker et al., 1999b; McKenzie & et al., 1995; McKenzie et al., 1996; Sallis et al., 1997; Sallis et al., 1993b).

The Internet has been used for student information search, communication, and collaboration as well as posting student work. Robert Ballard, the discoverer of the resting place of Titanic, founded the Jason project. This project uses live feeds and telecommunications technologies so that students can see and talk with deep-sea divers, archaeologists, and other professionals. In January 2000, 750,000 children used Jason (Elliott, 1997). The commonality between these Web-based projects are that they are designed by teachers. As previously described, teachers are not compensated for the time and frequently do not have the skills to develop such modules. Some websites do exist that provide self-contained instruction readily implemented into the classroom.

Kinzie et. al. (1996) saw a need for learning about frog anatomy and dissection before or as an alternative to dissecting frogs in a biology class (Kinzie, Larsen, Burch, & Boker, 1996). The original program used videodiscs, which caused problems because many schools did not have the necessary hardware. Therefore, the Interactive Frog Dissection program was transformed into a Web-based program called Net-Frog. Net-Frog provides a dissection experience online with preserved and pithed color images depicting frog anatomy. QuickTime movies demonstrate dissection techniques and show information still photos could not, such as holding skin and making incisions (Gordon-Larsen et al., 2000; Trost et al., 1996; Trost et al., 1997). The site was extremely popular with an average of over 9,800 machine visits each month (Pate et al., 1997; Sallis et al., 1999b; Trost et al., 1999). There are companies that have been developing instruction for schools, such as Aries (www.aries.com).

Aries develops instruction primarily for higher education, although Aries has a character education module for K-12 children. Such services are expensive, and typically school districts must purchase licenses for teachers to use. The problem for teachers once again is cost vs.

convenience. The higher amount of time necessary to create WBI from free resources often makes purchasing self-contained courseware, such as that developed by Aries, more attractive. Purchasing courseware is more convenient, however can be expensive. Instead of spending time to develop Web quests, purchasing online courseware would allow time for planning other classroom activities. Funds are frequently unavailable for purchasing such services, in which case teachers must create or design a project themselves. Another tradeoff is the convenience of prepackaged materials vs. instruction created specifically for individual students and teachers needs. For teachers to use the WWW in the classroom, they need WBI modules that meet curriculum needs, available for free or minimal expense, and that they can implement with the least amount of time.

As schools obtain more reliable computers and Internet connections, and self-contained and supplemental WBI modules are created, the WWW provides a greater opportunity to share and disseminate these units to students around the World. However, empirical data regarding the effects these programs have on student learning are rare. Beyond descriptive survey data, little is known about the effects specific WBI modules have on student learning. This could be due to the relative youth of the Internet and WWW as well as the short shelf life of many studies. General knowledge about the Internet and learning is predominantly inconclusive, however research on media attributes and learning help explain the potential impact the Internet may have on learning.

Media Attribute Research and the WWW

Media has been defined as "a physical element within an environment that is capable of communicating messages" (Sherman, 1998). Research on the effectiveness of media and learning, such as television (Argenta, Stoneman, & Brody, 1986; Atkin, Greenberg, & Baldwin, 1991; Dorman, 1997), images (Rogers & Erickson, 1998), computers (Freitas & Ramos, 1998; Sammons, 1995; Walker & et al., 1994), audio (Dallett & Wilcox, 1968), and text (Kelly & O'Kelly, 1993; Mayer & Anderson, 1991; Mayer & Moreno, 1998; Mayer & Sims, 1994) have been conducted for years, often with no significant difference between media. Some researchers claim this can be explained by the fact that comparing media is not specific enough because many forms of media possess identical attributes (Clark, 1994; Clark & Salomon, 1986; Dillon & Gabbard, 1998; Levie & Dickie, 1973). In reviews of literature on media comparisons, Clark (1994a, 1994b), Clark and Salomon (1986), Dillon and Gabbard (1998), and Levie and Dickie (1973) have found that media comparison research repeatedly resulted in no significant

difference. In a review of studies involving human interaction and hypertext, Chen and Rada (1996, in Dillon & Gabbard, 1998) found that there was little "real advantage for hypertext over other media in general information tasks".

Media attribute research does help explain learning with media. "Media attributes are properties of stimulus materials which are manifest in the physical parameters of media. The attributes of that medium...are the capabilities of that medium (Levie & Dickie, 1973). For example, a television is capable of presenting audio, color, and motion to users, however contains no interactive properties other than changing the channel. Clark (1994) stated "when learning is influenced by external events, those events must support cognitive processes or structures that are required for learning goals by students who are unable or unwilling to provide them for themselves". The media attributes of the Web must support the necessary cognitive processes of students. Kozma (1994) has responded to this argument by saying in good design, media and methods depend on one another. "Media constrain and enable methods" (Kozma, 1994). However, there is no compelling evidence that media cause learning increases (Clark & Salomon, 1986; Levie & Dickie, 1973; Wager & Gagne, 1988), thus the argument is made that learning depends on good instructional design that includes the selection of media and the appropriate attributes of a medium (Clark, 1994; Clark & Salomon, 1986; Dillon & Gabbard, 1998; Levie & Dickie, 1973; Wager & Gagne, 1988).

The Web is capable of a variety of media attributes, including interactive multimedia capabilities, accessibility, and flexible learning contexts such as drill and practice, game, and simulation. Another important attribute possessed by the WWW is learner control (Barab, Bowdish, & Lawless, 1997; Becker & Dwyer, 1994; Crooks, Klein, Savenye, & Leader, 1998; Yang & Chin, 1996).

Older students, and those of higher ability, perform better under guided learner control, or where learners control the path, pace, and/or contingencies of the instruction (Hannafin, 1984). Learner control is not considered beneficial with younger children, or those of lower ability because these children do not make the best choices regarding path of instruction and become disoriented (Crooks et al., 1998; Hooper, Temiyakarn, & Williams, 1993; Yang & Chin, 1996). One way learners can have control on the Web is by being able to control the pace and ability level by providing menus from which students select information (Litchfield, 1993 in Stemler, 1997). Control of pacing is an important attribute of the Web.

Another feature of the Web is an interactive capability through which users can communicate with instructors, one another, and other online resources (Khan, 1997). Interaction is the major difference between traditional computer based instruction (CBI) and multimedia. Many conditions of interaction relate to learner control. As learners make decisions or act within the WBI environment, the environment provides feedback according to their actions. The capabilities, or attributes of the WWW make it a promising medium of instructional delivery. As online modules are created, it is important to understand how the instructional medium fits in with the design of instruction.

Instructional Design

According to Dick and Carey (1996), the medium of delivery is only one consideration when developing instructional strategies and selecting instructional materials. The WWW is capable of many desirable attributes for a variety of instructional outcomes, making it an attractive medium of delivery. Development of instructional materials is the seventh step in the systematic design of instruction (see Figure 1). For a thorough review of the systematic design of instruction, see Dick & Carey's Systematic Design of Instruction. Nine steps for designing instruction are briefly described with specific examples from *Healthy Hearts* in Table 2. One consideration with *Healthy Hearts* is that the primary learning outcome is a change in behavior.

Learning outcomes can be identified as psychomotor skills, intellectual skills, verbal information, or attitudes (Gagne et al., 1992). Designing instruction to change behavior means essentially designing instruction for attitudinal outcomes. Except for some conditions specific to attitudes, instructional designers design instruction for attitudinal outcomes in the same way instruction is designed for motor skills, verbal information, intellectual skills, and cognitive strategies.

One condition specific to attitudes is whether the instruction is intended to develop a new attitude or modify an existing attitude. When negative attitudes preexist, certain strategies are necessary to make the learner aware of their current attitudes. Instructional approaches for a mandatory safe driving course required of people with reckless driving records, for example, are different than instruction for teens taking their first drivers education course. Similarly, designing calculus instruction for students who are not familiar with algebra or geometry, or encouraging children to rollerblade through a park in a dangerous neighborhood is inappropriate.

Another important consideration for designing instruction for attitudes is that the "substance of instruction for attitude consists of teaching the behavior to be demonstrated by the learner" (Dick & Carey, 1996). Objectives must be observable, so attitudinal objectives must include the behaviors outlined in the task analysis. Each of the behaviors identified in the task analysis should be matched with learning objectives. For the instructional goal of identifying possible activities to engage in, an instructional objective could be "given a list of physical activities, students will add at least one or indicate at least one activity that is available to them after school".

Attitudinal outcomes differ from instruction in other learning domains because they will probably not be achieved at the end of instruction, i.e. encouraging someone to modify an attitude leading to a lifestyle change is a long process. To assess learned attitudes, test instruments must include items from each of the behavioral objectives listed whether they are verbal, motor, or intellectual skills. To assess whether a student has identified activities they can participate in after school, a list of activities for them to choose from can assess whether they have met the instructional objective in addition to correctly identifying other questions based on verbal information. Whether they choose to participate in these activities (which is the purpose of *Healthy Hearts*) would have to be assessed by asking questions about after school activities, however a short-term picture of effects of the module can be gained from changes in verbal knowledge.

One more factor worth mentioning is learner motivation. With learning attitudes, it is especially important to maintain learner interest in the instruction, often by keeping instruction relevant to the learner. Keller and Suzuki's (1988) ARCS (Attention, Relevance, Confidence, Satisfaction) model addresses learner motivation.

Keller and Suzuki (1988) suggest strategies for gaining the learners attention, making the instruction relevant to the learner, promoting confidence through success, and providing opportunities for learners to gain confidence from positive feedback and knowledge of accomplishment (Keller & Suzuki, 1988). Decisions regarding selection of the instructional medium take place in preinstructional activities, whereas Keller's ARCS is appropriate to consider throughout instructional strategy development. A frequently referenced instructional strategy was developed by Gagné and Wager (1988), who describe nine steps for designing instruction. These are gaining attention, informing the learner of objectives, stimulating recall of

prerequisite learning, presenting stimulus material, providing learning guidance, eliciting performance, providing feedback, assessing performance, and enhancing retention and transfer. Note that these nine steps are components within the development of the instruction and describe the lesson itself. The Dick & Carey model previously discussed provides an outline for the entire curriculum development, whereas the Gagne' and Wager's (1988) nine steps outline the lesson or instructional strategy, one component of the systematic design of instruction. A description of each of these steps is provided next beginning with gaining the learners attention.

Gaining attention.

The first step in designing instructional strategy is to gain the learners attention. Keller & Suzuki (1988) suggest gaining attention by offering novel, surprising, incongruous, or uncertain events in instruction. Other techniques include posing a question or problem to be solved to elicit curiosity or questions. *Healthy Hearts* displays student names, colorful and moving graphics, as well as displaying how many points students have earned to gain their attention. Keller (1987) also suggests using humorous introductions, playing devil's advocate, or showing a visual representation of an important object. It is important to alert the learner and gain their attention so that they are prepared for instruction.

Informing the learner of objectives.

The second step is to inform the learner of the specific knowledge, skill, or attitude they will learn from the instruction. The learner must be aware of the specific learning objective. On each section of *Healthy Hearts*, an overview of the content in following sections is offered to students. The effect of informing learners of performance objectives has been extensively studied with some conflicting results, but the majority of research supports informing learners of the instructional objectives (Bassoppo-Moyo, 1996).

Stimulating recall of prerequisite learning.

Learners must be stimulated to recall relevant prior learning. This is especially important with attitudes in that a point of reference is necessary in order for learners to recognize their current attitude towards an object or behavior. For example, in *Healthy* Hearts students report their physical activity and diet behaviors for the previous day, and are offered feedback based on these behaviors. Once students are aware of their attitudes and behaviors, they need to compare these with the new information.

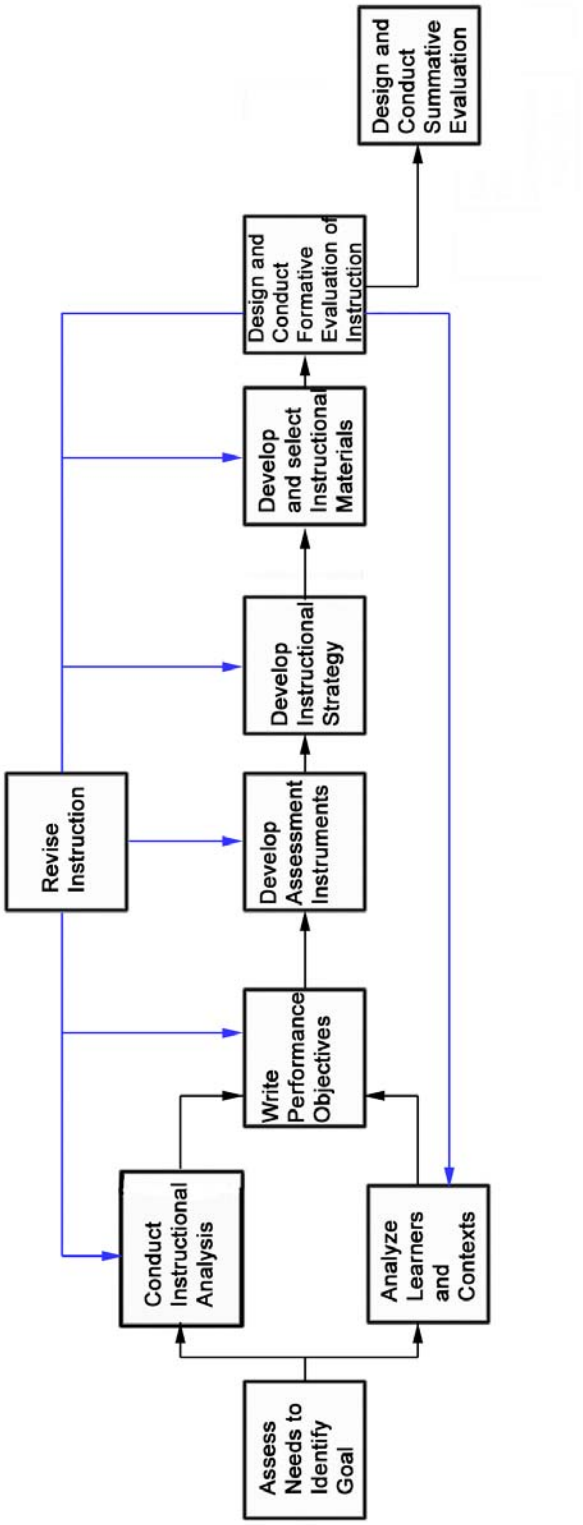

Figure 1. Dick & Carey's Systematic Design of Instruction from The Systematic Design of Instruction. (1996) New York: Longman.

Table 2

Components of the Systematic Design of Instruction, Description, and Related Example from Healthy Hearts

Component	Description	Healthy Hearts
Needs Assessment	Difference between current and desired behaviors.	Inactive children, increase physical activity to at least 60 minutes a day, minimum of 5 days a week.
Analyze Learners & Context	Information regarding learner knowledge and behavior related to need.	Health behaviors of fifth graders.
Instructional Analysis	Identify all of the skills and knowledge that should be included in the instruction	Choosing to be physically active, identifying physical activity, identify benefits of physical activity. See Appendix B
Write Performance Objectives	State specific skills, knowledge, or attitude a student will have following instruction	Identify the minimum recommendation for physical activity is 60 minutes a day.
Develop Assessment Instruments	Test instruments developed that include items corresponding with each of the behavioral objectives listed.	Self-report Weekly activity checklist
Develop Instructional Strategy	The arrangement of events to facilitate learning.	Drill and practice, anchored instruction.
Develop and Select Instructional Materials	Selection and development of instructional materials, such as texts, video, Web-based programs, tests, and instructor's manuals.	Web-based instruction
Design and Conduct Formative Evaluation of Instruction	Conducted throughout the design, development, and implementation of instruction with the intent of improving the instructional materials and process	Formative evaluation of *Healthy Hearts* (Elliott, 1997).
Design and Conduct Summative Evaluation of Instruction	Performed once instruction is completed, intended to pass judgment as to the effectiveness of the instruction.	Current summative evaluation of *Healthy Hearts* curriculum.

Presenting stimulus material.

The instruction must provide the learner with new information to compare with prior knowledge recalled in the retrieval stage. When students track their after school activity on paper or recall their activity by a 24-hour recall procedure such as the Self Administered Personal Activity Checklist (SAPAC) in *Healthy Hearts* (Sallis, 1991; Sallis et al., 1993a), an account of their behaviors and choices is recorded. Alternative choices, and the information as to why these are better choices, are presented to the learner. The next step is to provide the learner with guidance for making appropriate choices.

Providing learning guidance.

Teachers or experts must model desirable behavior and choices for guiding learners to select the desired attitude. It is important that when designing instruction for attitudes that desired behavior is modeled by an individual or character that the learner respects. Dick and Carey (1996) state that one of the most powerful methods for learning attitudes "is to observe a person we highly regard doing something for which they are rewarded or have received approval. It is then likely that we will tend to make the same choice when we are in a similar situation". For example, a video or image of Michael Jordan (if known by the learner) encouraging kids to play basketball after school would likely have a stronger effect on learners than someone unknown to them. The students will more likely change their behavior if someone whom they know or respect models the desired behavior.

Practice and feedback

Gagné and Briggs separate these two components of instruction, but they are included as one here because practice and feedback are used together to improve learning and performance. Gagné and Briggs describe practice eliciting performance as placing learners in an environment that they will make a choice or display the learned attitude. An important condition for attitudes is that practice must incorporate opportunities for the student to choose the appropriate behavior, followed by consistent feedback to help ensure that a specific behavior is associated with a specific response (Dick & Carey, 1996). Feedback is reinforcement of desirable or undesirable behaviors. Graham (1992) categorizes feedback as specific or general, congruent or incongruent, and positive, neutral, or negative. Specific feedback is information for the learner regarding what they need to practice whereas general feedback would be a general statement such as "nice job"

(Graham, 1992). Congruent feedback contains the specific learning cue whereas incongruent feedback was not contained in the informational cue of the instructional objective. Finally, positive feedback is informing the student of something they do correctly, negative feedback informs the learner of what they are doing wrong, and neutral is a statement that is neither right or wrong (Graham, 1992). It is important to provide feedback and reinforcement when learners elicit a desired or undesirable behavior. Practice and feedback are considered the two most important components for learning (Schmidt, 1991). Following adequate practice and feedback it is necessary to assess performance.

Assessing performance.

As described earlier in this chapter, it is necessary to assess whether an attitude is learned and learning is based on the instructional objectives. This is the point of instruction that the assessment instrument developed is administered to the students. As previously discussed, assessment is based on achievement of instructional objectives such as verbal information, as well as assessing behavior.

Enhancing retention and transfer.

The final component listed by Gagné is to provide opportunities for generalizing the learned attitude to new situations. This is especially important with attitudes. Although during instruction many realistic practice opportunities with new skills are provided, students will always be presented with new scenarios unforeseen by instructional designers when outside of the classroom. A variety of realistic practice opportunities for demonstrating the learned behavior are critical for retention of the learned behaviors and attitudes. One step in addition to those described by Gagné is to provide learners with the opportunity to continue instruction.

Opportunity for follow-through.

Dick and Carey (1996) suggest that follow-through instruction is necessary for attitudinal instruction because attitudes are long-term goals. Follow-through instruction is for those students who have not yet learned the desired attitude. Providing additional opportunity for practice, feedback, and support will further enhance opportunities for success. It is often difficult to maintain contact with students following instruction, but nevertheless doing so is an important aspect of designing instruction for attitudinal outcomes. As previously discussed, one attribute of

the WWW is accessibility, regardless of time and location. This attribute makes the WWW a potentially effective instructional medium.

Using the WWW does not cause learning, however many of the attributes of the WWW such as accessibility, display characteristics, and interactivity, are conducive to instruction meeting many of the specific needs related to attitudinal learning outcomes. The systematic design of instruction includes development of assessment instruments for learning outcomes. Although summative evaluation is the final step in the systematic design of instruction, true assessment is a cycle of continuous design, development, evaluation, and redesign. One component of the process is the selection of instructional medium such as the WWW. Computers and the WWW are hailed as effective tools for instruction. Significant funding and resources are being employed to develop instruction with these media. As more resources are directed for computers and the WWW as instructional media in schools, funding sources, including the general public are asking what effects computers have on schools, children, and learning. Media attribute research is important to consider as researchers inquire about the effects computers and the WWW have on education. Nonetheless, the impact computers have on schools is gaining much attention and must fit within an overall phase shift in education.

The U.S. Secretary of Education Richard Riley recently described a shift in schools' technology focus from building and implementing technology to evaluating the effectiveness of use in schools (McNabb et al., 1999). One issue discussed is an understanding that "the effectiveness of technology is embedded in the effectiveness of other school improvement efforts" (McNabb et al., 1999). Similar to what we know from media attribute research, there are many variables influencing children learning, let alone those affecting changes in the school environment. Identifying "technology's" role as predictor of change is unreasonable. However, it is important to take both a broad approach to evaluating schools, including organizational level study, as well micro effects by summatively evaluating curricula based on instructional objectives.

In looking at the broad picture of effects computers are having on schools, you can hear arguments that too much is being invested in computers when teachers have other needs. As an emphasis is placed on computers, hiring technology coordinators, and paying for access to the Internet, other teaching positions and buildings are in jeopardy of not being funded. One emerging concern about the effects of computer use on children is the inverse relationship with

physical activity levels. The following section examines research on physical activity levels and media use, as well as other correlates of physical activity in children.

Correlates of Physical Activity in Children

A wealth of research exists regarding correlates of physical activity in children, including gender, parental influence, age, perceived barriers, and perceived skill (Sallis et al., 1999a; Sallis et al., 1999b; Trost et al., 1996; Trost et al., 1997). Determinants of physical activity can be labeled as biological, social, and environmental. Biological determinants include gender and age. Social factors are variables such as peer and parental modeling of physical activity and environmental factors include time spent outdoors, computer use and television watching. Discusses determinants of physical activity beginning with environmental determinants.

Environmental Determinants of Physical Activity

Environmental determinants of physical activity include those variables, both fixed and modifiable, within the immediate environment of an individual. As previously discussed, much discourse regarding inverse relationships between environmental variables such as television viewing and computer game playing has emerged over the past decade.

Although little research directly comparing WWW use and physical activity exists, a broad picture can be drawn if television viewing is included as a means to analyze relationship between sedentary behaviors and physical activity. A number of studies have shown a negative relationship between television watching and computer game use with physical activity levels of children (Dorman, 1997; Gordon-Larsen et al., 2000; Pate et al., 1997; Robinson et al., 1993; Trost et al., 1999). In one such study, Trost et. al. (1999) used accelerometers to measure physical activity in sixth graders and a questionnaire to assess social and environmental determinants including television viewing and computer use resulting in an inverse relationship between computer use and physical activity. In a study including computer use and television viewing as independent variables, Pate (1997) also found a significant relationship between such sedentary pursuits and physical activity levels.

Many children spend a great deal of time watching television. In one study, seventy seven percent of 5th and 6th grade students averaged 2-3 hours of television watching a day (Walton et al., 1999). In a study of 971 middle school girls, Robinson et. al. (1993) examined relationships between television viewing, obesity, and physical activity. They found a negative correlation,

albeit weak, between television viewing time and physical activity in participants (Robinson et al., 1993). Television viewing time has been targeted by some researchers as a means to reduce sedentary activity and increase physical activity (Gortmaker et al., 1999a; Gortmaker et al., 1999b).

In one study, Gortmaker et. al (1999) successfully reduced television viewing time, but there was no change in physical activity levels of children. Many other environmental factors also influence physical activity levels. Trost (1996) found that boys were significantly more active than girls, although boys reported significantly more television watching than girls (Trost et al., 1996), which seemingly contradicts the theory that television and activity are inversely related. Other studies have not shown video games have a long-term effect on leisure activities (Dorman, 1997). Many of these studies have included other environmental variables such as access to facilities and equipment.

Children with access to more physical activity equipment at home are more active (Pate et al., 1997). In fact, children with access to community recreation, organized sports, and facilities are more active than those not involved in such programs (Trost et al., 1999). Access to facilities and time spent outdoors consistently correlate with physical activity (Sallis et al., 1999b). In addition to access to facilities, social determinants such as parental modeling of physical activities is related to children's physical activity levels.

Social Determinants of Physical Activity

Social determinants are those that relate to a child's interaction with other people such as peers, teachers, and parents. Research has shown that parents are a significant influence on children's physical activity levels. In a study with 81 boys and girls between 11 and 15 years old, Kimiecik (1996) found that children's beliefs and attitudes towards moderate to vigorous physical activity (MVPA) are related to levels of MVPA. Kimiecik (1996) also found that children's beliefs are related to the children's perceived parent value of MVPA and perceived parental levels of MVPA. Results indicated that parent's modeling physically active lifestyles more accurately predict children's involvement in MVPA although the child's perception of parental beliefs do not predict child MVPA (Kimiecik et al., 1996).

In a similar study, Brustad (1996) investigated social factors such as the relationship between parent encouragement and activity levels with biological factors with children's perceived value of sport involvement and perceived competence. The results indicated attraction

to physical activity and perceived competence for both boys and girls was strongly related to parental encouragement and modeling behavior (Brustad, 1996). In addition to encouraging physical activity, parents modeling active lifestyles predicted their children's attraction to physical activity and to a lesser extent perceived competence. Biddle and Goudas (1996) found similar results when studying adult encouragement, self-perceived competency, and task- and ego- orientations with children (4-5 grade). Adults who actively encouraged kids had a positive influence on children's activity levels (Biddle & Goudas, 1996). Peers have also influenced physical activity levels, but not to the extent of parental modeling and encouragement.

Trost et. al (1997) found that peer influence significantly correlated with physical activity levels. Many of the studies linking peer influence to physical activity levels also showed relationships between biological factors such as perceived skill, liking of skills, and self-efficacy (Biddle & Goudas, 1996; Brustad, 1996; Pate et al., 1997; Trost et al., 1997; Trost et al., 1999).

Biological Determinants of Physical Activity

Biological determinants include fixed factors such as gender and ethnicity, but can also be modifiable in the case of self-efficacy and perceived skill. Physical activity self-efficacy has proven to be a consistent predictor of physical activity (Pate et al., 1997; Trost et al., 1996; Trost et al., 1997; Walton et al., 1999). Gender has also consistently correlated with physical activity levels of adolescents, revealing boys are more active than girls (Pate et al., 1997; Trost et al., 1996; Trost et al., 1997; Walton et al., 1999), even in active adolescents. With students classified as vigorously active, significant differences in gender exist (Pate et al., 1997). However, these differences are inconsistent in pre-adolescents.

Faucette et. al. (1995) surveyed over 1200 fourth grade boys and girls from southern California about their out of school physical activity level and choices. Data was collected for weekday, weekend, and summer activities with a one-day physical activity checklist. Boys tended to participate in more vigorous physical activities including more team sports whereas girls more frequently participated in individual activities such as gymnastics and rope jumping. There were no significant differences by gender in weekend activities such as walking, running/jogging, and bicycling (Faucette et al., 1995). There have been mixed results when examining gender differences of fifth grade children, and we can conclude that many other factors at this age have an affect than gender alone (Pate et al., 1997; Trost et al., 1996; Trost et

al., 1997; Walton et al., 1999). Other variables related to physical activity in children that have emerged are perceived skill, perceived ability, self-efficacy, and enjoyment of activities.

In a study regarding determinants of physical activity in fifth grade children, Trost et. al. (1997) surveyed 202 fifth grade children and administered physical activity questionnaires. The questionnaire measured self-efficacy among other factors. They found that for boys, beliefs regarding physical activity outcomes and self-efficacy significantly correlated with vigorous physical activity. For girls, self-efficacy in overcoming barriers correlated with vigorous physical activity (Trost et al., 1997). This is an important consideration as interventions are developed, indicating that improvements in knowledge about the benefits of physical activity might help influence physical activity levels.

Sallis, Prochaska, & Taylor (1999) recently conducted a comprehensive review of research regarding correlates of physical activity in children. In adolescents, perceived benefits of physical activity had mixed results. In a study examining gender and developmental differences in beliefs and behaviors of 286 racially diverse fifth, sixth, and eighth grade students, Garcia et. al. (1995) found that children's perceived benefits and barriers to exercise were possibly a significant indicator of exercise adherence in adolescents (Garcia et al., 1995). The most common negative correlate in children was perceived barriers, which is a combination of biological and environmental factors. Sallis, Prochaska, & Taylor (1999) also confirmed that intention to be active and preference for physical activity were consistently positively correlated with physical activity levels.

Kimiecik (1996) states, "an array of biological, developmental, social, and psychological factors is likely to shape participatory interest and involvement" in children's physical activity. Multiple variables relate to physical activity in children, including environmental factors such as television and computer use, social variables such as peer and parental modeling of physical activity, and biological such as gender and age. Although many of the determinants of physical activity are debatable, the importance of a physically active lifestyle is undisputed.

Benefits of Physical Activity

The relationship between physical activity, health, and mortality in adults has been extensively studied (Blair, 1993; Blair & Connelly, 1996; Dunn et al., 1998b; Haskell, 1994; Pratt, 1999). Low to moderate intensity exercise is associated with lowered incidence of coronary artery disease (Karvonen, 1996) and other clinical variables such as reduced blood

pressure, cholesterol, and overweight (Blair & Connelly, 1996). The 1996 Surgeon General's Report on Physical Activity states that regular physical activity reduces the risk of dying prematurely, dying from heart disease, developing diabetes, and developing high blood pressure. Regular moderate physical activity also helps reduce blood pressure in people who already have high blood pressure, reduces the risk of developing colon cancer, reduces feelings of depression and anxiety, helps control weight, helps build and maintain healthy bones, muscles, and joints, helps older adults become stronger and better able to move about without falling, and promotes psychological well-being.

Active kids enjoy many benefits of health related fitness (Sallis et al., 1993b). In 1994, a special issue of Pediatric Exercise Science was devoted to amounts and benefits of physical activity in children (Sallis & Patrick, 1994). Benefits include increased bone mineral content (Bailey & Martin, 1994), obesity (Bar-Or & Baranowski, 1994), psychological variables (Calfas & Taylor, 1994), and blood pressure in extreme cases (Alpert & Wilmore, 1994). In children benefits specifically include helping control body fatness, improving skill thus improving ability and potential adherence to exercise, as well as improved self-image (Corbin & Pangrazi, 1998). The benefits of activity are generally uncontested, however, in1996 the debate shifted from general benefits of activity to address the amount of activity necessary to gain benefits from physical activity.

Physical Activity Recommendations

The recommendations released by the American College of Sports Medicine (ACSM) in 1978 provide a framework for improving physical fitness based on improved maximum oxygen uptake. These guidelines recommended three days of exercise a week for 30 minutes each session exercising at 60%-90% of maximum heart rate. However, the Surgeon General and other researchers have shown that in order to gain health benefits such as reduced obesity, improved blood pressure, and reduced risk of cardiovascular disease, more frequent lower intensity exercise may result in significant improved health. In a review of research on amount and intensities of physical activity, Blair and Connelly (1996) found that the traditional dichotomous view of a threshold of activity necessary for health is misleading. Blair and Connelly state "there is a continuous dose-response gradient of outcome variables across a wide range of activity and fitness levels". Instead of the traditional three-day/week exercise regimen of continuous high intensity physical activity, moderate amounts and intensities of physical activity are associated

with improved health. This position was the basis for the 1996 Surgeon General's report on Physical Activity.

The Surgeon General applied research on the association of health and moderate to vigorous physical activity in the 1996 report on physical activity by recommending adults accumulate a minimum of 30 minutes of moderate to vigorous physical activity at least five, preferably seven days of the week (USDHHS, 1996). It is important to note that this prescription represents recommendation of exercise for health benefits, not weight reduction or physical fitness. More recently, Corbin and Pangrazzi (1998) compiled specific guidelines for children based on the fact that children have different needs than adults and are inherently more active. The current recommendation for physical activity in children is to engage in sixty minutes of moderate to vigorous physical activity most days of the week with at least ten to fifteen minutes of sustained exercise daily (Corbin & Pangrazi, 1998). As part of these guidelines, it is also recommended to concentrate on lifestyle activities in children as opposed to structured exercise plans (Corbin & Pangrazi, 1998). Although perceived benefits of physical activity as well as attitudes such as intention to be physically active are associated with physical activity behavior, interventions most frequently address environmental factors.

Physical Activity Interventions

Among projects attempting to increase physical activity, the most commonly addressed factors are environmental. One intervention directed towards adults with significant implications for influencing physical activity levels was entitled Project Active. This study was a randomized trial comparing a structured exercise program with a lifestyle physical activity program in 235 healthy 35-65 year old adults (Dunn, Andersen, & Jakicic, 1998a; Dunn et al., 1998b; Dunn et al., 1997; Dunn et al., 1999). Structured exercise followed the recommendations of the American College of Sports Medicine as previously described while lifestyle physical activity encouraged the integration of more physical activity throughout the day by increasing short bouts of exercise such as walking. The primary outcome for this study was total energy expenditure estimated by self-reported physical activity (Dunn et al., 1998b). Initial results showed significant gains in the amount of physical activity for both structured and lifestyle groups (Dunn et al., 1998b). Findings indicated that after six months, the lifestyle physical activity intervention was as effective as the structured physical activity intervention for increasing energy expenditure (Dunn

et al., 1998b; Dunn et al., 1997; Dunn et al., 1999). Another program from Southern California addressed physical activity levels in children by providing further opportunities for activity.

The Sport, Play, and Active Recreation for Kids (SPARK) project provided curriculum and staff development opportunities in physical education primarily focusing on increasing kids MVPA. SPARK attempted to influence kids physical activity both in and out of school. Significant effects resulted during school with specialists and teachers who had participated in the training providing more opportunity for physical activity. However, outside of school physical activity had no significant differences between control and experimental groups (Sallis et al., 1997). In regards to children learning skills in the hopes that they would more regularly engage in physical activity, McKenzie et. al. (1998) compared throwing, catching, and kicking skills of over 700 fourth and fifth grade children who participated in SPARK. They found significant effects for throwing and catching suggesting the SPARK training and curriculum might improve children's manipulative skills (Mckenzie, Alcaraz, & Sallis, 1998). SPARK researchers also attempted to determine what students enjoyed during physical education class.

Fourth and fifth grade students (N = 242) from southern California were provided physical education class rating forms following physical education class. Questions addressed whether students liked/disliked the days activities and additional data was collected from teachers regarding what was taught in class during that day. All participants were part of the larger SPARK project. Over eight months, students seemed to have a "stable liking" of activities that did not change much during the study. Students seemed to like activities and these attitudes did not change much over time even with the addition of more lessons. Students showed significant liking for units such as parachute and softball while jogging/running and teacher led exercise seemed to show the least favor among children (Mckenzie et al., 1994). Yet another physical activity intervention approached cardiovascular health as a comprehensive school health program.

The Child and Adolescent Trial for Cardiovascular Health (CATCH) was arguably the largest randomized controlled school health education interventions ever conducted with more than 5,000 students from 96 schools in four states (Resnicow et al., 1996). CATCH was a 3-year multicenter randomized trial to test the effectiveness of a cardiovascular health promotion program for third to fifth grade students. The program included physical education, classroom curriculum, and school food services intervention. The primary goals of CATCH were to reduce

total fat, saturated fat, and sodium content of food served in school cafeterias, modify food intake behavior in children, and increase the amount of fitness time during physical education (Perry et al., 1990; Resnicow et al., 1996).

To measure effects of CATCH on physical activity, researchers observed physical education classes and also collected self-reported time engaged in moderate to vigorous physical activity (MVPA). Results of the CATCH study has revealed significant changes in the amount of MVPA during physical education and also total amount of MVPA in participants (Luepker et al., 1996; McKenzie et al., 1996). Researchers observed third graders' physical activity levels and associated variables in physical education classes in four Child and Adolescent Trial for Cardiovascular Health centers nationwide. Results found significant differences among centers for physical activity and lesson context variables and that during free play, boys were more active than girls (McKenzie & et al., 1995). In a three-year follow up study with 73% of the initial CATCH cohort, intervention students maintained significantly higher reported daily MVPA although the differences between the control group declined (Nader et al., 1999). CATCH is considered a coordinated school health program.

Physical education and physical activity have been described as one part of the comprehensive school health program. In 1997, the Centers for Disease Control and Health Promotion published guidelines for a comprehensive school health program.

Recommendations for School Health Programs

The National Center for Disease Control acknowledged the importance of physical activity for children and published guidelines for schools to promote physical activity (National Center for Chronic Disease Prevention and Health Promotion (CDC), 1997). These guidelines encompass school, community, and family recommendations and include areas such as policy promoting enjoyable lifelong physical activity, physical education, health education, parental involvement, and community programs. The CDC recommends implementing comprehensive school health programs that involve parents, communities, media, and schools to reach the Healthy People 2010 objectives (USDHHS, 2000; Kann et al., 1995; MMWR, 1997; Neumark-Sztainer & Story, 1997). "The school setting, ranging from preschool to university, is an important avenue to reach the entire population and specifically to educate children and youth" (Kolbe & et al., 1995).

The comprehensive school health program outlined by the CDC consists of eight interactive components: school counseling and social services, the psychosocial and biophysical school environment, food service, health services, faculty and staff health promotion, health education, physical education, and integrated efforts of schools, families, and communities to improve the health of students and staff (Kolbe & et al., 1995). Including these components in the school environment is important because classroom instruction alone is not enough to effect lasting changes in students' behaviors (MMWR, 1997). It is important to note that schools have more influence on the lives of youth than any other social institution except the family. Schools provide a setting in which friendship networks develop, socialization occurs, and norms that govern behavior are developed and reinforced" (USDHHS, 2000). With this in mind, extending physical activity interventions to cover biological factors such as knowledge and attitudes into regular classroom activities may provide further opportunities to influence children's physical activity behavior. As instruction is developed for physical activity knowledge and attitudes, assessing these outcomes becomes more important.

The results of Project Active, CATCH, and SPARK show that addressing environmental factors can improve levels of physical activity. However, such projects are expensive, time consuming, and difficult to implement outside of school. Individual components of the comprehensive school health program, including classroom curriculum, should be further explored as means of changing biological and social variables in addition to environmental determinants of physical activity to encourage out of school physical activity. High rates of television, and recently computer game and Internet use indicate a need to address sedentary behaviors. The WWW is a potentially effective means to deliver instruction during school, particularly when instruction is systematically designed beginning with a needs assessment, using appropriate attributes, and packaged as a self-contained intuitive instruction package that teachers can implement with little training.

It is important for educators to focus on out of school physical activity because teachers have limited time during school to modify the environment to increase activity. It is worth looking in to other means of influencing behavior outside of school, such as perceived barriers, perceived benefits, and peer modeling of physical activity. In order to change behavior such as increasing participation in physical activity, attitudes must be addressed so children choose to participate in physical activity over sedentary or other pursuits. As previously described in this

chapter, designing instruction for attitudes is very similar to designing instruction for psychomotor or cognitive skills. However, evaluating learned attitudes, such as changes in physical activity behavior, is not necessarily easy to do.

Evaluating Health Behavior Curricula

Attitudinal outcomes are difficult to measure in the short-term because they are typically achieved over a long period of time. Attitudes are typically measured by observing behaviors, or in other words, by having someone do something (Dick & Carey, 1996). Therefore, instructional designers develop performance objectives that list measurable and observable behaviors indicative of whether an attitude is learned. Attitudinal outcomes such as those described in the previous section are considered performance outcomes, which are general descriptions of the desired learning outcome following instruction. Performance or learning objectives are descriptions that include the specific desired behavior, the condition under which this behavior will be observed, and a standard or criterion for evaluating the degree to which the attitude has been learned (Sherman, 1998).

Attitudinal learning objectives are those that influence a learner to "choose, under certain circumstances, to perform an intellectual skill, psychomotor skill, or to state certain verbal information" (Dick & Carey, 1996) (p. 36). After describing a specific attitude, instructional designers must identify observable behaviors indicative of the learned attitude, used as a means of determining whether the attitude is learned. Writing performance objectives is discussed in greater detail earlier in this chapter. In their review of research on attitudes in physical education, Silverman and Subramaniam (1999) state that both qualitative and quantitative methods are used to assess attitudes.

Evaluation begins with the development of a reliable and valid instrument (Howell, 1997; Silverman & Subramaniam, 1999; Simonson & Maushak, 1996). Simonson (1996) recommends following six steps for measuring attitudes. The first step is to identify the construct to be measured. A construct is a mental abstraction, something that cannot be directly measured such as attitudes toward participating in physical activity after school. Once the construct is identified, the designer must either find an existing measure of the construct or create a measure. Silverman and Subramaniam (1999) distinguish between content-, criterion-, and construct-related validity. Construct validity is the degree to which tests measure an attribute it is designed to measure, while content validity refers to whether the instrument measures the intended content. Validity is

typically improved by having experts examine test items and empirically evaluating the existence of the intended constructs. Test items are frequently created directly from instructional objectives.

Simonson (1996) provides a good summary of the attitude/achievement literature. He summarizes that behavior is determined by intention to engage in the behavior which in turn is determined by attitude toward the behavior. Attitude is determined by behavioral beliefs and likely outcomes, which are determined by the beliefs and motivation of the individual to comply with the relevant action (Simonson & Maushak, 1996). Studies have shown that when an individual perceives behavioral control, attitudes are reliable predictors of behavior (Ajzen, 1991). Finally, it is understood that general behaviors can be used to imply general attitudes whereas specific behaviors are better indicators of specific learned attitudes (Simonson & Maushak, 1996). Instructional designers identify specific behavioral measures as part of designing instruction for attitudinal outcomes. One example taken from the literature reviewed in this chapter is the attitude towards physical activity, shown in the choice to choose sedentary pursuits such as playing computer games as opposed to physical activity. Assessing attitude by measuring physical activity behavior has proven to be difficult.

Assessing physical activity in children

Accurately measuring physical activity in children has been difficult. The most commonly used measures of physical activity are self-reports, interview administered recalls, and activity diaries. Self-reports are popular because of their convenience. They are cost effective, and have been shown reliable for children as young as fifth grade (Sallis, 1991). Many studies have been conducted to validate questionnaires assessing children's physical activity (Harro, 1997; Sallis, 1991; Sallis et al., 1993a; Sallis et al., 1996) and have been used in other studies to track children's physical activity (Bell, 1997). Sallis et. al. (1996) compared interview and self-administered physical activity checklists (SAPAC) with fifth grade students and found self-administered physical activity correlated with scores from an accelerometer (motion sensor).

SAPAC is a one-day physical activity questionnaire that has been validated by comparison with heart rate monitors and accelerometers for use with 5th grade children (Sallis et al., 1996). SAPAC provides a list of 21 activities that children use to self-report how long they participated in any given activity. Fifth graders also indicate the intensity level for the particular activity. Fourth and fifth grade children's measurement of time is unreliable, however relative

time reported by students is reliable (Sallis et al., 1993a; Sallis et al., 1996) for self-reports. To compensate for unreliable time estimates by fifth grade children, Bell (1997) recommended providing smaller increments of time from which students choose. Secondly, differentiation between before, after, and during school physical activity has further reduced reliability of fifth grade student's answers. An instrument similar to SAPAC that has been reliably used to measure activity over a longer period of time is the Weekly Activity Checklist.

The WAC instrument used to assess physical activity behavior was also used in the SPARK project. Similar to SAPAC, WAC uses a 21-item checklist with activities grouped according to low, moderate, and high metabolic intensity value. Instead of relying on children to estimate specific amounts of time spent in activity, any activity on a particular day that was engaged in for more than 15 minutes is marked with an "X". To avoid problems with estimating time spent being physical active during school, the WAC only records outside of school physical activity behavior. A recent issue of Research Quarterly for Exercise and Sport was devoted to assessing physical activity in children with self-reports (Sallis & Saelens, 2000). The WAC used in SPARK was validated with Caltrac accelerometers (.30) and is considered a valid and reliable estimate of weekly moderate to vigorous physical activity MVPA). Self-reports are frequently used because the cost to benefit is high and results are fairly reliable.

Recommendations from CATCH are that there is a need for continued development of integrated school health education programs (Resnicow et al., 1996) and that the decline in fifth grade measures implies a need for programs for adolescents (Edmundson et al., 1996). These programs have shown addressing environmental variables are an effective means to influencing physical activity. Other factors, such as intention to be physically active have proven to be consistent indicators of physical activity in children and adults (Biddle & Goudas, 1996; Gordon-Larsen et al., 2000; Sallis et al., 1999b). Sallis et. al. (1999a) stated that of the many variables studied in 54 published papers on physical activity correlates in children, biological determinants such as intention to be physically active and knowledge of benefits correlate with physical activity behavior.

These environmental interventions have successfully increased physical activity in children during school, however modifying outside of school physical activity continues to elude researchers. Classroom based interventions for improving physical activity levels have been unsuccessful (Gortmaker et al., 1999a; Gortmaker et al., 1999b). There is a need for

interventions addressing outside of school physical activity, however the high cost of modifying environmental factors out of school make this a daunting task. Considering other determinants of physical activity in children such as perceived benefits and barriers, classroom curricula could influence health decisions of children. The WWW is capable of providing follow-up contact with children, as well as offering many other capabilities desirable for delivering instruction. *Healthy Hearts* was developed as a self-contained WBI module that takes advantage of media attributes of the Web to deliver a health intervention for fifth grade children.

Healthy Hearts

Healthy Hearts (Elliott, 1997) was designed for teachers to implement in the classroom with minimal training. In addition to meeting teachers' classroom needs for using the Internet, *Healthy Hearts* addresses risk factors associated with cardiovascular disease. One significant risk factor for cardiovascular disease is inadequate physical activity, and as described in chapter 1 an alarming proportion of American children exhibit sedentary lifestyles in spite of the well documented benefits of physical activity on health. *Healthy Hearts* was designed to improve fifth grade children's health related behavior by addressing biological determinants of physical activity such as intention to be physically active and knowledge about the benefits of physical activity. With *Healthy Hearts*, we hope to use the computer to encourage children to move away from the computer.

At this time, there has been no study regarding summative effects the *Healthy Hearts* curriculum has on fifth grade children's knowledge, attitudes and behavior. The curriculum was designed to meet specific objectives. Elliott (1997) designed, developed, and conducted a formative evaluation of *Healthy Hearts* with two Virginia fifth grade classrooms. Results of this evaluation indicated that the WWW could be used to deliver a health curriculum. Based on the results of the formative evaluation and subsequent recommendations by Elliott, *Healthy Hearts* was redesigned and implemented in schools throughout West Virginia. The purpose of this study is to evaluate the effects *Healthy Hearts* has on fifth grade children. This study is a summative curriculum evaluation, based on student achievement regarding specific *Healthy Hearts* outcomes.

Summary

Developing effective physical activity and health interventions as part of the regular classroom curriculum reinforcing physical education and encouraging lifestyle physical activity are key components of a comprehensive school health program. Furthermore, widespread dissemination of these programs is needed (Sallis & McKenzie, 1991). "It is possible that lifestyle interventions could be integrated and delivered by new technologies such as interactive computer-mediated programs, telephone, or computer Web-based formats" (Dunn et al., 1999). The presence of computer technologies and the WWW in classrooms is becoming more prevalent and the need for self-contained WBI modules for teachers to readily implement as part of the curriculum is clear. *Healthy Hearts* promotes increased physical activity by presenting information regarding the health benefits of physical activity and the recommended amount of physical activity in hopes of improving fifth grade children's intention to be physically active and related levels of physical activity.

The Council for Physical Education for Children (COPEC) recommends that children should be physically active a minimum of five days a week for at least sixty minutes each day (Corbin & Pangrazi, 1998). Furthermore, many factors influence children's physical activity levels, including perceived benefits of physical activity (Gordon-Larsen et al., 2000). The National Center for Chronic Disease Prevention and Health Promotion and the Centers for Disease Control CDC recommend that a major contribution of health education is to promote health related knowledge, attitudes, and behaviors and develop the knowledge, attitudes, and behavioral skills needed to "establish and maintain a physically active lifestyle". Health education curricula must address basic health concepts, that for fifth grade children include explaining relationships between positive health behaviors and the prevention of injury, illness, disease, and premature death (AAHE, 1995; National Center for Chronic Disease Prevention and Health Promotion, 1997).

The objectives addressed in *Healthy Hearts* are in line with National guidelines and standards for fifth grade children (AAHE, 1995; National Center for Chronic Disease Prevention and Health Promotion, 1997), and address physical activity levels by improving attitudes and knowledge. No physical activity intervention directed towards fifth grade children as part of the classroom curriculum has been reported on, and to date, no research has been published about any physical activity interventions that are delivered over the Internet. Since the duration of the

Healthy Hearts WBI unit is short term and changes in behavior may not result, it is necessary to measure intention to be physically active and related physical activity knowledge in order to determine the impact *Healthy Hearts* has on fifth grade children's knowledge, attitudes, and behavior. The following chapter describes the methodology for evaluating the summative effects of *Healthy Hearts* on fifth grade children's knowledge, attitudes, and behavior.

CHAPTER 3
METHODOLOGY

The purpose of this study was to summatively evaluate the impact the Web-based instructional module *Healthy Hearts* has on fifth grade children's physical activity knowledge, attitudes, and behavior. *Healthy Hearts* is an instructional unit delivered via the Internet that addresses healthy lifestyle choices in fifth grade children regarding physical activity, nutrition, tobacco, and cardiovascular function (see Appendix C). A repeated measures design was used to measure changes in physical activity attitude and behavior.

Participants and Setting

In January 2001, principals (n=136) from thirteen West Virginia counties were contacted about implementing *Healthy Hearts* in their fifth grade teachers' classes. Seven of the twelve counties were those participating in the Coronary Artery Risk Detection in Appalachian Communities (CARDIAC) project during the 2000-2001 academic year. CARDIAC is a project developed by Dr. William Neal, a pediatric cardiologist from West Virginia University School of Medicine. CARDIAC is a comprehensive cholesterol screening to identify fifth grade children and their parents who are at risk of high blood cholesterol. *Healthy Hearts* was implemented as an intervention in conjunction with CARDIAC. Principals from the remaining six counties were contacted because of their proximity to the primary *Healthy Hearts* designer and developer.

Letters were sent to the principals from 136 schools with fifth grade classes in the thirteen target counties (see Appendix A). Follow-up phone calls were made to all schools. During phone calls, principals were asked whether their schools had the necessary computer hardware and Internet connection, and whether any fifth grade teachers would be interested in using *Healthy Hearts*. Teachers from twenty schools initially showed interest. After further communication via phone with interested principals and teachers, nine schools decided not to participate. Teachers who did not participate cited a number of reasons, including inadequate computers and Internet connection at the schools, not wanting to spend two hours each week working with *Healthy Hearts*, no access to a computer lab twice a week, and needing available time to prepare for state testing.

To recruit fifth graders for this study, an introductory letter (see Appendix D), parental consent (see Appendix E), and student assent form (see Appendix F) were distributed to

approximately 260 students and their parents/guardians from the eleven teachers' classes who agreed to implement *Healthy Hearts*. All letters and consent forms were mailed to participating classroom teachers, who then sent them home with students. The letter informed students and their parents/guardians that participation in the study was voluntary, that their child could still use *Healthy Hearts* even if they did not participate in the study, and that they could withdraw from the study at any time without consequence. Signed consent forms were then collected by the classroom teachers and mailed back to the researchers in postage paid envelopes provided by the researchers. One classroom teacher who did not return consent forms or use *Healthy Hearts* and was dropped from the study.

Classroom teachers recorded names of children who were participating in the study and indicated those who were on the *Healthy Hearts* website. Records identifying students participating in the study were kept in the *Healthy Hearts* website, initially marked by classroom teachers and verified by the investigator. On receipt of consent forms by the investigator, student records were looked up by name via the administration section of *Healthy Hearts* to verify that the appropriate status was set in *Healthy Hearts*. Data on the *Healthy Hearts* website was password protected and only classroom teachers and the investigators had access to student records. Consent forms were stored in a locked apartment in Blacksburg, VA. All students who returned signed parental consent and student assent forms participated in the study.

233 fifth grade boys and girls agreed to participate in the study. Because all participating students were in classes whose teachers intended to use *Healthy Hearts* during the Spring of 2001, all participants had access to the necessary computer hardware, software, and Internet access to implement *Healthy Hearts* at school (see Table 3). All teachers were asked whether they wanted to start using *Healthy Hearts* February 26 or after April 10. Students in classes whose teachers wanted to use *Healthy Hearts* beginning February 26 were assigned to Group 1 and the rest of the fifth graders were designated as Group 2. See Table 5 for the study timeline.

Table 3

Classroom and School Computer Requirements to Implement *Healthy Hearts*

- Pentium or equivalent Macintosh computers connected to the Internet, preferably a dedicated Ethernet connection.
- Classroom access to a computer lab or equivalent facility with ideally one computer for every student. Minimum of one computer for every two students.
- Computer facility available for each participating classroom for one hour twice a week over five consecutive weeks.
- Netscape Navigator 4.0/Internet Explorer 4.0 or more recent version installed on every computer.
- Parental permission for each student to use the Internet (if required by district/school).
- Teachers must have a working email address with access from the classroom or school site.

Design

A 2x3 repeated measures non-equivalent group design was used to measure the impact *Healthy Hearts* had on fifth grade student's physical activity knowledge, attitudes and behavior. This study is considered quasiexperimental, or non-equivalent group, because subjects were not randomly assigned to groups. Demographic and descriptive data are presented in Chapter Four to document similarities and differences between groups, a necessary protocol for quasiexperimental studies (Fitz-Gibbon & Morris, 1987). All participants completed a baseline test and two follow-up tests (see Appendix G Appendix I Appendix J).

Procedures

Baseline

Both groups completed a pretest for baseline measures. Questionnaires were mailed to all participating teachers by February 26. One day of the week before Group 1 began using *Healthy Hearts* (between February 26 and March 2), classroom teachers distributed baseline tests to their students while at school during class time. Before beginning the test, teachers were asked to read

a script (Appendix H) explaining what the test was for, and describing how to complete the survey. Teachers provided between forty and fifty five minutes of class time for students to complete the baseline test.

When completing the baseline test, participants or their teachers wrote student *Healthy Hearts* ID numbers on the top right corner of the questionnaire. To log in to the *Healthy Hearts* website, all intervention students had been assigned a *Healthy Hearts* ID. Although control group students did not know their *Healthy Hearts* ID at the time of the baseline test, each student had been assigned one. All but three control group classroom teachers wrote the *Healthy Hearts* ID on each student's survey. Three of the control group teachers placed student last names on the forms instead of the *Healthy Hearts* ID. Classroom teacher's mailed the tests back to the researchers in addressed postage paid envelopes that had been supplied by the researchers. On receipt of forms with student last names, their *Healthy* Hearts ID was looked up from the administrative section of *Healthy* Hearts and written on the test form. Only questionnaires for students who had returned signed parental consent and student assent forms were used for analysis.

Intervention Group 1– Healthy Hearts

For five consecutive weeks following baseline measures, children in Group 1 used *Healthy Hearts*. Designers of *Healthy Hearts* (Elliott, 1997) recommend that classroom teachers take their students to a computer lab for 45 minutes twice a week over four consecutive weeks. Children log in to the *Healthy Hearts* website with their own user ID and password. Lessons present information, practice and game-like activities, quizzes, and opportunities to ask questions of experts. While visiting the *Healthy Hearts* website, children choose their own activities, either reading content, taking quizzes, giving advice to imaginary people after reading hypothetical questions and submitting written answers to be posted on the Web, or submitting physical activity and dietary recalls.

Healthy Hearts was designed to influence fifth grade children's physical activity behavior by providing information regarding the benefits of physical activity, as well as informing them of the minimum recommended amount of physical activity needed for health benefits. Research indicates that perceived benefits correlate with physical activity levels in children, and the intention of *Healthy Hearts* was to promote the benefits in order to impact behavior. The second aspect was informing students of the minimum recommended amounts of

physical activity. Students could compare their activity with the recommended amounts in *Healthy Hearts*.

The method of recording physical activity as part of *Healthy Hearts* instruction was an online version of the Self-Administered Personal Activity Checklist (SAPAC), a 24-hour recall physical activity self-report. SAPAC was used for the CATCH project described in chapter two, and is similar in design to the Weekly Activity Checklist used in this study. For a more detailed description of the sections of *Healthy Hearts*, as well as content covered, see Appendix B : Healthy Hearts Task Analysis, and Appendix C Sections and Instructional Sequence of *Healthy Hearts*. Once Group 1 finished using *Healthy Hearts*, all participants completed Test 1.

Test 1

Within three weeks of Group 1 finishing *Healthy Hearts*, all participants completed Test 1, and participating teachers completed the teacher questionnaire. Most students completed an alternate form at Test 1. For example, those who completed Form A during the baseline test took Form B at Test 1. To ensure that students from each class randomly completed Form A or Form B during the baseline test, tests were stacked with Form A and B alternating, then given to teachers. In order to give students the alternate form for Test 1, participants wrote their *Healthy Hearts* userID on the baseline test. Before mailing out Test 1, stickers were printed with participants *Healthy Hearts* userID and placed on the appropriate form. This ensured that students who completed Form A during the baseline test filled out Form B for Test 1, and all students who completed Form B during the baseline test filled out Form A for Test 1. These stickers were not printed out for students from three classes at one Group 2 school, therefore these students randomly completed either Form A or Form B at Test 2. Form A and Form B are further discussed in Questionnaire Development.

The teachers distributed forms to all participants during class time and administered Test 1 at school during school hours. Teachers also completed the *Healthy Hearts* teacher questionnaire on their own time.

Teachers completed a 17-item questionnaire to help draw comparisons between groups (Appendix K). One limitation of this study is that Group 1 curriculum and classroom activities could not be controlled during times that the groups engaged in *Healthy Hearts*. For this reason, teachers reported non-*Healthy Hearts* instruction time provided for students related to objectives

addressed in *Healthy Hearts* from baseline to Test 1. Student forms and the questionnaire were mailed to participating teachers.

The teacher questionnaire and Test 1 were returned by mailing them in a postage paid envelope that was supplied by the researchers. Once Test 1 was received from Group 2 teachers, Group 2 began using *Healthy* Hearts.

Intervention Group 2 – Healthy Hearts

For six weeks, students in Group 2 engaged in *Healthy Hearts* following the same protocol as Group 1. Group 1 students engaged in normally scheduled classroom activities and did not have access to the *Healthy Hearts* module at school during this time. Following completion of *Healthy Hearts* by Group 2, all students completed Test 2.

Test 2

During the two weeks following completion of *Healthy Hearts* by Group 2, all participants completed Test 2. Test 2 included the same behavior and attitude items included on forms A and B used during baseline and Test 1, but included knowledge items from both forms (n = 30). Test 2 was mailed to teachers at schools, and administered to participants by the classroom teacher during regular school hours. Classroom teachers mailed Test 2 back in self-addressed postage paid envelopes that had been supplied by the researchers. Development, revision, and pilot of the questionnaires used for this study are discussed in the following section.

Table 4

Study Design

	Baseline	Intervention	Test 1	Intervention	Test 2
Group 1	Form A	X	Form B		Form A&B
	Form B	X	Form A		Form A&B
Group 2	Form A		Form B	X	Form A&B
	Form B		Form A	X	Form A&B

Table 5

Healthy Hearts Timeline

	Group 1	Group 2
January 15	Distribute consent forms	Distribute consent forms
February 26 – March 7	Administer Baseline Test (Form A or B)	Administer Baseline Test (Form A or B)
February 27 – March 8	Begin Intervention 1	
March 28 – April 10	End Intervention 1	
March 28 – April 15	Administer Test 1 (Form A or B)	Administer Test 1 (Form A or B)
April 10 – April 18		Begin Intervention 2
May 21 – May 28		End Intervention 2
May 18 – June 8	Administer Test 2 (Form A & B)	Administer Test 2 (Form A & B)

Questionnaire Development

The questionnaires used for baseline and Test 1 (Form A and Form B) each contained attitude (n=12), behavior (n=31), and knowledge (n=15) items for nutrition, tobacco, and physical activity. The 59 questions on the baseline and Test 1 questionnaire included 3 physical activity knowledge, three physical activity attitude, and the 21-item Weekly Activity Checklist (WAC). For Test 2, all knowledge items (n=30) were included on the 73-item questionnaire that included six physical activity knowledge items. Classroom teachers administered these tests during school by providing between 40 and 60 minutes of class time. All participants completed either Form A or Form B for baseline measures, the opposite form for Test 1, and the combined instrument (all knowledge items) for Test 2. The items used for this study include six knowledge, three attitude, and the 21-item WAC for physical activity. Nutrition and tobacco data will be analyzed as part of another study.

The three dependent variables measured in this study included physical activity related attitude, behavior, and curriculum knowledge. Three physical activity attitude and 21 behavior (Weekly Activity Checklist) test items were adapted from previously validated instruments (Sallis et al., 1997; Sallis & Saelens, 2000). Six physical activity curriculum knowledge items were developed based on content validity of the *Healthy Hearts* curriculum. Content validity for knowledge items is discussed later in this chapter.

The first draft of the test instrument was piloted with students from two Virginia fifth grade classrooms in November, 2000. Two fifth grade teachers from Virginia reviewed the physical activity knowledge, attitude, and behavior items for readability and understanding. The tests were revised based on teacher recommendations. The revised instrument was piloted and reviewed by one teacher and students from two fifth grade classes in West Virginia. During this pilot, the two classes completed the baseline test the first week of December, used *Healthy Hearts* for four weeks, and completed the posttest in early January, 2001.

Following this pilot, further revisions were made to the physical activity items based on teacher recommendations. Knowledge, behavior, and attitude items for tobacco, nutrition, and function of the heart test items were added to the instrument. The revised instrument was reviewed by a panel of 5 content experts at a meeting in Morgantown, WV. These experts made additional suggestions for revising questions and answers pertaining to accuracy of content. For example, the answer to a question asking children to identify an answer that was “not a benefit of

physical activity" was changed to "least likely to be a benefit from physical activity". The answer was also changed from "can run faster" to "getting lung cancer". Final revisions to the test items were made based on recommendations of this panel.

The physical activity questionnaire used in this study was part of a longer test instrument that included tobacco (n = 9) and nutrition (n = 10) attitude and behavior items, and tobacco (n = 6), nutrition (n = 8), and function of the heart curriculum knowledge (n = 10) items. Nutrition and tobacco test items will be analyzed as part of another study. Including these test items on the questionnaire resulted in a relatively long instrument (73 items).

One concern with this study was the length of the test instrument. Thirty knowledge items were originally developed to evaluate *Healthy Hearts*, however including all items on a single test resulted in a 73-item questionnaire. A second concern is that with repeated measures designs, there is potential for children to become sensitized to knowledge test items (Howell, 1997). Repeated testing is one threat to internal validity. When children are tested several times with the same test, their performance may be affected by practice, memory of earlier responses, sensitization, and or conjectures regarding the purpose of the research (Pedhazur & Schmelkin, 1991). Developing more than one test battery is often used to minimize sensitization to testing instruments.

To reduce the amount of classroom time necessary for participants to complete the questionnaire at baseline and Test 1 (Gokhale, 1996) , and to minimize potential for sensitization to test items (Ballard et al., 1999), knowledge items were paired and randomly included on one of two forms. All six test items measured one of five *Healthy Hearts* knowledge objectives, thus providing a measure of knowledge of the physical activity curriculum. The questionnaire used at Test 2 included all knowledge items.

Knowledge

This study attempted to determine if there were changes in curriculum-related physical activity knowledge. Assessing achievement of instructional objectives by creating corresponding test items from objectives has been described in The Systematic Design of Instruction (Dick & Carey, 1996), and recommendations for constructing test instruments were adhered to (Pedhazur & Schmelkin, 1991). "Tests designed to measure an explicit set of objectives are called criterion-referenced tests…(used when it) is important to (1) test and evaluate students' progress, and (2) to provide information about the effectiveness of the instruction" (Dick & Carey, 1996). Content

validity is an important consideration when measuring achievement and is used to assess the content of an instrument (Pedhazur & Schmelkin, 1991). Content validity for knowledge items was determined during the creation of each objective and test item based on literature regarding the benefits of physical activity, recommended amounts of physical activity, and factors related to children's physical activity levels such as perceived benefits (Pate et al., 1995; Sallis et al., 1999a; Sallis et al., 1999b; Silverman & Subramaniam, 1999; Slattery, 1996).

As described in Chapter 2, creating test instruments for assessing instruction is one step in the systematic design of instruction. To create test items for this study, five behavioral objectives were developed for *Healthy Hearts* based on a needs assessment and literature regarding benefits and recommended amounts of physical activity. Table 6 lists the five behavioral objectives, cites literature leading to development of the objectives, and presents the knowledge test item corresponding to each objective used in this study. The multiple choice question format for test items was adapted from a nutrition knowledge questionnaire used in CATCH with fifth grade children (Lytle et al., 1996; Perry et al., 1990; Perry et al., 1998; Resnicow et al., 1996).

Eight physical activity knowledge items were piloted with 21 fifth grade children in November, 2000 and reviewed by two fifth grade teachers. During the pilot, students were asked to circle questions they did not understand or thought were unclear. From results of the first questionnaire pilot, three physical activity knowledge items were removed because they were either redundant, unclear, or did not match instructional objectives. The remaining six items were modified slightly because they were not clearly written or included answers that could be misunderstood and therefore lead to incorrect response. These six items were reviewed by a panel of experts and modified based on the experts recommendations and included on the questionnaire.

Table 6

Behavioral Objectives for Physical Activity Knowledge and their Corresponding Test Item

Objective	Source	Test Question	Correct Answer
Identify that experts recommend children to be physically active at least five days a week.	(Corbin & Pangrazi, 1998)	What is the minimum number of days every week experts recommend you should be physically active? What is the fewest number of days a week that experts recommend you should be physically active?	5
Identify that the best way to determine intensity of physical activity is by how often they have to breathe hard.	(Blair & Connelly, 1996; Sallis et al., 1993a; Sallis & Saelens, 2000)	What is the best way to tell if a physical activity you are doing is of moderate to vigorous intensity?	I am breathing hard
Identify that experts recommend children should be physically active at least 60 minutes a day.	(Corbin & Pangrazi, 1998)	What is the minimum number of minutes a day experts recommend you should be physically active?	60
Presented a list of activities, identify the more vigorous physical activity.	(Ainsworth et al., 1993)	Which of these activities is the more vigorous physical activity?	Jogging
Identify that benefits of regular physical activity include lower cholesterol, reduced chance of heart disease, more energy to participate in physical activity for a longer period of time, and maintaining a healthy body weight.	(Bar-Or & Baranowski, 1994; Epstein, 1992; Epstein et al., 1999)	Which of the following is LEAST LIKELY to be a benefit of being regularly physically active?	Getting Lung Cancer

1

As previously described, two concerns when conducting repeated measures for achievement are questionnaire length and children learning from the test (sensitized to the test). A third concern when evaluating achievement of numerous instructional objectives is elevated stepwise error levels (Howell, 1997; Pedhazur & Schmelkin, 1991). One approach to minimize stepwise error rates is to combine scores as an indication of general curriculum knowledge. To reduce stepwise error rates that would be elevated if conducting t-tests on each individual instructional objective, general curriculum knowledge was estimated as the number of correct answers for all physical activity curriculum knowledge test items. This will be further discussed in the data analysis section of this chapter.

To shorten the test instrument, and to address concerns of sensitization to the test instrument, physical activity knowledge items were split into two three-item groups. Six items were paired by content and randomly assigned to one of two forms by flipping a coin, resulting in two sets of three test items that measure five *Healthy Hearts* curriculum objectives (Table 7). The two sets of three knowledge items were placed on one of two test forms (see items 13 – 15 on Form A in Appendix G & items 13 – 15 on Form B in Appendix I). Each test item is a multiple-choice question that corresponds with a *Healthy Hearts* knowledge objective. It is important to note that these forms are not considered equivalent because each test item addresses a different objective of the *Healthy Hearts* curriculum. In fact, Cronbach's alpha calculated for Test 2 data revealed low interitem reliability ($\alpha = 0.369$) for physical activity knowledge test items as expected. However, all test items do measure physical activity objectives from *Healthy* Hearts making them appropriate measures for estimating knowledge of the *Healthy Hearts* physical activity knowledge objectives. For Test 2, all participants completed all knowledge items (see Appendix J). Form A, Form B, and the combined AB test included identical behavior and attitude items.

Table 7

Physical activity knowledge test items on Form A and Form B

Form A	Form B
• What is the fewest number of days a week that experts recommend you should be physically active?	• What is the minimum number of days every week experts recommend you should be physically active?
• Which of these activities is the more vigorous physical activity?	• What is the best way to tell if a physical activity you are doing is of moderate to vigorous intensity?
• Which of the following is LEAST LIKELY to be a benefit of being regularly physically active?	• What is the minimum number of minutes a day experts recommend you should be physically active?

Attitude

As described in the previous chapter, intention to be active is a reliable indicator of actual physical activity. The three attitude items used in this study were adapted from the Sport, Play and Active Recreation for Kids (SPARK) project (Faucette et al., 1995; Mckenzie et al., 1994; Sallis et al., 1997). Each question asks students to indicate their intention to be physically active from "definitely will" to "definitely will not" on a five point Likert scale. The five point Likert scale was scored 1 to 5 points for each item with 1 point for "I definitely will not" and 5 points for "I definitely will" (see Table 8). Scores for the three attitude items measuring intention to be physically active were calculated as the sum of the three test items, a continuous variable. Validity of the three attitude items included on the questionnaire was established in a previous study (Sallis et al., 1999a; Sallis et al., 1999b) according to construct validity with a panel of experts (See Appendix G & Appendix I , items # 1-3). Construct validity, referring to whether test items measure the intended construct or "mental abstraction", is frequently determined by expert review of test items (Pedhazur & Schmelkin, 1991). Since reliability is necessary for validity, interitem reliability using Cronbach's alpha is reported in Chapter 4, showing the extent to which the three attitude items reliably measure the same construct. As described in Chapter Two, another approach to measuring attitude is to assess behaviors indicating learned attitudes.

Table 8

Sample Calculation of Mean Attitude Scores

Subject	Item 1	Item 2	Item 3	Attitude Score
1	5	4	4	13
	Definitely will	Probably will	Probably will	
2	3	4	2	9
	50/50 chance	Probably will	Probably will not	

Behavior

A modified version of the Weekly Physical Activity Checklist (WAC) from SPARK was adapted to measure physical activity behavior (see page 8 of Appendix G & Appendix I). The WAC is a self-report instrument by which participants indicate whether they participated in any of twenty activities for at least 15 minutes on each of the past seven days of the week. Students write an "X" in the appropriate box to indicate whether they participated in at least fifteen minutes of a particular activity on a given day. The activities listed are grouped according to metabolic value (MET), beginning with low (scored 3 METS), moderate (scored 5 METS), and vigorous (scored 9 METS) physical activity.

The list of activities on the original WAC included items that were traditional fitness activities and large sided games such as "swimming laps", "jumping jacks/sit-ups", and "volleyball". The national trend towards "lifestyle" rather than "sport and fitness" activities necessitated modifying the WAC to reflect the emphasis on lifestyle activities. The WAC was modified to include lifestyle physical activities such as "indoor chores" and "outdoor play" that seemed more appropriate to include as "lifestyle" activity(see Table 9). These items were taken directly from the SAPAC included in *Healthy Hearts*. The WAC was also modified by removing the indication of intensity of activities. On the original WAC, children were asked to indicate when they had to breathe hard during activity by writing an "H" next to the "X". Sallis & Saelens (2000) stated that this indication of intensity was not used as part of calculation and that its presence was not necessary (Sallis & Saelens, 2000). Therefore, this was removed to make completing the WAC for this study simpler and faster, thereby using less classroom time.

Student WAC scores were calculated by multiplying the frequencies of each activity by the appropriate MET value (see Table 10). Scored questionnaires provide an estimate of weekly energy expenditure in METs. Teachers were provided a script to read before students completed the questionnaire. One assumption of this study is that the teachers read this script to the students, and the students listened. The weekly activity checklist adapted for this study has been validated with Caltrac accelerometers and shown to be a reliable estimate of physical activity in fifth grade children (Sallis, 1991; Sallis et al., 1993a; Sallis & Saelens, 2000).

For each student, a continuous score was calculated following guidelines established by Sallis et al. (1993) to estimate weekly moderate to vigorous physical activity (MVPA). Weekly MVPA was calculated by multiplying low, medium, and high intensity by the respective values.

All activities listed on the WAC are grouped as low, medium, or high metabolic value. The number of "X's" marked in low intensity physical activity were multiplied by 3, medium by 5, and high by 9 resulting in an estimate of total energy expended in physical activity (see Table 10 for an example). To make any comparisons of behavior, knowledge, or attitude between nonequivalent control and experimental groups, it is necessary to document similarities and differences between the groups. Demographical data were used to make these comparisons.

Table 9

Physical activities included on the original and modified Weekly Activity Checklist (WAC)

Original WAC	Modified WAC
Low MET Value	Low MET Value
Four square	Ball playing: playing catch, volleyball
Gymnastics	Indoor chores: mopping, vacuuming
Volleyball	Outdoor chores: mowing, raking
	Combatives: karate, judo, wrestling
Moderate MET Value	Moderate MET Value
Tennis/Smashball	Dancing: line, jazz, ballet, tap
Baseball/softball	Outdoor Play: climbing trees, hiking
Basketball	Racket sports: tennis, racquetball
Football	Mixed walking/running
High MET Value	High MET Value
Jumping Rope	Exercise (push-ups, sit-ups, exercise video, jumping rope, etc.)
Jumping Jacks/Sit-ups	Chasing and tagging games
Running/Jogging	Running/Jogging
Soccer	Soccer
Skateboarding/Skating	Skating (rollerblading, ice, roller.)
Swimming Laps	Swimming Laps
Bicycling	

Demographical Data

Descriptive data were collected at two separate times from teachers to document similarities and differences of both groups (see Appendix K). Students were not asked questions pertaining to socioeconomic status, or other demographical data. Demographical data was collected from teachers about schools at two times during the study; first when teachers registered to use *Healthy Hearts*, and at Test 1 when Group 1 finished using *Healthy Hearts.*

Teacher Questionnaires

When teachers registered to use *Healthy Hearts* by going to the *Healthy Hearts* website, they answered questions regarding socioeconomic status and computer availability. The nature of the data collection did not allow for collecting direct measures of SES from individual students. Because students could not be asked about socioeconomic status, school SES was estimated by teacher reported percentage of students eligible for FRSLP. FRSLP is widely used to estimate SES (Brustad, 1996; Erbe, 2000), and SES is commonly linked to academic achievement (Chidolue, 1996; Erbe, 2000). Therefore, comparisons are made between groups SES in chapter 4 based on FRSLP. Another variable related to achievement is time spent with instructional materials (Chidolue, 1996; Erbe, 2000).

At Test 1, teachers in Group 1 completed a questionnaire pertaining to time allocated for *Healthy Hearts*. Time spent engaged with instruction frequently correlates with academic achievement. Since instruction provided for students could not be controlled for groups when not using *Healthy Hearts*, additional information regarding instruction related to objectives addressed in *Healthy Hearts* was also collected from teachers in both groups.

Teachers were asked to estimate the amount of non-*Healthy Hearts* instruction time provided to students for West Virginia Instructional Goals and Objectives (IGO's). Non-*Healthy Hearts* instruction time measures what students were doing when not doing *Healthy Hearts*. A list of objectives addressed in *Healthy Hearts* was provided for the teachers. Teachers reported amount of non-*Healthy Hearts* instructional time provided for each of these objectives during the study. Total minutes of non-*Healthy Hearts* IGO time was calculated by summing all teacher reported minutes for objectives listed. Web-based School SES, time allocated to *Healthy Hearts*, and non-*Healthy Hearts* instructional time are used in addition to baseline scores to make comparisons between groups and to evaluate effects of *Healthy Hearts* on children.

Data Analysis

When conducting non-equivalent control group studies, it is necessary to present similarities and differences between groups. Baseline scores are used as one means of documenting similarities between groups, which is built in to this repeated measures design. Descriptive data collected from teachers are reported in frequency tables to document similarities and differences between schools. These data are generalized by school because demographic data collected was from teachers about the school, not individual participants. Data collected was percentage of students eligible for free or reduced school lunch programs reported by classroom teachers as an estimate of class SES, class time allocated to non-*Healthy Hearts* instruction on objectives covered by the *Healthy Hearts* curriculum, and time allocated for *Healthy Hearts* instruction for Group 1. This data is displayed in tables in Chapter Four. To investigate the impact of *Healthy Hearts*, three continuous dependent variables were reported: physical activity attitude, behavior, and knowledge.

Attitude

Data were analyzed in repeated measures ANOVA to determine *Healthy Hearts* effects on total attitude score. Attitude scores were calculated by summing answers on the Likert scale with "definitely will not" counted as 1 point to "definitely will" scored as 5 points. Total scores range from 1 to 15 points. Higher scores indicate greater intention to be physically active, which research has shown to be a consistent predictor of physical activity in children (Faucette et al., 1995; Sallis et al., 1999a; Sallis et al., 1999b). The fixed factor analyzed was group (Group 1 and Group 2). Baseline comparisons were used to document similarities between control and experimental groups for attitude. Tests of significance were run at the .05 level. Cronbach's Alpha (α) was performed to test interitem reliability of the three attitude items. Significant differences between group and test (baseline, Test 1, and Test 2) would suggest that *Healthy Hearts* had an effect on fifth grade children's intention to be physically active.

Behavior

Data were analyzed in repeated measures ANOVA to determine *Healthy Hearts* effects on Weekly Activity Checklist (WAC) scores. Scores are an estimate of weekly energy expenditure from physical activity, and are calculated by multiplying frequency of participation in a given activity by the appropriate MET value (see Table 10) (Sallis & Saelens, 2000). The

independent variables used were groups (Group 1 and Group 2) and the dependent variable WAC score for the three tests. Follow-up repeated measures ANOVA compared differences within each group at baseline, Test 1 and Test 2. Baseline comparisons were used to document similarities between group behaviors. Tests of significance were run at the .05 level. Significant differences would indicate that *Healthy Hearts* had an effect on fifth grade children's amount of moderate to vigorous physical activity.

Table 10

Sample Calculation of Physical Activity Behavior Score

Activity	Monday	Tuesday	Met Value	Equivalent Score
Light Activity				
Indoor chores: mopping, vacuuming, sweeping	X	X	3	6
Outdoor chores: mowing, raking, gardening, shoveling		X	3	3
Moderate Activity				
Outdoor Play: climbing trees, hiking, skiing			5	0
Racket sports: tennis, racquetball, badminton	X		5	5
Baseball/softball		X	5	5
Vigorous Activity				
Chasing and tagging games	X	X	9	18
Running/Jogging		X	9	9
Soccer			9	0
			Physical Activity Score	46

Knowledge

Data were analyzed in repeated measures ANOVA to determine *Healthy Hearts* effects on fifth grade children's knowledge of physical activity content presented in *Healthy Hearts*. The dependent variables were number of correct responses at baseline, Test 1 and Test 2. Independent variables were groups (Group 1 or Group 2). Tests of significance were run at the .05 level. Since all participants answered six knowledge questions on Form AB, total number of correct responses were divided by two in order to directly compare performance to baseline and Test 1 scores. follow-up repeated measures ANOVA for Group 1 and Group 2 further explain significant test effects of *Healthy Hearts* (baseline, Test 1, Test 2) as recommended by Howell (1997). This would further explain whether differences between groups existed at different test administrations and is necessary since groups received the intervention at different times.

As previously discussed, documenting similarities and differences between control and intervention groups is necessary in nonequivalent control group studies.

Other Variables

Data collected included SES, time allocated to *Healthy Hearts*, and non-*Healthy Hearts* IGO instruction time. Baseline differences in mean scores between groups for Form A and Form B are presented as a means of comparing groups. Repeated measures ANOVA with non-*Healthy Hearts* IGO time and SES as covariates was used to determine whether these variables related to student performance. This nonequivalent group study was designed to reveal any impact *Healthy Hearts* has on fifth grade children's physical activity knowledge, attitude, and behavior.

Summary

The purpose of this study was to evaluate the impact *Healthy Hearts* has on fifth grade children's knowledge, attitudes, and behavior. A non-equivalent group repeated measures design was used to measure knowledge, attitudes and behavior. As necessary in nonequivalent group designs, similarities and differences are documented by baseline scores for knowledge, attitude, and behavior, as well as teacher reported descriptive data for participating schools and classrooms. This descriptive data will help strengthen the results of this study regarding effects of *Healthy Hearts*.

Student baseline, Test 1, and Test 2 scores were used to determine the impact *Healthy Hearts* has on fifth grade children's physical activity curriculum knowledge, attitude, and behavior. Repeated measures ANOVA tested effects of *Healthy Hearts.* Effects will indicate significant changes throughout the study as well as reveal any retention of knowledge, attitudes, and behaviors for Group 1.

Results of this study will help document any effects *Healthy Hearts* has on knowledge, behavior, and attitudes of fifth grade children who participated in the study. Because the selection process for this study was not random, no conclusions outside of the participants in this study will be drawn. The following chapter reports results of the statistical analyses.

CHAPTER 4
RESULTS AND DISCUSSION

This chapter reports the results of the statistical analyses conducted to answer questions regarding *Healthy Hearts* effects on fifth grade children's physical activity attitude, behavior, and curriculum knowledge. The results and discussion begin with frequency and descriptive data of schools, teachers, and students who participated in the study. Comparisons are then made between Group 1 and Group 2 on SES, and estimated instructional time provided for non-*Healthy Hearts* health instruction. This section is followed by presentation and analysis of knowledge, attitudes, and behavior data. The research questions are restated and used as the framework for a discussion of the results from the questionnaires as to the effects *Healthy Hearts* had on fifth grade children. The chapter begins with a description of participants and attrition from baseline to Test 2.

Participants and Setting

Consent forms (approximately 260) were sent to students in the classes of the teachers who agreed to participate in the study. Signed consent forms were returned by 233 children (approximately 89.6%) in 14 classes taught by eleven teachers from eight schools in five West Virginia counties. Three children were not present at Test 1, and 33 children missed Test 2 (see Table 11). Children missed tests because they were not present during the time teachers administered the questionnaire (Table 12). Test 2 was administered on one day during the last two weeks of the school year, possibly contributing to higher numbers of attrition at Test 2.

Descriptive Data of Participants

All participating teachers taught one fifth grade class, except for one Group 1 teacher (DC) who taught two classes using *Healthy Hearts* and one Group 2 teacher (CS) who worked with three classes. All together, students from fourteen fifth grade classes participated, with eight Group 1 and six Group 2 classes (see Table 11). In order to make initial comparisons between Group 1 and Group 2, descriptive data on class SES, Group 1 time allocated to *Healthy Hearts*, and non-*Healthy Hearts* instruction time were collected. Time engaged in instruction related to the intervention might also influence performance, and SES has consistently correlated with academic achievement. This information was gathered in order to make comparisons between

groups and provide opportunity for results to be generalizeable to all students participating in the study.

Table 11

Numbers of Participating Schools, Teachers, Classes, and Students by Group

	School	Teacher	N Classes	N Students
Group 1	AL	JW	1	14
		PB	1	19
	TC	DC	2	13
	WL	LB	1	15
	WI	SV	1	14
	PH	KK	1	22
		JM	1	25
Total	5	7	8	122
Group 2	CA	DJ	1	22
		RC	1	16
	GW	CS	3	53
	BI	DS	1	20
Total	3	4	6	111
Grand Total	8	11	14	233

Table 12

Fifth Grade Student Attrition for Groups at Baseline, Test 1, and Test 2

	Baseline		Test 1		Test 2		Total
	N	Missing	N	Missing	N	Missing	
Group 1	122	0	122	0	108	14	122
Group 2	111	0	108	3	92	19	111
Total	233	0	230	3	200	33	233

SES consistently correlates with academic achievement (Chidolue, 1996). As discussed in chapter 3, SES could not be collected from students so an estimate of SES was drawn by teacher reported percentage of students eligible for free or reduced school lunch program (FRSLP). FRSLP is frequently used as a measure of SES (Gilmer & et al., 1996; Grunbaum & et al., 1995; Nash, 1998). Table 13 shows that all participating classes are considered low or moderate SES and no classes were considered of high SES in Group 1 or Group 2. Another factor useful when conducting summative evaluation of curriculum is the amount of instruction provided for objectives similar to those covered in the intervention.

Table 13

Number of Classes by Socioeconomic Status (SES)

	SES			
	High	Medium	Low	Total
Group 1	0	1	7	8
Group 2	0	4	2	6

Some teachers may have provided additional health instruction for objectives similar to those addressed by *Healthy Hearts*. The amount of instruction time provided for health objectives, other than time allocated to *Healthy Hearts,* could potentially influence results of this study. The IGO's addressed in *Healthy Hearts* are presented in Chapter 3. Teachers reported the

amount of instruction time provided for classes during the intervention, not including *Healthy Hearts,* using a list of WV IGO's. Results show teachers reported an even distribution of time spent on health and technology instruction from none to more than 200 minutes for Group 1 and similar distribution for Group 2 (see Table 14). The only difference appears in the "none" category with all classes in Group 2 spending at least some time on related WV IGO's from baseline to Test 1.

Table 14

Instruction Time Allocated to Related Health IGO's Other than Healthy Hearts

	Instructional time provided for IGO's (minutes)				
	None	<100	100 - 200	>200	Total
Group 1	2	2	2	2	8
Group 2	0	3	2	1	6

Group 1Descriptive data generally suggest similar characteristics of Group 1 and Group 2 classes. Comparisons between groups can be made keeping in mind that participants were not randomly assigned to group. Data were analyzed using SPSS 8.0 for Windows. These are presented in the next section of this chapter, beginning with physical activity curriculum knowledge.

Results

Knowledge

The research question pertaining to knowledge for this study was whether *Healthy Hearts* had any influence on fifth grade children's physical activity knowledge following five weeks of instruction. Physical activity curriculum knowledge was measured at baseline, Test 1 and Test 2 for both groups. Baseline and Test 1 scores were calculated by adding the total number of correct responses on three questions. To make comparisons to baseline and Test 1 scores, Test 2 scores were calculated by summing correct responses on six questions and then dividing by two. This resulted in test scores between 0 and 3 at all tests. Table 15 displays mean knowledge scores and standard deviations for students in each teacher's class. Overall comparisons in knowledge are presented in Figure 2 and show similar scores at baseline, measurable differences between groups at Test 1, and converging scores at Test 2. The graph of mean scores by groups indicates that Group 1 mean scores were much higher at Test 1 following the intervention, and Group 2 knowledge increased at Test 2 following the intervention. Repeated measures ANOVA reveal effects of *Healthy Hearts* between and within subjects

Table 15

Students Physical Activity Knowledge Descriptive Statistics by Class

		Baseline		Test 1		Test 2	
	N	Mean	SD	Mean	SD	Mean	SD
Group 1							
JW	11	1.091	0.701	1.091	0.701	1.136	0.636
PB	16	0.688	0.602	1.000	1.033	0.875	0.695
DC1	4	0.750	.500	1.750	0.957	1.250	0.957
DC2	8	1.625	.744	2.000	0.534	1.562	0.623
LB	15	1.000	0.926	1.267	0.961	1.167	0.556
SV	14	0.857	0.864	2.071	0.917	1.714	0.611
KK	16	0.938	0.998	1.313	0.873	0.969	0.591
JM	24	0.708	0.690	0.958	0.999	0.938	0.558
Total	108	0.907	0.803	1.324	0.975	1.144	0.663
Group 2							
DJ	17	0.824	0.883	0.765	0.664	1.412	0.888
RC	10	0.600	0.699	0.200	0.422	1.150	0.580
CS1	17	0.882	.600	0.588	.795	1.559	0.726
CS2	15	0.533	.640	0.867	.990	1.767	0.594
CS3	13	0.538	.660	0.461	.660	1.346	0.516
DS	19	1.105	0.737	0.947	0.848	1.763	0.609
Total	91	0.780	0.727	0.681	0.787	1.533	0.690

Note. Only students who answered each question at baseline, Test 1, and Test 2 were included in this table.

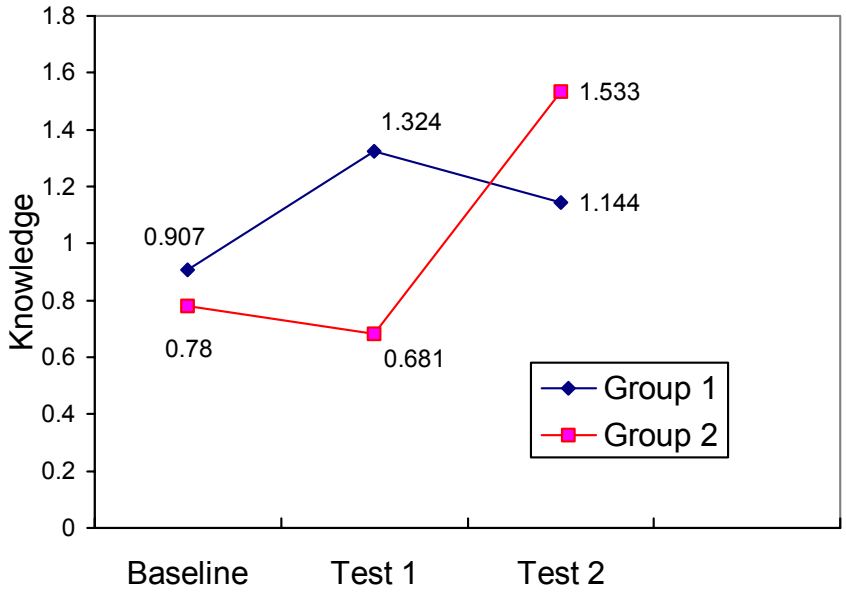

Figure 2. Mean knowledge scores by groups at baseline, Test 1 and Test 2.

Results of between subjects main effects (Group 1 and Group 2) revealed no statistical difference $F(1, 197) = 2.785$, $p = .097$ between groups (Table 16). Tests of between subject effects in repeated measures ANOVA is an indication of main effects of the intervention, generally identifying whether group scores differ. Main between groups effects were not statistically different suggesting both groups performed similarly when scores at baseline, Test 1, and Test 2 were combined. Tests of within subjects' effects do reveal significant effects of *Healthy Hearts* on physical activity curriculum knowledge $F(1, 197) = 780.374$, $p < .001$.

Table 16

Test of Between Subjects Effects for Knowledge by Group

Source	Sum of Squares	df	Mean Square	F	Sig.
Intercept	667.886	1	667.886	780.374	<.001
Group	2.383	1	2.383	2.785	.097
Error	168.603	197	.856		

Table 17 displays results of the within subjects repeated measures ANOVA. One assumption when using repeated measures ANOVA is sphericity, suggesting equal variances and covariances of data in both groups. Mauchly's test for sphericity revealed this assumption was not met, so Greenhouse-Geisser's approach to correcting degrees of freedom was used to compensate for not meeting the assumption of sphericity (Howell, 1997).

Repeated measures ANOVA reveal significant changes (significance < .001) in main effects for test, revealing significant changes in knowledge from Baseline to Test 2 for both groups. Significant interaction of group and test suggest groups performed statistically different at different test intervals $F(1.95, 26.523) = 26.523$, $p < .001$. Howell (1997) recommends parsing data and running follow-up repeated measures ANOVA for both groups to further identify differences within each group at each test interval when there is a significant interaction.

Table 17

Test of Within Subjects Effects for Knowledge by Test (Baseline, Test 1, Test 2)

Source	Sum of Squares	df	Mean Square	F	Sig.
Test	25.174	1.915	13.148	25.378	<.001*
Test * Group	26.310	1.915	13.742	26.523	<.001*
Error (test)	195.417	133.173	.518		

Follow-up repeated measures ANOVA for Group 1 and Group 2 confirm *Healthy Hearts* effects on students' knowledge. Children who received the intervention between baseline and Test 1 (Group 1) had significant improvements in knowledge ($p < .001$) during this interval (see Table 18). Group 2 students knowledge at Test 1 was statistically similar to baseline measures (.332), and can be considered a control group from baseline to Test 1. No significant changes for Group 2 and significant changes for Group 1 between baseline and Test 1 indicate *Healthy Hearts* was responsible for improvements in physical activity knowledge. Group 1 was also the only group tested for knowledge retention.

Retention of knowledge is apparent by Group 1 knowledge scores at Test 1 and Test 2. Significant differences between baseline and Test 2 suggest knowledge retention ($p = .008$),

however significant differences between Test 1 and Test 2 (p = .05) indicate some loss of knowledge, as is typically expected. Test 2 scores remained significantly higher than baseline measures for Group 1 (p = .008) revealing some retention of physical activity knowledge for Group 1 children. Children in Group 2 showed similar improvement in knowledge before and after completing the module (Test 1 to Test 2).

Table 18

Within Group 1 Knowledge Paired Comparison at Baseline, Test 1, and Test 2

(I) Test	(J) Test	Mean Difference (I-J)	Std. Error	Sig.
Baseline	Test 1	-.417	.115	.000
Baseline	Test 2	-.236	.087	.008
Test 1	Test 2	.181	.091	.050

Group 2 received the intervention between Test 1 and Test 2, during which time significant effects of *Healthy Hearts* on knowledge resulted (p <.001). Repeated measures ANOVA for Group 2 reveal significant differences between baseline and Test 2 (p <.001), and Test 1 and Test 2 (p <.001), however no significant differences between baseline and Test 1 knowledge (Table 19). Significant changes in knowledge for both groups immediately following use of *Healthy Hearts* indicate positive effects of the module on knowledge.

Table 19

Within Group 2 Knowledge Paired Comparison at Baseline, Test 1, and Test 2

(I) Test	(J) Test	Mean Difference (I-J)	Std. Error	Sig.
Baseline	Test 1	.099	.101	.332
Baseline	Test 2	-.753	.100	.000
Test 1	Test 2	-.852	.101	.000

Attitude

The second research question was, does *Healthy Hearts* have any influence on fifth grade children's intention to be physically active (attitude) following five weeks of instruction? Intention to be physically active was measured using three items adapted from SPARK (Sallis et al., 1997). Each item was scored on a five-point Likert scale, and scores for each item were tallied as an overall physical activity attitude score. Means and standard deviations for all teachers classes are displayed in Table 20. Interitem reliability (Cronbach's alpha) between the three items was .719 at Test 2, which is consistent with previous research (Sallis et. al., 1997). Repeated measures ANOVA determined changes in attitude for both groups at all three tests.

Results of repeated measures ANOVA reveal significant changes by test within subjects $F(2, 386) = 3.524$, $p = .030$. Both groups intention to be physically active increased from baseline to Test 2 (see Table 22). Since there was no significant interaction $F(2,386) = 1.35$, $p = .260$, the increase in attitude cannot be attributed to *Healthy Hearts* because both groups' attitudes improved regardless of when they used *Healthy Hearts*. Between groups main effects were not statistically significant $F(1, 193) = .009$, $p = .923$ (see Table 23), so the null hypothesis was accepted. The results of this study were consistent with published research regarding correlation between intention to be physically active and physical activity behavior. Positive trends did appear as displayed in Figure 3.

Follow-up repeated measures ANOVA for Group 1 and Group 2 reveal significant changes in attitude for Group 1 from baseline to Test 1 and no significant changes in Group 2 during this interval. These results indicate *Healthy Hearts* had significant effects on Group 1 attitude when Group 2 is considered a control group during the baseline to Test 1 interval. Group 2 attitude following using *Healthy Hearts* at Test 2 was significantly higher than baseline ($p = 0.028$), although not significantly higher than Test 1 ($p = 0.229$). Group 1 scores decreased slightly from Test 1 at Test 2, however were not significantly different ($p = 0.413$). No significant differences in attitude for Group 1 at baseline and Test 2 ($p = 0.204$) reveal *Healthy Hearts* effects on attitude were short lived. No significant changes from Test 1 to Test 2 for Group 2 suggest attributing changes in attitude to *Healthy Hearts* must be done with caution. The data from this study is consistent with published research on physical activity attitudes and behavior.

When physical activity behavior scores were regressed with attitude scores for baseline, Test 1, and Test 2 combined scores, a significant correlation resulted at the .001 level (see Table 21) (Edmundson et al., 1996; Trost et al., 1997). Results imply *Healthy Hearts* had significant effects on fifth grade children's intention to be physically active, although these results must be considered with caution because although Group 2 attitude changed from baseline to Test 2, the changes immediately following the intervention (from Test 1 to Test 2) were not statistically different. Intention to be physically active is typically correlated with physical activity behavior and suggests results of this study are consistent with published research. Although there were significant effects on attitude, significant effects on behavior however did not result. The following section presents the statistical analyses of *Healthy Hearts* effects on behavior.

Table 20

Fifth Grade Students' Attitude Means and Standard Deviations by Teacher

		Baseline		Test 1		Test 2	
	N	Mean	SD	Mean	SD	Mean	SD
Group 1							
JW	11	11.182	1.401	12.455	1.635	11.727	1.902
PB	15	12.067	1.944	12.000	1.813	12.267	1.870
DC1	4	10.500	3.512	13.000	1.414	13.250	1.500
DC2	8	11.875	2.748	12.250	2.053	12.625	2.326
LB	15	11.933	1.280	12.200	2.396	12.533	0.915
SV	14	12.429	1.158	12.786	1.424	12.143	2.656
KK	16	12.938	1.389	12.313	2.182	12.250	1.342
JM	24	11.833	2.220	12.542	2.064	12.042	2.156
Total	107	12.009	1.891	12.402	1.922	12.243	1.888
Group 2							
DJ	17	12.059	1.952	11.529	2.095	12.294	1.687
RC	10	13.100	1.524	13.200	1.135	12.100	2.331
CS1	17	11.529	1.908	11.941	1.391	12.824	1.629
CS2	14	11.214	2.045	12.214	1.762	12.286	1.437
CS3	13	11.538	1.854	11.923	2.597	11.846	1.676
DS	17	12.824	2.069	12.706	1.687	13.353	1.618
Total	88	12.011	1.986	12.193	1.868	12.511	1.735

Note. Only students who answered each question at baseline, Test 1, and Test 2 were included in this table.

Table 21

Physical Activity Behavior and Attitude ANOVA Table

Mode	Sum of Squares	df	Mean Square	F	Sig.
Regression	123209.22	1	123209.22	10.775	.001
Residual	2195479.15	192	11434.79		
Total	2318688.37	193			

a. Predictors: (Constant), Intention to be physically active

b. Dependent Variable: Physical Activity Behavior (Weekly Activity Checklist)

Table 22

Test of Within Subjects Effects for Attitude by Test (Baseline, Test 1, Test 2)

Source	Sum of Squares	df	Mean Square	F	Sig.
Test	14.38	2	7.19	3.524	.030
Test * Group	5.52	2	2.76	1.35	.260
Error (test)	787.72	386	2.04		

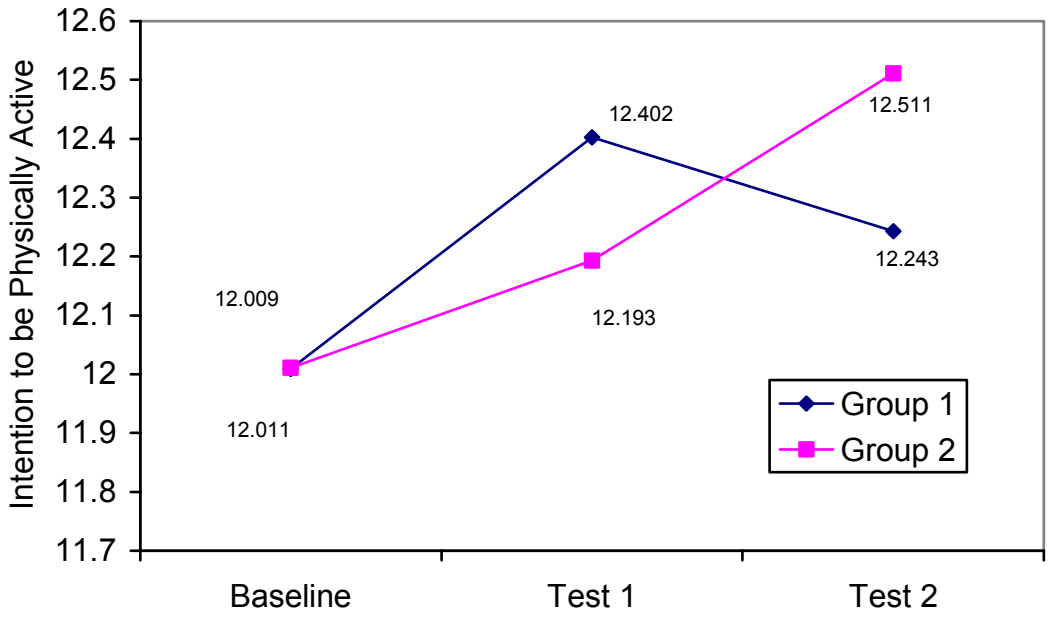

Figure 3. Mean attitude scores for both groups at baseline, Test 1, and Test 2.

Table 23

Test of Between Subjects Effects for Attitude by Group

Source	Sum of Squares	df	Mean Square	F	Sig.
Intercept	86646.09	1	86646.09	13174.03	.000
Group	.061	1	.061	.009	.923
Error	1269.4	193	6.58		

Behavior

The research question for behavior was, does *Healthy Hearts* have any influence on fifth grade children's participation in physical activity following five weeks of instruction? Physical activity behavior was measured by a seven-day physical activity recall called the Weekly Activity Checklist (WAC). The WAC was developed for use with fourth and fifth grade students in SPARK, and validated with Caltrac accelerometers (Sallis, 1991; Sallis et al., 1993a; Sallis & Saelens, 2000). Scores are an estimation of weekly energy expenditure in MET's. Repeated measures ANOVA was used to ascertain *Healthy Hearts* effects on physical activity behavior. Mean WAC scores and standard deviations are displayed in Table 24. Means are plotted in Figure 4 and suggest both groups increased physical activity from baseline to Test 1 and Test 2.

Table 24

Descriptive Statistics of Fifth Grade Students Behavior by Class

		Baseline		Test 1		Test 2	
	N	Mean	SD	Mean	SD	Mean	SD
Group 1							
JW	9	110.556	103.576	109.444	67.409	196.444	147.326
PB	15	101.400	94.141	125.533	108.254	175.333	127.380
DC1	3	60.000	51.098	104.333	116.573	66.333	45.786
DC2	8	91.750	45.121	127.125	54.241	129.375	85.799
LB	13	99.231	55.812	153.154	77.885	162.154	111.119
SV	11	126.364	97.254	170.545	68.941	132.091	67.221
KK	14	56.143	27.848	54.714	36.360	62.929	52.855
JM	17	128.353	111.588	134.529	112.562	188.529	104.537
Total	90	100.867	83.814	123.533	88.404	147.544	108.657
Group 2							
DJ	15	113.733	89.226	232.400	185.802	181.067	124.334
RC	9	132.444	74.788	181.444	75.193	116.222	80.224
CS1	14	89.143	56.071	105.857	83.343	98.571	72.034
CS2	15	136.333	131.063	136.733	127.373	150.067	134.244
CS3	13	83.923	70.657	89.077	60.806	106.154	63.884
DS	16	119.938	115.162	118.250	89.239	89.250	65.262
Total	82	112.207	94.781	142.707	122.247	124.402	98.921

Note. Only students who were present and completed the WAC at baseline, Test 1, and Test 2 were included in this table.

Tests of between subjects effects reveal no significant difference between groups for main effects $F(1, 170) = .043$, $p = .836$ (Table 25). Within subjects analysis revealed significant main effects for test $F(2, 340) = 7.524$, $p = .001$, as well as significant interaction $F(2, 340) = 3.617$, $p = .028$ (Table 26). The interaction is displayed in Figure 4 where the lines intersect between Test 1 and Test 2. Results suggest significant changes in behavior for both groups from baseline to Test 2. The significant interaction indicates group behavior changed at different test intervals. Follow-up repeated measures ANOVA was conducted to determine at what test interval significant changes resulted.

Table 25

Between Subjects Test for Physical Activity Behavior (WAC)

	Sum of Squares	df	Mean Square	F	Sig.
Intercept	8072144.854	1	8072144.854	448.726	.000
Group	777.412	1	777.412	.043	.836
Error	3058134.826	170	17989.028		

Table 26

Test of Within Subjects Effects for Physical Activity Behavior (WAC)

	Sum of Squares	df	Mean Square	F	Sig.
Test	90466.126	2	45233.063	7.524	.001
Test X Group	43494.196	2	21747.098	3.617	.028
Error (test)	2044152.467	340	6012.213		

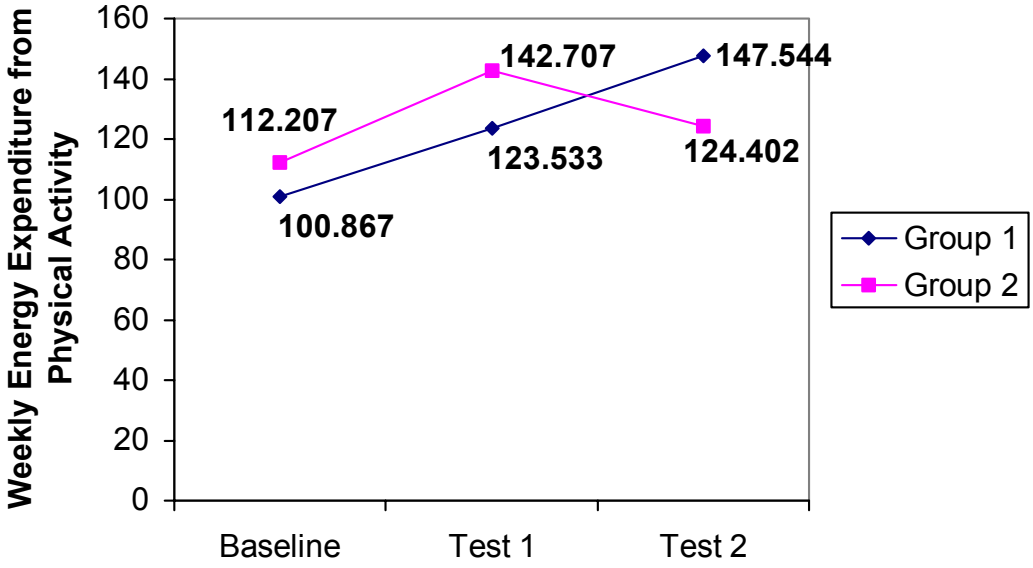

Figure 4. Mean Physical Activity Behavior (WAC) for both groups at baseline, Test 1 and Test 2.

Table 27

Within Group 1 Physical Activity Paired Comparison at Baseline, Test 1, and Test 2

(I) Test	(J) Test	Mean Difference (I-J)	Std. Error	Sig.
Baseline	Test 1	-22.67	9.84	.024
Baseline	Test 2	-46.68	11.44	<.000
Test 1	Test 2	-24.01	9.19	.011

Group 1 repeated measures analysis revealed significant changes from baseline to Test 1 ($p = .024$) and again from Test 1 to Test 2 ($p = .011$) in a paired comparison (see Table 27). Children in Group 1 were more active at Test 1 than baseline and again at Test 2. Group 2 physical activity also improved significantly from baseline to Test 1 ($p=.025$), suggesting change in behavior cannot be attributed to *Healthy Hearts*.

Paired behavior analysis for Group 2 is presented in (Table 28). Results reveal significant changes from baseline to Test 1 ($p = .025$). There were no significant changes in behavior for Group 2 from baseline to Test 2 ($p = .332$), or from Test 1 to Test 2 ($p = .214$) although behavior

scores were lower. An increase in both groups physical activity from baseline to Test 1 suggests *Healthy Hearts* did not impact physical activity behavior. In general, *Healthy Hearts* did not affect behavior, but had significant effects on knowledge and attitude suggesting potential for behavior change. The significant correlation between behavior and attitude further suggest potential behavior change, although these changes were not observed for this study. Other variables effects on knowledge gains are presented in the following section.

Table 28

Within Group 2 Physical Activity Paired Comparison at Baseline, Test 1, and Test 2

(I) Test	(J) Test	Mean Difference (I-J)	Std. Error	Sig.
Baseline	Test 1	-30.50	13.31	.025
Baseline	Test 2	-12.19	12.50	.332
Test 1	Test 2	18.30	14.61	.214

Other Variables

Teacher surveys were used to collect additional data used to investigate effects of *Healthy Hearts*. Socioeconomic status (SES), and non-*Healthy Hearts* IGO instruction time were considered covariates in a repeated measures analysis with knowledge as the dependent variable. Results revealed SES (within factor $p = 0.533$: between factor $p = 0.120$) and non-*Healthy Hearts* IGO instruction time (within factor $p = 0.665$: between factor $p = 0.865$) had no significant effects on knowledge. The final analysis looked at time allocated to *Healthy Hearts* regressed with knowledge scores at Test 1 for Group 1. There was no significant correlation between allocated time and knowledge ($R = 0.100$, $P = 0.275$). The following section discusses the results of the data analyses.

Discussion

When designing and developing curriculum, it is necessary to conduct formative and summative evaluations to further revise and develop the curricula. Formative evaluations are conducted throughout the development and implementation of a program and results in more information for revision of the program than quantifiable effects. Summative evaluations are conducted to measure the extent to which the instruction met intended outcomes. *Healthy Hearts* was designed and developed to promote healthy lifestyle choices regarding nutrition, tobacco, and physical activity. This study was conducted to evaluate summative effects the *Healthy Hearts* curriculum had on fifth grade children's physical activity knowledge, attitudes, and behavior. The results indicate *Healthy Hearts* had significant effects on physical activity curriculum knowledge and attitude, but did not have a measurable impact on physical activity behavior. The significant correlation between behavior and attitude indicates results of this study are consistent with published research. The following observations can be made based on results of this study beginning with knowledge.

Knowledge

Healthy Hearts led to improved knowledge about the benefits and recommended amounts of physical activity in fifth grade children. Children who used *Healthy Hearts* answered more questions right than students who did not use *Healthy Hearts*. Immediately following the intervention, Group 1 knowledge scores improved almost ½ a point, and Group 2 scores improved more than one point. Significant results were anticipated because knowledge test items were taken directly from the curriculum itself.

When evaluating curriculum, it is important to measure whether the learners are gaining knowledge the instruction intends to teach. In this case, knowledge of the physical activity curriculum was demonstrated by both groups because they identified more correct answers at Test 2 than at baseline. Between baseline and Test 1 there was no reason to expect any changes in Group 2 because the study was essentially experimental vs. control. This was verified by comparing the instruction time teachers provided for objectives covered in *Healthy Hearts*, not including time provided for students to use *Healthy Hearts*.

Both groups were provided similar amounts of instruction on objectives related to *Healthy Hearts*, however the quality or type of instruction was not addressed and could have a

significant impact on knowledge acquisition. Regarding time of instruction, the similarities between groups from baseline to Test 1 allow consideration of Group 2 as a control group during this test interval. Significant effects of *Healthy Hearts* were observed during this interval in an improvement in physical activity knowledge. Maintaining the assumption that teachers did implement *Healthy Hearts* with their classes, and provided time for students to engage in instruction, the intervention group had more exposure to instruction on those objectives, logically improving scores. Additional instruction time would explain the improvement in Group 1 scores at Test 1.

Gains in knowledge of the physical activity curriculum demonstrate *Healthy Hearts* potential as a behavioral intervention for fifth grade children. The objectives of *Healthy Hearts* were developed based on research regarding correlates and benefits of physical activity for children. Knowledge of the benefits of physical activity has been correlated with actual physical activity behavior. Children's knowledge of the benefits of physical activity might influence future participation in physical activity. However, as was demonstrated in this study, physical activity is a complex attitude influenced by many factors other than knowledge of benefits and recommended amounts of physical activity, and difficult to modify.

Attitude

The null hypotheses for attitude were that there would be no differences between test intervals (baseline, Test 1, Test 2), groups (Group 1, Group 2), and there would be no interaction between group and test interval. Fifth grade children's intention to be physically active did change significantly during the period of this study, however attributing changes in attitude solely to *Healthy Hearts* must be done with caution because Group 2 changes in attitude were significant from baseline to Test 2, but not immediately following the intervention (Test 1 to Test 2).

The attitude intention to be physically active was chosen because it has proven to be a reliable indicator of physical activity. In an eight-week period of time, a behavior change might not occur, therefore potential change in behavior was addressed by measuring intention to be physically active. The significant correlation of attitude and behavior in this study indicate the results are consistent with previous studies analyzing fifth grade children's attitude and behavior (Edmundson et al., 1996; Trost et al., 1997). Significant effects of *Healthy Hearts* on attitude suggest the potential for behavior change, even though actual behavior change was not observed.

Regardless, the inconsistent results indicating cautious reporting of the effects of *Healthy Hearts* on attitude are not unexpected. There are a number of reasons for such results. First of all, there are many variables contributing to children choosing physical activity or demonstrating intention to be physically active.

Extensive research reveals factors influencing physical activity include gender, perceived confidence, perceived skill, parental modeling, perceived benefits and barriers, access to facilities, and time spent outdoors (Edmundson et al., 1996; Gordon-Larsen et al., 2000; Pate et al., 1997; Sallis et al., 1999b; Trost et al., 1996; Trost et al., 1997; Trost et al., 1999). *Healthy Hearts* addressed perceived benefits as a means to change attitudes and behavior. There have been studies with mixed results regarding perceived benefits relationship with physical activity attitudes and behavior. Some studies have shown these to be related, while others have not (Gordon-Larsen et al., 2000; Pate et al., 1997; Sallis et al., 1999b; Trost et al., 1996; Trost et al., 1997; Trost et al., 1999). Intention to be physically active is a complex attitude that is influenced by many other variables. Significant knowledge results indicate participants of this study did identify many benefits of physical activity, however the curriculum did not address other variables such as parental behavior, barriers, or environmental factors such as access to facilities.

The intervention could be revised to better promote physical activity by addressing variables such as perceived barriers and skill. Physical activity levels have been changed through modifying the environment during school, however, school based curricula have been unsuccessful changing out of school physical activity levels of children (Edmundson et al., 1996; Sallis et al., 1997; Sallis et al., 1993b). Relatively successful interventions have been more comprehensive and have spanned a greater period of time.

Both CATCH and SPARK were long-term projects tracking behaviors over a period of years, as compared to the six-week *Healthy Hearts* project. CATCH was a comprehensive program that included physical education and lunchroom interventions in addition to a classroom component. Through teacher workshops, more physical activity time was provided during physical education however student intention to be physically active and physical activity outside of school did not change (Edmundson et al., 1996; Sallis et al., 1997; Sallis et al., 1993b).

Research does show that attitudes can be changed in a short period of time. Changing lifestyles and promoting behavior change, a complex attitudinal outcome, would take a longer period of time. It is suggested that consistent participation in physical activity over a 6 month

period might lead to continued physical activity (Corbin & Pangrazzi, 1998). *Healthy Hearts*' potential is evident in positive trends in attitude following the intervention, although changes as a result of *Healthy Hearts* must be considered with caution. It is not reasonable to expect changes in attitude with only a classroom component implemented over such a short period of time, however the positive effects on Group 1 attitude suggest potential effects of *Healthy Hearts* on behavior. As described in Chapters One and Two, true indication of attitude is measured by observable behavior.

Behavior

Changes in behavior during this study cannot be attributed to the *Healthy Hearts* intervention. The null hypotheses were that there would be no differences between amounts of reported physical activity between groups, by test interval, and no group by test interaction. The null hypothesis for group was accepted, however the null hypotheses for Test interval and Test by Group interaction were rejected.

Main effects for both groups indicated there were significant changes in physical activity levels from baseline to Test 2. Follow-up analyses revealed that both groups behavior improved from baseline to Test 1 although only Group 1 received the intervention. Results do not allow for claims that *Healthy Hearts* impacted physical activity behavior. One interesting result was the significant interaction. Following the intervention, Group 2 physical activity decreased. There are a few possible explanations for changes in behavior scores, beginning with differences in familiarity of physical activity recall instruments between groups.

Although the main difference between the two instruments was the number of days of physical activity to recall (7-day vs. 1 day), it is likely that the intervention influenced how children filled out the WAC because of their regular use of SAPAC in *Healthy Hearts*. Developers of SAPAC recommend 30 minutes to complete the instrument, although time for repeated use of this instrument has not been reported (Sallis, 1991). It is logical to assume that it would take children less time to complete SAPAC if they had filled it out numerous times because of familiarity with the test. Additionally, since only 45 minutes of class time twice a week was recommended for *Healthy Hearts*, children would begin to complete components of the module such as SAPAC in a shorter period of time to allow more time to spend on other sections. Familiarity with SAPAC and completing the form in a shorter period of time might have impacted how children completed the WAC. Children might have completed the

questionnaire the same way as they would SAPAC and might miss some additional days of activity that otherwise could have been reported.

A second reason activity scores might have decreased due to the intervention is because in *Healthy Hearts*, outside of school physical activity is emphasized when completing SAPAC. Without trained test administrators emphasizing outside of school physical activity, children might initially have reported all day physical activity instead of solely out of school physical activity, further causing greater overestimation of time prior to using *Healthy Hearts*. After using *Healthy Hearts* and repeatedly completing SAPAC, overestimation of time on the WAC might have decreased which would result in a decrease of reported activity following the intervention, as was the case with Group 2. These reasons might have caused a reduction in overestimation of time following *Healthy Hearts*. Reporting absolute time in recall instruments must be done with caution because of children's tendency to overestimate time.

Many studies have found gross overestimation of physical activity by children (Sallis & Saelens, 2000), with many estimates exceeding 100 percent (Sallis et al., 1996). Sallis et al. (1996) found fifth grade students overestimate physical activity an average of 48 minutes with self-administered instruments such as the WAC compared to accelerometer monitoring. These instruments are considered reliable estimates of relative activity, however are not used for absolute measures of physical activity. When using self-report instruments, especially with children around ten years old and younger, reliability and validity have traditionally been low (Sallis, 1991; Sallis & Saelens, 2000). Self-reports are still considered good low cost measures when used with larger studies and the sample size for this study was relatively small. The administration of the instrument could also have a significant effect on the results.

Classroom teachers, not test administrators trained to oversee children using the WAC, administered the test to participants. It is recommended that trained administrators oversee the instrument, however that was not feasible for this study. In a study to validate the WAC, careful administration procedures were adopted to prepare children for the test. Group instructions were given to the entire class, students were assisted in defining a 15-minute period, and the emphasis was made to report physical activities done outside of school. Due to testing time constraints for this study, these procedures were not followed in order to limit the amount of class time necessary to administer the test. This decision could explain a significant portion of the results, especially when considering group familiarity with self-reports following the intervention.

Another factor that might have influenced WAC scores is the date students completed Test 1 and Test 2.

All groups completed Test 1 within the three-week period following the intervention group's completion of *Healthy Hearts*. However, most of Group 2 classes tended to take this test toward the end of the three weeks, as opposed to Group 1 classes who completed the instrument earlier in this three-week period. This is assumed since all Group 1 tests were received in the mail by the end of the second week, while most Group 2 school tests were received after the end of the third week. When taken within the same time period, the WAC is a reliable instrument for comparisons, however when introducing time as a confounding variable, the reliability to compare physical activity patterns between groups comes under question.

It is possible that weather had a significant impact on reported physical activity. During the first week of Test 1, high and low temperatures in Charleston, WV on March 30 were 44 and 48 degrees Fahrenheit with light rain. This would have been closer to the time a majority of Group 1 were completing Test 1. In contrast, on April 13, around the time a majority of Group 2 were completing the Test 1, high and low temperatures in Charleston, WV were 57 and 63 degrees Fahrenheit with no precipitation (found at http://weather.about.com/gi/dynamic/offsite.htm). Weather is one variable in perceived benefits and barriers to physical activity. Lower incidence of physical activity on colder and rainy days would help explain differences between the two groups in this study.

When looking at changes from baseline to Test 2 of the intervention group, there were positive trends in attitude and behavior. Although statistically significant changes in behavior for the intervention group were not observed, significant results in knowledge and attitude indicate *Healthy Hearts* was effective for at least two dependent variables. This was an encouraging result for using *Healthy Hearts* as a curricular intervention. Further analysis of other variables provide valuable insight into factors that might influence the impact *Healthy Hearts* has on fifth grade children.

Other Variables

Descriptive data by class reveal groups one and two were similar in SES, time allocated to *Healthy Hearts*, and non-*Healthy Hearts* IGO time supporting baseline results of no significant differences between groups. This indicates both groups can be considered similar and comparisons can be made between group one and Group 2.

Significant effects of *Healthy Hearts* on knowledge and attitude suggest *Healthy Hearts* has potential as a behavioral intervention. Classroom curriculum is considered an important component of school based coordinated health promotion models, and new delivery mechanisms such as the WWW can extend classroom curricula outside of school. Classroom interventions have successfully improved dietary intake of children as well as reducing sedentary behaviors, as well as in-school physical activity levels (Gortmaker et al., 1999a; Gortmaker et al., 1999b; McKenzie & et al., 1995; McKenzie et al., 1996; Sallis et al., 1997; Sallis et al., 1993b). However, interventions have been unsuccessful modifying outside of school physical activity. Results of this study revealed *Healthy Hearts* had significant effects on knowledge, and suggest further development, evaluation, and provision of this module to children is necessary to further explore impact on health and physical activity behavior. The following chapter summarizes the results of this study, discusses implications, and makes recommendations for future research.

CHAPTER 5
SUMMARY, CONCLUSIONS, & RECOMMENDATIONS

The alarming incidence of obesity and physical inactivity among youth and adults justifies developing interventions addressing healthy behaviors. The increased popularity of sedentary activities such as television viewing, computer gaming and Internet use augments problems of physical inactivity in youth. School based interventions, such as SPARK and CATCH, have successfully modified physical activity during school, but have been unsuccessful changing outside of school physical activity behaviors. Furthermore, these programs have been expensive to conduct and are not cost feasible to implement on a wide scale. *Healthy Hearts* was developed as a health intervention delivered via the Internet. By taking advantage of the capabilities of the Internet, *Healthy Hearts* could be implemented in thousands of schools for a fraction of the resources and costs of other school health programs. This chapter provides a summary of the results of this study, draws conclusions based on the results and provides recommendations for future research.

Summary

The purpose of this study was to measure the influence *Healthy Hearts* had on fifth grade children's physical activity attitudes, behavior, and knowledge. A repeated measures quasi-experimental control design summatively evaluating effects of the *Healthy Hearts* Web Based instructional (WBI) module revealed significant effects on knowledge, mixed results for attitude, and no effects on behavior. This study was essentially a summative curriculum evaluation implemented as a follow-up to the initial formative evaluation and subsequent redesign of *Healthy Hearts* (Elliott, 1997). Participants in this study included 233 fifth grade children from eight public schools in five West Virginia counties.

Data was collected using three versions of a questionnaire (Form A, Form B, Form AB) that included physical activity attitude, behavior, and knowledge items. The physical activity items used for this study were part of a longer questionnaire that included items pertaining to nutrition and tobacco objectives. These latter variables will be analyzed as part of another study. Three attitude items measuring intention to be physically active were adapted from SPARK. A panel of experts had validated these items during that project. The Weekly Activity Checklist (WAC) used to estimate weekly energy expenditure in MET's was also adapted from SPARK

and had been previously validated using accelerometers. Six physical activity knowledge items were used to evaluate knowledge of the physical activity curriculum objectives. Knowledge items were developed from *Healthy Hearts* instructional objectives, and validated by a panel of experts.

Healthy Hearts is a five-week health curriculum delivered via the Internet. Fifth grade children use *Healthy Hearts* at school during classroom time. *Healthy Hearts* was designed for classroom teachers to take their classes to a computer lab at least two 45-minute sessions a week over four consecutive weeks for WBI. The instruction includes writing activities, information presentation, physical activity and diet recall and analysis, and practice and quizzing opportunities. Other curricula were not controlled, suggesting this study compares instruction and non-instruction. The participating children completed a baseline test, and two follow-up tests. Group 1 used *Healthy Hearts* between baseline and Test 1, and Group 2 used *Healthy Hearts* between Test 1 and Test 2. Tests were administered to determine the influence *Healthy Hearts* had on fifth grade children's physical activity knowledge, attitudes, and behavior.

Conclusions

Results revealed significant changes in physical activity knowledge following the *Healthy Hearts* intervention for both groups, i.e. children were more likely to answer knowledge questions right following completion of *Healthy Hearts* than before. The increase in physical activity knowledge can be attributed to the *Healthy Hearts* intervention.

Significant changes in attitude did occur. Attributing these changes to *Healthy Hearts*, however, must be done with caution because of inconsistencies in results between groups. Results of repeated measures ANOVA showed there were no significant differences in attitude between groups regardless of when the intervention was administered, but follow-up analyses revealed significant changes for Group 1 from baseline to Test 1. There was also a significant correlation between attitude and behavior.

The results of this study were consistent with related studies in regard to correlation between physical activity behavior and intention to be physically active, thus strengthening the results of this study. Improved intention to be physically active does suggest potential for behavior change, although there were no changes in behavior during this study that can be attributed to *Healthy Hearts*.

There were significant changes in behavior for both groups from baseline to Test 2 as well as differences between groups. Between groups differences showed significant improvements in behavior from Baseline to Test 1, however, these changes were not necessarily a result of participation in the intervention. Regardless, significant changes in attitude and the positive correlation between attitude and behavior data suggest potential for future behavior change.

Significant changes in attitude and knowledge, and positive trends in behavior, suggest *Healthy Hearts* may be an effective intervention. No statistically significant changes in behavior or attitude were expected during this study, however significant changes in curriculum related knowledge and attitude warrants further development and dissemination of *Healthy Hearts*. The following section makes recommendations for future development of *Healthy Hearts* as well as for future study.

Recommendations

There is a need for health interventions, and schools are considered good places to implement such programs. Elements of a coordinated school health program include curricular, as well as environmental changes (MMWR, 1997). Any health instruction supplementing, or in addition to existing curricula, may help promote active lifestyles among children leading to healthy and active choices by adults. The results of this study have led to a number of recommendations. They include addressing additional determinants of physical activity, developing a parents' section, additional modules to extend instruction to other grades and to the home, and conducting further formative assessment to improve the module. Additional recommendations include using physical activity data collected from children while they complete parts of the *Healthy Hearts* module as a means to analyze behavior in place of the WAC pre/posttest, analyzing each knowledge objective individually, and including additional attitude test items. The discussion begins with recommendations for addressing additional determinants of physical activity.

Revisions Addressing Other Determinants of Physical Activity

Healthy Hearts addresses the benefits and amounts of physical activity necessary for good health. Knowledge of the benefits of physical activity has been shown to be a correlate of physical activity. Changing lifestyles is a complicated task, and many variables, both fixed and

modifiable, contribute to these lifestyles. Research describes fixed factors such as gender, race, and age correlating in some degree with physical activity (Gordon-Larsen et al., 2000; Trost et al., 1996; Trost et al., 1997). These are important to understand although they cannot be changed. Modifiable determinants of physical activity include perceived benefits and intention to be physically active (Pate et al., 1997; Sallis et al., 1999b; Trost et al., 1999), which are both focused on in the module. Other correlates include beliefs about the outcomes of participation in physical activity (Pate et al., 1997), television viewing (Robinson et al., 1993), parental modeling (Sallis et al., 1999b), and environmental variables such as access to facilities (Sallis et al., 1999b).

For example, teacher training interventions to modify the environment have been successful improving physical activity of children (Faucette et al., 1995; Lytle et al., 1996; Perry et al., 1990; Perry et al., 1998; Sallis et al., 1997). Unfortunately, modifying the environment is expensive, and the feasibility of modifying the outside of school environment for large numbers of students is questionable. It is unrealistic to directly modify the home environment for individual students. Therefore, other modifiable determinants of physical activity, which include perceived skill, opportunity/barriers, parental modeling, and self-efficacy (Pate et al., 1997; Sallis et al., 1999b; Trost et al., 1999) should be addressed in *Healthy Hearts* to potentially contribute to behavior change. For example, having children identify through a series of questions specific activities they could participate in, as well as directions for making or acquiring equipment to participate in these activities, could further enhance the behavioral change potential of *Healthy Hearts*. In addition, activity related prizes such as Frisbees and rollerblades could be offered to participating children, contributing to the environmental opportunity to improve physical activity and reduce sedentary behaviors.

National data regarding sedentary and active behaviors suggest an inverse relationship between television viewing time and physical activity (Gordon-Larsen et al., 2000). Gortmaker et. al. (1999a, 1999b) did reduce television viewing time in fifth grade children while improving obesity levels through classroom instruction coupled with family, food service, and teacher training. Creating assignments to include parents and teachers in the intervention might further reduce sedentary behavior. Addressing sedentary behaviors is a potentially effective variable to include in interventions.

Research frequently reveals a negative relationship between sedentary and physical activity behaviors, and use of the Internet is considered a potential contributor to increased sedentary activity (Walton et al., 1999). *Healthy Hearts* could contribute to more time engaged in sedentary pursuits since it is delivered via computer. There have been inconsistencies in some studies examining relationships between television and computer use and physical activity of children suggesting increases in sedentary pursuits does not always result in reduced physical activity (Epstein, 1997). It is important to note, however, that *Healthy Hearts* is not intended to be implemented as an alternative to physical education or any other opportunities for children to be active.

Healthy Hearts should be implemented as part of regular classroom activities without reducing opportunities to be active. Research has shown that reducing in-school physical activity does not lead to increased out of school activity (Dale, Corbin, & Dale, 2000). Therefore it is critical that *Healthy Hearts* be implemented as a classroom intervention, or during normally sedentary periods of the day, and not as a substitute for physical education or other opportunities to be physically active. However, use of computers can be considered a sedentary pursuit, similar to television viewing, and necessitates further attention in *Healthy Hearts*. One reason children choose to watch television over physical activity are perceived barriers to activity.

Revisions should include instruction pertaining to perceived barriers and opportunities to be active. Research has shown both of these factors correlate with physical activity behavior. By including a component of instruction for students to identify barriers, followed by suggested opportunities to be active would be an important addition to the module. Similarly, including instruction that addressed reducing sedentary activities might further contribute to improved health behaviors. Classroom based interventions have been largely unsuccessful improving physical activity behavior, however health behaviors such as decreased obesity, television viewing time and fat intake and increased fruit and vegetable consumption have improved through classroom intervention (Gortmaker et al., 1999a; Gortmaker et al., 1999b). One commonality between these successful interventions is an extended approach to change behavior by involving parents and characteristics from the home, as well as extending the intervention over a longer period of time.

Expanding Healthy Hearts

With so many factors related to physical activity, expanding the intervention could improve *Healthy Hearts*' contribution to a physically active lifestyle. The literature suggests extending an intervention to parents, and to grades K-12, as well as extending the length of time children spend engaged in the intervention might improve contributions to behavior changes. The following section begins by discussing expanding the instruction to parents, extending the intervention over a greater period of time, followed by suggestions to develop *Healthy Hearts* modules for other grades in addition to fifth.

Parents Section

Children who see their parents as active are more likely to be active themselves (Atkin et al., 1991; Brustad, 1996; Kimiecik et al., 1996; Pate et al., 1997; Sallis et al., 1999b; Trost et al., 1997; Trost et al., 1999). Including a parent component to *Healthy Hearts* might offer further opportunity to modify behavior. If parents are encouraged to model an active lifestyle, children might become more active themselves. By developing *Healthy Hearts* for parents, steps could be taken to improve activity levels of adult role models. Studies conducted have successfully encouraged physical activity in adults (Coleman et al., 1999; Dunn et al., 1998a; Dunn et al., 1998b; Dunn et al., 1997; Dunn et al., 1999; Saelens & Epstein, 1999). Dunn et al. (1999) compared structured physical activity such as running and lifting weights with lifestyle activity, such as walking instead of driving or taking the stairs instead of an elevator. They found that lifestyle activities in adults resulted in health improvements, similar to structured activity. One notable difference was that adults engaged in a lifestyle activity intervention were more likely to stick with the program (Dunn et al., 1998a; Dunn et al., 1998b; Dunn et al., 1997; Dunn et al., 1999). Curriculum designers should consider making a stronger distinction between lifestyle and structured activity so that adults would identify lifestyle activities such as walking and gardening as "physical activity", potentially leading to modeling improved activity levels. A second consideration would be to extend the length of time the intervention is implemented.

As previously described, developing take home assignments, or encouraging parents and students to access the module from home would extend the intervention outside of the classroom and into student's homes. Attempts to include parents in the intervention are justified and might include recipes, opportunity to analyze dinner menus for nutritional value, as well as suggesting

physical activities to participate in as a family. In addition to including a parents section, the literature suggests longer interventions have greater potential for modifying behavior.

Extending the Intervention Duration

Gortmaker et. al. (1999) successfully modified dietary behaviors and obesity in children over a period of 2 years with classroom instruction (Gortmaker et al., 1999a; Gortmaker et al., 1999b). Most successful interventions are mulit-year, multi-grade projects. For example, CATCH, SPARK, Planet Health, and Eat Well and Keep Moving were all implemented over a period of at least two years (Gortmaker et al., 1999a; Gortmaker et al., 1999b; Lytle et al., 1996; Perry et al., 1990; Perry et al., 1998; Sallis et al., 1997). The short duration of this study limits observable effects on lifestyle behaviors and attitudes. By including a parent section, and developing additional modules for pre-fifth grade and middle school students, instruction could be ongoing and the effects of the intervention more likely to be significant. Developing additional instructional modules would extend the intervention and provide greater opportunity to make a difference in children.

Healthy Hearts for Grades K - 12

Fifth grade is an important time to implement behavioral interventions because children are beginning to have more control over their own activities. Based on health and physical education objectives, additional modules should be developed beginning with middle school, then spanning into grades K-4. This would effectively extend the intervention, as well as provide greater opportunity to track behavior and attitudes over a period of years leading to improved assessment of instruction and behavior, as well as contribute to the literature base regarding child and adolescent behaviors.

The version of *Healthy Hearts* evaluated in this study was developed for fifth grade students. This module should be revised as a 5th and 6th grade module and a 7th and 8th grade module should be developed and implemented to extend the intervention time frame. Teachers are in need of WBI modules such as *Healthy Hearts* (Butler, 2000; Shotsberger, 1996). To meet teachers' needs, classroom time can be used to address children and adolescents health behaviors. Additional modules should be developed based on national health, physical activity, and technology objectives and provided to teachers from grades K-12. This is no small task, but beginning with development of a middle school (grades 7 & 8) module could extend the

intervention into middle schools. As additional modules are developed, conducting reliable and valid evaluation is imperative.

Measurement of Physical Activity Behavior

There is some doubt as to the reliability of the results collected by the WAC used to measure physical activity behavior in this study. The results were inconsistent for both groups. Standard deviations for both groups were almost as large as mean scores. A number of factors could explain the inconsistencies including weather, date of completing the tests, and familiarity with a similar instrument. One suggestion is to require all participants to complete tests on the exact same day. This would negate any differences in weather in specific locations, although *Healthy Hearts* dissemination to broader geographical regions in this intervention would further confound results. A second recommendation would be to use an instrument other than the WAC.

The similarities between the WAC and online SAPAC included in the *Healthy Hearts* curriculum may have contaminated results. To get a broader picture of physical activity, the WAC should be avoided and SAPAC data collected during the intervention used to estimate group activity. If control groups are used, they should also complete the online SAPAC on the same days as an intervention group. An accurate long-term analysis could then be conducted based on intervention data available throughout the school year over a period of years if the intervention is extended as previously suggested. Tracking weekly physical activity as a series of seven one-day recalls might provide a more accurate account of behavior than a weekly seven-day recall. The original SAPAC was validated with accelerometers and is considered a valid and reliable instrument for measuring energy expenditure from physical activity (Sallis et al., 1996) and would be an appropriate method of collecting physical activity behavior data from children. Some improvement in design regarding knowledge data can also be made.

Measurement of Knowledge

To get a better picture of knowledge effects, future evaluation of knowledge items should not separate knowledge items into two forms. Students should answer the same knowledge items at both the pretest and posttest. Separate forms were used for this study to shorten the test instrument and because of concerns with children becoming sensitized to the test. In a summative evaluation of instruction, children becoming sensitized to the test instrument should not be a concern because the purpose of the intervention is for children to learn the answers to

the test questions. Children using *Healthy Hearts* are repeatedly exposed to the correct answers to all test questions. This then would result in a test that determines whether the children actually learn the information that is presented in *Healthy Hearts* compared with those children who do not use Healthy Hearts. The length of the test instrument, however, would continue to be a concern.

To keep the knowledge instrument relatively short, it is important to include only one or two questions for each objective. Performance on each objective could then assessed to determine which objectives are being met instead of a general measure of knowledge improvement. This would also lead to greater improvements in the *Healthy Hearts* module because instruction could be improved in specific areas of the module after identifying which objectives are and are not being met. Yet another recommendation pertains to assessing attitudes.

Measurement of Attitudes

For this study, only intention to be physically active was measured. Beyond measuring physical activity behavior, additional subscales of attitudes should be included. Such subscales worth including are perceived barriers, perceptions of parental modeling, self-efficacy, and perceived skill to collect a broader range of attitudes (Gortmaker et al., 1999a; Sallis et al., 1999b; Trost et al., 1999; Walton et al., 1999). Such attitudes have been shown related to physical activity behavior and test items have been validated for measuring these attitudes. A valid picture of summative curriculum effects can be drawn by including additional attitude items, and employing a pretest-posttest design. Formative evaluation should also be implemented in addition to summative. Summative evaluations provide information regarding the extent to which an intervention was successful, but offer limited information regarding revision and modification of instruction.

Formative Assessment

Future evaluations should include formative assessment of the current module, as well as all modules in development. Evaluation is one component of the systematic design of instruction (Dick & Carey, 1996). Elliott (1997) conducted a formative evaluation of *Healthy Hearts* and made recommendations for further modification. She employed student and teacher interviews and surveys to evaluate *Healthy Hearts*. Procedures for conducting formative evaluations include expert review, one-to-one evaluation, small group evaluation, and field tests (Tessmer, 1998).

Data is collected by observation, interview, and survey following development of an evaluation strategy. It is critical to include formative assessment throughout the design, development, and implementation of the current *Healthy Hearts*, and any new instructional modules. The results of the summative evaluation conducted for this study did reveal that this curriculum does have a significant impact on fifth grade children.

Healthy Hearts targeted specific knowledge objectives, and the results of the statistical analysis did show significant effects for children participating in this study. With further development of the current module, as well as additional modules to extend the intervention, *Healthy Hearts* has the potential to be an effective curricular component of a coordinated school health program, contributing to potential improvements in children's physical activity knowledge, behaviors, and attitudes. The WWW can be used to deliver an intervention to K-12 children at school and at home for a fraction of the cost of other comprehensive interventions because of the accessibility, interactivity, and display capabilities of the WWW. Non Web-based interventions require substantial resources for delivery, training, update, and implementation. CATCH and SPARK both required multimillion-dollar grants to develop and implement in their respective locales. *Healthy Hearts*, however, uses computer and Internet technology already established in most schools. Therefore, a Web delivered intervention can be implemented at a fraction of the cost to any school or child with access to a computer connected to the Internet. The Internet has gained more attention in recent literature as a method of delivering health interventions because of the relatively low cost, widespread accessibility, and interactive capabilities (Cassell, Jackson, & Cheuvront, 1998; Marcus, Nigg, Riebe, & Forsyth, 2000; McKay, King, Eakin, Seeley, & Glasgow, 2001; Tate, Wing, & Winett, 2001).

With some data revealing an inverse relationship between computer use and physical activity levels, it is an apparent oxymoron to use WBI to increase physical activity levels of children. As long as such instruction is limited to the classroom and other times where physical activity is not feasible, however, the WWW could prove to be a powerful medium for delivering health interventions impacting lifestyle choices of children throughout the nation. *Healthy Hearts* has the potential to be an effective component of a coordinated school health program and should be further developed, implemented, and evaluated.

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APPENDIXES

APPENDIX A
HEALTHY HEARTS RECRUITMENT LETTER

Principal
Elementary School
Address

Dear Principal Name:

West Virginia has one of the highest rates of heart disease in the nation. The process of developing cardiovascular disease begins in childhood, and preventing or slowing this process could extend the years of healthy life for many of us. West Virginia University Coronary Artery Risk Detection in Appalachian Communities (CARDIAC) is teaming up with Healthy Hearts to offer a cardiovascular health intervention to fifth grade students in your county beginning in January, 2001.

In 1998, Dr. William A. Neal, M.D. from the School of Medicine at West Virginia University spearheaded the CARDIAC project to identify children and parents at risk of heart disease. 709 fifth grade students from seven West Virginia counties have had cholesterol levels tested, and cholesterol screenings have recently begun in an additional eight West Virginia counties. To further address risk factors of Heart disease in West Virginia children, Healthy Hearts is being offered as a classroom intervention.

Healthy Hearts is a five-week unit of instruction that is delivered to students via the Internet and addresses risk factors associated with cardiovascular disease. Classroom teachers implement Healthy Hearts as part of regular classroom activities by taking students to a computer lab twice a week for lessons delivered over the Internet. Students are presented information meeting a number of West Virginia Instructional Goals and Objectives related to the function of the heart and the effects of tobacco, nutrition, and physical activity on the heart. To implement Healthy Hearts, schools must have access to a lab with computers connected to the Internet that is available to teachers twice a week.

This fall, Healthy Hearts is being piloted and evaluated in two West Virginia classrooms. We are prepared to deliver Healthy Hearts to more fifth grade students beginning in January, 2001 to further evaluate effects of the module on fifth grade students health related knowledge, behavior, and attitudes. We ask for your help to invite fifth grade teachers from your County to implement Healthy Hearts this spring.

If you are interested in this project, we would be happy to meet with you and answer any additional questions. Feel free to visit the Healthy Hearts Web site for samples of student lessons and a more detailed description of this project. We hope you find this project as exciting as we do and that you will help us in the fight to improve cardiovascular health of children from West Virginia.

Sincerely,

William A. Neal, M.D.

Eloise Elliott, PhD.

CARDIAC
PO Box 9214
Morgantown, WV 26506-9214
Phone: (304) 293-4341

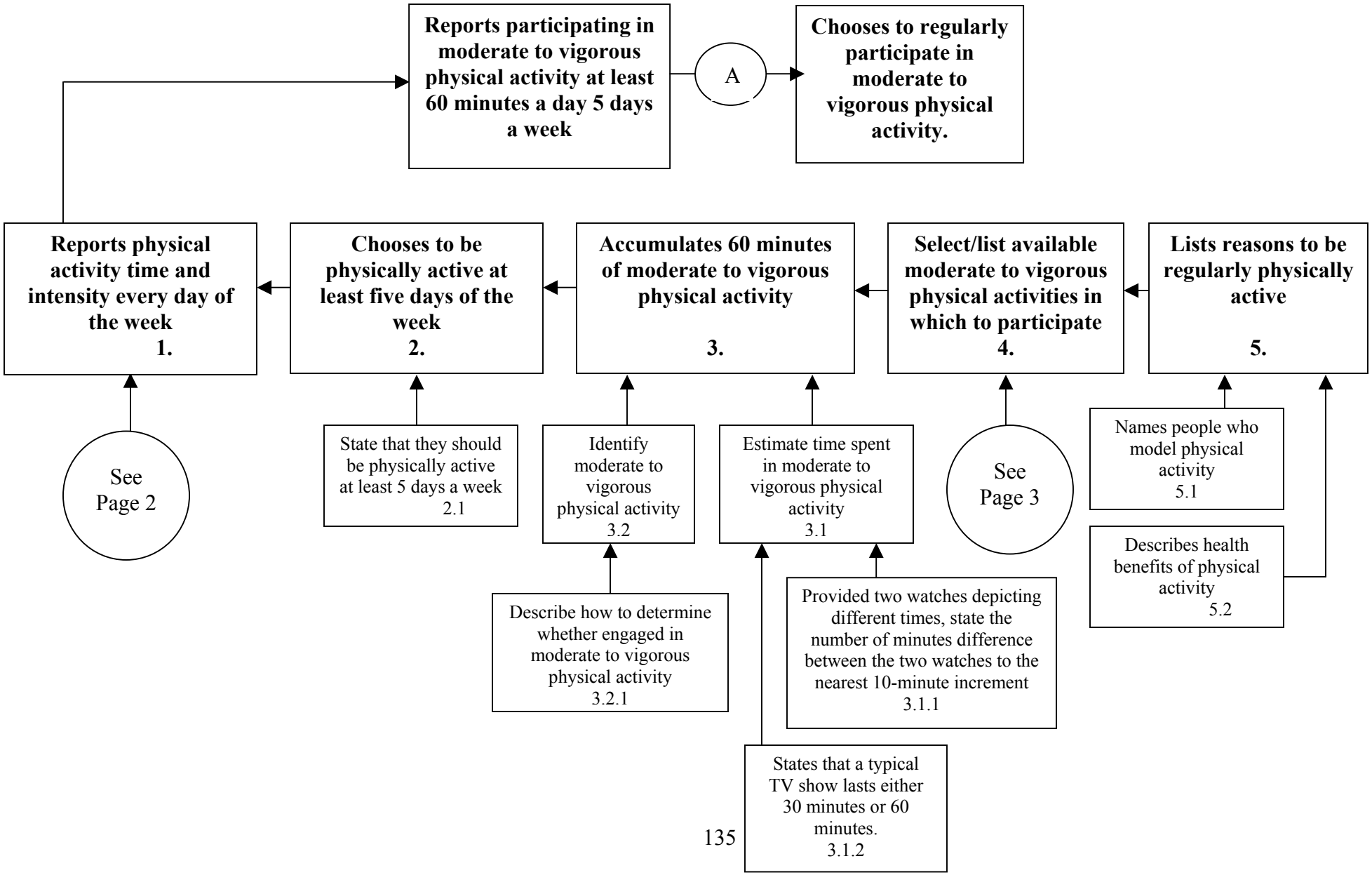
Healthy Hearts
PO Box 451
Athens, WV 24712
*Phone: *(304) 384-5345 Email: info@healthyhearts4kids.org*

APPENDIX B

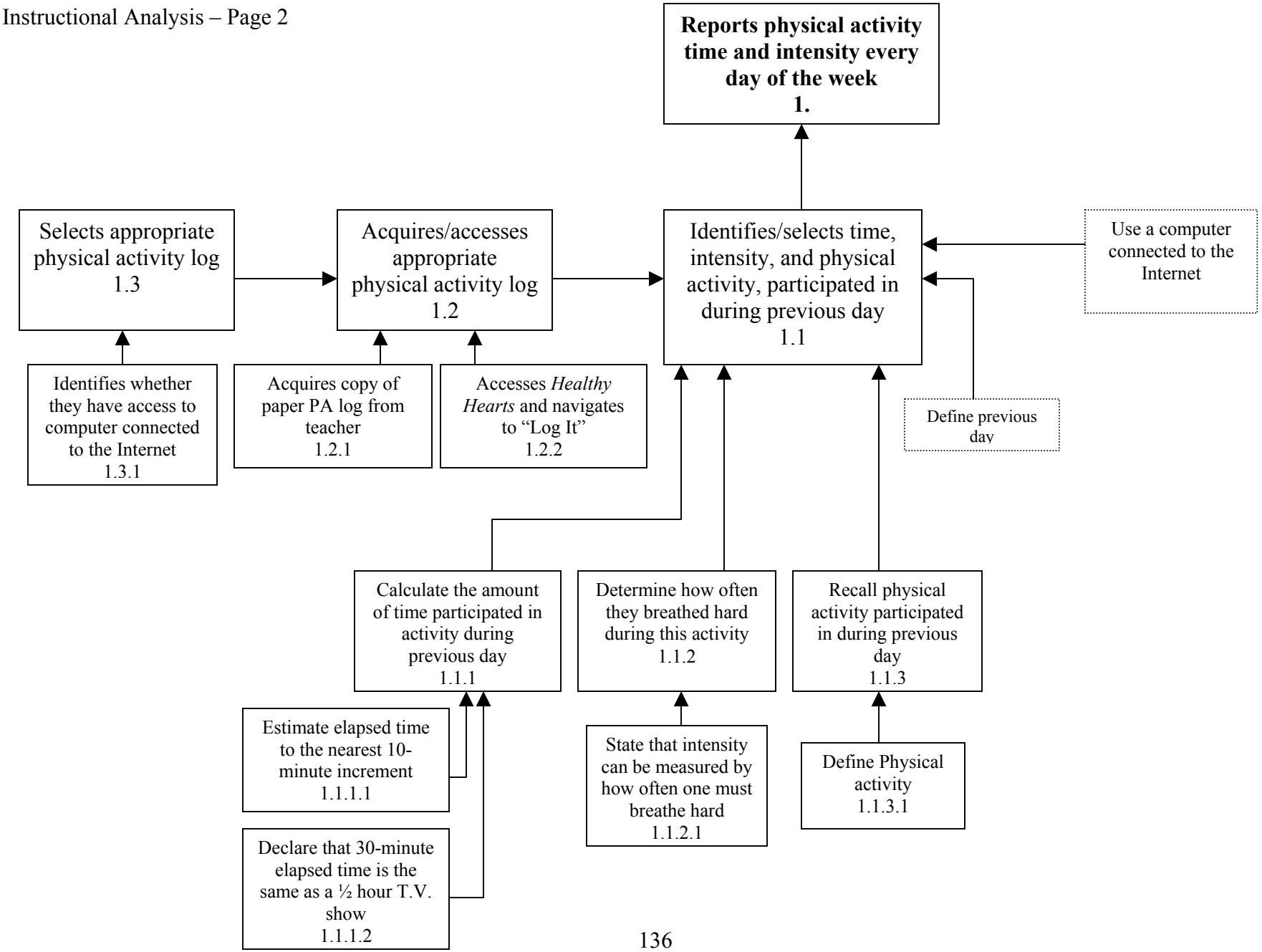
HEALTHY HEARTS TASK ANALYSIS

Instructional Analysis – Page 1

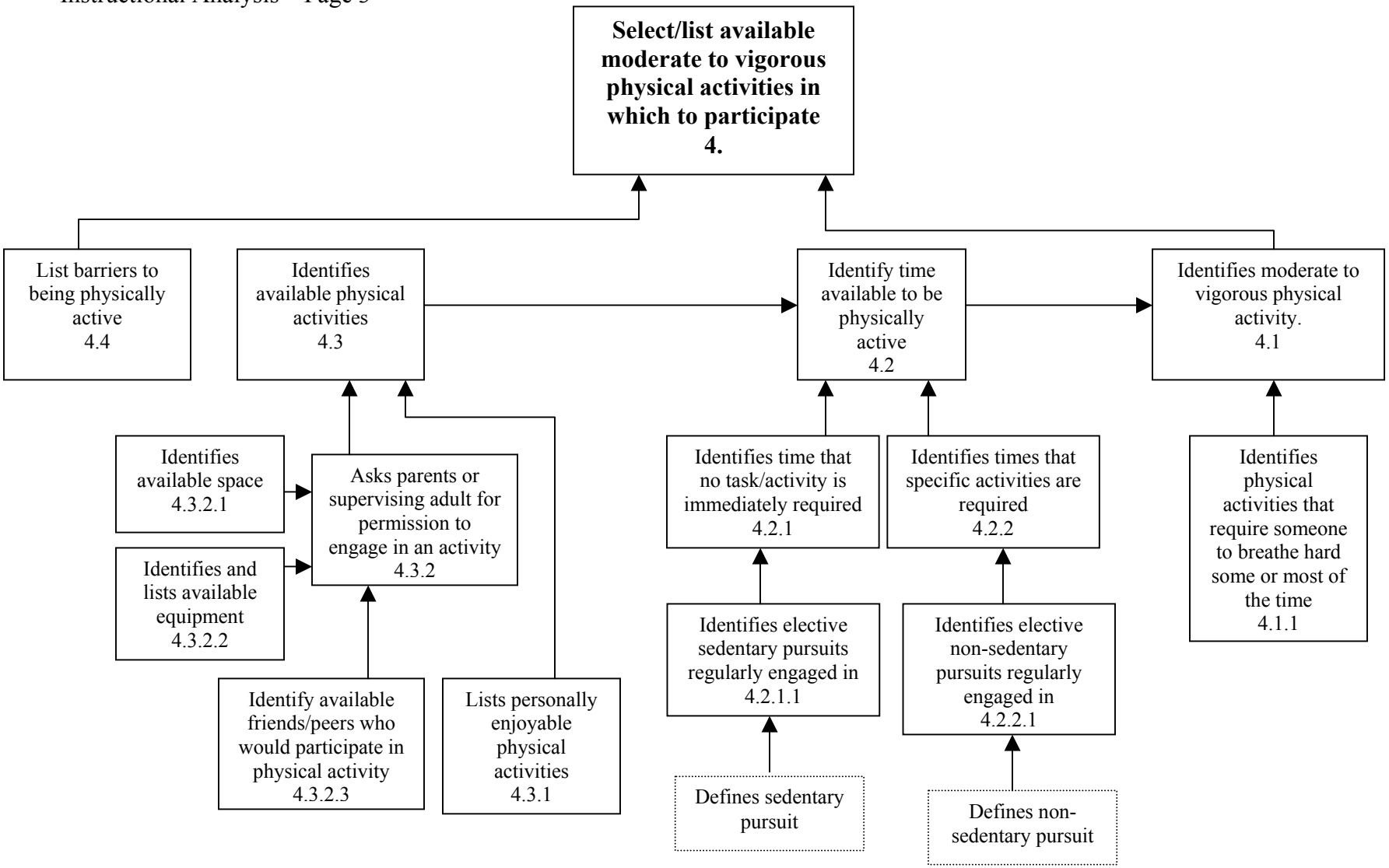
Fifth Grade Children's Physical Activity



Instructional Analysis – Page 2



Instructional Analysis – Page 3



APPENDIX C

SECTIONS AND INSTRUCTIONAL SEQUENCE OF HEALTHY HEARTS

Sections of Healthy Hearts

Get Smart

In get smart, students navigate through web pages that present information to learn. Within the Get Smart section, activities reinforcing the content are available to students. Get smart is the content section of *Healthy Hearts.*

Log It

In this section, students recall and submit their physical activity and diet from the previous day. The physical activity section is entitled Movin' and Groovin. Every day of the school week, students are instructed to report all physical activity they participated in on the previous day. This is the only section that students have access to from home, and they will be encouraged to log in on weekends to report their physical activity. On days that students do not have access to the *Healthy Hearts* website, the physical activity log paper version will be provided for students to track their physical activity which they then transcribe to the computer when they have access to the Internet. Every time students report their physical activity, they can view a summary of their physical activity and are asked questions related to this information. Individualized responses are displayed depending on how much physical activity the student had during the previous day and week, and how they respond to the questions asked. The second part of Log It is the Diet Diary.

One time each week, students will scroll through a list of fruits, vegetables, beverages, and sweets and report how many servings they ate/drank of each food/drink. They are then presented with summaries of the number of fruits and vegetables they consumed the previous day and whether they ate enough fruits or vegetables.

Do You Know?

Do you know is the assessment section of *Healthy Hearts.* Students go to Do You Know? and take quizzes on the information presented in Get Smart. Each quiz contains five questions randomly selected from a pool of questions. Feedback regarding correct and incorrect answers is provided for each question. At the end of the quiz, students are offered links to sections of Get Smart that display the information for questions they answered incorrectly. Students can retake the quizzes as many times as they like.

Write On!

In Write On!, students are presented hypothetical problems and can respond, using what they have learned to offer sound advice. Students write suggestions for solving the hypothetical problem and can view theirs, and other student's answers that are displayed on the website.

Ask an Expert

As a class, the teacher is responsible for selecting one question each week and submitting it to the weekly expert. Questions submitted to *Healthy Hearts* are viewed by professionals from around the nation who then write a response to the question. Questions and expert's responses are displayed in the Ask an Expert section of *Healthy Hearts.* Teachers and students can view their questions as well as other questions that have been submitted and that experts have replied to.

Go for the Gold

Students can earn points that are equivalent to entries in weekly drawings by submitting responses in Write On!, getting perfect scores on Do You Know? quizzes, and completing yesterday physical activity logs and their weekly diet diary. In Go for the Gold, students can see how many points they have earned in other sections of *Healthy Hearts,* view prizes available in the weekly drawing, and see who won previous drawings.

Instructional Sequence

Each week, a new content theme is presented in Get Smart and the rest of the sections of *Healthy Hearts* present questions, quizzes, and activities corresponding to the particular content theme. Beginning week two, each student spends at least one hour logged on to *Healthy Hearts.* Preferably, students will have two one hour blocks of time each week to work on *healthy Hearts.* The first week of *Healthy Hearts* is dedicated to introducing the website to students.

Week 1

During week one, both the experimental and control groups will complete the baseline test. Within one week of completing the baseline test, the experimental group will spend one hour in the computer lab becoming familiar with *Healthy Hearts.* Teachers will assign and provide login and password information to each student. Students will learn how to log in to the

website, what each of the menu items are, and how to log out. Students also practice completing a yesterday physical activity log and a diet diary.

Week 2

In week two, the first content section of *Healthy Hearts* is presented. During this week, students learn about the heart, and how it functions. During this instruction, students read about veins, capillaries, and arteries as well as learn that the heart is a muscle that gets stronger with more exercise.

Week 3

Week three is dedicated to teaching students about the benefits of physical activity, how much physical activity they should get each day and each week, as well as share ideas as to how they can increase their daily physical activity. This information is related to how it affects their heart.

Week 4

Week four covers nutrition and shares that a healthy diet should consist of consuming at least five fruits or vegetables each day. Students practice identifying fatty and healthy foods and learn how eating these foods affects their heart.

Week 5

In week five, students learn how the use of tobacco affects their heart. Refusal techniques are taught and scenarios presented in which students can practice refusing tobacco products. This is the final week of instruction and the last of Go for Gold prizes are awarded. One additional week will be scheduled in case teachers and students cannot engage in *Healthy Hearts* lessons for any reason. Reasons for missing lessons might include school assemblies, field trips, or school closure.

APPENDIX D
PARENTAL CONSENT LETTER

Healthy Hearts

An Integrated Internet Learning Module for Kids

http://www.healthyhearts4kids.org

Dear Parent:

Your child is invited to participate in a research study conducted by Virginia Polytechnic Institute and State University and Concord College.

West Virginia has one of the highest rates of heart disease in the nation. Many of the choices children make today influence how their heart functions today and in the future. This spring, your child will begin participating in an instructional unit delivered over the Internet called Healthy Hearts as part of his/her regular classroom activities. Healthy Hearts is a six-week instructional unit that is delivered to fifth grade students via the Internet and was designed to teach students about risk factors associated with heart disease, specifically tobacco, physical activity, and nutrition. The purpose of this study is to measure changes in what fifth grade children know about, their attitudes towards, and their behaviors related to physical activity and diet.

To determine if Healthy Hearts has any influence on students, we would like to administer a questionnaire to your child on two occasions, once around January 15 and again around March 1. The questionnaires will be given by the teacher at school during class time. We would also like access to your child's reported physical activity and diet records collected when your child completes online worksheets reporting what activities she/he did during the previous day, how long he/she did each activity, how often she/he breathed hard, and how many servings of fruits, vegetables, beverages, and other treats she/he ate during the previous day.

We also would like to interview students who are randomly selected for interviews by drawing names from a hat. Interviews will take place during school on the school grounds. To ensure your child's comfort, we will interview students in groups of two. Questions asked during interviews will relate to what he/she liked and disliked about Healthy Hearts, and any suggestions she/he has for improving Healthy Hearts. From this information, we hope to learn how to increase the effectiveness of Internet instruction for fifth grade children.

Please be assured that we will do everything reasonably possible to ensure your child's anonymity and to keep his/her information confidential. Your child will not be identified in any publications or articles we write, and pseudonyms will be used for any reference to specific schools or children. Therefore, it would be very unlikely that anyone would be able to recognize his/her information.

Please help us improve health instruction for fifth grade children. If you would like your child to participate, please read and sign the parental consent form. Your child, after giving his or her permission by signing the child assent form, is asked to return these forms to their school teacher. Together, we can help to decrease heart disease in West Virginia. We are grateful for your contribution to the health of our community.

Sincerely,

Eloise Elliott, PhD.
Concord College

Steve Palmer, MA
Virginia Tech

APPENDIX E
PARENTAL CONSENT FORM

Healthy Hearts Parental Consent Form
Virginia Polytechnic Institute and State University

Agreement for child's participation: I, _____, have been asked to allow my child, _____ to participate in this research study. This signed consent is to certify my willingness for my child to participate in this research study.

Purpose of the Study:
Healthy Hearts (HH) is a five-week instructional unit that is delivered to fifth grade students via the Internet. It was initially implemented in the spring of 1997 (Elliott, 1997) with two classrooms and two classrooms during the fall of 2000. The module features interactive learning experiences related to nutrition, tobacco, and cardiovascular health. This spring the revised module will be implemented in up to 20 fifth grade classrooms in West Virginia. The purpose of this study is to determine if there are any changes in students' knowledge, behaviors, and attitudes before and after completing the Healthy Hearts module.

Procedures:
By choosing to allow my child to participate in this study, he/she will be asked to complete a survey on two separate occasions; once before he/she begins working with Healthy Hearts and once immediately after the six week unit is completed. The purpose of the survey is to determine what my child learns from Healthy Hearts by asking my child to answer multiple choice questions regarding his/her knowledge, behavior, and attitudes related to tobacco, diet, and physical activity. This questionnaire will be given with paper and pencil that will be provided for my child. The surveys will be given during class time at school and should take approximately 45 minutes.

As part of Healthy Hearts, my child will complete daily physical activity worksheets and weekly diet worksheets. The physical activity worksheet asks my child to identify outside of school activities in which he/she participates, how long she/he participates, and how often he/she had to breathe hard while engaged in each activity. The diet worksheet asks my child to report how many servings of fruits, vegetables, beverages, and treats they had during the previous day. I understand that information my child reports on these worksheets will be available to researchers.

During the study, my child might be interviewed with one other student one time at school during regular school hours. Children will be randomly selected for interviews by drawing names out of a hat, and will be interviewed in pairs to ensure their comfort levels during the interview, however, these interviews will not be confidential because the other student participating in the interview will witness any comments made by my child. My child will be asked what he/she liked and disliked about Healthy Hearts, and if she/he has any suggestions for improving instruction.

Risks:
There are minimal risks to my child from participating in Healthy Hearts, that is, no more risk than when my child participates in regular classroom activities. All of the information collected on the survey will be stored in a secure file cabinet in Blacksburg, Virginia. Information collected from activity logs will be stored in a database on a computer in Blacksburg, Virginia that is not accessible to anyone other than Eloise Elliott and Steve Palmer.

Benefits:
There are no direct benefits to my child from participating in this study. Students not participating in this study will have the same opportunity to work with Healthy Hearts as students whom are participating in the study. However, the data obtained from participating students will be beneficial in improving the design and delivery of the module for use in the future.

Extent of Anonymity and Confidentiality:
Every reasonable precaution will be taken to ensure my child's anonymity. While specific information referring to schools and children may be reported, the use of pseudonyms will make it very unlikely that anyone besides my child's teacher, my child, or a close friend would be able to identify my child's information.

Only the principal investigators will have access to any information sent in to Healthy Hearts. I understand that every reasonable precaution to ensure my child's confidentiality will be taken. At any time I may request to view any information collected from my child or remove my child from the study with no negative consequences.

Freedom to Withdraw:
I may withdraw my child from participation in this study at any time without penalty by calling any of the people listed at the bottom of this form. My decision to allow my child to participate or not participate has no connection to his/her education, so withdrawing him/her from this study will in no way affect his/her grade. My child can refuse to answer any questions with no penalty at all, and she/he is free to withdraw from the study at anytime by informing his/her classroom teacher or any of the people listed on this form that he/she does not wish to participate in the Healthy Hearts study. This decision will not affect my child's education and will therefore not affect their grade.

If, after giving permission for my child's participation, I later choose to withdraw my child from any aspect of this study, I can inform the classroom teacher or call one of the people listed at the bottom of this page.

If I have any additional questions, I can contact Dr. Eloise Elliott (304) 384-5345, or Steve Palmer at (540) 961-5171 or by email at steve.palmer@vt.edu.

By signing below, I indicate that I have read and understand the informed consent and conditions of this project, that I have had all of my questions answered, and that I give my voluntary consent for my child's participation in this project. I have been offered a copy of this form.

Signature of Parent/Guardian	Date	Time

Steve Palmer (Investigator)	Phone: (540) 961-5171
Eloise Elliott (Investigator)	Phone: (304) 425-6410
George Graham (Faculty Advisor)	Phone: (540) 231-7545
David Moore, DVM (Chair, VT Institutional Review Bd.)	Phone: (540) 231-4991
Jan Nespor, (VT Dept. of Teaching and Learning IRB representative)	Phone: (540) 231-8327

APPENDIX F
STUDENT ASSENT FORM

Assent Form
Virginia Polytechnic Institute and State University

I, _____, have been asked to participate in this research study.

Title of the Project: Healthy Hearts

Purpose of the Study:
I understand that the purpose of this study is to learn if the Web site Healthy Hearts is effective for teaching about the heart and what I can do to have a healthy heart.

Procedures:
I understand that I can participate in Healthy Hearts without participating in this study. This study is going to be performed at my school. In addition to going to the computer lab to see lessons from Healthy Hearts in which I report my physical activity and diet, I will be asked to complete two surveys that ask me questions about what I know about physical activity and being healthy and also how much physical activity I did during the past seven days. I also agree to being interviewed during school hours at school. During interviews, I will be asked what I like and don't like about Healthy Hearts, and what I think would improve Healthy Hearts.

Risks:
I understand that there is no more risk by participating in this study than if I was participating in regular classroom activities.

Benefits:
My participation in this study may help improve health instruction.

Extent of Anonymity and Confidentiality:
Healthy Hearts will do everything in their power to make sure I cannot be identified by anyone other than my teacher, the researchers, or my parent/guardian.

Freedom to Withdraw:
I can withdraw from participation in this study at any time without penalty. I also can refuse to answer any questions on surveys without any negative consequences. If I want to withdraw, I can tell my classroom teacher or any of the people listed at the bottom of this form that I do not wish to participate in the Healthy Hearts study. This decision will not affect my education and will therefore not affect my grade.

By signing below, I indicate that I have read and understood the above information and conditions of this project, and that I have had all of my questions answered. I give my voluntary consent to participate in this project.

Signature	Printed Name	Date	Time

Steve Palmer (Investigator)	Phone: (540) 961-5171
Eloise Elliott (Investigator)	Phone: (304) 425-6410
George Graham (Faculty Advisor)	Phone: (540) 231-7545
David Moore, DVM (Chair, VT Institutional Review Bd.)	Phone: (540) 231-4991
Jan Nespor, (VT Dept. of Teaching and Learning IRB representative)	Phone: (540) 231-8327

APPENDIX G

HEALTHY HEARTS QUESTIONNAIRE – FORM A

Healthy Hearts Questionnaire

Write your Healthy Hearts Username here

Are you a (please circle one): Girl Boy

We are trying to find out what you think and know about physical activity.

Remember:

a. **This does not count towards your grade in class.**
b. **Please answer all the questions as honestly and accurately as you can – this is very important.**
c. **If you do not understand a question, please raise your hand.**
d. **You may skip any question you do not want to answer.**

For the following 12 questions, please fill in the circle that best describes your feelings about the question asked.

1. How likely is that you will be physically active most days this coming summer?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

2. How likely is that you will be physically active most days one year from now?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

3. How likely is that you will be physically active most days when you are an adult?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

4. How likely is it that you will eat five fruits and vegetables tomorrow?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

5. How likely is it that you will eat five fruits and vegetables a day this coming summer?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

6. How likely is it that you will drink three or more soft drinks tomorrow?
   - ○ I Definitely will not
   - ○ I Probably will not
   - ○ About a 50/50 chance
   - ○ I Probably will
   - ○ I Definitely will

7. How likely is it that you will drink three or more soft drinks a day this coming summer?
   - ○ I Definitely will not
   - ○ I Probably will not
   - ○ About a 50/50 chance
   - ○ I Probably will
   - ○ I Definitely will

8. When choosing a snack how likely is that you will eat fruit rather than cookies or candy tomorrow?
   - ○ I Definitely will not
   - ○ I Probably will not
   - ○ About a 50/50 chance
   - ○ I Probably will
   - ○ I Definitely will

9. When choosing a snack how likely is that you will eat fruit rather than cookies or candy this coming summer?
   - ○ I Definitely will not
   - ○ I Probably will not
   - ○ About a 50/50 chance
   - ○ I Probably will
   - ○ I Definitely will

10. How likely is it that you will smoke one or more cigarettes tomorrow?
    - ○ I Definitely will not
    - ○ I Probably will not
    - ○ About a 50/50 chance
    - ○ I Probably will
    - ○ I Definitely will

11. How likely is it that you will smoke one or more cigarettes one year from now?
    - ○ I Definitely will not
    - ○ I Probably will not
    - ○ About a 50/50 chance
    - ○ I Probably will
    - ○ I Definitely will

12. How likely is it that you will use smokeless tobacco this coming summer?
    - ○ I Definitely will not
    - ○ I Probably will not
    - ○ About a 50/50 chance
    - ○ I Probably will
    - ○ I Definitely will

Read the following questions and fill in the circle for what you think is the best answer.

13. What is the fewest number of days a week that experts recommend you should be physically active?

0 days	(A)
1 days	(B)
3 days	(C)
5 days	(D)
7 days	(E)

14. Which of these activities is the more vigorous physical activity? (Choose one answer)

Playing Volleyball	(A)
Walking	(B)
Jogging	(C)
Horseback riding	(D)
These are all vigorous physical activities	(E)

15. Which of the following is **LEAST LIKELY** to be a benefit of being regularly physically active?

Lower cholesterol	(A)
Reduced chance of having a heart attack	(B)
I will have more energy and be able to exercise for a longer time.	(C)
Reduced chance of getting lung cancer	(D)
Better weight control	(E)

16. Two risks to having a healthy heart that you can control by what you do are (choose one answer):

Your age and what you eat	(A)
Using tobacco products and your family history of heart disease	(B)
Eating foods low in fat and being physically active	(C)
Your age and your family history of heart disease	(D)

17. It is important to understand how to keep your heart healthy because

Your body depends on your heart to live	(A)
What you do now as a child will affect your chances of having heart disease as an adult	(B)
Heart disease is the number 1 killer of people in the United States	(C)
All of the reasons listed in A, B, and C	(D)

18. When high cholesterol causes plaque buildup on the arteries, less blood can flow to the heart, and therefore, less _____ can be delivered to the rest of the body.

Cholesterol	(A)
Oxygen	(B)
Disease	(C)
Food	(D)

19. Anyone can find out if they have high blood cholesterol by

- Checking your pulse (A)
- Having a simple blood test done by a medical worker, such as your doctor or nurse (B)
- Taking a written test on cholesterol (C)
- Having an operation at the hospital (D)

20. The higher your cholesterol level, the higher your chances of

- Heart disease (A)
- Plaque buildup on the arteries of the heart (B)
- Having a heart attack (C)
- All of the things happening that are listed in A, B, and C (D)

21. For every cigarette you smoke, it takes away _____ minutes of your life.

- 1 (A)
- 3 (B)
- 5 (C)
- 8 (D)

22. Is chewing tobacco a safe choice instead of smoking cigarettes? (Choose the best answer)

- No, chewing tobacco leads to heart disease. (A)
- I don't know (B)
- Yes because I won't be inhaling smoke. (C)
- Sometimes, it matters what kind of chewing tobacco you use. (D)

23. People who smoke die about ____ years earlier than people who do not smoke.

- 4 (A)
- 8 (B)
- 12 (C)
- 16 (D)

24. In food, which of these things can lead to higher levels of blood cholesterol?

- protein (A)
- fat (B)
- carbohydrates (C)
- sugar (D)

25. You are having a sandwich for a snack, and want to keep it lowfat. What would be the high fat dressing to **AVOID** putting on your sandwich?

- mustard (A)
- catsup (B)
- salsa (C)
- mayonnaise (D)

26. Milk is a healthy drink because it is high in calcium which your body needs to grow. What is the best milk choice?

- whole milk (A)
- Chocolate milk (B)
- 2% milk (C)
- milkshake (D)

---

27. The choices you make now about the foods you eat

- can affect your chances of having heart disease when you become an adult. (A)
- will have no affect on your heart. (B)
- should be up to an adult. (C)
- don't really matter - I can eat anything I want at this age. (D)

---

28. How often do you generally smoke cigarettes?

- Never (A)
- A few a month (B)
- A few a week (C)
- Every day (D)
- I used to but I quit (E)

---

29. Did you smoke any cigarettes in the last 30 days?

- Yes (A)
- No (B)

---

30. Did you smoke any cigarettes in the last week?

- Yes (A)
- No (B)

---

31. How often do you generally use smokeless tobacco?

- Never (A)
- A few times a month (B)
- A few times a week (C)
- Every day (D)
- I used to but I quit (E)

---

32. Did you use smokeless tobacco in the last 30 days?

- Yes (A)
- No (B)

---

33. Did you use smokeless tobacco in the last week?

- Yes (A)
- No (B)

---

34. How many fruits and vegetables did you eat yesterday?

None ◯		3 ◯	
1 ◯		4 ◯	
2 ◯		5 ◯	
		More than 5 ◯	

35. Fill in **ALL** of the snacks you ate yesterday.

Apple ◯	Carrots ◯	Donuts ◯	Other fruits ◯
Banana ◯	Cereal ◯	French fries ◯	Popcorn ◯
Candy ◯	Chips ◯	Ice cream ◯	Pretzels ◯
Cake ◯	Cookies ◯	Low fat snack ◯	Pudding ◯
Other:_____ ◯			

36. Check **ALL** of the items you drank yesterday.

Water	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯
Whole Milk	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯
Lowfat/nonfat milk	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯
Soft Drink	None ◯	1 can ◯	2 cans ◯	3 cans ◯	4+ cans ◯
Diet Soft Drink	None ◯	1 can ◯	2 cans ◯	3 cans ◯	4+ cans ◯
Fruit Juice	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯
Other:_____	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯

37. Fill in **ALL** of the fruits and vegetables you ate yesterday.

Apples or applesauce ◯	Corn ◯	Peaches, plums, apricots ◯
Bananas ◯	Grapes ◯	Pears ◯
Beans/lentils/soybeans ◯	Green beans ◯	Peas or lima beans ◯
Broccoli ◯	Green/red peppers ◯	Raisins ◯
Cantaloupe, melons ◯	Greens/Kale ◯	Spinach ◯
Carrots ◯	Lettuce/tossed salad ◯	Strawberries ◯
Celery ◯	Mixed vegetables ◯	Tomatoes ◯
Coleslaw ◯	Oranges, grapefruit ◯	Yams/sweet potatoes ◯
Zucchini, summer squash, eggplant ◯		Other:_____ ◯

Out of School Physical Activity Questionnaire

THERE ARE NO RIGHT OR WRONG ANSWERS. WRITE DOWN ONLY WHAT YOU ACTUALLY DID. DON'T LOOK ON ANYONE ELSE'S PAPER.

1. Think about activities you did outside of school during the past week. That means before or after school or on weekends.
2. For each activity you did for 15 minutes or more at one time, mark an **X** to show which day you did that activity.

Example: If you played basketball for more than 15 minutes last Tuesday, you would write this down in the form

Activity	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Basketball		X					

Fill out the form below for what activities you did outside of school during the past week.

	Out of school, 15 minutes or more						
Activity	**Mon**	**Tues**	**Wed**	**Thur**	**Fri**	**Sat**	**Sun**
Walking							
Ball playing: (playing catch, four square, dodge ball, kickball, volleyball, etc)							
Gymnastics							
Indoor chores: mopping, vacuuming, sweeping							
Outdoor chores: mowing, raking, gardening, shoveling							
Combatives: karate, judo, wrestling							
Other games: footbags, golf, bowling							
Dancing: aerobic, line, jazz, ballet, tap, folk, square, etc.							
Outdoor Play: climbing trees, hiking, skiing							
Racket sports: tennis, racquetball, badminton							
Baseball/softball							
Basketball							
Football							
Mixed walking/running							
Exercise (push-ups, sit-ups, exercise video, jumping rope, etc)							
Chasing and tagging games							
Running/Jogging							
Soccer							
Skating (rollerblading, ice, roller, skateboarding)							
Swimming Laps							
Other:							

APPENDIX H

LETTER TO TEACHERS WITH TESTING SCRIPT

Healthy Hearts Questionnaire

Test Administrator Script

Every student will need their Healthy Hearts User Username to write on the top of this questionnaire. Bring the print out from the HH Web site to inform students of their username.

Please read the following statements to the children before they complete the Healthy Hearts questionnaire.

1. **You are not expected to know all of the answers. This questionnaire you are about to fill out will help evaluate Healthy Hearts, the on-line health instructional unit we are using in class.**

2. **You don't have to complete this survey if you don't want to and can skip any questions you don't feel comfortable answering.**

3. **If you don't understand a question, make your best guess.**

4. **On all of the questions, just fill in one answer.**

5. **Please turn to the last page that says "Out of School Physical Activity Questionnaire".**

6. **On this sheet, you will write what activities you did outside of school for at least 15 minutes during the past 7 days. For example, if today is Wednesday, you would start by looking down the Tuesday column and put an X for any activities you did for 15 minutes or more. Then do the same thing for the previous Monday, Sunday, Saturday, etc… until you have filled out the past 7 days.**

7. **To estimate 15 minutes, think about snack breaks we have. Those are 15 minutes. (or use ½ of a 30 minute TV show if a break during school is not 15 minutes).**

8. **It is OK if you did not do any activities on any days, just mark the form as accurately as you can.**

9. **Don't look at other people's papers.**

10. **Go ahead and get started.**

If there are any questions students have that need to be addressed, please let me know and I will make necessary changes or provide answers for the next time this questionnaire is used.

Thanks again for helping out with this study!

APPENDIX I

HEALTHY HEARTS QUESTIONNAIRE – FORM B

Healthy Hearts Questionnaire

Write your Healthy Hearts Username here

Are you a (please circle one): Girl Boy

We are trying to find out what you think and know about physical activity.

Remember:

a. **This does not count towards your grade in class.**
b. **Please answer all the questions as honestly and accurately as you can – this is very important.**
c. **If you do not understand a question, please raise your hand.**
d. **You may skip any question you do not want to answer.**

For the following 12 questions, please fill in the circle that best describes your feelings about the question asked.

1. How likely is that you will be physically active most days this coming summer?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

2. How likely is that you will be physically active most days one year from now?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

3. How likely is that you will be physically active most days when you are an adult?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

4. How likely is it that you will eat five fruits and vegetables tomorrow?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

5. How likely is it that you will eat five fruits and vegetables a day this coming summer?
   - ◯ I Definitely will not
   - ◯ I Probably will not
   - ◯ About a 50/50 chance
   - ◯ I Probably will
   - ◯ I Definitely will

6. How likely is it that you will drink two or more soft drinks tomorrow?

- ○ I Definitely will not
- ○ I Probably will not
- ○ About a 50/50 chance
- ○ I Probably will
- ○ I Definitely will

---

7. How likely is it that you will drink two or more soft drinks a day this coming summer?

- ○ I Definitely will not
- ○ I Probably will not
- ○ About a 50/50 chance
- ○ I Probably will
- ○ I Definitely will

---

8. When choosing a snack how likely is that you will eat fruit rather than cookies or candy tomorrow?

- ○ I Definitely will not
- ○ I Probably will not
- ○ About a 50/50 chance
- ○ I Probably will
- ○ I Definitely will

---

9. When choosing a snack how likely is that you will eat fruit rather than cookies or candy this coming summer?

- ○ I Definitely will not
- ○ I Probably will not
- ○ About a 50/50 chance
- ○ I Probably will
- ○ I Definitely will

---

10. How likely is it that you will smoke one or more cigarettes tomorrow?

- ○ I Definitely will not
- ○ I Probably will not
- ○ About a 50/50 chance
- ○ I Probably will
- ○ I Definitely will

---

11. How likely is it that you will smoke one or more cigarettes one year from now?

- ○ I Definitely will not
- ○ I Probably will not
- ○ About a 50/50 chance
- ○ I Probably will
- ○ I Definitely will

---

12. How likely is it that you will use smokeless tobacco this coming summer?

- ○ I Definitely will not
- ○ I Probably will not
- ○ About a 50/50 chance
- ○ I Probably will
- ○ I Definitely will

Read the following questions and fill in the circle for what you think is the best answer.

13. What is the minimum number of minutes a day experts recommend you should be physically active?

- 15 minutes (A)
- 30 minutes (B)
- 45 minutes (C)
- 60 minutes (D)
- 90 minutes (E)

---

14. What is the MINIMUM number of days every week experts recommend you should be physically active?

- 0 days (A)
- 1 days (B)
- 3 days (C)
- 5 days (D)
- 7 days (E)

---

15. What is the best way to tell if a physical activity you are doing is of moderate to vigorous intensity? (choose one answer)

- I am breathing hard (A)
- I am having fun (B)
- I am getting tired (C)
- My muscles are getting sore (D)

---

16. It is important to understand how to keep your heart healthy because

- Your body depends on your heart to live (A)
- What you do now as a child will affect your chances of having heart disease as an adult (B)
- Heart disease is the number 1 killer of people in the United States (C)
- All of the reasons listed in A, B, and C (D)

---

17. When there is too much cholesterol in the blood, the excess builds up on the walls of the arteries of the heart and can (choose one answer)

- Make you overweight (A)
- Make your heart beat slower (B)
- Speed up the flow of the blood to the heart (C)
- Slow down or block blood flow to the heart (D)

---

18. The Number 1 cause of death each year for people in the United States is

- Cancer (A)
- Heart disease (B)
- Automobile accidents (C)
- Murders, and other accidents with guns (D)

---

19. Cholesterol exists

- In everyone (A)
- Only in adults (B)
- Only in people who have heart disease (C)
- Only in people who eat too much fatty foods (D)

---

20. An important time in your life to be concerned about heart disease is

- When you become a young adult (A)
- When you become an older adult and are more at risk for heart disease (B)
- Now - because choices you make when you are young can affect if you have heart disease when you get older (C)
- After you have been told by your doctor that you have heart disease (D)

---

21. How long does it take for some people to become addicted to tobacco?

- 3 days (A)
- 3 weeks (B)
- 3 months (C)
- 3 years (D)

---

22. Nicotine in tobacco products such as cigarettes and chewing tobacco (complete the sentence)…

- is addictive. (A)
- makes my heart beat faster than it should. (B)
- leads to heart disease. (C)
- All of the answers above are true. (D)

---

23. Is chewing tobacco a safe choice instead of smoking cigarettes? (Choose the best answer)

- No, chewing tobacco leads to heart disease. (A)
- I don't know (B)
- Yes because you won't be inhaling smoke. (C)
- Sometimes, it matters what kind of chewing tobacco you use. (D)

---

24. You are reading the fat grams on the labels of the foods you are considering eating for a snack - which snack below would be the snack lowest in fat?

- 2 donuts (12 grams of fat for 1 donut) (A)
- 4 cookies (6 grams of fat for 1 cookie) (B)
- 1/2 cup of ice cream (18 grams of fat for 1 cup) (C)
- 1 bag of potato chips (10 grams of fat for 1/2 of the bag) (D)

---

25. Everyone should eat AT LEAST how many servings of fruits and vegetables a day?

- 3 (A)
- 4 (B)
- 5 (C)
- 7 (D)

26.	Which snack whould be the BEST low-fat choice?	apple	A
		carrots	B
		raisins	C
		Apples, carrots, and raisins would ALL be good healthy snack choices.	D
27.	Which of the sentences below is NOT TRUE?	Fruits and vegetables are high in vitamins.	A
		Fruits and vegetables are low in fat.	B
		Fruits and vegetables are high in fat.	C
		Everyone should eat at least five servings of fruits and vegetables a day.	D
28.	The two major risk factors for heart disease that **are** affected by what you eat are:	high blood cholesterol and obesity (being overweight)	A
		high blood cholesterol and smoking	B
		obesity (being overweight) and happiness	C
		Popularity and high blood cholesterol	D
29.	How often do you generally smoke cigarettes?	Never	A
		A few a month	B
		A few a week	C
		Every day	D
		I used to but I quit	E
30.	Did you smoke any cigarettes in the last 30 days?	Yes	A
		No	B
31.	Did you smoke any cigarettes in the last week?	Yes	A
		No	B
32.	How often do you generally use smokeless tobacco?	Never	A
		A few times a month	B
		A few times a week	C
		Every day	D
		I used to but I quit	E
33.	Did you use smokeless tobacco in the last 30 days?	Yes	A
		No	B
34.	Did you use smokeless tobacco in the last week?	Yes	A
		No	B

35. How many fruits and vegetables did you eat yesterday?

None ◯		3 ◯	
1 ◯		4 ◯	
2 ◯		5 ◯	
		More than 5 ◯	

36. Fill in **ALL** of the snacks you ate yesterday.

Apple ◯	Carrots ◯	Donuts ◯	Other fruits ◯
Banana ◯	Cereal ◯	French fries ◯	Popcorn ◯
Candy ◯	Chips ◯	Ice cream ◯	Pretzels ◯
Cake ◯	Cookies ◯	Low fat snack ◯	Pudding ◯
Other:_____ ◯			

37. Check **ALL** of the items you drank yesterday.

Water	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯
Whole Milk	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯
Lowfat/nonfat milk	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯
Soft Drink	None ◯	1 can ◯	2 cans ◯	3 cans ◯	4+ cans ◯
Diet Soft Drink	None ◯	1 can ◯	2 cans ◯	3 cans ◯	4+ cans ◯
Fruit Juice	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯
Other:_____	None ◯	1 glass ◯	2 glasses ◯	3 glasses ◯	4+ glasses ◯

38. Fill in **ALL** of the fruits and vegetables you ate yesterday.

Apples or applesauce ◯	Corn ◯	Peaches, plums, apricots ◯
Bananas ◯	Grapes ◯	Pears ◯
Beans/lentils/soybeans ◯	Green beans ◯	Peas or lima beans ◯
Broccoli ◯	Green/red peppers ◯	Raisins ◯
Cantaloupe, melons ◯	Greens/Kale ◯	Spinach ◯
Carrots ◯	Lettuce/tossed salad ◯	Strawberries ◯
Celery ◯	Mixed vegetables ◯	Tomatoes ◯
Coleslaw ◯	Oranges, grapefruit ◯	Yams/sweet potatoes ◯
Zucchini, summer squash, eggplant ◯		Other:_____ ◯

Out of School Physical Activity Questionnaire

THERE ARE NO RIGHT OR WRONG ANSWERS. WRITE DOWN ONLY WHAT YOU ACTUALLY DID. DON'T LOOK ON ANYONE ELSE'S PAPER.

1. Think about activities you did outside of school during the past week. That means before or after school or on weekends.
2. For each activity you did for 15 minutes or more at one time, mark an **X** to show which day you did that activity.

Example: If you played basketball for more than 15 minutes last Tuesday, you would write this down in the form

Activity	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Basketball		X					

Fill out the form below for what activities you did outside of school during the past week.

	Out of school, 15 minutes or more						
Activity	**Mon**	**Tues**	**Wed**	**Thur**	**Fri**	**Sat**	**Sun**
Walking							
Ball playing: (playing catch, four square, dodge ball, kickball, volleyball, etc)							
Gymnastics							
Indoor chores: mopping, vacuuming, sweeping							
Outdoor chores: mowing, raking, gardening, shoveling							
Combatives: karate, judo, wrestling							
Other games: footbags, golf, bowling							
Dancing: aerobic, line, jazz, ballet, tap, folk, square, etc.							
Outdoor Play: climbing trees, hiking, skiing							
Racket sports: tennis, racquetball, badminton							
Baseball/softball							
Basketball							
Football							
Mixed walking/running							
Exercise (push-ups, sit-ups, exercise video, jumping rope, etc)							
Chasing and tagging games							
Running/Jogging							
Soccer							
Skating (rollerblading, ice, roller, skateboarding)							
Swimming Laps							
Other:							

APPENDIX J

HEALTHY HEARTS QUESTIONNAIRE - FORM AB

Healthy Hearts Questionnaire

Write your Healthy Hearts Username here

Are you a (please circle one): Girl Boy

We are trying to find out what you think and know about physical activity.

Remember:

a. **This does not count towards your grade in class.**
b. **Please answer all the questions as honestly and accurately as you can – this is very important.**
c. **If you do not understand a question, please raise your hand.**
d. **You may skip any question you do not want to answer.**

For the following 12 questions, please fill in the circle that best describes your feelings about the question asked.

1. How likely is that you will be physically active most days this coming summer?
   - ◌ I Definitely will not
   - ◌ I Probably will not
   - ◌ About a 50/50 chance
   - ◌ I Probably will
   - ◌ I Definitely will

2. How likely is that you will be physically active most days one year from now?
   - ◌ I Definitely will not
   - ◌ I Probably will not
   - ◌ About a 50/50 chance
   - ◌ I Probably will
   - ◌ I Definitely will

3. How likely is that you will be physically active most days when you are an adult?
   - ◌ I Definitely will not
   - ◌ I Probably will not
   - ◌ About a 50/50 chance
   - ◌ I Probably will
   - ◌ I Definitely will

4. How likely is it that you will eat five fruits and vegetables tomorrow?
   - ◌ I Definitely will not
   - ◌ I Probably will not
   - ◌ About a 50/50 chance
   - ◌ I Probably will
   - ◌ I Definitely will

5. How likely is it that you will eat five fruits and vegetables a day this coming summer?
   - ◌ I Definitely will not
   - ◌ I Probably will not
   - ◌ About a 50/50 chance
   - ◌ I Probably will
   - ◌ I Definitely will

6. How likely is it that you will drink two or more soft drinks tomorrow?

- ◌ I Definitely will not
- ◌ I Probably will not
- ◌ About a 50/50 chance
- ◌ I Probably will
- ◌ I Definitely will

---

7. How likely is it that you will drink two or more soft drinks a day this coming summer?

- ◌ I Definitely will not
- ◌ I Probably will not
- ◌ About a 50/50 chance
- ◌ I Probably will
- ◌ I Definitely will

---

8. When choosing a snack how likely is that you will eat fruit rather than cookies or candy tomorrow?

- ◌ I Definitely will not
- ◌ I Probably will not
- ◌ About a 50/50 chance
- ◌ I Probably will
- ◌ I Definitely will

---

9. When choosing a snack how likely is that you will eat fruit rather than cookies or candy this coming summer?

- ◌ I Definitely will not
- ◌ I Probably will not
- ◌ About a 50/50 chance
- ◌ I Probably will
- ◌ I Definitely will

---

10. How likely is it that you will smoke one or more cigarettes tomorrow?

- ◌ I Definitely will not
- ◌ I Probably will not
- ◌ About a 50/50 chance
- ◌ I Probably will
- ◌ I Definitely will

---

11. How likely is it that you will smoke one or more cigarettes one year from now?

- ◌ I Definitely will not
- ◌ I Probably will not
- ◌ About a 50/50 chance
- ◌ I Probably will
- ◌ I Definitely will

---

12. How likely is it that you will use smokeless tobacco this coming summer?

- ◌ I Definitely will not
- ◌ I Probably will not
- ◌ About a 50/50 chance
- ◌ I Probably will
- ◌ I Definitely will

Read the following questions and fill in the circle for what you think is the best answer.

13. What is the minimum number of minutes a day experts recommend you should be physically active?

- 15 minutes (A)
- 30 minutes (B)
- 45 minutes (C)
- 60 minutes (D)
- 90 minutes (E)

---

14. What is the MINIMUM number of days every week experts recommend you should be physically active?

- 0 days (A)
- 1 days (B)
- 3 days (C)
- 5 days (D)
- 7 days (E)

---

15. What is the best way to tell if a physical activity you are doing is of moderate to vigorous intensity? (choose one answer)

- I am breathing hard (A)
- I am having fun (B)
- I am getting tired (C)
- My muscles are getting sore (D)

---

16. What is the fewest number of days a week that experts recommend you should be physically active?

- 0 days (A)
- 1 days (B)
- 3 days (C)
- 5 days (D)
- 7 days (E)

---

17. Which of these activities is the more vigorous physical activity? (Choose one answer)

- Playing Volleyball (A)
- Walking (B)
- Jogging (C)
- Horseback riding (D)
- These are all vigorous physical activities (E)

---

18. Which of the following is **LEAST LIKELY** to be a benefit of being regularly physically active?

- Lower cholesterol (A)
- Reduced chance of having a heart attack (B)
- I will have more energy and be able to exercise for a longer time. (C)
- Reduced chance of getting lung cancer (D)
- Better weight control (E)

---

19. It is important to understand how to keep your heart healthy because

- Your body depends on your heart to live (A)
- What you do now as a child will affect your chances of having heart disease as an adult (B)
- Heart disease is the number 1 killer of people in the United States (C)
- All of the reasons listed in A, B, and C (D)

---

20. When there is too much cholesterol in the blood, the excess builds up on the walls of the arteries of the heart and can (choose one answer)

- Make you overweight (A)
- Make your heart beat slower (B)
- Speed up the flow of the blood to the heart (C)
- Slow down or block blood flow to the heart (D)

---

21. The Number 1 cause of death each year for people in the United States is

- Cancer (A)
- Heart disease (B)
- Automobile accidents (C)
- Murders, and other accidents with guns (D)

---

22. Cholesterol exists

- In everyone (A)
- Only in adults (B)
- Only in people who have heart disease (C)
- Only in people who eat too much fatty foods (D)

---

23. An important time in your life to be concerned about heart disease is

- When you become a young adult (A)
- When you become an older adult and are more at risk for heart disease (B)
- Now - because choices you make when you are young can affect if you have heart disease when you get older (C)
- After you have been told by your doctor that you have heart disease (D)

---

24. Two risks to having a healthy heart that you can control by what you do are (choose one answer):

- Your age and what you eat (A)
- Using tobacco products and your family history of heart disease (B)
- Eating foods low in fat and being physically active (C)
- Your age and your family history of heart disease (D)

---

25. It is important to understand how to keep your heart healthy because

- Your body depends on your heart to live (A)
- What you do now as a child will affect your chances of having heart disease as an adult (B)
- Heart disease is the number 1 killer of people in the United States (C)
- All of the reasons listed in A, B, and C (D)

---

26. When high cholesterol causes plaque buildup on the arteries, less blood can flow to the heart, and therefore, less _____ can be delivered to the rest of the body.

- Cholesterol (A)
- Oxygen (B)
- Disease (C)
- Food (D)

---

27. Anyone can find out if they have high blood cholesterol by

- Checking your pulse (A)
- Having a simple blood test done by a medical worker, such as your doctor or nurse (B)
- Taking a written test on cholesterol (C)
- Having an operation at the hospital (D)

---

28. The higher your cholesterol level, the higher your chances of

- Heart disease (A)
- Plaque buildup on the arteries of the heart (B)
- Having a heart attack (C)
- All of the things happening that are listed in A, B, and C (D)

---

29. For every cigarette you smoke, it takes away _____ minutes of your life.

- 1 (A)
- 3 (B)
- 5 (C)
- 8 (D)

---

30. Is chewing tobacco a safe choice instead of smoking cigarettes? (Choose the best answer)

- No, chewing tobacco leads to heart disease. (A)
- I don't know (B)
- Yes because I won't be inhaling smoke. (C)
- Sometimes, it matters what kind of chewing tobacco you use. (D)

31. People who smoke die about _____ years earlier than people who do not smoke.

- 4 (A)
- 8 (B)
- 12 (C)
- 16 (D)

32. How long does it take for some people to become addicted to tobacco?

- 3 days (A)
- 3 weeks (B)
- 3 months (C)
- 3 years (D)

33. Nicotine in tobacco products such as cigarettes and chewing tobacco (complete the sentence)…

- is addictive. (A)
- makes my heart beat faster than it should. (B)
- leads to heart disease. (C)
- All of the answers above are true. (D)

34. Is chewing tobacco a safe choice instead of smoking cigarettes? (Choose the best answer)

- No, chewing tobacco leads to heart disease. (A)
- I don't know (B)
- Yes because you won't be inhaling smoke. (C)
- Sometimes, it matters what kind of chewing tobacco you use. (D)

35. You are reading the fat grams on the labels of the foods you are considering eating for a snack - which snack below would be the snack lowest in fat?

- 2 donuts (12 grams of fat for 1 donut) (A)
- 4 cookies (6 grams of fat for 1 cookie) (B)
- 1/2 cup of ice cream (18 grams of fat for 1 cup) (C)
- 1 bag of potato chips (10 grams of fat for 1/2 of the bag) (D)

36. Everyone should eat AT LEAST how many servings of fruits and vegetables a day?

- 3 (A)
- 4 (B)
- 5 (C)
- 7 (D)

37. Which snack whould be the BEST low-fat choice?

- apple (A)
- carrots (B)
- raisins (C)
- Apples, carrots, and raisins would ALL be good healthy snack choices. (D)

38. Which of the sentences below is NOT TRUE?

- Fruits and vegetables are high in vitamins. (A)
- Fruits and vegetables are low in fat. (B)
- Fruits and vegetables are high in fat. (C)
- Everyone should eat at least five servings of fruits and vegetables a day. (D)

39. The two major risk factors for heart disease that **are** affected by what you eat are:

- high blood cholesterol and obesity (being overweight) (A)
- high blood cholesterol and smoking (B)
- obesity (being overweight) and happiness (C)
- Popularity and high blood cholesterol (D)

40. In food, which of these things can lead to higher levels of blood cholesterol?

- protein (A)
- fat (B)
- carbohydrates (C)
- sugar (D)

41. You are having a sandwich for a snack, and want to keep it lowfat. What would be the high fat dressing to **AVOID** putting on your sandwich?

- mustard (A)
- catsup (B)
- salsa (C)
- mayonnaise (D)

42. Milk is a healthy drink because it is high in calcium which your body needs to grow. What is the best milk choice?

- whole milk (A)
- Chocolate milk (B)
- 2% milk (C)
- milkshake (D)

43. The choices you make now about the foods you eat

- can affect your chances of having heart disease when you become an adult. (A)
- will have no affect on your heart. (B)
- should be up to an adult. (C)
- don't really matter - I can eat anything I want at this age. (D)

44. How often do you generally smoke cigarettes?

- Never (A)
- A few a month (B)
- A few a week (C)
- Every day (D)
- I used to but I quit (E)

45. Did you smoke any cigarettes in the last 30 days?

- Yes (A)
- No (B)

46. Did you smoke any cigarettes in the last week?

- Yes (A)
- No (B)

47. How often do you generally use smokeless tobacco?

- Never (A)
- A few times a month (B)
- A few times a week (C)
- Every day (D)
- I used to but I quit (E)

48. Did you use smokeless tobacco in the last 30 days?

- Yes (A)
- No (B)

49. Did you use smokeless tobacco in the last week?

- Yes (A)
- No (B)

50. How many fruits and vegetables did you eat yesterday?

- None ☐
- 1 ☐
- 2 ☐
- 3 ☐
- 4 ☐
- 5 ☐
- More than 5 ☐

51. Fill in **ALL** of the snacks you ate yesterday.

Apple ☐	Carrots ☐	Donuts ☐	Other fruits ☐
Banana ☐	Cereal ☐	French fries ☐	Popcorn ☐
Candy ☐	Chips ☐	Ice cream ☐	Pretzels ☐
Cake ☐	Cookies ☐	Low fat snack ☐	Pudding ☐
Other:_____ ☐			

52. Check **ALL** of the items you drank yesterday.

Water	None ☐	1 glass ☐	2 glasses ☐	3 glasses ☐	4+ glasses ☐
Whole Milk	None ☐	1 glass ☐	2 glasses ☐	3 glasses ☐	4+ glasses ☐
Lowfat/nonfat milk	None ☐	1 glass ☐	2 glasses ☐	3 glasses ☐	4+ glasses ☐
Soft Drink	None ☐	1 can ☐	2 cans ☐	3 cans ☐	4+ cans ☐
Diet Soft Drink	None ☐	1 can ☐	2 cans ☐	3 cans ☐	4+ cans ☐
Fruit Juice	None ☐	1 glass ☐	2 glasses ☐	3 glasses ☐	4+ glasses ☐
Other:_____	None ☐	1 glass ☐	2 glasses ☐	3 glasses ☐	4+ glasses ☐

53. Fill in **ALL** of the fruits and vegetables you ate yesterday.

Apples or applesauce ☐	Corn ☐	Peaches, plums, apricots ☐
Bananas ☐	Grapes ☐	Pears ☐
Beans/lentils/soybeans ☐	Green beans ☐	Peas or lima beans ☐
Broccoli ☐	Green/red peppers ☐	Raisins ☐
Cantaloupe, melons ☐	Greens/Kale ☐	Spinach ☐
Carrots ☐	Lettuce/tossed salad ☐	Strawberries ☐
Celery ☐	Mixed vegetables ☐	Tomatoes ☐
Coleslaw ☐	Oranges, grapefruit ☐	Yams/sweet potatoes ☐
Zucchini, summer squash, eggplant ☐	Other:_____ ☐	

Out of School Physical Activity Questionnaire

THERE ARE NO RIGHT OR WRONG ANSWERS. WRITE DOWN ONLY WHAT YOU ACTUALLY DID. DON'T LOOK ON ANYONE ELSE'S PAPER.

1. Think about activities you did outside of school during the past week. That means before or after school or on weekends.
2. For each activity you did for 15 minutes or more at one time, mark an **X** to show which day you did that activity.

Example: If you played basketball for more than 15 minutes last Tuesday, you would write this down in the form

Activity	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Basketball		X					

Fill out the form below for what activities you did outside of school during the past week.

	Out of school, 15 minutes or more						
Activity	**Mon**	**Tues**	**Wed**	**Thur**	**Fri**	**Sat**	**Sun**
Walking							
Ball playing: (playing catch, four square, dodge ball, kickball, volleyball, etc)							
Gymnastics							
Indoor chores: mopping, vacuuming, sweeping							
Outdoor chores: mowing, raking, gardening, shoveling							
Combatives: karate, judo, wrestling							
Other games: footbags, golf, bowling							
Dancing: aerobic, line, jazz, ballet, tap, folk, square, etc.							
Outdoor Play: climbing trees, hiking, skiing							
Racket sports: tennis, racquetball, badminton							
Baseball/softball							
Basketball							
Football							
Mixed walking/running							
Exercise (push-ups, sit-ups, exercise video, jumping rope, etc)							
Chasing and tagging games							
Running/Jogging							
Soccer							
Skating (rollerblading, ice, roller, skateboarding)							
Swimming Laps							
Other:							

APPENDIX K
TEACHER QUESTIONNAIRES

Healthy Hearts
Teacher Instructional Goals and Objectives Questionnaire

Name: _____ School: _____

Thank you for participating in this study, we hope you found it to be a useful experience. As part of using Healthy Hearts, we'd like you to answer the following questions to help us improve Healthy Hearts as well as develop additional Web based instructional modules. Any and all comments and suggestions are welcome.

1. Please review the following West Virginia fifth grade instructional goals and objectives (IGO's). **OTHER THAN HEALTHY HEARTS** (if applicable), for each objective below, check whether or not you provided instruction related to that particular IGO **between February 26 and March 30.**

   If you check "yes", please approximate the average instructional time spent per student on that particular IGO between February 26 and April 5. Instructional time is the amount of time students are engaged in instruction and practice activities related to a particular objective.

IGO #	Instructional Goal	No	Yes	Time in minutes (if yes)
Health				
5.24	Define "nutrient" and "calorie" and list the six major nutrient classifications; identify food sources and functions of each nutrient class.	□	□	
5.26	Describe the impact of food and activity choices on personal health, growth and development.	□	□	
5.27	Use food labels to compare the nutrient contribution of foods (e.g., types of snacks, cereals, beverages).	□	□	
5.28	Recognize serving sizes and numbers of servings as they relate to Food Guide Pyramid recommendations.	□	□	
5.32	Identify barriers to regular physical activity and strategies to overcome these barriers.	□	□	
Physical Education				
5.4	Identify principles of lifetime wellness (e.g. nutrition, play, rest, personal hygiene).	□	□	
5.9	Describe the concept of energy balance; compare caloric intake with caloric expenditure through physical activity.	□	□	

5.13	Identify specific types of unstructured physical activity and exercise (e.g. walking, rope jumping, playing, fishing).	□	□	
5.18	Discuss the role and importance of physical activity in remaining drug-free and the influence of peers, media and the family on the decision not to use tobacco, alcohol and drugs.	□	□	
5.26	Use appropriate software and a variety of other technologies to practice and master fifth grade instructional objectives in physical education.	□	□	
5.27	Enter and edit data from physical education investigations into a database.	□	□	
5.28	Use appropriate software and/or technologies to practice reading, interpreting, analyzing and evaluating data on a map, chart, graph, table or diagram; practice making conclusions and predictions from data.	□	□	
Technology				
5.186	Select and use appropriate software and/or other technologies to locate and use reference sources.	□	□	
5.187	Develop keyboarding skills: proper posture, finger placement, keying letters, numbers, symbols, and special keys.	□	□	

Healthy Hearts
Teacher Instructional Goals and Objectives Questionnaire

Name: _____ School: _____

Thank you for participating in this study, we hope you found it to be a useful experience. As part of using Healthy Hearts, we'd like you to answer the following questions to help us improve Healthy Hearts as well as develop additional Web based instructional modules. Any and all comments and suggestions are welcome.

1. Please review the following West Virginia fifth grade instructional goals and objectives (IGO's). **OTHER THAN HEALTHY HEARTS** (if applicable), for each objective below, check whether or not you provided instruction related to that particular IGO **between February 26 and March 30.**

   If you check "yes", please approximate the average instructional time spent per student on that particular IGO between February 26 and April 5. Instructional time is the amount of time students are engaged in instruction and practice activities related to a particular objective.

IGO #	Instructional Goal	No	Yes	Time in minutes (if yes)
Health				
5.24	Define "nutrient" and "calorie" and list the six major nutrient classifications; identify food sources and functions of each nutrient class.	□	□	
5.26	Describe the impact of food and activity choices on personal health, growth and development.	□	□	
5.27	Use food labels to compare the nutrient contribution of foods (e.g., types of snacks, cereals, beverages).	□	□	
5.28	Recognize serving sizes and numbers of servings as they relate to Food Guide Pyramid recommendations.	□	□	
5.32	Identify barriers to regular physical activity and strategies to overcome these barriers.	□	□	
Physical Education				
5.4	Identify principles of lifetime wellness (e.g. nutrition, play, rest, personal hygiene).	□	□	
5.9	Describe the concept of energy balance; compare caloric intake with caloric expenditure through physical activity.	□	□	

5.13	Identify specific types of unstructured physical activity and exercise (e.g. walking, rope jumping, playing, fishing).	□	□	
5.18	Discuss the role and importance of physical activity in remaining drug-free and the influence of peers, media and the family on the decision not to use tobacco, alcohol and drugs.	□	□	
5.26	Use appropriate software and a variety of other technologies to practice and master fifth grade instructional objectives in physical education.	□	□	
5.27	Enter and edit data from physical education investigations into a database.	□	□	
5.28	Use appropriate software and/or technologies to practice reading, interpreting, analyzing and evaluating data on a map, chart, graph, table or diagram; practice making conclusions and predictions from data.	□	□	
Technology				
5.186	Select and use appropriate software and/or other technologies to locate and use reference sources.	□	□	
5.187	Develop keyboarding skills: proper posture, finger placement, keying letters, numbers, symbols, and special keys.	□	□	

Healthy Hearts - Teacher Registration Form

You selected to register a class at the following school:

[School Name].

If this is correct please complete the form below to register for Healthy Hearts. Otherwise, return to the previous page and select the correct school. Questions regarding registration may be sent to: *info@hh4kids.org*.

Registration Information

First Name:

Last Name:

Email:
(Please enter carefully!!!)

Job Description:
(select all that apply)

- ☐ **Classroom Teacher**
- ☐ **Physical-Health Education Teacher**
- ☐ **Tehnology-Media Teacher**
- **Other:**

How many years of teaching experience do you have?

How often do you use/check email? -- Select --

How often have you used the Internet for instructional purposes in the past year? -- Select --

How comfortable are you using computers as an instructional tool (with students)? -- Select --

How many computers do you have in your classroom that are connected to the Internet?

Do you have a computer lab available to you and your students? ○ **Yes** ○ **No**

How many computers in this lab are connected to the Internet?

How often is this lab available to your students? -- Select --

Do you have a full time technology support person at you school? Yes No

Are any of your students participating in the WVU CARDIAC project this academic year? Yes No

Can you attend an all day September 19 meeting at Flatwoods, WV if your expenses are covered? Yes No

Can we contact you for further information? Yes No

Submit registration information reset

Healthy Hearts School Registration

Please complete the form below to register your school for Healthy Hearts. Once this form has been submitted it should take about 3 days to process the form and your school should then appear on the list of participating schools. If you know that your school has been registered within three days and did not appear in the previous list, please do not complete this form. Send email to *info@hh4kids.org* if you do not see your school listed within 3 days, or if you have any questions regarding registration.

School Registration Information

School Name:

Street Address:

City:

State: -- Select State --

Zip:

County:

District:

Time Zone/ Daylight Savings: -- Select Time Zone --

Does your state use daylight savings time? Yes No

School Phone:

School Fax:

Principal's Name:

Principal's Email: (***Please type carefully!***)

School Web Site:

(***Please use FULL address i.e., http://...***)

Demographic Information

Total School Enrollment: --- select ---

Percentage of students eligible for free or reduced school lunch program: %

How would you classify your school: --- select ---

register your school reset

APPENDIX L
TEACHER CONSENT FORM

Teacher Consent Form
Virginia Polytechnic Institute and State University

AGREEMENT TO PARTICIPATE: I, _____, have been asked to participate in this research study, which has been explained to me by Eloise Elliott and/or Steve Palmer. This signed consent is to certify my willingness to participate in this research study.

Purpose of the Study:
Healthy Hearts (HH) is a six-week instructional unit that is delivered to fifth grade students via the Internet. It was initially implemented in the spring of 1997 (Elliott, 1997) with two classrooms. The module features interactive learning experiences related to nutrition, tobacco, and cardiovascular health. This fall the revised module will be implemented in 15 fifth grade classrooms in West Virginia. The purpose of this study is to determine if there are any changes in students' knowledge, behaviors, and attitudes before and after completing the Healthy Hearts module.

Procedures:
For five weeks this Fall, I will implement Healthy Hearts as part of regular classroom activities. To implement Healthy Hearts, I will be taking my class to a computer lab to engage in lessons teaching them about how to have and keep a healthy heart by making healthy lifestyle decisions related to nutrition, tobacco, and physical activity.

I have been asked to administer a survey to students participating in the study on three separate occasions (weeks of Feb. 20, March 28, & June 10). The purpose of the survey is to determine what students learn from Healthy Hearts. The survey asks students to answer questions regarding their knowledge, attitudes, and behaviors related to physical activity, nutrition, and diet. This questionnaire will be given with paper and pencil which will be provided to me and my students. The surveys should be given during school and will take approximately 45 minutes. Other worksheets will be provided for students who are not participating in the study, or I can provide alternate assignments for them.

In addition to the pretest and posttest, participating student physical activity and diet behaviors as reported on Healthy Hearts worksheets will be available to researchers.

Also during this study, students may be interviewed by researchers. Students will be selected randomly and will be interviewed in groups of two during school on school grounds. Questions students will be asked during interviews relate to what they like and dislike about Healthy Hearts, and any changes they would recommend in the module.

Risks:
There are minimal risks to me from participating in Healthy Hearts, that is, no more risk than there would be from regular classroom activities.

Benefits:
There are no direct benefits to me or my students from participating in the study. However, my participation in this study will contribute to evaluating and improving the instructional effectiveness of Healthy Hearts.

Extent of Anonymity and Confidentiality:
My name and any other identifying information will be changed on all Healthy Hearts publications and materials so that someone reading the transcript would most likely not be able to connect it to me. At any time I can request to view any information collected from me during the study with no negative consequences.

Only the principal investigators will have access to any information collected during the study. They have ensured me they will take every reasonable precaution to ensure my and my student's confidentiality.

The information collected from this study could be used in articles and/or reports. In any reports or articles using information collected, pseudonyms will be used to preserve my confidentiality. While information referring to me or my students may be used, the use of pseudonyms will make it very unlikely that anyone besides me, my students, or a close friend would be able to identify my or my student's information.

Freedom to Withdraw:
If, giving consent to participation, I later choose to withdraw from any aspect of the study, I can inform any of the people listed at the bottom of this page. I may withdraw from participation in this study at any time without penalty. To withdraw, I only have to contact any of the people listed at the bottom of this form.

I have had an opportunity to ask any questions about this study. If I have any questions, I can contact Dr. Eloise Elliot at 304-384-5345 Steve Palmer at 540-961-5171 or by email at steve.palmer@vt.edu.

By signing below, I indicate that I have read and understand the informed consent and conditions of this project, that I have had all of my questions answered, and that I give my voluntary consent to participate in this project. I have been offered a copy of this form.

Signature of Teacher	Printed Name of Teacher	Date	Time

Steve Palmer (Investigator)	Phone: (540) 961-5171
Eloise Elliott (Investigator)	Phone: (304) 425-6410
George Graham (Faculty Advisor)	Phone: (540) 231-7545
David Moore, DVM (Chair, VT Institutional Review Bd.)	Phone: (540) 231-4991
Jan Nespor, (VT Dept. of Teaching and Learning IRB representative)	Phone: (540) 231-8327

Stephen E. Palmer, Ph.D.
Curriculum Vita

CONTACT INFORMATION

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http://jan.ucc.nau.edu/~sep28/
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EDUCATION

Ph.D. Virginia Polytechnic Institute & State University
Curriculum & Instruction: August, 2001

M.A. California State University, Chico
Physical Education Pedagogy: June, 1998

B.A. California State University, Chico
Physical Education (Teaching Option): December, 1994

TEACHING CREDENTIAL

1997 State of California Single Subject Credential in K-12 Physical Education

PROFESSIONAL EXPERIENCE

2001 - Present **Assistant Professor, Northern Arizona University**

1998-2001 **Graduate Teaching Assistant -Virginia Tech**

Health and Physical Education Student Teaching Coordinator (Fall 1999 – Present)

- Locate placements for Health and Physical Education student teachers in elementary and secondary schools.
- Supervise student teachers.
- Maintain Web site

EDPE 2344: Teaching Large Group Activities (Fall 1999)

- Design and teach course required of Health and Physical Education majors, focusing on exposure to and teaching group activities in K-12 schools.
- Develop and maintain Web site to supplement course activities.

EDPE 2354: Teaching Individual/Dual Activities (Spring 2000, Spring 2001

- Design and teach course required of Health and Physical Education majors, focusing on exposure to and teaching individual and dual activities in K-12 schools.
- Develop and maintain Web site to supplement course activities, including on-line assessment.

HNFE 1214: Weight Training (Fall 1998-Spring 1999)

- Taught basic instruction program weight training course.

HNFE 12564: Racquetball (Fall 1998)

- Taught basic instruction program racquetball course.

Work Experience

Faculty Development Institute (Summer 1999, Summer 2000)

- Assist and Train Virginia Tech faculty in the use of computers and technology in teaching.
- Help develop Web enhanced/assisted/based instruction using HTML, Course Info, and Microsoft Office.

1998-Present **Managing Editor, PE Central Secondary Lesson Ideas** (http://www.pecentral.org/) (October 1998 - present)
Review, edit, and distribute lesson ideas to advisory board, and accept/reject middle and high school lesson ideas submitted for publication on PE Central. PE Central averages over 2,000,000 hits and 300,000 unique visitors a month.

1995 - 1998 **Public/Private School Teaching**

Stonegate Year Round School - San Jose, CA (1997 – 1998)
- Physical Education Teacher grades 6-8
- Gifted and Talented Education (GATE) Teacher grades 6-8
- Technology Coordinator

Committee Work
- District Technology Committee, Franklin-McKinley School District (1997-Summer)

Rhythm & Moves - Burlingame, CA (1996 – 1997)
Payne Elementary School - San Jose, CA
- Physical Education Teacher grades 1-5

St. Leo the Great School - San Jose, CA
- Physical Education Teacher grades 3-8

Jay Partridge Elementary School - Chico, CA (1995 – 1996)
- Volunteer Physical Education Teacher grade 1

1994-1996 **Graduate Teaching Assistant - California State University, Chico**

Teaching/Advising Responsibilities

Academic Advisor: Physical Education Majors (Spring 1994-Spring 1996)
- Advise undergraduate and transfer students in coursework planning.
- Design and implement electronic graduation check for physical education majors.

PHED 102: Teaching Elementary Physical Education (Spring 1996)
- Design and teach a course required of Liberal Studies majors covering physical education teaching methods for students grades K-5.

PHED 112: Outdoor Education (Spring 1994-Spring 1996)
- Team teach rock climbing, orienteering, cross country skiing, and backpacking to physical education majors in final semester of coursework.

PHED 173: Theory of Weight Training (Fall 1994-Spring 1996)
- Team teach application of weight training principles for teaching K-12 education. Course is required of physical education majors.

PHED 109: Teaching Elementary Physical Education for PE Majors (Fall 1994-Spring 1996)
- Team teach elementary physical education teaching methods course required of physical education majors.

PHED 098: Fitness Training (Spring 1995)
- Design and teach basic instruction fitness training course to university students.

PRESENTATIONS AND WORKSHOPS

Tacla, C., Palmer, S., Fortner, S., Harkrader, L., & Pomeroy, J. (November, 2000). The PE Central Challenge. Virginia Association for Health, Physical Education, Recreation, and Dance Annual Conference. Williamsburg, VA.

Elliott, E., & Palmer, S. (October, 2000). Healthy Hearts: An Internet Instructional Module for 5th Grade Kids. West Virginia Association for Health, Physical Education, Recreation, and Dance Annual Conference, Glade Springs Resort, Daniels, WV.

Palmer, S. & Elliott, E. (October, 2000). Let's Get Movin' with PE Central. West Virginia Association for Health, Physical Education, Recreation, and Dance Annual Conference, Glade Springs Resort, Daniels, WV.

Krouscas, J., Palmer, S., & Parker, S. (October, 2000). Successful Physical Education. Botetourt County Teacher Inservice, Daleville, VA.

Trimmer, D., Fahey, T., Burleson, L, & Graduate Students. (March, 2000). Speed and Quickness Training. American Alliance for Health, Physical Education, Recreation, and Dance Annual Conference, Orlando, FL.

Palmer, S. & Poole, J. (August, 1999). Implementing Orienteering in K-12 Physical Education. Montgomery County Physical Education Teacher Inservice, Riner, VA.

Trimmer, D., Fahey, T., Burleson, L, & Graduate Students. (March, 1999). Speed and Quickness Training. American Alliance for Health, Physical Education, Recreation, and Dance Annual Conference, Boston, MA.

Trimmer, D., Fahey, T., Burleson, L, & Graduate Students. (March, 1998). Speed and Quickness Training. American Alliance for Health, Physical Education, Recreation, and Dance Annual Conference, Reno, NV.

Palmer, S. & Westfall, S. (July, 1997). Teaching with Video in Physical Education. California Association for Health, Physical Education, Recreation, & Dance Technology Conference, Sacramento, CA.

Burleson, L., Palmer, S., & Sesock, R. (March, 1997). Teaching Orienteering with the Internet. California Association for Health, Physical Education, Recreation, & Dance Annual Conference, Los Angeles, CA.

Trimmer, D., Fahey, T., Burleson, L, & Graduate Students. (March, 1996). Speed and Quickness Training. California Association for Health, Physical Education, Recreation, and Dance Annual Conference, San Jose, CA.

PUBLICATIONS

Palmer, S. E. (2001). The Effects of the Web Based Instructional Unit Healthy Hearts on Fifth Grade Children's Physical Activity Knowledge, Attitudes, and Behavior. Unpublished Doctoral Dissertation, Virginia Polytechnic Institute and State University, Blacksburg.

Graham, G., Manross, M. A., Palmer, S., Tacla, C., & Konukman, F. (1999). Encouraging children to practice motor skills with the PE Central Challenge. Unpublished manuscript.

Palmer, S., Elliott, E. (2000) Healthy Hearts Teacher Manual. Unpublished manuscript. Blacksburg, VA.

Palmer, S. E. (1998) Olympic sprint training. PE Central [On-line]. Blacksburg, VA.

Palmer, S. E. (1998). The effect of practice on non-preferred hand and foot performance in a gross motor task. Unpublished master's thesis, California State University, Chico. Chico, CA.

RESEARCH AND OTHER PROJECTS

1999-Present **Healthy Hearts Project Coordinator**
http://www.healthyhearts4kids.org/

- Help design, develop, and implement Healthy Hearts, a five-week Web based instructional unit for fifth grade students.
- Evaluate effectiveness on physical activity knowledge, attitude, and behavior

1998-Present **PE Central Challenge**
http://www.pecentral.org/

- Part of team to design and disseminate motor skills program to fourth and fifth grade children around Nation.
- In 2000-2001, over 30,000 children will participate in the PE Central Challenge.

GRANTS

Northern Arizona University, 2001. Secured $11,225 for purchase of Digiwalkers (Pedometers) to conduct research regarding Digiwalker effects on fifth grade childrens physical activity when included with the *Healthy Hearts* curriculum. Funded by NAU Intramural Grants Program.

Concord College, 2000. Part of team that secured $30,500 for design, development, dissemination, and use of E-learning module: Healthy Hearts. Project funded by West Virginia Bureau for Public Health, Virginia Tech's Institute for Connecting Science Research to the Classroom, WVU Compton Nutrition, WVU CARDIAC, and SmithKline-Beecham.

Virginia Tech, 1999. Submitted a grant proposal for $26,200 to the Carilion Community Health Fund for development of Web based instructional unit for fifth grade children. Proposal was not funded.

WEB DEVELOPMENT/MANAGEMENT

Virginia Tech Health and Physical Education Electronic Portfolios (Fall 2000).
Designed and implemented electronic portfolios for Virginia Tech Health and Physical Education student teachers.
http://www.tandl.vt.edu/hpestudentteaching/eportfolios/

Personal Health/Drug Education (Fall 1999 – Summer 2000)
Worked with Virginia Tech professor (Dr. Kerry Redican) to design and create Web based Health Education courses as part of a University Technology grant. Course was implemented with University students during Second Summer 2000, and Fall 2000.
http://www.tandl.vt.edu/kredican/personalhealth/
http://www.tandl.vt.edu/kredican/drugeducation/