Health and Physical Activity Content Knowledge of Pima Children

Timothy Brusseau, Pamela H. Kulinna, and Donetta J. Cothran

Abstract

This study grounded in constructivist theory and the public health literature investigated Native American children's knowledge related to physical activity and healthy behavior concepts. Learning tends to be more meaningful and relevant when teachers take into consideration the students' knowledge and experiences. Therefore it is important to know more about students' context-specific knowledge in order to build upon their understanding in culturally appropriate ways at school to help them develop the skills, knowledge, attitudes, and behaviors needed to live healthy and active lives. Elementary school students (N = 262) from two different Native American communities in the Southwestern United States shared their understanding of physical activity and healthy behavior. Students completed three to six health-related physical activity and healthy behavior portfolio tasks. Student knowledge varied significantly across portfolios, running the gamut from 53% of the students having a perfect score on drawing their favorite activity that helps them become fit to only 2% of students scoring full points on explaining aerobic fitness. MANOVA results suggested that there were some grade level differences by portfolio tasks. In general, students performed better as they got older. Students had minimal success and demonstrated little understanding of physical activity and healthy behaviors concepts as well as expressed some misconceptions. Native American children participating in this study had similar levels of understanding of basic concepts as previously studied children with diverse ethnic backgrounds.

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Guided by both the public health literature and constructivist theory this investigation attempted to answer the critical question, "What do elementary school students know about health and physical activity?" First, negative health trends are spiraling out of control and public health policy experts have identified schools as a primary intervention site (Flynn et al., 2006). Second and relatedly, one of the most powerful influences on what students will come to know is what students already know (Alexander, Kulikowich, & Schulze, 1994). Both these factors suggest that educators must understand students' current knowledge base to design effective teaching practices and curricula that can help students develop the knowledge base necessary for an active and healthy life.

Public Health

The importance of children's physical activity and health is supported by an overwhelming amount of evidence (Strong et al., 2005). A complete review of the benefits of a healthy lifestyle is beyond the scope of this paper, but in short, increases in both physical activity and physical fitness are associated with improved health measures (e.g. morbidity from coronary heart disease, cardiovascular disease, cancer) in children and adults (Blair, Cheng, & Holder, 2001; National Center for Chronic Disease Prevention and Health Promotion, 1997). Improved health via physical activity is also associated with enhanced cognitive performance (Strong et al., 2005).

Students' negative health trends related to inactivity are even worse for minority populations with the most at-risk group being Native Americans (Salbe, Weyer, Lindsay, & Tatranni, 2002). Native American students were selected for the current study for two reasons: (a) their severe health risk related to inactivity (related to health knowledge and behavior); and (b) their pending participation in a health and physical activity program targeting nutrition and physical activity content knowledge. Since the 1950s, Type 2 Diabetes incidence rates in Pima Indians have increased dramatically (Kriska et al., 2003; Price, Charles, Pettitt, & Knowler, 1993). Caballero and colleagues (2003) found that 53.7% and 27.3% of Pima Indian boys and girls respectively were above the 95th percentile for Body Mass Index (BMI). Zephier, Himes, and Story (1999) found Pima youth were three times more likely to be obese than other United States youth. More Native American school-aged children also rank above the 85th percentile of BMI than all other ethnic backgrounds combined in the United States (Broussard et al., 1991). This unfavorable body composition, found commonly in Native American children, is likely related to lower physical activity levels.

Constructivism

As Shuell (1986) notes in his review of cognitive conceptions of learning, learning is cumulative in nature. It is therefore imperative to understand students' current knowledge as new learning is "built" upon this current knowledge base. What an individual already knows influences what he or she is able to remember (Chi & Ceci, 1987). It also influences the encoding, storage, retention, and retrieval of information (Ornstein, Shapiro, Clubb, Follmer, & Baker-Ward, 1997).

Current knowledge on physical activity and health. Specific to physical activity and health, very little is known about students' current knowledge of physical activity and healthy behavior concepts. In one of the early explorations into student knowledge related to physical activity and fitness, Hopple and Graham (1995) interviewed 4th and 5th grade students and gave them a written quiz. They found that more than half of the students did not recognize that the mile run was a test for aerobic fitness and that students did not understand the purpose of the test. Placek et al. (2001) reported that middle school students also had many misconceptions or incomplete knowledge regarding physical activity and healthy behavior concepts. Many students did not have knowledge regarding components of physical fitness, the purpose of certain physical activities, and principles of training. They also had difficulty defining physical activity and fitness terms and matching certain activities with the appropriate components of fitness. Similarly, Trost et al. (2000) showed that eight- and nine-year-old children had trouble identifying physical activities (e.g., many thought reading a book or working on the computer was physical activity) on a checklist without video or verbal instruction.

It is important to recognize this lack of physical activity and health knowledge, because content knowledge is a critical step for youth developing healthy and active lifestyles. Physical activity guidelines for adolescents (Centers for Disease Control and Prevention [CDC], 1997; United States Department of Health and Human Services [USDHHS], 2000), children (National Association for Sport and Physical Education [NASPE], 2004a), and all individuals (USDHHS, 1996, Haskell et al., 2007) highlight the need for physical activity and health knowledge leading to a lifetime of healthy behaviors and understanding. Researchers have also directly promoted the link of knowledge about and understanding of physical activity and healthy behavior concepts to improved physical activity behaviors (DiLorenzo, Stucky-Ropp, VanderWal, & Gotham, 1998).

This study is important for a variety of reasons. First, very little is known about students' current knowledge, and without that information, educational reform is limited in its effectiveness. By understanding students' current knowledge of

health and physical activity; educators are better prepared to design teaching methods and curricula that can meet students' needs. Furthermore, the Native American culture is a unique and important population that has received minimal attention in regards to children's understanding of content knowledge needed to develop healthy behaviors. Once more is understood about what students know and understand about this content area, culturally meaningful steps can be taken to help children adopt the knowledge, skills, attitudes, and behaviors needed for adopting a physically active lifestyle and for making healthy lifestyle choices.

Given the importance of physical activity, current knowledge, and the role of schools in influencing healthy lifestyle choices, it was the purpose of this study to investigate Pima children's knowledge related to physical activity and healthy behavior concepts. A secondary purpose was to investigate possible gender and grade level differences in students' understanding of these concepts.

Methods

Participants

Elementary school students ($N = 262$) from two different Native American communities (Community A, $n = 96$; Community B, $n = 166$) in the Southwest U.S. shared their understanding of physical activity and healthy lifestyles concepts. Both genders were well represented (51% male and 49% female) and students from two schools in Kindergarten through fourth grade participated (kindergarten $n = 54$; 1st $n = 61$; 2nd $n = 40$; 3rd $n = 59$; 4th $n = 48$). Student ages ranged from 5–13 years (M=7.74 SD=1.58). Most (97%) of the participants had a Native American background (Hispanic 1.7%, and "Other" 1.3%). The students were affiliated with a total of 43 tribes or combinations of tribal affiliations with most being of Pima descent.

These children were selected as they were beginning a health and physical activity program targeting nutrition and physical activity content knowledge. One elementary school from each community agreed to participate. The communities were each located in a rural area with little infrastructure for physical activity. Schools struggled with student attendance, low retention, as well as low academic test scores.

Recruitment and Data Collection

After receiving permission from the University Institutional Review Board, School Districts, Tribal Council Educational Boards, and principals, interested elementary classroom teachers and physical education teachers from the two communities agreed to participate (project leader's recruited teachers to participate via word of mouth). Informed consent was provided by teachers and parents/guardians with students assenting to participate.

Elementary classroom and physical education teachers were trained to administer the portfolio tasks to their students at separate in-service sessions for the two communities. They were also given a written standard administration protocol. Teachers read each portfolio task to their students and then circulated among them in order to help individuals who did not fully understand the task. In addition, teachers were asked to clarify illegible writing with students and to note students' responses at the bottom of the portfolio tasks. Teachers and school personnel were also asked to substantiate data recorded on the demographic forms with school records. Completed portfolio tasks were picked-up by a member of the research team at each school.

Instrument

Elementary students completed up to six health-related physical activity and healthy behavior portfolio tasks. A specification table for the six portfolio tasks is available in Table 1. Kindergarten to grade 2 (n=155) students completed easier portfolio tasks specific to identifying physical activities that help them become fit, heart smart activities, and levels of physical activity participation with labeling of working muscles. Third and fourth grade students

(n=107) also completed these easier portfolio tasks as well as more advanced or harder tasks dealing with the effects of the modern world on physical activity behaviors, defining the term aerobic exercise, and rating activities as good or poor for developing muscular strength and endurance.

The six portfolio tasks were previously validated through a calibration process. Findings supported that the portfolio tasks produced reliable and valid scores in a sample of Caucasian and African-American children (Kulinna & Zhu, 2001). Additional validation measures were taken with the current sample of Native American children in order to support that the six portfolio tasks produced reliable and valid scores in the current population.

Internal consistency reliability was assessed for the instrument using Cronbach's alpha. A confirmatory factor analysis (CFA) was also conducted with the current population of Native American children using Liseral (8.70) in order to determine if the six portfolio tasks were measuring the three factor model theorized in the original design of the portfolio tasks, that is, introduction to physical activity and fitness knowledge, cardiorespiratory fitness, and muscular strength and endurance (Kulinna & Zhu, 2001). Only third and fourth grade students were included in these analyses, since they completed all six of the portfolio tasks.

Raters

Three trained raters with vast experience teaching physically active physical education classes participated as raters of the portfolio tasks. They used the previously validated scoring rubrics for the six portfolio tasks in order to take a detailed look at students' knowledge and understanding of physical activity and healthy behavior concepts (Kulinna & Zhu, 2001). Refer to Table 1 for specific rating criteria. A high level of interrater reliability (r > .90) was established among the three raters before coding began. Periodic checks (i.e., 30% of the data were coded by all raters) throughout data collection verified that adequate interrater reliability was maintained (r = .82).

Data Analyses

Data were screened and composite means were calculated for the six portfolio tasks. Descriptive statistics for the overall portfolio tasks and each scoring rubric were also calculated. Two-way Multivariate Analysis of Variance (MANOVA) was used to investigate grade and gender differences in portfolio task performance with Tukey follow-up tests.

Results

Instruments

Internal consistency reliability results (α=.74) supported the internal consistency of the scores produced by the six portfolio tasks and met the minimum guidelines for internal consistency for research purposes (i.e., α=.70) indicated by Nunnally and Bernstein (1994). CFA findings suggested a reasonable fit of the data to the model in this current population of Native American students. The Chi-squared Ratio (χ^2/df) of 3.5 supported a favorable fit according to guidelines from Marsh and Hocevar(1983) suggesting ratios from 2.00- 5.00 as reasonable. Error results showed an acceptable fit with RMR=.08 and RMSEA=.16. McDonald (1999) indicated that RMR values should be less than 0.10 to be considered an acceptable model fit; however, ideally the fit would have been stronger. Finally, some of the factor loadings did not meet the minimum criteria (i.e., .30), they ranged from .14-.80 (M = .36, SD = .26).

Descriptive

The descriptive statistics results provided detailed information about students' understanding of concepts related to physical activity and healthy behaviors. Overall students had minimal success on the portfolio tasks. Table 2 presents descriptive results for the six portfolio tasks. Portfolio task 3 resulted in the highest

Table 1

Specification of Six Portfolio Tasks

Physical Activity and Healthy Behavior Units	Portfolio Tasks	Portfolio Task Rubrics (points)
	Easier Tasks	
Introduction to Physical Activity & Fitness	3 - Identify a physical activity that helps them become fit.	1. Student is able to draw a picture of themselves in a favorite activity that helps them become physically fit. (1-2) 2. Student is able to explain what they are doing in the picture. (1-2) 3. Student is able to state why the activity is good for them beyond being fun. (1-3)
Cardio-Respiratory Fitness	6 - Identify and draw a heart smart activity.	1. Student is able to draw a picture of themselves participating in at least 2 aerobic (heart smart) activities. (1-3) 2. Student is able to correctly explain what they are doing. (1-3)
Strength & Endurance	9 - Identify levels of activity and label working muscles.	1. Student is able to correctly number all 3 pictures. (1-4) 2. Student is able to correctly identify more than one of the general muscles of the body performing work. (1-3)
	Difficult Tasks	
Introduction to Physical Activity & Fitness	1 - Effects of industrialization on physical activity behaviors, global understanding.	1. Student is able to identify people who lived 100 years ago as being more physically active. (1-2) 2. Student is able to state at least 2 reasons why people were more physically active 100 years ago. (1-3) 3. Student is able to demonstrate their understanding by 2 or more appropriate examples. (1-3)
Cardio-Respiratory Fitness	4 - Explain term aerobic exercise, why it is important, and give examples of activities.	1. Student is able to correctly define aerobic exercise in their own words. (1-3) 2. Student is able to correctly describe why aerobic exercise is important in their words. (1-3) 3. Student is able to give at least 2 examples of aerobic activity. (1-3)
Strength & Endurance	7 - Rated activities as good or poor for muscular endurance and strength and why.	1. Student correctly labels 8-10 items. (1-3) 2. Student is able to correctly explain why 8-10 of the items are good or poor. (1-3)

scores with 53% of students earning a perfect score, (i.e., the ability to draw a picture of themselves participating in an activity that will help them become fit, and explain what they are doing and why it is good for them). Portfolio task 4 (i.e., being able to define aerobic fitness, explain its importance, and give examples) resulted in the lowest cumulative score, with only 2% of the students with the highest rating (sample available in Figure 1).

MANOVA

All students completed portfolio tasks 3, 6, and 9. MANOVA results showed a significant main effect for grade, Wilks' Lambda = $F(4, 619) = 4.21, p < .0001, \eta_p^2 = .07$. There was no overall main effect for gender or interaction for grade X gender. Between subject effects showed differences were present for Portfolio 9 only, $F(4, 236) = 8.16, p < .0001, \eta_p^2 = .12$. Tukey follow-up tests indicated that the differences were present between kindergarten students (lower scores) and all other grades. Additionally there were significant differences between third and fourth students, with higher fourth grade scores.

The more difficult portfolio tasks (i.e., tasks 1, 4, 7) were only completed by the third and fourth grade students. MANOVA results showed a significant main effect for grade, Wilks' Lamda = $F(1, 95) = 7.84, p < .001, \eta_p^2 = .20$. For this group of portfolios there was also no overall gender effect or grade X gender interaction. Between subject effects showed differences occurring for portfolio 1 $F(1, 97) = 4.30, p < .05, \eta_p^2 = .04$ and portfolio 4 $F(1, 97) = 18.18, p < .001, \eta_p^2 = .16$. Interestingly, fourth grade students performed significantly better than third grade students on portfolio task 1, while third grade students outperformed the fourth grade students on portfolio task 4.

Discussion

Based on constructivist theory, the understanding that students construct knowledge and behavior; and these tend to be cumulative, it is evident that these students are failing to learn the basic physical activity and healthy behavior content. Therefore, they lack the foundation upon which to build their knowledge base. Studies have also shown that programs addressing children's knowledge, attitudes, and behaviors are linked to increased physical activity patterns (CDC, 1997). Furthermore, adults with a greater awareness of health risks have shown a greater likelihood of being sufficiently active (Martin, Morrow, Jackson, & Dunn, 2000). Having this knowledge of concepts and principles related to PA and healthy behaviors and of how to apply them enhances the likelihood of independent cumulative learning and therefore more regular and effective participation in physical activity and healthy behaviors (NASPE, 2004b). It is essential to both provide opportunity for activity and to provide learning opportunities for scaffolding knowledge related to physical activity and healthy behaviors in school settings.

Children's Knowledge

Overall, this Native American sample of students performed better on portfolio tasks as they got older and showed some understanding of concepts related to physical activity and healthy behaviors. Furthermore, children in kindergarten scored significant lower on portfolio tasks, this however, was expected as they were starting school for the first time and had yet to spend time learning in physical education and other health or science arenas. The Native American students in this project showed some misconceptions and misunderstandings of the concepts (e.g. drawing heart smart activities or rating

activities for muscular endurance). In general, this study's participants lacked detail in their explanations and failed to demonstrate complete understanding of the concepts, as only 7% of third graders were able to describe why physical activity was important and only about half were able to explain ("other than fun") why physical activity was good for them.

Other Knowledge Studies

The current study's students with incomplete knowledge is comparable to Hopple and Graham's (1995) and Trost et al.'s (2000) findings regarding children's understanding of healthy behavior concepts. Hopple and Graham found that students had difficulty relating the mile run to cardiorespiratory fitness and didn't understand the purpose of the one mile run. Similarly, Trost et al. (2000) reported that 8 and 9 year old children had little understanding of physical activities that were reported on a checklist without video or verbal instruction. In a similar vein, Burrows (2002) and her colleagues reported from a study of New Zealand children, that student conceptions of health focused primarily on health as a corporeal notion or just occurring in the physical domain.

Native American students in the current project also had many misconceptions. For example, they had difficulty understanding and using the term aerobic fitness. Only 8% of fourth grade students were able to correctly define aerobic fitness. Forty-five percent of 3rd and 4th graders could not give an example of at least one aerobic activity. When the terminology changed from aerobic fitness to heart smart activity, 85% of students were able to draw at least one picture of themselves participating in a "heart smart" activity. A clear relationship exists between cardiorespiratory endurance and improved health. Educating all youth on these concepts and corresponding activities needs to be a focus in schools.

Physical activity and healthy behavior knowledge have also been studied with urban students (Kulinna, 2004). Assessed using the same knowledge instruments, Caucasian and African-American students in an urban setting showed similar trends to the current results regarding students' misconceptions of physical activity and healthy behavior content knowledge.

Teaching Content Knowledge in School

It is exciting to note that one recent study using a web-based health program targeting increased physical activity knowledge; showed students were able to increase their knowledge base in this area (Palmer, Graham, & Elliot, 2005). The Internet, along with other technology (e.g. pedometers, accelerometers), are great tools to help people of all ages learn as well as monitor behaviors in and out of school. Much of the responsibility associated with educating children about physical activity and healthy behaviors has been the job of the health and/or physical educator. This endeavor needs to be a team approach, however, utilizing classroom teachers (whom see the students daily), families, and the community.

One limitation of the current study is the sample size used in the CFA of the six portfolio tasks. Thus, the fit of the data to the existing model was marginal. Future work with these six portfolio tasks and/or all nine of the originally conceptualized physical activity and healthy behavior portfolio tasks (Kulinna & Zhu, 2001) is needed with diverse populations and specifically with students from Pima Indian communities to verify the factor structure. In addition, only third and fourth grade students were used in the CFA since they completed all six of the portfolio tasks used in the current study.

Table 2

Descriptive Results for Portfolio Tasks

Portfolio Task	Specification	Mean	SD	Range
1[b]	Introduction to Physical Activity & Fitness (Effects of Industrialization)	5.11	1.77	3.00 – 8.00
3[a]	Introduction to Physical Activity & Fitness (Identify Physical Activity Leading to Fitness)	6.08	1.19	3.00 – 7.00
4[b]	Cardio-Respiratory Endurance (Explain Aerobic Exercise)	4.70	1.73	3.00 – 9.00
6[a]	Cardio-Respiratory Endurance (Draw Heart Smart Activity)	4.79	1.31	2.00 – 6.00
7[b]	Muscular Strength & Endurance (Rate Activities for Muscular Endurance)	4.42	1.25	2.00 – 6.00
9[a]	Muscular Strength & Endurance (Identify Activity Levels and Working Muscles)	5.01	1.65	2.00 – 7.00

Note. *N* for portfolio tasks ranged from 103–262. [a]Easier portfolio tasks completed by all grades; [b]Harder portfolio tasks completed by older students (i.e., grades 3 and 4).

Figure 1

Student Example for Portfolio 4

1. Explain what the term aerobic exercise means.

2. Why it is important?

3. Give examples of activities that you participate in that are aerobic activities.

1. It means doing exercises everyday.

2. So you cam be physically fito

3. Running everyday before I go to schoo!

Conclusion

This study is important in that it was the first to explore content knowledge related to physical activity and healthy behaviors in a Native American population of school children. Results suggested the Native American children had minimal levels of understanding of basic physical activity and healthy behavior concepts, similar to the previously studied children with diverse ethnic backgrounds. Given the importance of healthy lifestyles and the constructivist nature of student learning, it is essential to know more about students' knowledge and understanding related to concepts of physical activity and healthy behaviors. This is particularly critical for Native American students due to their higher incidence of sedentary related diseases. Students come to the school environment with vastly different levels of cognitive knowledge,

understandings, and feelings about the meaningfulness of being active. Addressing students' current knowledge and understandings and relating this to current and future learning and performance will help facilitate students' comprehension of this content and may lead to adoption of healthy behaviors. This may also ultimately help to seamlessly blend the cognitive and psychomotor domain learning areas in school settings.

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Dr. Timothy Brusseau is on the faculty at the College at Brockport, State University of New York, Dr. Pamela Kulinna is a teacher at Arizona State University and Dr. Donetta Cothran is on the faculty at Indiana University.