Middle-School Children’s Understanding of Physical Activity: “If You’re Moving, You’re Doing Physical Activity”

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This qualitative descriptive study explored the understanding of physical activity from the perspectives of middle-school children (n = 12; ages 11–15 years) who participated in 15 collaborative exploratory meetings (~1.5 hours/meeting) that were audiorecorded. Content analysis was completed; a pediatric nurse specialist and the participating children validated the findings. The children understood physical activity concretely, considering everything they did as physical activity based on their primary criterion of body movement. The children adeptly recalled activities and activity time duration, but struggled with categorizing the intensity of their activities. Domains of activity included home and school; social activities crossed both arenas. The study contributes to our knowledge of children’s understanding of physical activity, highlighting the concreteness of the children’s thinking, including their perspectives on evidence and conclusions based on their notions of evidence. Implications for nursing are discussed.

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Key words: Adolescent behavior; Qualitative research methods; Physical activity; Research support, NIH, Extramural

BACKGROUND AND SIGNIFICANCE

Physical activity is integral to children’s overall development and health, and is considered essential for the prevention of early-onset cardiovascular risk, obesity, and type 2 diabetes (USDHHS, 2000; World Health Organization, 2004). There is consensus on the importance of physical activity in children’s overall health and development (Must & Strauss, 1999; USDHHS, 2000; World Health Organization, 2004), and that physical activity patterns established in childhood continue in adulthood (Gidding et al., 2005; Hills, King, & Armstrong, 2007; Telama et al., 2005). Healthy People 2010 (USDHHS, 2000) goals include regular physical activity as a priority for all children. Furthermore, there are recommendations for clinicians regarding physical activity screening and intervention for children (American Academy of Pediatrics, 2003; American Nurses Association, Adolescent Health Task Force, 2000; Society of Pediatric Nurses, 2005). Discussion about physical activity with parents and children, the use of structured questionnaires for screening, and development of individualized, tailored physical activity interventions and goals for intervention are all recommended (Betz, 2000; Larsen, Mandleco, Williams, & Tiedeman, 2006; Robbins et al., 2001; Schumann, Nichols, & Livingston, 2002).

Physical activity is a phenomenon that is difficult to assess and measure. Activities tend to change with days, weeks, and seasons; estimation of activity

duration and intensity that are needed for accuracy is difficult; and factors such as environmental context (e.g., inside or outside, and environmental conditions) affect the energy cost of the activities (Kemper, 2002; Shephard, 2003). Furthermore, as most clinicians know, discussions, screening, and measurement are more easily recommended than actually done, and interventions for children pose their own unique challenges. Thus, to effectively screen, measure, and communicate with children about physical activity, clinicians and researchers must have knowledge of how the child understands physical activity. Additionally, clinicians and researchers must have reliable and valid tools.

Reliability and validity data derived from measuring children’s physical activity with self-report questionnaires are equivocal (Bryant, Lucove, Evenson, & Marshall, 2007; Goran, 1998; Pratt, Macera, & Blanton, 1999; Prochaska, Sallis, & Long, 2001; Rice & Howell, 2000; Sallis & Saelens, 2000). Overall consistency and repeatability have been reported from weak to strong, but results vary widely (e.g., Gilmer, Speck, Bradley, Harrell, & Belyea, 1996; McMurray et al., 2004; Ridley, Olds, & Hill, 2006; Sallis, Buono, Roby, Micale, & Nelson, 1993; Trost et al., 2000). Validity data range even more widely and inconsistently (e.g., Crocker, Holowashuk, & Kowalski, 2001; McMurray et al., 2004; Ridley et al., 2006; Sallis et al., 1993). As a result, for measuring and understanding children’s physical activity, current available questionnaires are not particularly useful. If a questionnaire produces invalid and inconsistent results, using the questionnaire is not worth time or effort for the clinician, researcher, or child.

The inconsistent reliability and validity of physical activity questionnaires may be due to the lack of attention to matching the content of questionnaire items with children’s understanding of physical activity. Many of the measures of activity for children are modifications of instruments originally developed for adults, but the study of physical activity of children is complicated by developmental differences, vocabulary, and unique activities specific to children, in a rapidly evolving technologic environment. Little attention has been paid to how children understand the meaning of the term physical activity. Asking children about their understanding of physical activity is the logical first step for improving overall knowledge about children’s physical activity. This is especially important in light of children’s roles in self-reporting physical activity during clinical visit discussions and their ability to use self-report questionnaires.

The purpose of this qualitative descriptive study was to determine middle-school children’s understanding of physical activity, to provide a basis for clinical decision making and to develop a reliable and valid computer-based questionnaire for physical activity screening and measurement. This study reports on children’s understanding of physical activity based on the research question: “What were children’s understandings of physical activity, including their specific activities, how they recall their activities and activity duration, and their perceptions of activity intensity?”

CONCEPTUAL FRAMEWORK

The study used a Vygotskian developmental perspective (Vygotsky, 1978). In exploring children’s perspectives, Vygotsky suggests working with children in their own environment, providing an arena that supports children to express their thoughts. In doing so, both participants and researcher merge their understanding, while emphasizing the children’s understanding and needs and providing feedback to the children and the researcher.

A Vygotskian orientation is well-suited for understanding the construct of physical activity, as well as the initial phase of computerized-questionnaire development, because it focuses on the importance of the underlying construct—physical activity—from the perspectives of the children who would be expected to answer the questionnaire items themselves. The Usability Engineering Model (UEM) (Mayhew, 1999) supports the Vygotskian orientation. The UEM involves a repeating process used to determine users’ understanding and needs—in this case, the children’s understanding of physical activity. Although an engineering model, the UEM addresses the importance of matching users’ understanding and needs with parameters for representing the construct in the questionnaire, discussion, or both. Working with middle-school children in their own environment is recommended to accommodate developmental level and for an in-depth understanding of the children’s perspectives (Druin, 1999, 2002; Guha et al., 2005). Working with children as young as preschoolers has been successful in hands-on computer application design focused on children’s understanding and developmental challenges (Druin, 1999).
METHODS

Setting and Sample

Study activities were conducted at a rural public middle school during regular school hours for 6 months. The per-capita income for the rural county was US$25,000 (State of North Carolina Department of Commerce, 2004). The racial distribution for the school district was 52.3% African American, 39.9% Caucasian, 6.9% Hispanic/Latino, 0.8% Asian, and 0.1% Native American (State of North Carolina Board of Education, 2004).

A purposeful sampling design was used to select 12 children for participation in the study. Equal age and gender cohorts were used to capture any differences in children’s understanding between grades and gender. The school principal randomly selected one homeroom from the possible six to eight homerooms for each grade (sixth, seventh, and eighth grades). Signed assent and consent forms were returned for 29 children (return rate, 38%). Names of four children (two girls, two boys) in each grade were randomly selected from the names of all children who provided written assent and parental consent. The children’s mean age was 12.5 years (range, 11–15 years), representing African-American (n = 4), Caucasian (n = 6), and Hispanic (n = 2) children. Each participant received a US$25 gift certificate to a local department store for each week of study participation.

Design and Procedures

The study design was descriptive and qualitative (Sandelowski, 2000). Group meetings with children, by grades (two girls and two boys per grade), were conducted by the principal investigator (PI; P.F.P.) and were audiorecorded. Verbatim transcripts, with integrated field notes, were analyzed and coded.

A schedule of semistructured probes was used and then tailored to each group based on children’s comments. The initial discussions began with an open-ended probe, “When I use the word activity, what do you think about?” After the initial discussion, “What does physical activity mean to you?” was posed, with similar probes to explore the children’s notions about how they judged activity intensity and recalled activity time duration. The children were asked to talk about the general activities of their lives, followed with probes directed at expanding their discussions of physical activity, recalling activity items and duration, and judging intensity.

During meetings, children had access to Post-it notes, colored pens and pencils, construction paper, and Play-Doh to help them express their ideas through creative expression (Druin, 1999, 2002). A portable SMART Board (SMART Technologies, Calgary, AB, Canada) was used for freehand drawing that could be saved and directly downloaded to computer files.

Following each group meeting, the PI listened to each audiorecording, reviewed field notes, identified any issues that needed clarification, and summarized the discussion. The PI began each subsequent meeting with a summary from the prior group meeting, discussing the children’s thoughts and ideas, or questions that arose since the last group meeting. Progression through the activities was determined on an ongoing basis in each grade group, depending on the discussion and on the needs and skills of the children.

Field notes and pseudonyms were integrated into verbatim transcripts. Transcripts were then analyzed iteratively. Transcripts were coded both manually and using ATLAS.ti (version 5.0; Sage Publications) software. Content analysis (Krippendorff, 1980), supplemented with concept synthesis (Walker & Avant, 1995) and domain analysis (Spradley, 1979) techniques, was used. Content analysis technique (Krippendorff, 1980) was used to identify repeated single words and phrases within the discussions, followed by groupings into common themes. Concept synthesis is an analytic strategy that is particularly useful for improving the understanding of an “old” concept for which there is understanding but for which further understanding is needed (Walker & Avant, 1995, p. 56). Identifying the exclusion and inclusion parameters of a domain is an essential component of domain analysis (Spradley, 1979) and is critical for concept synthesis (Walker & Avant, 1995). Concept synthesis and domain analysis required identifying what “is” and what “is not” part of physical activity, according to the children’s perspectives. Domain analysis involved scrutiny of linkages and boundaries that establish inclusion and exclusion parameters (Spradley, 1979). Semantic relationships, such as association, characteristics or properties, or equivalency, were identified (Spradley, 1979) and conceptually mapped to domains of physical activity, as well as activity items.

Codes were developed using both in vivo and open coding techniques described by Strauss and Corbin (1998). For example, when a child talked of “running,” the in vivo code generated was
“running.” Open codes, or terms that were different from the words children used but meant to include specific items, as well as multiple references that logically grouped together, were generated. For example, the code “watching TV” represented both in vivo (the exact phrase spoken, “watching TV”) and open coding (“watching cartoons”), as well as children’s references to watching a specific TV show (e.g., South Park) or a specific movie (e.g., Harry Potter, Finding Nemo). The children differentiated playing “Playstation” as being distinctly different from “TV”; thus, Playstation was coded as a separate in vivo code.

The collaborative, exploratory meetings included five meetings per grade, with 15 meetings with the children and PI averaging 64 minutes each. These discussions yielded 15 verbatim transcripts, 96 pages of field notes, and 28 children’s drawings. To assure trustworthiness of the data (Denzin & Lincoln, 2000), transcripts and drawings were reviewed extensively with experts in nursing and physical activity (J.S.H.) and exercise science (R.G. M.), and with an expert in pediatric nursing who was experienced with qualitative research.

**Ethical Considerations**

The University of North Carolina, Institutional Review Board, county school superintendent, and school principal approved the study. Children provided written assent, and their parents provided written consent for the study.

**RESULTS**

The findings are presented according to the concepts explored with the children: their understanding of physical activity, how they remembered their activity, and how they considered time and activity duration, and their perceptions of and judgments on activity intensity. Exemplars, presented phonetically, are provided, using fictitious names for the children.

**Physical Activity is Body Activity: “If You’re Moving…”**

Children were asked about all the activities they do every day. Their responses included a number of general activities (e.g., go to school), as well as some of their favorite activities (e.g., volleyball, reading, cheerleading, running, and playing). When children were asked, “What does physical activity mean to you?”, children in all groups provided varied examples with a predominant theme: They thought of physical activity as body movement, or body activity, as shown in the following examples:

- **Terri:** Physical activity means, like, physical, like you move your body to do it. Like in walking, jogging, playing.
- **Liz:** Moving. Just moving (seventh grade).
- **Cheryl:** Like, uh, just, moving your body. Body active. Body movement.
- **Terri:** Physical activity means [Terri: move a chair: affirms with nod] like your body is physically active in the process of doing something, huh. So something has to be moving (sixth grade).
- **Mick:** Sports.
- **Mick:** Running.
- **Andrew:** Yeah, sports. Soccer. Yeah, soccer is it.
- **Sheila:** Keeping your body active... Moving the body (eighth grade).

**Exercise: “…is When You Mean to Do It [Physical Activity]”**

In addition to the notion of muscle use in body movement, the children introduced the ideas of awareness and intention in relationship to exercise. To help discern their understanding of similarities or differences between exercise and physical activity, the children were asked whether physical activity and exercise were different. Within and across groups, the children puzzled over their own notions of exercise, especially as a category of activity:

- **Cheryl:** …Exercise is physical activity. Using your muscles...
- **Terri:** Physical activity, exercise. You’re still pumpin’ muscles.
- **Cheryl:** But you don’t realize it.
- **Terri:** Not really, ’cuz exercise and physical activity are, like, in the, um, groups of stuff, like sports and stuff. Well, physical activity is a group, and exercise is under that group.
- **Jon:** Every physical activity uses muscles. Period (sixth grade).

The children had difficulty with categorizing activities and their thought regarding intention and awareness in relationship to physical activity, as reflected in the examples below:

- **Terri:** Exercising is when you mean to, like mean to work your body out.
Jon: Like, when you’re exercising, it’s not fun.

Terri: Well, when you’re exercising. Well, like when you have physical activity, like, I’m doing right now, when I’m mooovving [emphasis] my fingers [demonstration of moving fingers over desk], you really don’t know that you’re trying, that you’re working your muscles. But you ARE [emphasis] moving your muscles. But you do know, kinda (sixth grade).

The children did not necessarily agree with each other’s explanations of exercise, but agreed that exercise involved movement and, therefore, muscles. Their notions of exercise also included the intent to “work your body out.” A sixth-grade girl identified a planning difference between exercise and physical activity, stating that, for exercise, “wear[ing] a leotard” was essential. The children indicated that they sometimes chose to exercise or to play for themselves, but also for others (e.g., mothers). The children were aware of their choice and the specific activity. They also focused on whether they labeled or categorized the activity as fun or play. Although children concluded that exercise could be fun or play, they agreed that it was not necessarily fun or play.

The Play Principle

The labels “fun” and “play” appeared to be synonymous and to have a wide function in children’s thinking: as a noun, a generic activity called play; as a verb, “I played sports, games, musical instruments”; or, as an adjective, “play time.” The children’s perceptions that an activity was a fun or play activity provided their rationale for enjoyment, and often the reason the children said they chose a specific activity. Furthermore, the more fun was the activity, or the more they considered an activity as play, the less likely they were aware of the time spent in the activity or its intensity. In contrast, “boring” was the opposite of fun and play. Across all grades, the word play was the term with the highest frequency count (n = 332) in the transcription database, followed by fun (n = 220), and boring (n = 113). These terms had the highest counts of all coded data, except for the word computer (n = 160).

Play was used as a reward or punishment in school and at home for all children, across all grades. For example, playing flashlight tag in the dark and free play in physical education (PE) were rewards for good behavior, while not being allowed to engage—or to be with friends—in a specific activity was used as punishment. Activity was used to encourage children to follow the rules: “You cannot play if you don’t dress out [for gym].” If you do not dress out for PE, you are sent for detention. The children exploited the rules for their activity choices. For example, several girls (sixth to eighth grades) said they “forget” to dress out on days when PE included activities they do not enjoy. An eighth-grade boy purposefully disobeyed gym rules so that he was given the usual penalty—laps—because “I like doing laps—so when I’m bored, I get myself in trouble, so I get to do them [laps].”

Overall, the children broadly used terms such as “sports” and “exercise” for classifying activities. References to specific sports often included the notion of official, organized “team” sport, as well as unofficial neighborhood teams “with my friends.” Only three children identified baseball, volleyball, or soccer as formal community-based team sports in which they participated, whereas the other children did not participate in organized team sports. None of the children participated in school-based team sports. However, all children mentioned informal group games and activities comprising up to 20 other children, including tag and hide-and-seek, and school PE activities (e.g., “girls against guys”), that they considered team activities.

Altogether, 101 individual codes were generated for activity items identified in transcripts (frequencies ranging from 1 to 328), with few differences across grades. Each activity was related at least

<table>
<thead>
<tr>
<th>Activity Item</th>
<th>Sixth Grade</th>
<th>Seventh Grade</th>
<th>Eighth Grade</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseball</td>
<td>13</td>
<td>2</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>Basketball</td>
<td>12</td>
<td>31</td>
<td>34</td>
<td>77</td>
</tr>
<tr>
<td>Biking</td>
<td>15</td>
<td>11</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Exercise</td>
<td>18</td>
<td>9</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Football</td>
<td>1</td>
<td>18</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>Homework</td>
<td>22</td>
<td>4</td>
<td>8</td>
<td>34</td>
</tr>
<tr>
<td>Playstation a</td>
<td>20</td>
<td>21</td>
<td>16</td>
<td>57</td>
</tr>
<tr>
<td>Running</td>
<td>25</td>
<td>12</td>
<td>13</td>
<td>50</td>
</tr>
<tr>
<td>Soccer</td>
<td>33</td>
<td>29</td>
<td>30</td>
<td>92</td>
</tr>
<tr>
<td>Swimming</td>
<td>4</td>
<td>19</td>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>Volleyball</td>
<td>23</td>
<td>5</td>
<td>21</td>
<td>49</td>
</tr>
<tr>
<td>Walking</td>
<td>8</td>
<td>11</td>
<td>9</td>
<td>28</td>
</tr>
</tbody>
</table>

Note: Items with frequencies ≥ 20.

a Children specified Playstation as distinctively different from watching TV, although they “played” Playstation using a TV.
once to school, home, social activity, or in combination. The information provided in Table 1 (in vivo codes) and Table 2 (open codes) indicates the concreteness of children’s thinking during discussion regarding all their activities and the frequency with which the children talked about the activities. Children used only a few categorical descriptors, but talked about their activities using highly specific items.

**Working on the Computer:** “You’re Moving Your Fingers... and Using Your Brain”

To better understand children’s thoughts regarding computer activity in relationship to their body

<table>
<thead>
<tr>
<th>Activity Item</th>
<th>Children’s Descriptor Terms</th>
<th>Sixth Grade</th>
<th>Seventh Grade</th>
<th>Eighth Grade</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathing</td>
<td>Shower, bath, in the tub, soaking in tub</td>
<td>24</td>
<td>15</td>
<td>8</td>
<td>47</td>
</tr>
<tr>
<td>Bed sleep Classes</td>
<td>Future or past bed or sleep (e.g., sleeping, go to sleep, to bed)</td>
<td>20</td>
<td>17</td>
<td>32</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>• Class in general (e.g., went to class)</td>
<td>42</td>
<td>17</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>• Specifically named class (e.g., art, computer, geography, history, math classes, and so on) or teacher (without identification of class)</td>
<td>42</td>
<td>17</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>• Homework coded separately (Table 1)</td>
<td>42</td>
<td>17</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>• Gym/PE class</td>
<td>8</td>
<td>27</td>
<td>32</td>
<td>67</td>
</tr>
<tr>
<td>Computer</td>
<td>• Working on, being on, playing on the computer, and computer tests (not class based)</td>
<td>48</td>
<td>72</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>• Specific Web sites for “fun” (e.g., Runscape, Yahoo, Excite, Barney, Disney, Oofun, Cheatcodes)</td>
<td>48</td>
<td>72</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>• Informational sites (e.g., sites for African-American or Egyptian history, Spanish language sites, Hotwheels)</td>
<td>48</td>
<td>72</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>• Downloading music; a specific musician site</td>
<td>48</td>
<td>72</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>• Generic or specific references to computer-based games (e.g., Nintendo, Yahoo games, DragonBZ, generic war games, lemonade concoction game, bookworm, Cubix, word games, crossword puzzles, Tetris, zit-popping game, Pogo, Pop-it)</td>
<td>48</td>
<td>72</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>• Excludes references to computer class</td>
<td>48</td>
<td>72</td>
<td>40</td>
<td>160</td>
</tr>
<tr>
<td>Eating</td>
<td>• Specific variations of “eating” (includes references to eat/ate breakfast, lunch, dinner/supper, snack)</td>
<td>18</td>
<td>11</td>
<td>14</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>• Specifically named food (e.g., ate cereal, eggs for dinner, Oreos)</td>
<td>18</td>
<td>11</td>
<td>14</td>
<td>43</td>
</tr>
<tr>
<td>Games</td>
<td>Noncomputer or nonvideo games, group or individual</td>
<td>53</td>
<td>28</td>
<td>29</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>• Balloon fights, four square, jump rope, kickball, kickboxing, soccerball, tag, flashlight tag, water games</td>
<td>53</td>
<td>28</td>
<td>29</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>• Card games like UNO and hearts; chess</td>
<td>53</td>
<td>28</td>
<td>29</td>
<td>110</td>
</tr>
<tr>
<td>Reading</td>
<td>• Generic and specific reading (e.g., reading a book, cartoon book, or names book; e.g., Harry Potter, Lemony Snicket series)</td>
<td>25</td>
<td>11</td>
<td>6</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>• Excludes reading associated with a class period</td>
<td>25</td>
<td>11</td>
<td>6</td>
<td>42</td>
</tr>
<tr>
<td>School</td>
<td>• Generic school activities (e.g., “going to school,” “at school”)</td>
<td>24</td>
<td>5</td>
<td>17</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>• Specific responsibilities (e.g., “flag raising,” “club”)</td>
<td>24</td>
<td>5</td>
<td>17</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>• Excludes specifically named classes (see “classes”)</td>
<td>24</td>
<td>5</td>
<td>17</td>
<td>46</td>
</tr>
<tr>
<td>Sports</td>
<td>• General (e.g., “…everybody likes sports”)</td>
<td>8</td>
<td>13</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>• Specific sport with the term sport used (e.g., sports like volleyball, soccer, bicycling, walking the dog, climbing trees)</td>
<td>8</td>
<td>13</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>• Winning at sports [generic], competition sports [generic]</td>
<td>8</td>
<td>13</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>• Friends talk about sports as sport</td>
<td>8</td>
<td>13</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>Talking</td>
<td>While hanging out, on phone, general</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>TV/movies</td>
<td>Total (including general and specific; excludes Playstation)</td>
<td>30</td>
<td>42</td>
<td>41</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>• Generic variation of watching TV, without specific show</td>
<td>19</td>
<td>20</td>
<td>20</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>• Specific TV watching, including movies</td>
<td>11</td>
<td>22</td>
<td>21</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>• Specific TV shows (e.g., South Park, Barney)</td>
<td>11</td>
<td>22</td>
<td>21</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>• Watching a movie (generic) or named a movie (e.g., Harry Potter)</td>
<td>11</td>
<td>22</td>
<td>21</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>• Particular named show (e.g., South Park, I’ll Love You In Secret, basketball championship)</td>
<td>11</td>
<td>22</td>
<td>21</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>• Character (e.g., Sponge Bob)</td>
<td>11</td>
<td>22</td>
<td>21</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>• Network (e.g., MTV)</td>
<td>11</td>
<td>22</td>
<td>21</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>• Particular sports show (e.g., basketball championship)</td>
<td>11</td>
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Note: Items with frequencies ≥20.
movement criterion, the children were queried regarding “working on [or playing on, or being on] the computer”—a more sedentary activity and an activity that children typically misclassify (Trost et al., 2000). The children struggled with their own understanding of the relationship of body movement and awareness of computer work as a physical activity, but all groups reached a consensus that computer activity was, in fact, physical activity because “you moved your fingers and hands a lot” and “used your brain.” The association of hand movement and awareness provided a logical deduction for them that using the computer is physical activity:

Mick: ...Your hands are moving. Well, if you’re in computers, like on the computer.

Mick: Moving, for your fingers.

Beca: And the brain (eighth grade).

Terri: Well you’re moving your fingers a lot. And you have to learn the keys. And you have to use your brain.

Jon: Well, it’s moving your fingers. It’s learning how to type.

Terri: Yeah, cuz you’re moving your fingers, and you gotta move the chair.

Jon: And you’re head, can start hurting, your head starts thinking. Concentrating (sixth grade).

The perception of brain movement while working on the computer provided a complex example of children’s thinking that addressed their understanding of activity and intensity, with both being related to finer discrimination. “Working hard on the computer” was associated with “learning,” “using your brain,” “concentrating” and “thinking.” But the children indicated that working hard on the computer was vastly different from “working hard” and “sweating” at other activities. The children associated the brain with “working,” “thinking,” or “remembering,” perhaps as an equivalent of “movement,” demonstrating their limited degree of knowledge regarding the human body and a systematic logic of concrete operational thinking that are developmentally appropriate (Santrock, 1996). For these children, their logic made sense.

Sleep as Physical Activity: “Well, You Do It All Night”

To better understand the children’s perceptions that physical activity required body movement, they were asked specifically about sleep as a physical activity, with the PI expecting that sleep might be a negative case example of physical activity. A negative case, “what physical activity is not,” represents the parameters of exclusion in domain analysis and concept synthesis (Spradley, 1979; Walker & Avant, 1995). Overall, during these group discussions, “sleep” was mentioned frequently ($n = 69$), not specifically as a physical activity but in accounting for other activities. Sleep was mentioned by all the children as the “last thing you remember you did yesterday” (“I went to sleep/bed”), first thing in the morning (“I woke up”), or as a measure of time (as long as a TV show). The children used lack of sleep as a rationale for being tired during the day, for falling asleep in classes, and for taking naps after school. The children in all three grade groups were well aware of the number of hours of sleep nightly and provided examples of body activities they perceived to be related to sleeping. The children’s discussions in response to the question, “How about sleeping? Is sleeping a physical activity?” are highlighted in the following:

Ron: Well, you close your eyes.

Mark: Yeah. You do it [sleep] all night (seventh grade).

Jon: Well, you still are alive... using muscles. Like, you get up in the morning and you squeeze your hands, well it hurts when you squeeze your hands. You musta used muscles.

Jon: Well, I know about that. 'Cuz I fall off the bed sometimes, so I gotta be rolling over! ...Almost every single night I knock the rail off the bunk bed. I’m trying to figure out how I do that.

Cheryl: So I think I’m doing physical activity in my sleep, I just don’t really know it.

Terri: ...I didn’t use muscles. But I was breathing. I musta been moving, 'cuz, a my covers, like, all torn up.

Jon: Just like falling off my bed. Moving and don’t know it (sixth grade).

“Breathing,” “dreaming,” and closing their eyes were examples of physical movement for the children. Knocking the rail off the bed, covers in disarray, and falling out of bed indicated to them that their bodies were working, or were in
Recalling Time and Activities: “Your Head...is Like a Big Filing Cabinet”

To explore whether children were able to recall activities and the time spent in activities, the children were asked how they remembered activities from a previous day and week. Children in all groups compared remembering to using a file cabinet: “Head is, your head is, well, kinda like a file...like a big file cabinet,” and “I take the activities from the back of my head to the front of my head...” to remember. Furthermore, the issue of paying attention to time was important in how they thought about their activities, when they occurred, and how they remembered time spent in activities:

Tim: I knew, ’cuz it was 7:30 when I got off the computer. I looked at the clock. The clock told me.
Mark: I use clocks all the time.
Ron: Gotta use clocks. You look at the clock and decide how much time you have. You got to be able to tell time.
Mark: Cuz you got to know to do the stuff you do.
Ron: And ya look at the clock (seventh grade)!

Using a modified world tour (Spradley, 1979), each child provided several verbal and written “tours” of a single day in the previous week. In discussions and drawings, all children presented daily activity recalls in a highly time-sequenced and linear manner, beginning with a home activity, moving to school activities, then returning to home activities. The linear nature (identifying sequentially—first I did this, then I did that) and specificity of their recall are shown in their drawings (Figures 1 and 2). The drawings reflected their concrete notions of their activities: The children delineated specific activities, with few categories. They had no difficulty recalling activities in discussion or in creative drawings. The children varied in the use of time increments, recalling in ranges of 5- to 10-minute to 1- to 3-hour segments. Figure 1 exemplifies linear activity and time sequencing in 30-minute intervals drawn by an eighth-grade boy. Figure 2 shows a linear sequencing of time by a sixth-grade girl, with unidentifiable time increments, shown with tick marks. However, in describing the drawing in Figure 2, the sixth-grade girl detailed her descriptions using predetermined, fixed, “usual” periods from her scheduled classes (Figure 2; AC-1, AC-2, Art, AC-3, and Chorus are names of her classes). She also included time parameters that she specifically remembered (20 minutes) between AC-2 and AC-3 classes.

The children referenced cues that helped them remember activity and time (Figures 1 and 2). Children emphasized the importance of “knowing” time, with references to clocks of all sorts, digital time on computers, DVD/VCRs, and TVs, and the use of calendars and their Agenda (school-provided day-timer-type calendars). Other cues included significant events of the day: nervousness about presenting in front of the class, recollection of whether an activity was fun or play, or simply knowing the length of a regularly scheduled activity, such as a ballgame, TV show, or class period.
Activity Intensity: “How Hard You’re Working”

Working hard at physical activity was mentioned by children as a judgment of activity intensity. Discussion focused on activity intensity starting with asking children to explain about working hard, and additional probes to pinpoint what the children meant by their responses. Although the children all mentioned “working hard” at an activity in earlier discussions, they had some difficulty assigning degrees of intensity. Although they had difficulty expressing their thoughts, they provided vivid examples of their perception of intensity and related sensory cues, and illustrated their understanding of cause–effect relationships. The children’s discussions included 12 body cues that they associated with heightened activity intensity. References to heartbeat, sweat, breathing, muscle awareness, and being tired were the most frequent body cues that children discussed (Figure 3). They provided multiple vivid sound effects (mimicking or imitating strongly beating hearts and heavy breathing) and hand demonstrations of sweating that they related to working hard at an activity. The following examples from the seventh- and eighth-grade groups highlight the cues and demonstrate context:

Andrew: Like when, I feel I’m getting tired. Like, I’m playing soccer.

Andrew: Tired is like when you don’t have so much strength or something, and you be like, needing to sitting down and rest. That’s tired. About an hour [of playing soccer], then for sure.

Mark: Well, if you’re in computers, like on the computer, it’s not so hard, you’re just using your fingers. But if you’re doin’ an activity, like soccer, well you start sweatin’. Sweating and you know you’re working hard.

Mark: Your muscles start to ache.

Beca: Start to slow down a bit, like if you been running really fast, you start to run slower.

Sheila: And breathing heavy. And, well, like when you’re holding somebody up [cheerleader: pyramid demonstration, arms up], all that weight is coming down on your arms, and then your arms get real heavy... Or when we’re doing like a dance, and... cheers, you get tired and... muscles really feel it.

Beca: I like playing volleyball, like, with my sisters, it’s like working hard. First you start breathing hard. And then you start sweating (eighth grade).

Mick: Cuz when she’s done her face is as red as that shirt.

Liz: Well, hot. And sweaty.

Mick: Well, football, when I finish, I’m hungry and want some water.

Liz: Hungry and thirsty (seventh grade).

The children identified ample body cues and punctuated the examples with vivid demonstrations, analogies, and comments. The following exemplars demonstrate one of the more highly energetic and enthusiastic discussions about intensity from the sixth-grade discussions, during which the children persistently interrupted each other, their voices were heightened, and they were gleeful about discussing how their bodies felt during activities:

Terri: Especially when you’re going fast[excited voice!]. You’re working hard. I don’t like walking, but riding! [Demonstration of not going fast, saying “ba-boom, ba-boom, ba-boom,” up and down in her seat, discussing an example of horsebackriding] [excited, waving hand] You can feel it [pointing to heart; moving hand up and down over chest] pumping, and you start sweating [everybody affirms with head nods].

Jon: [interrupts] And your sides start hurting [pointing to upper abdomen].

Figure 3. Frequency of body cues that children used to judge “working-hard” intensity.
Cheryl: [interrupts] And you have to stop for a rest, your muscles are tired.

Jon: When you stop you can hear it pumpin’ [heart], feel it. Yeah, it’s like you’re in a steel chamber and, somebody’s yelling, ba-boom, ba-boom, ba-boom [demonstrates], and you can hear it, can hear it [hands over ears] in your ears... pump, pump, pump, like you’re in a steel chamber and you’re hearing bah-boom, bah-boom, bah-boom.

Terri: And you can feel it go [sound effects: ba-ha-ding, ba-ha-ding]

Altogether: Faster and [emphasis] harder (sixth grade).

Furthermore, the children could make some fine-line discriminations about activity intensity. Children provided examples of discrimination between body cues that were related to working hard with an activity and the same body cues they attributed to emotion or other related causes. An eighth-grade girl attributed a fast heart rate to her nervousness in giving a speech in front of the class. Knowing her increased heart rate was not due to working hard in physical activity, she attributed the fast heart rate to simple “nervousness,” stating, “My heart was beating really, really hard. But I’m not working hard at all!” In another example, a sixth-grade boy was aware of both breathing fast and increased heart rate that he attributed to the excitement of playing video games, “I got so excited playing video games, my heart was beating really fast and I felt like I was breathing fast [panting demonstration], and breathing faster and faster.” He stated that it was a different “breathing fast” than when he was running. “You’re moving, you’re breathing harder.” For a sixth-grade boy who has asthma, he knew that “breathing right” was dictated by his asthma. Increased breathing for him meant he may need medication.

Although the children were able to describe their bodily responses to various activities, their body cues were obscured if the children considered an activity to be fun or play. Additionally, competence or skill in an activity, or physical limitations affected the children’s ability to judge intensity. For example, if unfamiliar with an activity (e.g., “You never played it before”) or if the activity provided physical challenges (“Basketball is hard if you’re short”), then the activity required more “work”—and more work translated to perceptions of higher intensity. Conversely, physical characteristics (e.g., increased physical stature for basketball) or experience with an activity was equated to the perception of less physical exertion. The fine-line discriminations in assessing their activities and knowing situational context and cause–effect deductions were age appropriate for these children (Santrock, 1996).

DISCUSSION

This study explored the meaning of physical activity from the perspectives of middle-school children. The children understood physical activity at a concrete level. Children across all three grades considered all of their activities as some form of physical activity, based on their criteria of body activity or body movement. Secondary criteria of awareness and intention were integrated into their assessments, but seemed of lesser importance in their understanding, especially regarding thinking activities and sleep. Children in all groups acknowledged working on the computer and sleep as physical activity because they had evidence of body movement with these activities. But they had difficulty reconciling their understanding of these activities in relationship to their thoughts that physical activity involved awareness and intention. Their overall consensus was, “If you are moving, then you are doing physical activity,” even if you are unaware of the movement. They tied their conclusions to concrete evidence of movement. Thus, the children in this study had an encompassing definition of physical activity.

Because they considered any activity that involved movement to be a physical activity, children in this study understood physical activity in a manner compatible with both dictionary definitions of physical activity (Merriam-Webster, 1993) and the widely used scientific definition of Caspersen, Powell, and Christenson (1985). These findings are consistent with one study in which overweight children talked of exercise as a type of physical activity (Snethen & Broome, 2007), but are in contrast to research regarding children’s lack of understanding of the construct of physical activity (Trost et al., 2000) and measurement of self-reported physical activity (Baranowski, 1988; Sallis, 1991). However, in contrast to research measuring self-reported physical activity in children, this study focused on children’s understanding of the concept of physical activity—a process that logically should precede measurement.

The children’s recalls were linear and chronological, using sequencing as a predominant cue in
recalling their activities. The time increments they used in recalling their activities varied from 5 minutes to several hours. Cues for recalling activities and time were identified. Children in all groups in this study were adept at recalling their activities and time spent doing their activities for a single prior day. They had no difficulty discussing and detailing their activities in discussions, as well as in drawings and time lines. This ability of children to effectively recall and independently identify cues related to physical activity is in contrast to literature (Levesque, Cargo, & Salsberg, 2004; McMurray et al., 2004; Sallis et al., 1993).

McMurray et al. (2004) compared activity-based and time-based physical activity recalls and demonstrated little difference between the two self-report forms, although in 3-day recalls the time-based recall performed slightly better than the activity-based recall. Ridley et al. (2006) reported using a computerized questionnaire with a time/activity-item-based format that supported children’s recall. Similarly, children in this study used both activity- and time-based cues in discussions and in drawings about their activities. Given these findings, a format for both discussion and questionnaire that integrates both time- and activity-based recall, emphasizing children’s understanding of physical activity, may be a more effective technique to support children’s recall than is currently available in self-report questionnaires. Additional investigation of the optimal period for recall and positioning of both activity- and time-based cues is warranted. In this study, there was no attempt to have children recall activities for more than a single day. If clinicians are aware of the importance of time and activity cues being used together to support children’s recalls, discussion regarding physical activity may be enhanced.

Although the children generally had difficulty categorizing their perceptions of intensity, they provided some fine-line discriminations in assessing the intensity of their activities, which is consistent with the literature (Pfeiffer, Pivarnik, Womack, Reeves, & Malina, 2002; Robertson et al., 2000, 2005). Children have demonstrated some facility with judging the intensity of their activities in laboratory settings (Pfeiffer et al., 2002; Robertson et al., 2000, 2005), but more difficulty in nonlaboratory settings (Levesque et al., 2004; Prochaska et al., 2001; Snethen & Broome, 2007). Nonathletic but active girls identified heart rate as one method of assessing the health-related contribution of activity (Brooks & Magnusson, 2007). Similar to Levesque et al., the children in this study provided information regarding activity intensity in discussions and drawings. In this study, awareness of heartbeat was the most common cue for intensity, with sweat as the second most common. Similarly, Levesque et al. reported sweat as the most common body cue for activity intensity. “Tired” as an indicator for higher intensity activity was the fifth most common body cue that children identified in this study, consistent with both Levesque et al. findings and the OMNI exertional scales for children, which was developed using the body cue “tired” (Robertson et al., 2000, 2005). These children provided a number of cues that they used to judge the intensity of activities. In practice, clinicians can include varying the uses of intensity cues in assessing physical activity. Furthermore, these cues could be integrated into screening tools and questionnaires.

Children demonstrated high levels of cognitive thinking, and logical deductions based on concrete evidence were age appropriate (Santrock, 1996). The children used categorical descriptors only loosely in their talk, vacillating between highly specific activity names and more global categorical descriptors. But even when they acknowledged or used a categorical label (such as “classes,” “school,” “exercise,” and “sports”) verbally in their discussions, timeline drawings and other art reflected the use of a more highly specific activity name or term for classes (e.g., math, computers, and English) or a specific sport (e.g., volleyball, soccer, and so on).

Initial categorization (Spradley, 1979) for activities included references to school and home, with general references to health, sports, and play. Activities did not fit into mutually exclusive groupings. Social activities overlapped school and home. These loosely used boundaries (home and school) reflected the primary—but overlapping—conceptual, geographic, and temporal boundaries of their lives.

For all children, the terms fun and play were used extensively as descriptors of their activity, and their counterpart was boring. Although these terms permeated their discussions, the children could not define the terms, except by example. However, the children were emphatic that play and fun were interchangeable. Their use of the terms fun and play demonstrated equivalent relationships, which are parameters of semantic relationships (Spradley, 1979). This play principle was consistent throughout the group discussions. Each child had unique likes and dislikes about activities that were linked to
Mota and Esculcas (2002) demonstrated that intensity of their activities and activity duration. Moderator of children’s ability to assess the activity as play, fun, or boring may function as a perception of competence.

Informal and gender reported a high number of examples of activities. In this study, the children across grades children in this age group prefer unstructured activities. In organized team activities. Thus, further investigation of the relationship of play to unstructured and structured activities may be warranted to better understand children’s activities. For pediatric clinicians, rather than asking about activities, asking children about play specifically may provide clearer answers about children’s activities.

The study is limited to a small sample of middle-school children in rural North Carolina. Children’s understanding of sleep as physical activity may have been influenced by the probe about sleep during discussions of physical activity—that sleep should be considered physical activity. Only three of the children participated in organized team sports; thus, it is possible that children who are more sports oriented may have a different understanding of physical activity.

CONCLUSIONS

The collaborative nature of this study with children in their own environment was highly effective, as documented in other studies (Drum, 1999, 2002; Guha et al., 2005) and as recommended by the UEM (Mayhew, 1999). Children readily discussed and documented in their drawings their understanding of physical activity, recall of activities and duration, and perceptions of activity intensity. This study fills a gap in the literature regarding middle-school children’s understanding of physical activity and provides insight into children’s perceptions about physical activity and its meaning to them. However, the children’s understanding of the term physical activity and their patterns of recall may not coincide with those of pediatric nurses or researchers. This is particularly important regarding screening tools and questionnaires for pediatric clinicians and researchers, as the differences between children’s understanding of physical activity and what is integrated into interviews and questionnaires may not adequately capture physical activity. These differences may contribute to current perceptions that children do not understand the construct of physical activity itself and that they cannot adequately recall their activities (Baranowski, 1988; Levesque et al., 2004; McMurray et al., 2004; Sallis, 1991; Sallis et al., 1993). Additionally, these differences may contribute to inconsistencies in validity and reliability with the use of self-report tools. Important, this study suggests that children can recall their activities, but may require an approach that integrates the use of both time and activity cues, and specific activity items, while minimizing the use of categories. Because these children did not use categorical terms, a reduction in category use is warranted for both discussion and questionnaire items. Although limited to a small group of rural middle-school children in the United States, the findings of this study can serve as a basis for clinical discussions, development of questionnaires and other screening tools, and additional research investigation of children’s understanding or other aspects of physical activity.

Nursing Implications

With increases in overweight, obesity, diabetes, and other chronic conditions now being seen in younger children, the issue of physical activity is a critical component of health and a cornerstone of intervention. Pediatric nurses are in an extraordinary position to understand children’s physical activity, to screen for physical activity levels, and to intervene in ambulatory, school, and acute-care settings, across the spectrum of physically inactive to excessively active children. Thus, pediatric nurses can bridge the gap between what children know about physical activity, the activities children do, and activity measurement, with interventions aimed at a better understanding of children’s activity and its contribution to overall health.

Physical activity recommendations and general guidelines are available but difficult to integrate into pediatric clinical practice. To fully understand the multidimensional construct of physical activity and
to estimate energy expenditure related to activity, the components of activity item, duration, and intensity must be assessed. Children’s understanding of physical activity can inform the discussion of physical activity. However, discussion and measurement of physical activity with children must include those components as understood by children, thus posing unique assessment challenges for pediatric clinicians. It is not surprising that children in this study recalled their activities in a sequential fashion. As most pediatric clinicians know, children often provide information in a sequential format that must be accommodated—especially for assessing a phenomenon as complex as physical activity. For screening tools and questionnaires, integrating activity items in a format and language using cues that children readily understand will result in more precise self-reporting.

The importance of focusing information and language at the appropriate developmental level of the child is well-known in pediatrics. Thus, communication that is child friendly—reflecting children’s understanding of physical activity, as well as developmentally appropriate cues for remembering time and intensity—will improve children’s ability to self-report physical activity. Communication that represents children’s understandings of physical activity should enhance understanding and measurement, potentially transatlating to more effective interventions.

ACKNOWLEDGMENT

This research was supported by grants from the American Nurses Foundation Scholar/2003 Nurses Charitable Trust Award (no. 2003023) and the National Institutes of Health, National Institute of Nursing Research, National Research Service Award (individual fellowship no. F31 NR08173; 2002–2004) to the PI (P.F.P.).

REFERENCES


