Investigating the Youth Physical Activity Promotion Model: Internal Structure and External Validity Evidence for a Potential Measurement Model

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The purpose of the study was to investigate the measurement properties of questionnaires associated with the Youth Physical Activity Promotion (YPAP) model. Data were collected from 296 children in Grades 5–8 using several existing questionnaires corresponding to YPAP model components, a physical activity questionnaire, and 6 consecutive days of pedometer data. Internal validity of the questionnaires was tested using confirmatory factor analyses, and external validity was investigated via correlations with physical activity and body composition. Initial model fit of the questionnaires ranged from poor to very good. After item removal, all scales demonstrated good fit. Correlations with percentage body fat and objectively measured physical activity were low but in the theoretically predicted direction. The current study provides good internal validity evidence and acceptable external validity evidence for a brief set of questionnaire items to investigate the theoretical basis for the YPAP model.

Despite the increasing recognition of health benefits associated with an active lifestyle, many children and youths do not meet public health physical activity recommendations (8). Physical activity levels decline across adolescence (20), and adolescent inactivity tracks into adulthood (24). In addition, sedentariness is associated with pediatric obesity (28). From a public health perspective, developing interventions to promote physical activity in children and youths is therefore critical.

Intervention development should be based on theory-testing research examining why children and youths might or might not be physically active. To facilitate physical activity promotion and research, Welk (36) delineated the Youth Physical Activity Promotion (YPAP) model, integrating existing theoretical frameworks to explain youth physical activity behavior (see Figure 1). Two major components are psychosocial in nature, namely “predisposing” and “reinforcing” factors.
Predisposing factors increase the likelihood that youths will participate in physical activity, whereas reinforcing factors deal with social influences that encourage activity.

One subcomponent of predisposing factors is labeled “Am I able?” encapsulating variables related to self-perceptions including physical self-worth, perceived competence, and self-efficacy. Self-perceptions play a central role in social learning (e.g., social cognitive) and motivational theories (e.g., competence motivation). For example, Harter (17) proposed that task engagement is mediated by one’s perceptions of and desire to develop competence, whereas Eccles and Harold (12) identified expectations of success or failure as a key determinant of activity choice. Perceptions of ability also serve as a key factor in Bandura’s (2) social-cognitive theory of self-efficacy. Although the conceptualization of these variables differs somewhat across theoretical perspectives, the core of these beliefs involves how individuals think and feel about their abilities in the physical domain. Positive self-perceptions relate to higher activity levels and more positive affective experiences (35).

A second subcomponent of the predisposing factors titled “Is it worth it?” addresses the value placed on expected outcomes associated with physical activity. These include positive affective experiences such as enjoyment and liking of

Figure 1 — The YPAP model (adapted from Welk, 1999).
physical activity, as well as positive attitudes and beliefs. Collectively, youths who have positive self-perceptions (Am I able?) and feel that participating has valued benefits (Is it worth it?) are more likely to participate in regular physical activity. Eccles and Harold’s (12) expectancy-value model, for instance, identified utility and incentive values to be those that an adolescent believes to be useful in the attainment of long-term goals or the rewards received through participating in some activity.

The second major component of the YPAP model (reinforcing factors) includes social influences that encourage children’s physical activity behaviors. Specifically, Welk (36) highlighted the role of significant others in reinforcing activity choices. Parents are thought to influence children’s physical activity through a variety of mechanisms including role modeling, encouragement, facilitation, and involvement (5,41). Similarly, peers are also thought to influence activity through a variety of mechanisms such as through peer acceptance in physical activity contexts (30). The beliefs and influences of significant others can serve as interpreters, supporters, and providers of experiences for children (12) and are prominent in other social-cognitive models of behavior (2,17).

Testing models such as the YPAP model requires psychometrically sound measures developed specifically for youths. Compared with similar research in adults, fewer established measures are available for youths. Welk (36) noted that in some cases instruments originally developed for adults have been reworded and assumed to be suitable for youths. This is probably not appropriate because of the unique developmental characteristics that differentiate youths from adults. It is important to note that developing and testing effective physical activity interventions is predicated on understanding factors that influence physical activity. To date, research examining psychosocial correlates of physical activity has been limited by the lack of psychometrically sound and developmentally appropriate measures.

Given the multifactorial nature of most theoretical models, brief scales are necessary in model-testing studies to keep questionnaires to a practical length. In addition, much of the theory-testing research now uses structural equation modeling analyses, which also leads to a need for scales with few items. Commonly cited sample size guidelines for structural equation modeling require more participants as the number of items increases (4).

As part of scale development in this area, it is also important to evaluate whether the scales predict physical activity. To date, most researchers who have examined the relationship between various YPAP model components and physical activity have used self-report measures of physical activity (27,30,32,41). It is not clear to what extent the resulting correlations are a result of common method variance (i.e., all the variables were measured using questionnaires) rather than the existence of relationships between the underlying constructs. In addition, self-report measures are influenced by accuracy of recall and biases such as social desirability and, thus, are not considered as valid as more direct measures of physical activity (21). In studies investigating youth physical activity, it is therefore important to include objective physical activity measures such as pedometers.
Purpose of the Study

The purpose of this study was to evaluate internal validity evidence and external validity evidence for constructs within the YPAP model, as measured by a set of items from existing instruments. Internal validity evidence supports the internal structure of each YPAP component as measured by the various scales, and external validity evidence supports construct validity by testing theoretically predictable relationships between the YPAP psychosocial constructs and other constructs. The concepts of internal and external validity evidence were introduced in the measurement theory literature as early as the 1950s (9,23).

Method

The study was conducted using a cross-sectional design. Data were collected on each child over a 2-week period, and all data collection was completed over 2 months in mid to late spring. Before data collection, all procedures were approved by the University Medical Center Institutional Review Board, the district school system, and the principal at each school.

Participants

Confirmatory factor analyses were conducted on data from 296 children in Grades 5–8 from two local middle schools, most of whom were White (55%) or Black (41%). Parental consent and participant assent were obtained before data collection. Demographic variables describing the participants are presented in Table 1.

Table 1 Sample Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Boys (n = 129) M (±SD)</th>
<th>Girls (n = 163) M (±SD)</th>
<th>All (N = 292) M (±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>12.6 (±1.2)</td>
<td>12.3 (±1.3)</td>
<td>12.4 (±1.3)</td>
</tr>
<tr>
<td>Height (in)</td>
<td>62.9 (±4.6)</td>
<td>61.8 (±3.8)</td>
<td>62.3 (±4.2)</td>
</tr>
<tr>
<td>Weight (lb)</td>
<td>120.0 (±34.7)</td>
<td>122.7 (±39.4)</td>
<td>121.5 (±37.4)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>21.1 (±4.7)</td>
<td>22.4 (±6.3)</td>
<td>21.8 (±5.6)</td>
</tr>
<tr>
<td>%BF</td>
<td>23.1 (±10.8)</td>
<td>28.5 (±9.9)</td>
<td>26.1 (±10.6)</td>
</tr>
<tr>
<td>LTEQ</td>
<td>96.5 (±100.6)</td>
<td>99.0 (±81.2)</td>
<td>97.9 (±90.1)</td>
</tr>
<tr>
<td>Steps/day</td>
<td>10,513 (±4,083)</td>
<td>8,650 (±2,799)</td>
<td>9,473 (±3,543)</td>
</tr>
</tbody>
</table>

Note. Sample sizes are after listwise deletion. BMI = body mass index; %BF = percent body fat; LTEQ = Leisure Time Exercise Questionnaire composite score.
Procedures

We collected data from each child via three sets of data collection procedures.

**Demographic and Body Composition Data.** We measured height and weight using a combined stadiometer and physician’s scale (Health O Meter, Inc., Bridgeview, IL), with shoes and heavy clothing removed. Skinfolds were measured at triceps and calf sites by an experienced, trained tester using Lange calipers (Cambridge Scientific Industries, Cambridge, MD), following American College of Sports Medicine guidelines (1). The sum of calf and triceps was used to estimate percentage body fat (%BF), using the equations of Slaughter et al. (29).

**Daily Steps.** Step count data were collected over a 7-day period using Yamax SW-200 pedometers (Yamax Corp., Tokyo, Japan), starting on a Wednesday morning. Acceptable reliability has been demonstrated previously using Yamax pedometers to measure children’s free-living physical activity (3,33). Children recorded their daily steps each morning in school, under the supervision of a teacher. On the weekend, a record card was taken home to record steps and was returned to school on Monday morning. The first day was omitted from analyses, because children received their pedometers at varying times during the morning. The remaining 6 days of data were acceptably reliable ($\alpha = .83$).

**Questionnaires.** The questionnaires were administered during a single class period in a quiet, controlled environment. The first author led the children through the questionnaires, with at least three research assistants available to assist children with questions or difficulties. Before starting, the first author read a list of lifestyle physical activities such as cycling, swimming, and skateboarding and instructed the children to consider all such activities as “games and sports” any time this term was used in an item. The structured alternative format was then explained using an example item printed at the beginning of the questionnaire. The respondents would first select from two alternative statements (e.g., “Some kids don’t enjoy exercise very much” or “Other kids enjoy exercise a whole lot”) the one that described them best. They would then decide whether the statement was “sort of true” or “really true.” Each item would subsequently be scored between 1 and 4, with 1 reflecting the most negative response and 4 reflecting the most positive response. Example items are shown in Appendix A, and the complete set of items is available from the first author. Each alternative statement was read aloud in a neutral tone to avoid stressing either alternative in a way that might be interpreted as being favorable or unfavorable.

**Instruments**

Godin and Shephard (15) developed the Leisure Time Exercise Questionnaire (LTEQ) as a simple measure of habitual exercise behavior in adults, although it has been used in several published studies of children’s physical activity (7,16,26,30). Respondents indicate the number of discrete 15-min bouts of varying intensity (mild, moderate, strenuous) activity during a typical 7-day period. A composite score is then calculated.
To identify suitable existing questionnaires to measure YPAP model components, we used three criteria: (a) all scales should have a common response format, (b) scales must be reasonably brief, and (c) satisfactory reliability and validity evidence must be available in children. The scales we selected met all of these criteria more clearly than all other available scales.

The Children’s Attraction to Physical Activity scale (CAPA) (5,6) measures several of the YPAP model constructs. The original CAPA included 5 subscales: Liking of Games and Sports, Liking of Physical Exertion, Liking of Vigorous Exercise, Peer Acceptance, and Importance of Exercise. We omitted the Importance of Exercise scale because Brustad found extremely low internal consistency (6) and subsequently deleted this scale in his research. Smith (30) reported internal consistencies of .87 (Liking of Games and Sports), .75 (Liking of Physical Exertion), and .76 (Liking of Vigorous Exercise) in adolescents ages 12–15 years.

In a later study, Brustad (5) presented three parent-socialization subscales (Parent Encouragement, Parent Enjoyment, and Parent Role-Modeling). We selected the 6-item Parent Encouragement subscale, because the wording reflected parental behaviors directed at the child’s physical activity, rather than parents’ own physical activity behaviors and enjoyment.

We also selected the 6-item Perceived Physical Competence scale (PPC) (18) to measure the “Am I able?” subcomponent of the YPAP model. The PPC follows the same structured alternative format as the CAPA scales, has been used extensively in research on children’s physical activity, and internal consistency reliability above .70 in children has previously been reported in several studies for versions ranging from an abbreviated 3-item to an extended 9-item version (5,6,11,18,41). We reworded four items slightly, changing “sports” to “games and sports,” so they represented physical activity generally rather than athletic competence.

We also included the Physical Self-Worth scale (PSW) (42) as a potential indicator of the “Am I able?” model component. We included PSW because it represents a more global depiction of children’s perceptions of their physical self (13,39). High internal consistency for the PSW scale has been reported in adolescents (.93) (30) and younger children (.90) (38).

Data Analysis

Data analysis comprised two stages: (a) analyses to evaluate the underlying factor structure of the selected scales and obtain reduced versions where appropriate and (b) correlations of the YPAP scale scores with objectively-measured physical activity and body composition to provide external validity evidence.

Measurement Models

Initially, the complete version of each scale was tested using maximum likelihood confirmatory factor analysis. Criteria for eliminating or retaining items were (a) empirical evidence (item loadings, global fit, residuals), (b) previous research evidence (from the published literature, personal communications with other researchers, and unpublished data we have collected previously on similar-age
children), and (c) substantive or conceptual reasoning (including inspection of item wording for redundancy and unidimensionality). Internal structure also was tested by combining two sets of conceptually linked scales.

To set a metric for the variance of each factor, the loading of one item per factor was set to 1.0 in all analyses. Results were inspected for global fit and specific fit (i.e., individual parameter estimates). We report several global fit statistics. The $\chi^2$ statistic represents how closely the reproduced covariance matrix matches the observed covariance matrix. The CFI and NNFI reflect overall goodness of fit, with higher numbers indicating better fit and the CFI being restricted within a range of 0–1. RMSEA represents “badness” of fit, and smaller values are desirable. These indexes are affected by multiple design factors, and the interpretation of what constitutes good fit varies across studies. Marsh, Hau, and Wen (25) cautioned against setting hard and fast standards for fit indices in response to an earlier article by Hu and Bentler (19), who recommended more stringent standards than previously had been applied. Hu and Bentler suggested standards of “close to .95” for the CFI and NNFI and “close to .06” for the RMSEA, although the more traditionally used standards are .90 for CFI and NNFI and .08 for RMSEA (19). Because the debate regarding standards has not been resolved, the results of the current study should be interpreted in the context of both sets of recommendations.

**External Validity**

Evidence of the internal structure of an operationally defined construct does not confirm its nature in terms of external relations, and so we correlated each of the subscales with two measures of physical activity (pedometer steps and LTEQ) and %BF, using Pearson correlations.

**Results**

All confirmatory factor analyses were conducted using AMOS Version 4.0.1 (Smallwaters Corporation, Chicago, IL) by the first author, and independently using PRELIS and LISREL version 8.72 (Scientific Software International, Lincolnwood, IL) by the third author. There were no meaningful differences in results from the two software programs, and the results obtained from AMOS are reported.

**Measurement Models**

We initially inspected the descriptive statistics for each item (see Table 2). Item means were all above the midpoint of the 4-point distribution, indicating that the children typically had positive attitudes toward physical activity and positive self-perceptions. Most item scores were univariate normally distributed, with only 4 of 39 items having skewness or kurtosis values above |2.0|. Multivariate kurtosis values were significant for all scales. Based on the general univariate normality and the robustness of maximum likelihood estimators to even substantial violations of normality (14), however, we used maximum likelihood to estimate parameters and fit statistics.

Fit statistics and standardized item loadings for the original and reduced scales are presented in Table 3. Overall fit ranged from very good to poor. Within the
better-fitting scales, standardized item loadings were all substantial, in the expected
direction (i.e., positive), and significant \((p < .05)\). In the less well-fitting scales,
all standardized loadings were in the expected direction and significant \((p < .05)\),
although there were some low item loadings.

To determine which items might be deleted from the scales, we used the
following system: (a) no scale was reduced below 3 items to avoid identification
problems, (b) weak items were omitted one at a time with subsequent reanalysis
and evaluation of the effect on model fit and remaining item loadings, and (c)
empirical evidence was interpreted in the context of prior evidence from our own
previous use of the instruments and the results of other researchers, as well as
theoretical considerations. The goal of scale reduction was to balance parsimony

### Table 2: Summary of Item Descriptive Statistics by Scale

<table>
<thead>
<tr>
<th>Scale</th>
<th>Number of Items</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPC</td>
<td>7</td>
<td>2.71–3.40</td>
<td>0.80–1.12</td>
<td>-1.39–0.80</td>
<td>-1.35–0.92</td>
</tr>
<tr>
<td>PSW</td>
<td>6</td>
<td>3.05–3.54</td>
<td>0.74–1.00</td>
<td>-0.99–1.59</td>
<td>-0.68–1.91</td>
</tr>
<tr>
<td>LGS</td>
<td>5</td>
<td>3.19–3.71</td>
<td>0.62–1.02</td>
<td>-1.52–2.40</td>
<td>-0.37–5.74</td>
</tr>
<tr>
<td>LPE</td>
<td>5</td>
<td>2.89–3.31</td>
<td>0.91–1.13</td>
<td>-1.08–1.07</td>
<td>-1.06–0.01</td>
</tr>
<tr>
<td>LVE</td>
<td>5</td>
<td>2.52–3.43</td>
<td>0.78–1.12</td>
<td>-1.24–1.40</td>
<td>-1.37–1.61</td>
</tr>
<tr>
<td>PA</td>
<td>5</td>
<td>2.93–3.45</td>
<td>0.76–1.01</td>
<td>-1.42–0.86</td>
<td>-0.79–1.74</td>
</tr>
<tr>
<td>PE</td>
<td>6</td>
<td>2.82–3.64</td>
<td>0.64–1.13</td>
<td>0.45–2.15</td>
<td>-1.19–4.88</td>
</tr>
</tbody>
</table>

*Note.* Values are ranges (of means, \(SD\), skewness, and kurtosis) of items in each subscale. PPC = perceived physical competence; PSW = perceived self-worth; LGS = liking of games and sports; LPE = liking of physical exertion; LVE = liking of vigorous exercise; PA = peer acceptance; PE = parent encouragement.

### Table 3: Summary of Fit Statistics and Loadings; Original Scales (O) and Reduced Scales (R)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Items</th>
<th>df</th>
<th>(\chi^2)</th>
<th>CFI</th>
<th>NNFI</th>
<th>RMSEA</th>
<th>(\alpha)</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPC (O)</td>
<td>6</td>
<td>9</td>
<td>16.99</td>
<td>0.98</td>
<td>0.97</td>
<td>.06</td>
<td>.81</td>
<td>.67, .59, .62, .72, .61, .71</td>
</tr>
<tr>
<td>PSW (O)</td>
<td>6</td>
<td>9</td>
<td>7.14</td>
<td>1.00</td>
<td>1.00</td>
<td>.00</td>
<td>.88</td>
<td>.76, .75, .67, .79, .69, .82</td>
</tr>
<tr>
<td>LGS (O)</td>
<td>5</td>
<td>5</td>
<td>34.90</td>
<td>0.95</td>
<td>0.91</td>
<td>.14</td>
<td>.85</td>
<td>.80, .66*, .66, .76, .84</td>
</tr>
<tr>
<td>LGS (R)</td>
<td>4</td>
<td>2</td>
<td>3.96</td>
<td>1.00</td>
<td>0.99</td>
<td>.06</td>
<td>.83</td>
<td>.83, .66, .71, .85</td>
</tr>
<tr>
<td>LPE (O)</td>
<td>5</td>
<td>5</td>
<td>25.14</td>
<td>0.95</td>
<td>0.90</td>
<td>.12</td>
<td>.79</td>
<td>.52, .71, .63, .76, .67*</td>
</tr>
<tr>
<td>LPE (R)</td>
<td>4</td>
<td>2</td>
<td>3.87</td>
<td>0.99</td>
<td>0.98</td>
<td>.06</td>
<td>.75</td>
<td>.56, .80, .60, .68</td>
</tr>
<tr>
<td>LVE (O)</td>
<td>5</td>
<td>5</td>
<td>4.90</td>
<td>1.00</td>
<td>1.00</td>
<td>.00</td>
<td>.77</td>
<td>.71*, .41, .85, .54, .77</td>
</tr>
<tr>
<td>LVE (R)</td>
<td>4</td>
<td>2</td>
<td>1.81</td>
<td>1.00</td>
<td>1.00</td>
<td>.00</td>
<td>.70</td>
<td>.40, .83, .56, .78</td>
</tr>
<tr>
<td>PA (O)</td>
<td>5</td>
<td>5</td>
<td>8.55</td>
<td>0.99</td>
<td>0.98</td>
<td>.05</td>
<td>.75</td>
<td>.67, .45*, .71, .56, .71</td>
</tr>
<tr>
<td>PA (R)</td>
<td>4</td>
<td>2</td>
<td>2.27</td>
<td>1.00</td>
<td>1.00</td>
<td>.02</td>
<td>.75</td>
<td>.65, .71, .58, .72</td>
</tr>
<tr>
<td>PE (O)</td>
<td>6</td>
<td>9</td>
<td>84.08</td>
<td>0.91</td>
<td>0.84</td>
<td>.17</td>
<td>.85</td>
<td>.38*, .80, .83, .54*, .88, .64*</td>
</tr>
<tr>
<td>PE (R)</td>
<td>3</td>
<td>1</td>
<td>0.001</td>
<td>1.00</td>
<td>1.00</td>
<td>.00</td>
<td>.88</td>
<td>.83, .79, .91</td>
</tr>
</tbody>
</table>

*Note.* One factor loading and one item error were set to fixed values in the modified PE subscale in order to obtain an overidentified model. PPC = perceived physical competence; PSW = perceived self-worth; LGS = liking of games and sports; LPE = liking of physical exertion; LVE = liking of vigorous exercise; PA = peer acceptance; PE = parent encouragement.

*Items subsequently deleted.*
and improved fit with a strong theoretical or logical rationale. For example, some items with high factor loadings had very similar wording (e.g., Item 7 “Some kids don’t like to exercise very much” and Item 21 “Some kids don’t enjoy exercise very much”). Retention of both items on the Liking of Vigorous Exercise scale would lead to better fit at the expense of a narrowly defined construct. In such cases, an item with an adequate but lower loading (e.g., Item 14 “Some kids feel really tired after they exercise or play hard”) might be retained because its wording broadened the operational definition of the construct. This process was conducted iteratively by the first three authors via e-mail and telephone conference calls, and all three authors arrived at a consensus on each decision before progressing. A step-by-step description of the process is available on request from the first author; however, a brief rationale is provided below.

**Perceived Physical Competence.** Initial global fit was good. Although removal of Items 18 (“Some kids think they could do well at just about any new game or sport activity they haven’t tried before”) and 11 (“Some kids wish they could be a lot better at games and sports”) improved overall fit considerably, we retained all six items because in some studies PPC items alone might be used to focus this major YPAP component on specific feelings of competence (27).

**Physical Self-Worth.** Initial global fit was very good. No changes were made to this subscale because in some studies PSW might be the only scale used to represent this major component of the YPAP model more globally (30).

**Liking of Games and Sports.** Initial global fit was not acceptable. Item 9 (“Some kids have more fun playing games and sports than anything else”) was deleted, leading to good fit.

**Liking of Physical Exertion.** Initial global fit was not acceptable. Item 33 (“Some kids don’t like to run very much”) was deleted because it did not fit conceptually with the other items (did not relate to the physical experience of exertion), and this led to good fit.

**Liking of Vigorous Exercise.** Although initial fit was very good, we deleted Item 7 because of redundant wording with Items 21 and 35 (“Some kids really don’t like to exercise”).

**Peer Acceptance.** Although initial fit was good, Item 10 (“Some kids get nervous or worried about playing games and sports”) was deleted based on previous deletion by other researchers (including the scale originator), and this improved global fit.

**Parent Encouragement.** Three items were deleted from this scale. Initial fit was extremely poor. Item wording indicated a conceptual dichotomy of verbal encouragement (2 items) and material or behavioral support (4 items). We deleted Items 6 (“Some kids have parents who encourage them to play games and sports”) and 27 (“Some kids have parents who tell them that they are good at games and sports”), which had lower loadings, and this improved some indices of global fit, but RMSEA was still unacceptable (.13). We subsequently deleted Item 38 (“Some kids have parents who give them equipment [balls, bats, gloves] to play games and
sports”) because it was specific to particular sports in which many active children might not participate, and this resulted in very good fit.

**Combined Subscale Analyses**

After item deletion based on the unidimensional confirmatory factor analyses, we also combined two sets of scales that were conceptually linked in the YPAP model. First, items on the reduced versions of the Liking of Games and Sports, Liking of Vigorous Exercise, and Liking of Physical Exertion subscales (conceptually linked via the “Is it worth it?” subcomponent) were analyzed together in a correlated-factor model, forcing simple structure and allowing no cross-loadings. Global fit met traditionally employed guidelines for acceptable fit ($\chi^2[87] = 229.97$, CFI = .93, NNFI = .91, RMSEA = .08), all interfactor correlations were high (.62–.86), and item loadings were similar to those obtained in the unidimensional CFAs. Modification indices indicated only one item as potentially cross-loading (.17) on another factor.

The Parent Encouragement and Peer Acceptance subscales also were analyzed in a correlated-factor model, because they are conceptually linked via the reinforcing factors component of the YPAP model. Global fit was good ($\chi^2[13] = 21.43$, CFI = .99, NNFI = .98, RMSEA = .05), the interfactor correlation was moderate (.50), and modification indices indicated no potential cross-loadings. Although the PPC and PSW scales are associated via the “Am I able?” component of the YPAP model, we did not test them together in a correlated factors model because of the commonly-accepted theoretical rationale that global physical perceptions (PSW) are hierarchical (not parallel) to specific feelings of physical competence (PPC) (13,39).

**External Correlations**

The results of the external correlations, and correlations among the various subscales, are presented in Table 4. Correlations with pedometer-determined physical activity were consistently positive (average $r = .17$), and 10 of the 14 correlations were significant ($p < .05$). Correlations between subscale scores and LTEQ-determined physical activity were all positive except three (average $r = .09$), and only 5 of 14 correlations were significant ($p < .05$). Body fatness was negatively correlated with all YPAP model subscale scores except Parent Encouragement in boys (average $r = .13$), and 7 of 14 correlations were significant ($p < .05$). It is interesting that %BF was significantly negatively correlated with pedometer-determined physical activity ($r = -.15$ in both boys and girls), but not with self-reported physical activity ($r = -.05$ in boys and .00 in girls).

**Discussion**

Our intent was to evaluate potential measures for testing the YPAP model (36). After identifying potential existing questionnaires, we tested their factor structure and determined a reduced number of items on each scale for the purpose of future model testing. We subsequently correlated the scales with physical activity (from objective and self-report measures) and %BF.
Table 4  Correlations of Reduced Scales With External Variables and With Each Other for Boys (Above Diagonal) and Girls (Below Diagonal)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Average steps</th>
<th>LTEQ</th>
<th>%BF</th>
<th>PPC</th>
<th>PSW</th>
<th>LGS</th>
<th>LPE</th>
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Note. After listwise deletion, n (boys) = 129, n (girls) = 163. PPC = Perceived physical competence; PSW = perceived self-worth; LGS = liking of games and sports; LPE = liking of physical exertion; LVE = liking of vigorous exercise; PA = peer acceptance PE = parent encouragement.

*p < .05, 1-tailed.
Measurement Model

Decisions about item retention or elimination were made using a combined empirical and conceptual procedure. Adding conceptual considerations and previous evidence to our empirical evidence reduced the likelihood of sample-specific modifications.

To summarize, although a shorter four-item version of the PPC subscale resulted in slightly better fit, the six original items were empirically sound (had good fit) and theoretically strong (i.e., each item represented a unique aspect of perceived physical competence). Our recommendation is to conceptualize PPC as a six-item scale whenever feasible but to consider the four-item scale where greater parsimony is required. The PSW subscale remained as a 6-item measure with very good psychometric properties and is deemed suitable for further testing of the YPAP model. If both scales were used in a test of the YPAP model, they should be represented hierarchically, in keeping with prevailing theory on physical self-concepts.

The Liking of Games and Sports, Liking of Physical Exertion, and Liking of Vigorous Exercise subscales were each reduced to four items. The extent to which these three subscales are conceptually different is uncertain, and decisions to analyze the subscales separately or combined should be considered carefully. Tested individually, each subscale had good model fit, consistent with Brustad’s original conceptualization of three independent dimensions. Testing the three subscales simultaneously led to high interfactor correlations, implying potential unidimensional structure. Notably, Welk, Wood, and Morss (41) and Welk and Schaben (40) conceptualized these scales as a unidimensional construct using a 15-item combined measure. In future model-testing efforts it might be appropriate to also test a single factor model representing physical activity attraction. However, testing each subscale separately might offer independent information about specific salient aspects of attraction (Brustad, personal communication).

The Parental Encouragement subscale was shortened from six items to three, partly because two of the items reflected verbal encouragement of physical activity and four items reflected provision of support. Although both aspects might be important, their different nature might warrant separate subscales. Eccles and Harold (12) indicated that significant others might play two roles in children’s activity choice, namely as “interpreters of experience” and “providers of experience” (p. 13). The Peer Acceptance subscale, on the other hand, fit well when item 10 was removed, as has been done in previous research, and the omission of this item is recommended.

External Correlations

Our examination of relationships between each of the psychosocial subcomponents and indicators of physical activity (pedometers and self-report) and health (body fat percentage) provided interesting results. The low correlation between the LTEQ and the pedometer scores illustrated the challenges inherent in measuring physical activity in children (for an excellent review, see Welk et al. [37]). Objective assessment of physical activity is often viewed as impractical for large sample sizes, necessitating a reliance on self-report measures. We demonstrated that reliable
objective data collection is possible, however, from samples of several hundred children and that these data correlate with physical activity determinants more highly than self-report measures. It is surprising that three negative correlations were observed in girls between the LTEQ and three of the psychosocial variables. Possibly, spurious results might occur in physical activity determinants research when self-report rather than objectively determined measures of physical activity are used. To our knowledge, this is the first published study to compare correlations of children’s physical activity determinants with objective and subjective measures of physical activity in the same sample.

The relatively low correlations between the psychosocial variables and physical activity were consistent with past research (40) and underscore the complex nature of physical activity patterns in children. Two major areas of the YPAP model were explored in this study, reflecting “predisposing” and “reinforcing” aspects of physical activity. In past research, affective variables such as attraction and enjoyment have been explored as indirect predictors of physical activity involvement (10,27) and, although traditionally neglected in past research (34), should continue to be included with cognitive variables in the understanding of physical activity behavior. As Welk indicated in the YPAP model, correlates of physical activity are symbiotic in nature, and both cognitive and affective variables should be examined. The measurement properties of cognitive measures are more established than affective measures, and our attempt here was to also examine commonly used affective scales.

The complexity of physical activity behavior makes accounting for all predictors of physical activity in a single study particularly challenging. In addition to individual factors (such as those in the current study), social and environmental factors also influence youth physical activity patterns. Welk (36) included environmental, cultural, and socioeconomic factors in the YPAP model. Likewise, Krizek et al. (22) conceptualized discretionary (e.g., choice) and obligatory (e.g., school and family) factors as predictors of physical activity. Including such measures along with individual-level variables in physical activity studies is thus important.

It is interesting that body fatness correlated most highly with variables associated with physical self-perceptions and peer acceptance (i.e., PSW, PPC, and Peer Acceptance). Although this was not a major focus of the current study, it provides insight into current associations of physical activity determinants and obesity. Self-perceptions of body image related to obesity have previously been established in children (31), and the current evidence constitutes rudimentary support for this area of research.

**Summary**

This study has demonstrated that a set of existing items can be used with a common response format to simultaneously test several components of the YPAP model in a single study. We have provided validity evidence for the internal structure of the underlying constructs using a reasonable number of items. In addition, theoretically predictable correlations with objectively measured physical activity and health (i.e., body fatness) provided external validity evidence for the psychosocial constructs as measured by these items. Cross-validation of the reduced item set in a separate
sample is recommended. We also recommend that future model-testing studies using these items should compare models that conceptualize the predictors as both multidimensional (e.g., modeling Liking of Games and Sports, Liking of Vigorous Exercise, and Liking of Physical Exertion as separate subdimensions) and unidimensional (e.g., combining the Liking of Games and Sports, Liking of Vigorous Exercise, and Liking of Physical Exertion items in a single dimension).

**References**


## Appendix A—Example YPAP Questionnaire Items

### Physical Self Worth

1. Some kids are proud of themselves physically  
   **BUT**  
   Other kids don’t have much to be proud about physically

### Perceived Physical Competence

4. Some kids do very well at all kinds of games and sports  
   **BUT**  
   Other kids don’t feel they are very good when it comes to games and sports

### Liking of Games and Sports

30. Some kids look forward to playing games and sports  
   **BUT**  
   Other kids don’t look forward to playing games and sports

### Liking of Physical Exertion

5. Some kids don’t like getting sweaty when they exercise or play hard  
   **BUT**  
   Other kids don’t mind getting sweaty when they exercise or play hard

### Liking of Vigorous Exercise

35. Some kids really don’t like to exercise  
   **BUT**  
   Other kids do like to exercise

### Peer Acceptance

24. Some kids don’t make many friends when they play games  
   **BUT**  
   Other kids make a lot of friends when they play games and sports

### Parent Encouragement

20. Some kids have parents who really help them to be good at games and sports  
   **BUT**  
   Other kids have parents who don’t help them very much at games and sports