Using Systematic Observation to Research School Physical Education and Physical Activity Programs

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MODERATOR
Chad Spoon
Active Living Research
Webinar Goals

 Discuss relevance of DO in assessing PA and its contexts in schools

 Highlight DO research considerations

 Review two DO systems widely-used in schools (SOFIT and SOPLAY)
Background

- Schools are important locations for PA
  - Assessing PA at school is important

- Access to schools can be difficult
  - Studies must be as unobtrusive as possible and produce data that is relevant to the school
    - Program and environmental evaluation is valuable to schools

- Systematic Observation
  - Provides data schools care about
  - Is relatively unobtrusive
Systematic Observation

- Method for assessing observable behaviors in any context
- Assessing PA
- Simultaneous examination of behavior and physical and social environments
  - location, presence of others, prompts, consequences
- SOFIT and SOPLAY are systematic observation instruments
- Assess PA in schools
Observation Techniques

- Frequency
- Duration (including latency)
- Time sampling/interval recording
  - Momentary time sampling
    - At specific moment only
  - Partial interval recording
    - Any time
  - Whole interval recording
    - Whole time
Systematic Observation

- **Advantages**
  - Direct and objective measure
  - Assesses contextual variables
    - (e.g., social & physical environment)
  - Low participant burden
  - Suitable for aquatic environments
  - Results understood by practitioners
Systematic Observation

- Disadvantages
  - Expense (observer time)
  - Accessibility to all locations
  - Potential subject reactivity
Feasibility of Systematic Observation

- Observer training required
  - Ranges from simple to complex
  - Depends upon complexity of system (number of activity and contextual codes)

- Time for measurement
  - Real time plus travel
  - Data entry
  - Recording and playback if video is used
Observer Training

- Memorize codes
- Directed practice using video segments
- Assessments using ‘gold standard’ video
- Field practice
- Field reliabilities with certified assessor
- Additional training to prevent observer drift
Video Observer Training Tools

- **Include**
  - Definitions and examples for each variable
  - Samples for practice coding
  - Samples for initial observer assessment
  - Samples for recalibration
Using Video For Data Collection

- Some additional challenges
  - Human subjects considerations
  - Increased subject reactivity
  - Increased costs

Avoid mixing live and video data!
General Planning

- IRB considerations
  - Individual students typically not identified
  - Student assent & parent written consent usually not required
General Planning (2)

- How many observations are enough?
  - The more the better
  - Consider generalizability

- Adequacy of the sample (representativeness)
  - Enough schools, lessons, teachers, students
  - Diversity of subject matter
  - Seasonality/day of week/time of day
Introduction to SOFIT and SOPLAY

• **System for Observing Fitness Instruction Time (SOFIT)**
  – PE Lessons
    • Student PA
    • Lesson Context
    • Teacher Behaviors

• **System for Observing Play and Leisure Activity in Youth (SOPLAY)**
  – School Environments
    • Use and PA
SOFIT and SOPLAY

THOM MCKENZIE
Observation Systems

- Designed for specific purpose
  - (e.g., SOFIT, SOPLAY, SOPARC)

- Key ingredients
  - Behavior categories
  - Observation protocols (e.g., pacing)
  - Coding conventions

- Use a validated system or create your own?
  - Establishing validity (e.g., PA)
  - Generality and comparison considerations
SOFIT Main Categories

- **Student Physical Activity**
  - Lying Down, Sitting, Standing, Walking, Vigorous

- **Lesson Context**
  - Management, Knowledge, Fitness, Skill Drills, Game Play, Other

- **Instructor Behavior**
  - Promotes PA (in class; outside)
Lesson Context

(How content is delivered or time is allocated--50% plus of students)

- Management
- Knowledge
- Fitness
- Skill Development
- Game Play
- Other (free play)
## SOFIT Data Entry Form
### Abbreviated

<table>
<thead>
<tr>
<th>Int</th>
<th>Activity</th>
<th>Context</th>
<th>Teacher P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12345</td>
<td>MKFSGO</td>
<td>ION</td>
</tr>
<tr>
<td>2</td>
<td>12345</td>
<td>MKFSGO</td>
<td>ION</td>
</tr>
<tr>
<td>3</td>
<td>12345</td>
<td>MKFSGO</td>
<td>ION</td>
</tr>
</tbody>
</table>
Pacing Observations/Entering Data

- **Duration** (Computer; each key is toggle switch)
- **Interval** (10 sec observe/10 sec record)
  - Computer (audio or video prompting)
  - Audio cassette tape/CD/MP3/IPOD/smart phone
- **Data entry**
  - Computer/apps
  - Hand score
    - Form
  - Scantron
Physical Activity & Lesson Context
- decision made at **end** of observe interval
  - analysis by both min and %

Teacher Behavior
- decision based on behavior **any time during** observe interval
  - analysis by % of intervals only

**MOMENTARY TIME SAMPLING**

**PARTIAL INTERVAL RECORDING**
Physical Activity Levels -Validation-

- SOFIT/SOPLAY Activity Codes
- heart rates (lab and field; ages 4-17)
- accelerometer (PE and recess)
- pedometer
Estimated Energy Expenditure

(McKenzie et al., JABA, 1991)

Kcal/kg/min

- Lying Down: 0.029
- Sit: 0.047
- Stand: 0.051
- Walk: 0.096
- Vigorous: 0.144

Sedentary
Estimated Energy Expenditure
(serves as summary score & variable of interest to public health)

- **EER = Energy Expenditure Rate (kcal/kg/min)**
  (PA intensity during a lesson)
  - = (% Lying Down x 0.029 kcal/kg/min)
  - + (% Sitting x 0.047 kcal/kg/min)
  - + (% Standing x 0.051 kcal/kg/min)
  - + (% Walking x 0.096 kcal/kg/min)
  - + (% Vigorous x 0.144 kcal/kg/min)

- **TEE = Total Energy Expenditure (kcal/kg)**
  (also includes lesson length)
  - TEE = EER multiplied by lesson minutes
  - (e.g., 0.100 kcal/kg x 30 min = 3 kcal/kg for lesson)
## Typical SOFIT Dependent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson Length (actual)</td>
<td>min</td>
<td>(34.3 min)</td>
</tr>
<tr>
<td>Lying down</td>
<td>min, %</td>
<td>(00.2 min, 00.5%)</td>
</tr>
<tr>
<td>Sitting</td>
<td>min, %</td>
<td>(05.9 min, 17.2%)</td>
</tr>
<tr>
<td>Standing</td>
<td>min, %</td>
<td>(11.6 min, 33.9%)</td>
</tr>
<tr>
<td>Walking</td>
<td>min, %</td>
<td>(11.6 min, 33.9%)</td>
</tr>
<tr>
<td>Vigorous</td>
<td>min, %</td>
<td>(05.0 min, 14.6%)</td>
</tr>
<tr>
<td>MVPA (Walking + Vigorous)</td>
<td>min, %</td>
<td>(16.5 min, 48.5%)</td>
</tr>
<tr>
<td>EER (of lesson)</td>
<td>kcal/kg/min</td>
<td>(0.077)</td>
</tr>
<tr>
<td>TEE (EER x lesson minutes)</td>
<td>kcal/kg</td>
<td>(2.64)</td>
</tr>
</tbody>
</table>

(McKenzie et al., *RQES*, 2000, 430 MS lessons)
## Typical Dependent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Context</strong> (lesson = 34 minutes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>min, %</td>
<td>(09.3 min, 27.2%)</td>
</tr>
<tr>
<td>Knowledge</td>
<td>min, %</td>
<td>(2.0 min, 5.7%)</td>
</tr>
<tr>
<td>Fitness</td>
<td>min, %</td>
<td>(08.4 min, 24.9%)</td>
</tr>
<tr>
<td>Skill</td>
<td>min, %</td>
<td>(01.8 min, 5.4%)</td>
</tr>
<tr>
<td>Game play</td>
<td>min, %</td>
<td>(10.0 min, 28.7%)</td>
</tr>
<tr>
<td>Other (free play)</td>
<td>min, %</td>
<td>(02.7 min, 8.1%)</td>
</tr>
<tr>
<td><strong>Teacher Behavior</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-class PA prompts</td>
<td>% intervals</td>
<td>(15.0%)</td>
</tr>
<tr>
<td>Out-of-class PA prompts</td>
<td>% intervals</td>
<td>(00.5%)</td>
</tr>
<tr>
<td>No PA prompts</td>
<td>% intervals</td>
<td>(84.5%)</td>
</tr>
</tbody>
</table>

(McKenzie et al., RQES, 2000, 430 MS lessons)
Alternative Teacher Behavior Codes

- **Variable** | **Units**
- Promotes Fitness (P) | % intervals
- Demonstrates Fitness (D) | % intervals
- Instructs Generally (I) | % intervals
- Manages (M) | % intervals
- Observes (O) | % intervals
- Other task (T) | % intervals

- Teacher Behavior codes based on a hierarchy
# SOFIT Data Analysis

- **BASIC**
  - Use lesson summary scores (add columns)

- **ADVANCED**
  - Enter interval by interval (assess by line)

<table>
<thead>
<tr>
<th>Int</th>
<th>Activity</th>
<th>Context</th>
<th>Teacher P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 2 3 4 5</td>
<td>M K F S G O</td>
<td>I O N</td>
</tr>
<tr>
<td>2</td>
<td>1 2 3 4 5</td>
<td>M K F S G O</td>
<td>I O N</td>
</tr>
</tbody>
</table>
Lesson summary scores permit assessing both minutes and % of PA and Lesson Context Variables:

Lesson Context

- Free Time: 7.9
- Game Play: 29.2
- Skill Drills: 5.3
- Fitness: 24.6
- Fit Know: 0.3
- Gen Know: 5.6
- Management: 27.2

Minutes

- 2.7
- 10.0
- 1.8
- 8.4
- 0.1
- 1.9
- 9.3

Percent of Lesson
Lesson summary scores permit analyzing:
Effects of Interventions on MVPA Minutes

N=24 Schools; 214 Teachers; 1847 Lessons
Lesson summary scores permit assessing effects of a program using MVPA percent

(N=96 Elementary Schools; 2650 Lessons; McKenzie et al., Prev Med, 1996; Health Ed & Beh, 2003)
Line by line data entry needed
to assess interactions among PA and conditions

MVPA % by Lesson Context

<table>
<thead>
<tr>
<th>Lesson Context</th>
<th>% Time in MVPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitness</td>
<td>59.2</td>
</tr>
<tr>
<td>Free Play</td>
<td>51.9</td>
</tr>
<tr>
<td>Game Play</td>
<td>50.3</td>
</tr>
<tr>
<td>Skill Drills</td>
<td>47.5</td>
</tr>
<tr>
<td>Management</td>
<td>43.3</td>
</tr>
<tr>
<td>Know</td>
<td>5.8</td>
</tr>
</tbody>
</table>

(N=24 schools; 430 lessons; McKenzie et al., 2000, RQES)
Reliability of SOFIT Observations

- Observers simultaneously code same student
- Ideally: calculate interval-by-interval agreement
  - Especially during training
  - Assess all observers & all variables
  - Start immediately; spread reliabilities over study

- Reporting in manuscripts
  - For each level of analysis
  - Some report only overall lesson scores
    - Higher than I-I scores
Observing Places!

SOPLAY
If You Build It, Will They Come?

If They Come, Will They Be Active?
SOPLAY

- Target area score, not individual student score
- Observers scan designated target area and record activity intensity of each student
- Levels validated via heart rates enable energy expenditure in area to be estimated
- Simultaneous entries for relevant environmental characteristics

(McKenzie et al., 2000, Preventive Medicine)
SOPLAY/SOPARC Categories

- Area User Characteristics
  - (Gender, Age, Race/Ethnicity)
- User Physical Activity Levels
  - (Sedentary, Walking, Vigorous)
- Primary Activity Modes
  - (e.g., soccer, dance)
- Area Contexts
  - (Accessible, Usable, Equipped, Supervised, Organized)
- Other Contexts
  - (Day, Time, Temperature)

(McKenzie et al., 2006)
Mapping School Areas

- Print out satellite map (from Google)
- Walk around area, get a feel for it
- Identify the target areas
- Draw them and number them
McKenzie School-7 Activity Areas

Activity Area 1
- Library
- Bike storage

Activity Area 2
- Arcade

Activity Area 3
- Gym

Activity Area 4

Activity Area 5
- Community Classrooms
- Food vending
- Pool

Activity Area 6
- Weights

Activity Area 7
- Parking
SOPLAY Board with Two Counters
-left for females; right for males

KEY COLORS
- red = sedentary (whoa)
- yellow = walking (slow)
- green = vigorous (go)
Figure 1. Abbreviated SOPLAY data recording form.

**SOPLAY**
(System for Observing Play and Leisure Activity in Youth)

<table>
<thead>
<tr>
<th>START TIME</th>
<th>AREA</th>
<th>CONDITION</th>
<th>GIRLS</th>
<th>BOYS</th>
</tr>
</thead>
<tbody>
<tr>
<td><em><strong>:</strong></em></td>
<td>1</td>
<td>N  N  N  N  N  N</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y  Y  Y  Y  Y  Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em><strong>:</strong></em></td>
<td>2</td>
<td>N  N  N  N  N  N</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Y  Y  Y  Y  Y  Y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Form Codes:  Temp.=Fahrenheit Temperature  BS=Before School  LU=Lunchtime  AS=After School  A=Accessible  
U=Usable  S=Supervised  O=Organized Activity  E=Equipment Provided  S=Sedentary  W=Walking  V=Very Active  Act.=Prominent Activity

Activity Codes:  0=No identifiable activity  1=Aerobics  2=Baseball/Softball  3=Basketball  4=Dance  5=Football  6=Gymnastics  7=Martial Arts  
8=Racquet sports  9=Soccer  10=Swimming  11=Volleyball  12=Weight Training  13=Other playground games  14=None of the above
**SOPLAY**

**Typical Dependent Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units (1000 students)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary</td>
<td>#, % (700, 70%)</td>
</tr>
<tr>
<td>Walking/moderate</td>
<td>#, % (200, 20%)</td>
</tr>
<tr>
<td>Vigorous</td>
<td>#, % (100, 10%)</td>
</tr>
<tr>
<td>MVPA (walking + vigorous)</td>
<td>#, % (300, 30%)</td>
</tr>
</tbody>
</table>

**SUMMARY SCORE USING MET VALUES**

- # Sedentary (700) x 1.5 METs plus (1050 METS)
- # Walking (200) x 3 METs plus (0600 METS)
- # Vigorous (100) x 6 METs (0600 METS)

TOTAL = 2250 METS
Percent of Total School Population in Activity Areas

N=24 M-SPAN schools; 151 areas
(McKenzie et al., 2000, Preventive Medicine)
Percent of Total School Population in Activity Areas by Gender

N=24 M-SPAN schools; 151 areas
(McKenzie et al., 2000, Preventive Medicine)
Percent of Students in Observed Area in MVPA by Gender and Time Period

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before School</td>
<td>57.4</td>
<td>32.2</td>
</tr>
<tr>
<td>Lunch Time</td>
<td>64.5</td>
<td>48.4</td>
</tr>
<tr>
<td>After School</td>
<td>51.4</td>
<td>46.5</td>
</tr>
</tbody>
</table>

N=24 M-SPAN schools; 151 areas

(McKenzie et al., 2000, Preventive Med)
% = Observed incidences/total area visits

Area Contexts by Time Period

N=10 Hong Kong Schools; 65 Activity Areas
(Sit, McKenzie, et al., 2010, HK Gov Report)
Sample Reliability Measures

BACKGROUND
- Observer-pairs did 472 simultaneous measures in 125 activity areas

AREA CHARACTERISTICS
- Accessibility, 98%; Usability; 94%; Supervised, 97%, Organized, 97%; Equipped, 99%

NUMBER COUNT FOR AREA
- Correlation=.99 for both females and males
- % Agreement= 92% females, 89% males

ACTIVITY LEVELS (Overall)
- Females, 90%; Males, 88%
SUMMARY AND RESOURCES

MONICA LOUNSBERRY
SOFIT

• **Assesses instructional lessons**
  – Time approximations for both PA levels and lesson contexts
    • Minutes and % of the lesson
  – Frequency of teacher behavior prompts
    • Rate (% of intervals)
  – Unit of analysis is usually the lesson
    • Across an individual teacher or multiple teachers
      – Can be used to examine
        » aspects of teaching effectiveness
        » generalities of the program
  – Can be used to assess individual children
    • Protocol modification is needed
SOPLAY

• Assesses environmental use and PA
  – Recess and before, during and after school programs
    • Characteristics of the space
    • People in the space
      – Number
      – Gender and other characteristics
      – Activity Levels
  – In broader school projects, PE environments might be included as part of the SOPLAY protocol

• Can help schools adopt policies and practices to optimize school facilities and resources
School Based PA

• What happens at school matters

• Need to know what goes on there

• Need to optimize PA in schools

• SOFIT and SOPLAY are great ways tools to help accomplish both
Observation Resources (FREE)

• **SOFIT and SOPLAY protocols**
  – On Active Living Research website

• **SOFIT and SOPLAY training videos**

• **App for SOPLAY**
  – ISOPARC for iPad—from the App Store
# ALR Systematic Observation

**by Thom McKenzie**

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<td>---</td>
<td>5/22/12</td>
<td>Free</td>
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<td>---</td>
<td>9/4/12</td>
<td>Free</td>
<td>View In iTunes</td>
</tr>
</tbody>
</table>

**Free**

**Category:** iTunes U  
**Language:** English

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## Links

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## More from North Carolina State University
iSOPARC App for IPAD

Free on App Store
Advantages of iSOPARC App

• **Digital Counter**
  - 3 different counter modes (includes speech)
  - automatically marks time and location of scans

• **Paperless data collection and storage**
  - no more paper, clock, pen, or mechanical counter
  - no need to transfer data to paper forms
  - re-uses repeated/common data from scan to scan

• **Consistent and Foolproof**
  - timestamp and GPS marked for each scan
  - photos for validation
  - area calculation

• **Easy export**

• **Faster development**
PA Observation Papers-General


Selected SOPLAY/SOPARC Papers
Design and Statistics


Selected SOFIT Papers
Design and Statistics


Resources

Systematic Observation of Physical Activity in School Contexts
(T. McKenzie & M. Lounsbery, ALR Webinar, 5.20.15)

Physical Activity Observation Papers: General


SOFIT and SOPLAY Protocols

SOFIT: System for Observing Fitness Instruction Time

SOPLAY: System for Observing Play and Leisure Activity in Youth

SOFIT and SOPLAY Training Videos (and SOFIT pacing audio file)

North Carolina State University through ITUNES University

Selected SOFIT Papers: Design and Statistics


Selected SOPLAY/SOPARC Papers: Design and Statistics


SOPLAY App

iSOPARC for iPAD—from the App Store

SOPLAY Counters

Counters are to be used for counting without taking eyes off people in target area. Typically they have red, yellow, and green keys (whoa, slow, go). A ‘totalizer’ is not needed. Sample source for counter purchase: http://www.denominatorcompany.com/