

Multilevel Analysis of Student Activity Levels in Hawai'i Physical Education Classes

Hawai'i's Model Schools Program

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Background

- The Healthy Hawai'i Initiative (HHI), a program of the Hawai'i State Department of Health, collaborated with the Hawai'i State Department of Education to develop the 2010-2013 Model Schools program.
- HHI health and physical education District Resource Teachers (RTs) provide professional development, technical assistance & instructional support to 9 model schools for health education, nutrition education, or physical education (PE). Of the 9 model schools, 7 focused on enhancing PE.

Key Components of Model Schools

- Common curriculum and assessment
- Professional development
- Implement Wellness Guidelines
- Conduct 1 culminating event
- Meet instructional minutes as specified in the Wellness Guidelines
- Encourage staff wellness

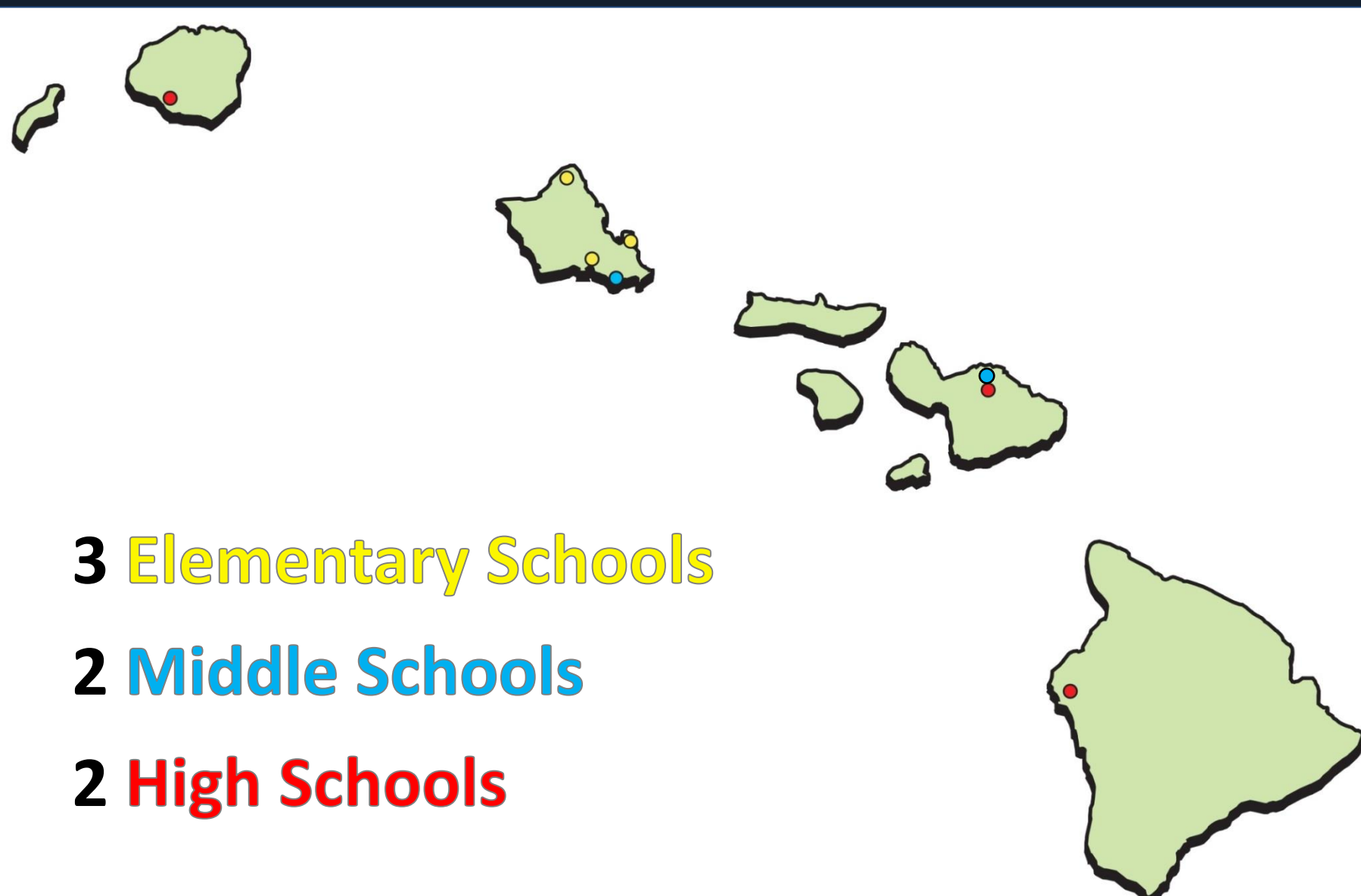
- Study purpose:** To assess student physical activity levels in PE classes at the Model Schools and to determine associations with teacher and class characteristics.

Model PE School Activities

Examples of PE activities implemented by the Model PE Schools:

- SPARK and Fitness for Life curricula
- Fitness assessments
- Culturally-tailored PE electives
- Integration of technology (e.g., iPads)
- Focus on New PE and lifetime sports
- Environmental improvements, including a new fitness room and walking path
- Fitness Day celebrations

7 Model PE Schools



Evaluation Methods and Data Analysis

- Multiple methods were used to evaluate the Model Schools program, including: student surveys, an annual Safety and Wellness Survey completed by the school principal, fitness assessments (e.g., Fitnessgram), systematic observation of PE classes and recess, and process evaluation of professional development activities.
- This study analyzed the PE class data collected in the 3rd year of the Model Schools program. The **System for Observing Fitness Instruction Time (SOFIT)**, a validated observational tool developed by McKenzie (2009), was used to assess physical activity behaviors of students during instructional PE time. The SOFIT PE Observation Form was used to collect data about the teacher and class lesson. Each model school was visited once during the school year, and all PE classes for the day were observed.

SOFIT Data

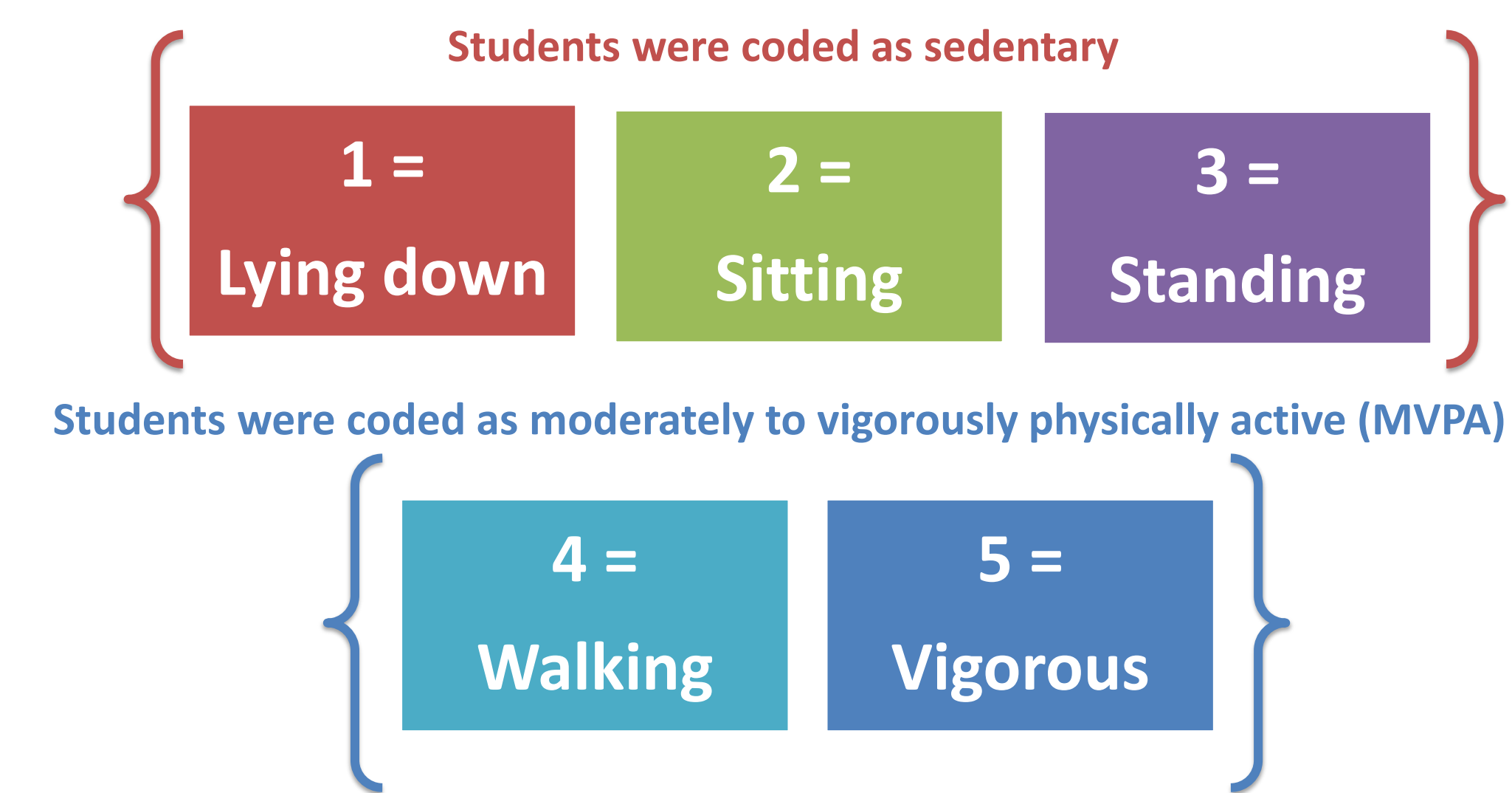
Student Variables (Level 1)

- Student gender (coded as 0=male, 1=female)
- Physical activity levels: the dependent variable was

$$\text{Percent of time engaged in moderate- to-vigorous physical activity (\% MVPA)} = \frac{\# \text{ of MVPA coded intervals}}{\text{Total \# of intervals observed}}$$

Class and Teacher Variables (Level 2)

- Class size
- Class level (coded as 0=elementary, 1=middle, 2=high)
- Teacher gender (coded as 0=male, 1=female)
- Observed teacher behaviors: giving praise, encouraging students, and showing enthusiasm were rated on a 4-point scale from 1=observed none of the time to 4=observed all of the time



- Four target students were selected per PE class using interval sampling. Each target student was observed for four minutes at a time by a trained data collector, resulting in 12 observations on 20-second intervals. Observation of the target students was done in repeated sequence from the start to end of class.
- To examine the association between student physical activity levels and teacher/class variables, multilevel modeling was conducted using HLM 7 (student version) statistical software.

Results

2012-13 School Year Observations: Sample Sizes

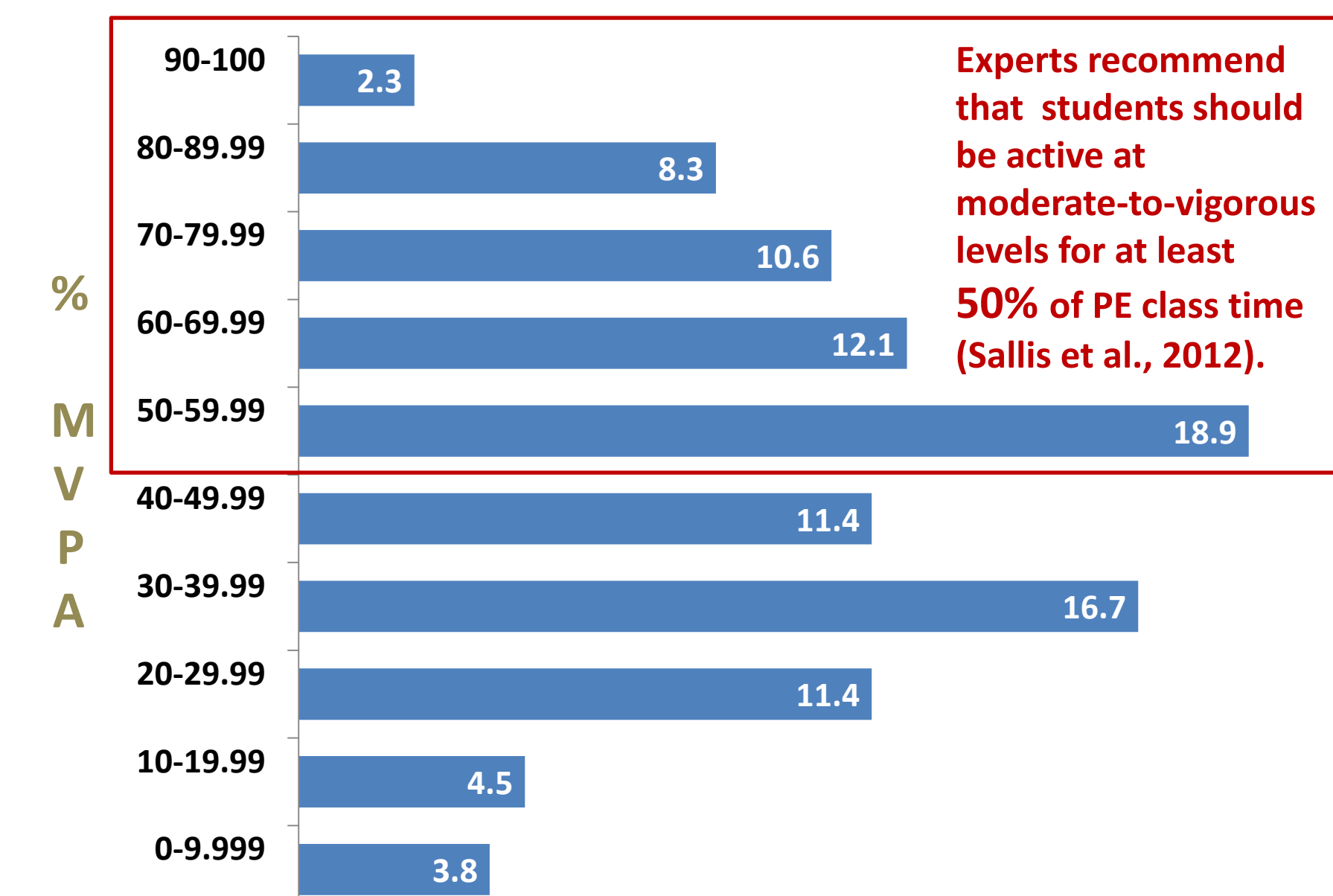
	PE TEACHERS	PE CLASSES	STUDENTS
Elementary 1	1	5	20
Elementary 2	2	2	8
Elementary 3	2	3	12
Middle 1	1	3	12
Middle 2	5	5	20
High 1	3	11	44
High 2	1	4	16
TOTAL	15	33	132

Each student was observed for a minimum of 12 intervals. The average number of intervals was 29.7 (SD = 9.8).

Only 5 female PE teachers were observed, accounting for 36.4% of PE classes.



52.3% of the students were observed being moderately to vigorously physically active ≥ 50% of the time.



Student MVPA levels ranged from 0% to 91.7%.

Descriptive Statistics

- Average class size: 20.2 (SD = 6.3)
- 41.7% of observed students were girls (n = 55)
- Average % MVPA for girls: 42.7%
- Average % MVPA for boys: 55.1%*
- Overall average % MVPA: 50.0% (SD = 22.0)
- Average levels of observed teacher behaviors:
 - Teacher praise: 2.8 out of 4 (SD = 0.5)
 - Teacher encouragement: 2.7 out of 4 (SD = 0.5)
 - Teacher enthusiasm: 3.8 out of 4 (SD = 0.4)

*The difference in % MVPA for boys and girls was statistically significant, $t(130) = 3.32, p = 0.001$.

Multilevel Model

Null Model

$$\% MVPA_{ij} = 49.95 + u_{0j} + r_{ij}$$

- The intraclass correlation coefficient was 0.457.

Final Model

Level-1 Model

$$\% MVPA_{ij} = \theta_{0j} + \theta_{1j} * (\text{STUDENT_GENDER}_{ij}) + r_{ij}$$

Level-2 Model

$$\theta_{0j} = \gamma_{00} + \gamma_{01} * (\text{SCHLEVEL}_j) + \gamma_{02} * (\text{CLASSSIZE}_j) + u_{0j}$$

$$\theta_{1j} = \gamma_{10} + \gamma_{11} * (\text{TCHR_GENDER}_j)$$

Fixed Effect	Coefficient	Standard error	p-value
For INTRCPT1, β_0			
INTRCPT2, γ_{00}	52.70	2.58	<0.001
SCHLEVEL, γ_{01}	11.33	2.75	<0.001
CLASSSIZE, γ_{02}	-0.89	0.37	0.023
For GENDER slope, β_1			
INTRCPT2, γ_{10}	-13.00	3.86	0.001
TCHR_GENDER, γ_{11}	15.35	5.61	0.007



Key Findings

- Boys had significantly higher levels of % MVPA than girls.
- Smaller class sizes were associated with higher student activity levels. In addition, compared to Elementary-level PE classes, middle and high school level PE classes had higher student % MVPA.
- Teacher gender was not a significant predictor of student % MVPA. However, the interaction term between student gender and teacher gender was significant for females.
- Positive teacher behaviors (praise, encouragement, enthusiasm) were not significantly associated with student % MVPA in the final multilevel model.



Discussion

- The Model PE Schools were able to achieve the recommendation of being active at least 50% of PE class time for the majority of students. The Model Middle and High School PE classes had higher levels of MVPA than the Elementary School PE classes.
- The results of this study suggest that female students have higher levels of MVPA when they have female teachers. This interaction should be further explored in future studies.
- Several important limitations should be considered, including the challenge of generalizing these results to other schools in Hawai'i because of selection bias and participant reactivity to being observed. In addition, the relatively small sample sizes may have constrained the ability to test associations between teacher characteristics and student MVPA levels.
- Further research is needed to examine the validity of applying multilevel modeling techniques to SOFIT data.

