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ORIGINAL ARTICLE

Physical Competence in Thai Schoolchildren Aged 10–12 Years: A Cross-Sectional Comparison of Rural and Urban School Contexts Using CAPL-2

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ABSTRACT

Background. Globally, physical activity among children and adolescents is declining, with only 27% of Thai youth meeting the recommended 60 minutes daily. This trend raises public health concerns and emphasizes the role of school-based interventions. While rural children often have more active lifestyles, urban students face environmental and academic constraints. Comparative studies in the Thai context remain scarce. **Objectives.** This study aimed to compare physical competence—comprising physical fitness and motor performance —among students in rural and urban Thai schools to assess the impact of contextual differences. **Methods.** A total of 223 students aged 10–12 years were assessed using CAPL-2 across four schools: Tak rural school: n=66, Suphanburi: n=66, Chulalongkorn University Demonstration School: n=38, Srinakharinwirot University Demonstration School: n=53. The PACER, plank test, and CAMSA were used to evaluate aerobic fitness, muscular endurance, and motor performance. Group differences were examined using one-way ANOVA with post-hoc tests and partial η^2. **Results.** Students from the Tak rural school had significantly higher overall physical competence and motor performance, while those from Chulalongkorn University Demonstration School performed best in muscular endurance. Suphanburi students consistently showed the lowest scores. All differences were statistically significant ($p<0.001$). **Conclusion.** School context significantly influences children's physical competence. Rural environments support more natural movement, while urban schools may benefit from targeted endurance training.

INTRODUCTION

There is a continuing global decline in physical activity among children and adolescents (1). According to the Global Matrix 4.0 on Physical Activity (PA) for children and youth aged 5–17 years, the overall physical activity level across 57 countries received a global grade of D, with Thailand ranking similarly (2-4). Specifically, only 27% of Thai children and adolescents met the recommended level of at least 60 minutes of PA per day (5). This declining trend in PA among youth contributes to an increased risk of non-communicable diseases (6). Therefore, promoting PA and physical fitness in children, particularly within school-based health promotion contexts, is a critical concern (7).

Schools are environments where children spend most of their time during their developmental years. The education system is essential in integrating PA with academic learning and skill development, fostering long-term healthy behaviors. This integration is crucial for fostering long-term healthy behaviors, including developing fundamental movement skills and physical fitness (6, 8). However, many children today spend a significant portion of their day engaging in sedentary behaviors (SB) and, on average, do not achieve sufficient PA (9).

Physical competence is a fundamental component of physical literacy (PL). It comprises two main elements: physical fitness and motor performance (10). These competencies play a vital role in children's development, influencing their health, physical growth, and learning potential. High levels of physical competence, including strength, endurance, and agility, offer long-term benefits for cardiovascular health, musculoskeletal development, and mental well-being (11). Building on this evidence, these benefits align with global health promotion goals that emphasize the integration of PL into school curricula to foster lifelong healthy behaviors. In the Thai context, identifying disparities in physical competence across school settings can inform targeted policy and practice, such as designing space-efficient motor skill interventions for urban schools and enhancing structured physical education (PE) in rural schools, contributing to equitable health and educational outcomes nationwide. Such contextual differences are particularly important because rural school children generally exhibit better physical fitness due to greater movement and outdoor play opportunities. Conversely, urban children often encounter space limitations and increased academic pressures restricting PA (12).

Despite global evidence of rural–urban disparities in PL, comparative studies in Thailand remain limited due to multiple factors, including restricted research funding that prioritizes academic outcomes over physical competence, policy frameworks that position PE as a supplementary rather than core subject, and cultural attitudes, particularly in urban areas that emphasize academic tutoring over active play. Additionally, the absence of large-scale, context-specific datasets hinders robust cross-school comparisons. In contrast, sustained investment in PL research in other countries, such as through the Active Healthy Kids Global Alliance's Global Matrix initiative, has enabled regular monitoring and informed targeted policy interventions (2, 4). Bridging this gap in Thailand will require coordinated policy action, dedicated funding, and integration of PL assessment into national school monitoring systems.

A review of the existing literature reveals a significant knowledge gap; there is a lack of in-depth comparative studies on students' physical fitness within the Thai school context. Specifically, differences between urban schools, such as demonstration schools in Bangkok, and rural schools in the provinces remain underexplored. These schools differ in curriculum structures, environmental settings, and health promotion cultures. This is the first study to apply the Canadian Assessment of Physical Literacy, Second Edition (CAPL-2) in Thai schools to directly compare physical competence between rural and urban settings. While similar CAPL-2–based comparisons have been conducted internationally, no published research has examined these differences within the Thai educational context, where cultural, policy, and environmental factors may produce unique patterns. Therefore, this study aims to compare students' physical fitness from four different school contexts: a school in Tak Province, a school in Suphanburi Province, and two demonstration schools in Bangkok. This comparison aims to deepen our understanding of how structural and cultural differences within schools influence students' physical health, ultimately guiding the development of context-appropriate PA promotion strategies in the future.

MATERIALS AND METHODS

Conceptual Framework. This study employs a cross-sectional comparative design to compare PL in physical competence among upper elementary school students across four school settings. The primary objective was to compare physical competence among students from different school contexts at a single point in time. A purposive sampling method was used to ensure the inclusion of schools representing diverse geographic, environmental, and curricular settings relevant to the research aims. The participating schools are located in four distinct areas: a school in Tak Province, a school in Suphanburi Province, and two demonstration schools in Bangkok—Chulalongkorn University Demonstration School and Srinakharinwirot

University Demonstration School. The study was approved by the Research Ethics Review Committee for Research Involving Human Subjects, Group 1, Chulalongkorn University, Thailand (COA No. 218/67, October 7, 2024). Written informed consent was obtained from parents or guardians, and verbal assent was obtained from the students prior to participation.

Setting and Participants. Two hundred twenty-three students aged 10–12 years participated in this study. The sample comprised 66 students from a rural school in Tak Province, 66 from a rural school in Suphanburi Province, 38 from Chulalongkorn University Demonstration School (urban), and 53 from Srinakharinwirot University Demonstration School (urban). All participants were free from injuries or medical conditions that could limit participation in physical fitness testing.

Data Collection and Instruments. This study employed the CAPL-2 developed by the Healthy Active Living and Obesity Research Group (2017) to assess participants' PL in physical competence. The assessment covered two main components: physical fitness and motor performance.

The physical fitness component included:

- Aerobic fitness is measured by the Progressive Aerobic Cardiovascular Endurance Run (PACER) over a 20-meter distance. Participants ran back and forth across a 20-meter course in time with audio signals, increasing speed at each level. The test was terminated if a participant failed to reach the line before the signal on two consecutive occasions.
- Muscular endurance is assessed through the plank hold to evaluate core strength and endurance. Participants maintained a correct plank position for as long as possible. The test was stopped if the participant received a second warning for improper form or body alignment.
- Motor performance component was evaluated using the Canadian Agility and Movement Skill Assessment (CAMSA), which incorporates seven fundamental movement skills: two-foot jumping, sliding, catching, throwing, skipping, hopping, and kicking. Participants were allowed one practice trial followed by two formal assessment trials. The best performance, based on skill execution and completion time, was recorded.

Data Collection. Testing was conducted in each school's gymnasium or multipurpose area to ensure consistent surface and space availability.

All tests were administered by trained assessors with prior certification in CAPL-2 administration, who underwent a two-day refresher workshop to standardize protocols. Testing was performed during school hours in small groups of 5–7 students, with adequate rest between stations to minimize fatigue. Environmental conditions (e.g., temperature, surface safety) were recorded, and all equipment met CAPL-2 specifications.

Data Analysis. Demographic variables were analyzed using descriptive statistics, including age, weight, height, body mass index (BMI), resting heart rate, and systolic/diastolic blood pressure. Differences in the means of the dependent variables across the four schools were analyzed using a one-way multivariate analysis of variance (MANOVA). Prior to the main analysis, all relevant statistical assumptions were rigorously examined. No univariate outliers were detected through boxplot inspection. The Shapiro–Wilk test results indicated that the assumption of normality was satisfied for all dependent variables across the four groups of the independent variable ($p>0.05$). Linearity was confirmed through visual inspection of scatterplots. Intercorrelations among the dependent variables were statistically significant, with Pearson's correlation coefficients ranging from 0.40 to 0.74. When the omnibus test revealed statistically significant differences ($p<0.05$), Tukey's HSD post hoc comparisons were conducted to identify pairwise group differences. Effect sizes were estimated using eta squared (η^2) to quantify the magnitude of observed effects. For interpretive clarity, Cohen's (1988) benchmarks for partial eta squared—small (0.01), medium (0.06), and large (0.16)—were applied. All statistical analyses were performed using IBM SPSS Statistics, version 29.0.2.0.

RESULTS

The descriptive statistics for the study variables across the four groups (Tak, Suphan, Chula, and SWU) are summarized in Table 1. The data include mean values and standard deviations for age, weight, height, body mass index (BMI), pulse rate, systolic and diastolic blood pressure, and various performance scores (Pacer scores, CAMSA scores, Plank scores, and Physical Competence).

Demographic. The MANOVA revealed a statistically significant multivariate effect of school on the combined demographic variables, Wilks' $\Lambda=0.247$, $F(21, 660) = 19.74$, $p<0.001$, partial $\eta^2=0.37$. Follow-up univariate ANOVAs

indicated a significant main effect of group on age (partial η^2=0.58), weight (partial η^2=0.31), BMI (partial η^2=0.112), pulse rate (partial η^2=0.052), systolic blood pressure (partial η^2=0.180), diastolic blood pressure (partial η^2=0.131) (all, $p<0.001$). The effect of group on height was not statistically significant ($p>0.05$).

Table 1. Participant's characteristics.

Variable	Tak (M ± SD)	Suphan (M ± SD)	Chula (M ± SD)	SWU (M ± SD)
Age (years)	11.76 ± 0.60	10.39 ± 0.49	11.00 ± 0.00	11.56 ± 0.50
Weight (kg)	43.72 ± 10.50	60.03 ± 12.13	42.12 ± 12.52	46.29 ± 9.82
Height (cm)	150.35 ± 8.01	148.54 ± 7.16	149.92 ± 8.11	151.71 ± 6.19
BMI (kg/m²)	19.20 ± 3.73	30.27 ± 25.34	18.58 ± 4.16	20.00 ± 3.45
Pulse (bpm)	90.70 ± 14.24	98.71 ± 13.93	96.09 ± 14.62	94.53 ± 14.81
Systolic BP (mmHg)	103.22 ± 14.48	113.45 ± 13.37	101.00 ± 14.44	96.53 ± 10.93
Diastolic BP (mmHg)	64.84 ± 12.93	74.51 ± 10.63	66.09 ± 10.67	64.84 ± 9.66
Physical competence	16.74 ± 5.06	9.89 ± 2.13	12.00 ± 3.88	12.38 ± 4.23
Pacer Score	3.49 ± 1.97	1.52 ± 0.63	3.25 ± 1.46	1.49 ± 0.70
CAMSA Score	7.30 ± 1.11	6.34 ± 0.87	1.25 ± 1.35	6.70 ± 1.05
Plank Score	5.95 ± 3.42	2.03 ± 1.54	7.50 ± 2.69	4.19 ± 3.52

M: Mean; SD: Standard deviation; BP: Blood pressure; bpm: Beats per minute; BMI: Body mass index; CAMSA: Canadian Agility and Movement Skill Assessment. Higher scores in Physical competence, Pacer, CAMSA, and Plank indicate better physical literacy, aerobic fitness, movement skill proficiency, and core muscular endurance, respectively.

The MANOVA revealed a statistically significant multivariate effect of school on the combined dependent variables, Wilks' Λ=0.131, $F(9, 589.15) = 85.25$, $p<0.001$, partial η^2=0.49. Follow-up univariate ANOVAs indicated significant differences among schools for physical competence, PACER score, CAMSA score, and plank score variables. The details are presented as follows:

Physical Competence. A significant main effect of group on physical competence was observed, $F(3, 219) = 37.62$, $p<0.001$, with a large effect size (partial η^2=0.340). The Tak group scored significantly higher than all other groups. Higher than Suphan by 6.62 points, higher than Chula by 4.54 points, higher than SWU by 4.05 points (all, $p<0.001$). The Suphan group scored significantly lower than Chula by -2.08 points ($p<0.05$) and SWU by -2.57 points ($p<0.01$). No significant difference was observed between the Chula and SWU groups ($p>0.05$), see Figure 1.

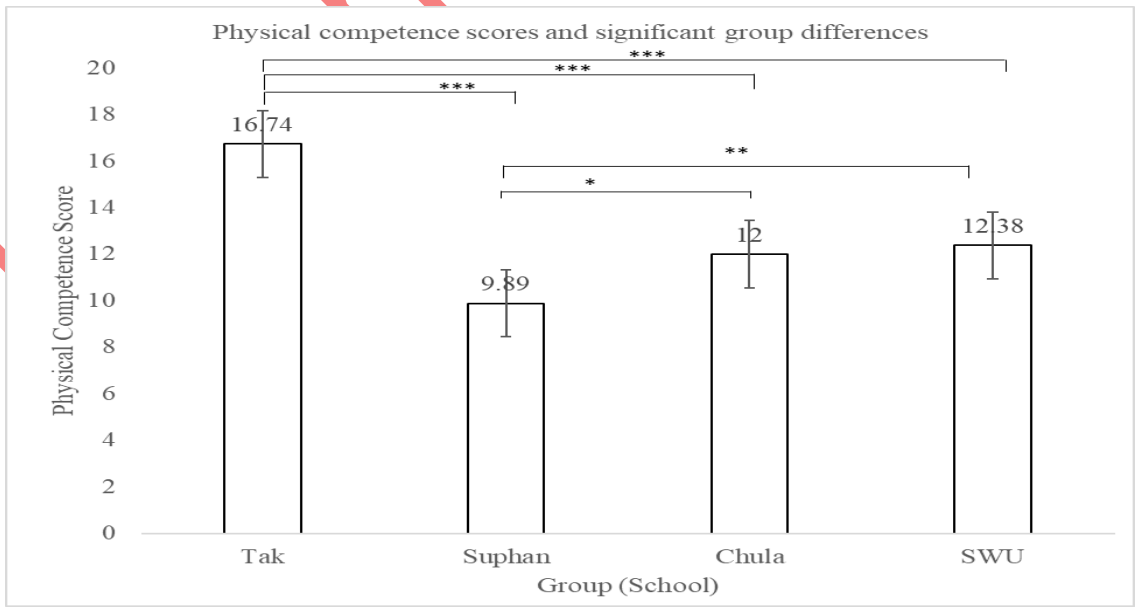

Figure 1. Mean physical competence scores among Tak, Suphan, Chula, and SWU students. Significant group differences were found, with Tak scoring highest and Suphan lowest ($p<0.001$). *: $p<0.05$; **: $p<0.01$; ***: $p<0.001$.

Pacer Score. A significant main effect of group on pacer scores was observed, $F(3, 219) = 35.95$, $p<0.001$, with a large effect size (partial $\eta^2=0.330$). The Tak group scored significantly higher than Suphan by 2.01 points and SWU by 1.98 points (all, $p<0.001$). The ($p<0.001$). The Chula group scored significantly higher than SWU by 1.66 points and Suphan by 1.68 (all, $p<0.001$). No significant difference was observed between the Tak and Chula groups ($p>0.05$), see Figure 2.

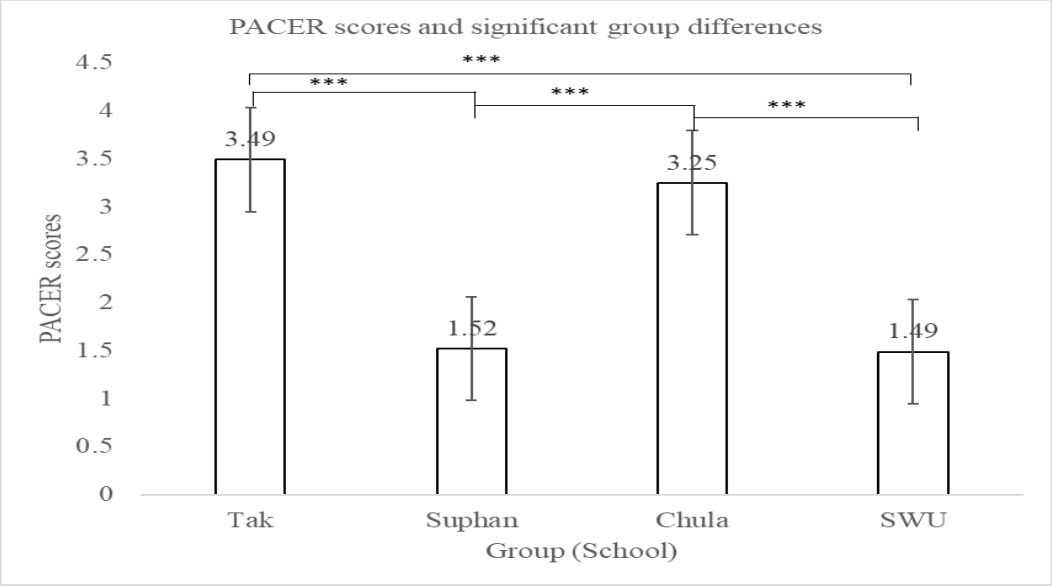

Figure 2. Mean PACER scores among Tak, Suphan, Chula, and SWU students. Tak and Chula scored significantly higher than Suphan and SWU ($p<0.001$), with no difference between Tak and Chula ($p>0.05$). ***: $p<0.001$.

CAMSA Score. The effect of group on CAMSA scores was highly significant, $F(3, 219) = 257.57$, $p<0.001$, with a considerable effect size (partial $\eta^2=0.779$). The Tak group scored significantly higher than Suphan by 0.93 points and Chula by 5.98 points (all, $p<0.001$). The SWU and Suphan group scored significantly higher than Chula by 5.44 and 5.05 points, respectively ($p<0.001$). The Chula group scored significantly lower than all other groups ($p<0.001$). No significant difference was observed between the Tak, SWU, and Suphan groups (all, $p>0.05$), see Figure 3.

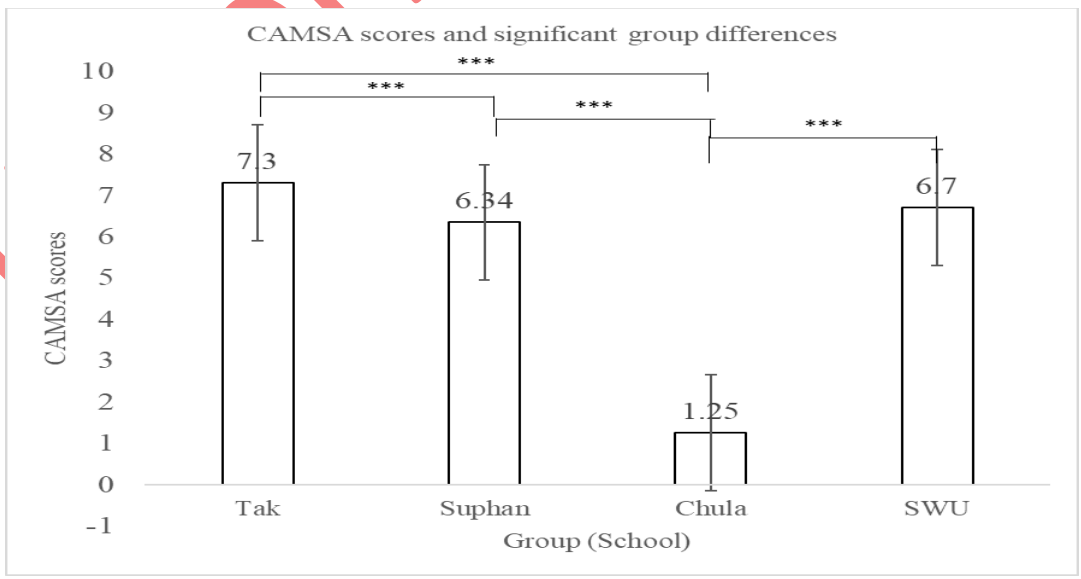

Figure 3. Mean CAMSA scores among students from four school groups. The Chula group scored significantly lower than all others ($p<0.001$), while no significant differences were found between Tak, Suphan, and SWU. ***: $p<0.001$.

Plank Score. A significant main effect of group on plank scores was found, $F(3, 219) = 35.15$, $p<0.001$, with a large effect size (partial $\eta^2=0.325$). The Chula group scored significantly higher than Suphan by 5.44 points ($p<0.001$), SWU by 3.30 points ($p<0.001$), and Tak by 1.76 points ($p<0.05$). The Tak group scored significantly higher than Suphan by 3.68 points ($p<0.001$). The Suphan group scored significantly lower than Chula by -5.44 points ($p<0.001$) and SWU by -2.15 points ($p<0.01$), see Figure 4.

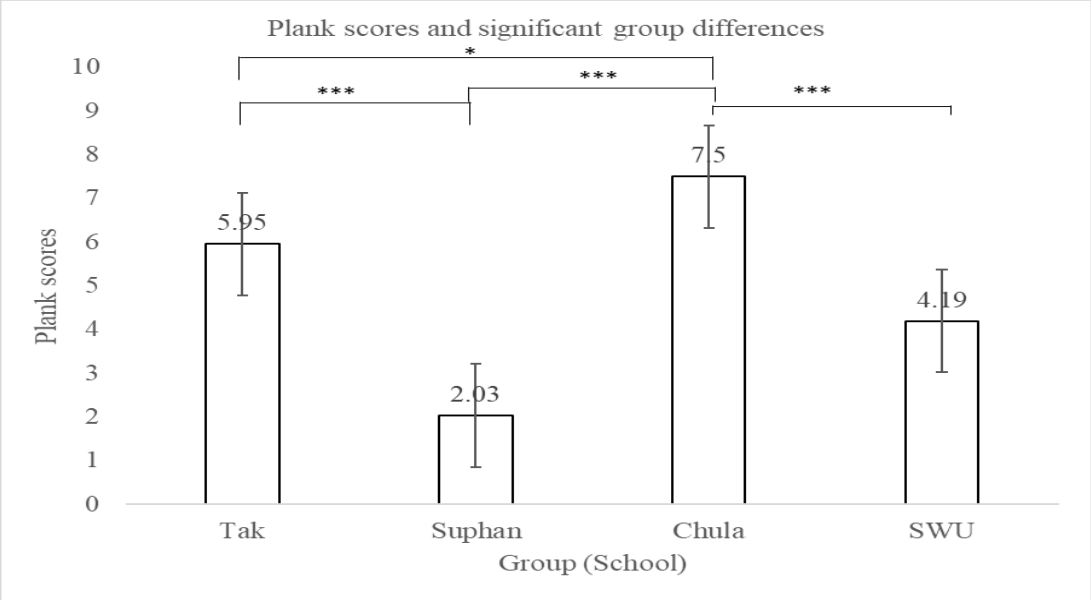

Figure 4. Mean plank scores among Tak, Suphan, Chula, and SWU students. Chula scored significantly higher than all other groups, while Suphan scored the lowest ($p<0.001$). *: $p<0.05$; ***: $p<0.001$.

DISCUSSION

The findings of this study reveal significant differences in physical competence among students from schools located in distinct geographical and social contexts ($p<0.05$), indicating that school environment and context exert a measurable influence on physical performance. Notably, students from the rural school in Tak Province exhibited the highest overall physical competence scores compared to all other groups, including urban demonstration schools in Bangkok. These results suggest that rural environments may provide more favorable conditions for physical development, particularly through increased opportunities for outdoor play and unstructured PA (12), consistent with the PL framework that emphasizes the role of diverse movement experiences in fostering competence, confidence, and motivation (13). This pattern is consistent with the Thailand Report Card data, which shows higher active transportation and outdoor play participation among rural children compared to their urban peers. Rural Thai youth have been found to record higher daily step counts and accumulate more outdoor moderate-to-vigorous physical activity (MVPA) than Bangkok youth, who face spatial restrictions and greater academic workloads (5, 14). Similar patterns have been reported in other Thai studies, where rural students demonstrated higher physical fitness levels and daily activity than urban peers due to active transportation, outdoor chores, and greater access to open space (5, 15).

In contrast, urban students may experience space limitations and academic demands that restrict PA opportunities (1, 12). This aligns with recent findings indicating that, in some contexts, children in urban areas may exhibit better physical fitness than their rural counterparts—especially among overweight groups—highlighting how demographic and environmental factors shape physical development (12, 16). Similar trends are evident in China, where children in rural provinces outperform their urban peers on physical fitness tests, attributed to more unstructured outdoor play and physically demanding chores (12, 17, 18). Evidence from Taiwan also supports this pattern,

showing rural students surpassing urban students in aerobic fitness and motor skill assessments, a difference linked to lower sedentary time and greater engagement in unstructured play (19).

Regarding aerobic fitness measured by the PACER test, students from Tak and Chulalongkorn University Demonstration School scored significantly higher than those from Suphanburi and Srinakharinwirot University Demonstration School ($p<0.05$). The CAPL-2 validation literature emphasizes that targeted motor skill interventions, delivered by well-trained educators, can improve aerobic and motor outcomes across settings (8, 20). Similarly, evidence from Australian and Canadian contexts suggests that intentional skill progression in PE, regardless of geography, can enhance fitness levels (21).

Interestingly, the results for CAMSA revealed that students from Chulalongkorn had significantly lower scores than all other groups ($p<0.05$). This outcome may reflect limited opportunities to develop fundamental movement skills in urban settings. Previous studies highlight that school design and policies that discourage active play, such as restrictive playground equipment or risk-averse rules, can increase SB and hinder motor skill development (9, 22). Furthermore, competitive academic environments in urban schools may reduce the time allocated for PA, thereby affecting skill proficiency (5). Conversely, urban students may face additional constraints such as limited physical space and high academic demands, which further restrict PA opportunities and hinder the acquisition of fundamental movement skills (23).

In contrast, the plank test, measuring core muscular endurance, revealed that students from Chulalongkorn scored the highest, followed by students from Tak. This may suggest that specific strength-based training or core-focused activities are more emphasized in certain urban curricula. Meanwhile, students from Suphanburi scored the lowest on the plank test, which may be associated with their significantly higher BMI levels. Prior research has shown that overweight children often face challenges in muscular endurance and functional movements (11). This aligns with Thai surveillance data indicating that higher BMI among school-aged children correlates with lower muscular endurance performance (15).

This study confirms that individual factors and broader environmental, curricular, and cultural elements shape physical competence. The integration of statistical evidence and PL theory highlights the need for context-specific PA strategies, such as space-efficient motor skill programs in urban schools and reinforcement of structured PE in rural settings that align with national and global health promotion goals (6, 7). Given similar findings in other Asia Pacific countries, adopting culturally adapted, school-based physical activity interventions such as active play programs, teacher training to enhance physical literacy, and curriculum designs integrating both structured and unstructured activities could enhance physical competence across diverse settings in Thailand (24, 25).

Limitations include a small sample size, purposive sampling, and potential selection bias, which may limit generalizability. Policy recommendations include enhancing outdoor activity opportunities in rural schools and implementing space-efficient, skill-focused programs in urban schools to promote equitable PL and health outcomes.

CONCLUSION

This study found significant differences in physical competence among Thai students aged 10–12 across rural and urban school contexts. Rural schools, particularly in Tak Province, generally scored higher overall, likely due to greater access to outdoor play, while urban schools, such as Chulalongkorn University Demonstration School, excelled in core muscular endurance as shown by their highest plank scores. These findings highlight that each context has unique strengths, underscoring the need for tailored physical activity strategies.

APPLICABLE REMARKS

- Rural schools can build on their strengths by incorporating structured active play sessions and fundamental movement skill programs into the school day, further enhancing PACER and CAMSA performance. Urban schools, where space is limited, should adopt space-efficient PE strategies such as station-based circuits, motor skill games in multipurpose spaces, and core-strength routines, supported by targeted teacher training to optimize delivery.

- At the policy level, integrating PL benchmarks into the national PE curriculum and routinely assessing students with standardized tools such as CAPL-2 will enable schools to monitor progress, address gaps, and implement evidence-based strategies. These actions can lead to measurable improvements in physical competence and contribute to lifelong healthy activity habits.

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AUTHORS' CONTRIBUTIONS

Study concept and design: Raweewan Maphong, Charinthip Manyuen. Acquisition of data: Raweewan Maphong, Charinthip Manyuen. Analysis and interpretation of data: Sonthaya Sriramatr. Drafting the manuscript: Raweewan Maphong, Sonthaya Sriramatr. Critical revision of the manuscript for important intellectual content: Raweewan Maphong. Statistical analysis: Sonthaya Sriramatr. Administrative, technical, and material support: Raweewan Maphong. Study supervision: Sonthaya Sriramatr.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FINANCIAL DISCLOSURE

There are no financial interests related to the material in the manuscript.

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It did not receive any financial or material support for the research and work, nor was it limited to grant support, funding sources, and provision of equipment and supplies.

ETHICAL CONSIDERATION

The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the institution's human research committee.

ROLE OF THE SPONSOR

There are no sponsors for this study.

ARTIFICIAL INTELLIGENCE (AI) USE

It did not use AI or AI-assisted tools in this study.

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