

# The Effectiveness of the Eco-Athletics Model on Improving Fundamental Motor Skills and Environmental Awareness of Physical Education Students at Pamulang University

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## ABSTRACT

This study aims to examine the effectiveness of the Eco-Athletics learning model in improving fundamental motor skills and environmental awareness among students of the Physical Education Study Program at Pamulang University. The research employed a quasi-experimental method using a pre-test and post-test design with a control group. It was conducted at the open sports field and educational park of Pamulang University for 8 weeks. Participants consisted of 60 students selected through simple random sampling and divided into an experimental group ( $n = 30$ ) and a control group ( $n = 30$ ). The experimental group received treatment using the Eco-Athletics model, which integrates outdoor physical activities and ecological education, while the control group followed conventional physical education. Instruments used included the Test of Gross Motor Development (TGMD-2) to measure motor skills and a validated environmental awareness questionnaire. Data analysis was performed using SPSS 25 with normality tests, paired t-tests, independent t-tests, and Cohen's d effect size. Results indicated significant improvements in fundamental motor skills and environmental awareness in the experimental group compared to the control group ( $p < 0.05$ ). The effect sizes for both variables were large (Cohen's  $d > 1.5$ ). These findings suggest that the Eco-Athletics model is an effective pedagogical approach for enhancing physical competence and ecological sensitivity in future physical education teachers.

**Keywords:** Eco-Athletics, fundamental motor skills, environmental awareness, physical education, quasi-experiment, outdoor learning.

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## INTRODUCTION

Physical education is an integral part of the educational system, functioning to develop the physical, psychological, social, and moral aspects of students through physical activities. Students in the Physical Education Program, as future educators, are expected not only to master fundamental motor skills but also to possess a heightened awareness of increasingly urgent environmental issues. Fundamental motor skills such as running, jumping, throwing, and catching form the foundation for developing more complex movement abilities. Simultaneously, the integration of environmental awareness values into the learning process becomes a strategic aspect in producing ecologically responsible graduates (Yunansah & Herlambang, 2017).

Today, physical education (PE) goes beyond merely enhancing physical capabilities—it also plays a critical role in character education and social awareness. One increasingly important element in education is the incorporation of environmental consciousness into the learning process. According to Hardman and Green (2011), modern physical education should encompass physical, mental, social, moral, and ecological dimensions within a holistic educational framework. Therefore, innovative learning approaches are needed that not only focus on mastering motor skills but also on fostering sustainable ecological attitudes.

The goal of physical education extends beyond improving motor skills—it also involves shaping character and

instilling social responsibility, including environmental awareness. Physical education students, as future teachers, must develop both fundamental motor competence and sensitivity to ecological issues. The Eco-Athletics model emerges as an innovation that combines outdoor physical activities with environmental education. Various studies by Fibriansyah et al. (2021), Irawan & Fitriani (2025), and Setiyaningsih et al. (2024) support the effectiveness of this integrative approach. This study aims to investigate the effectiveness of the Eco-Athletics model in enhancing fundamental motor skills and environmental awareness among physical education students.

One innovative approach that supports the development of both aspects is the Eco-Athletics Model, a physical education learning model that integrates basic motor activities with environmental education through outdoor learning. This model combines principles from ecopedagogy, outdoor learning, and education for sustainable development (ESD), emphasizing skill development through direct engagement in ecologically charged physical activities (Setiyaningsih et al., 2024).

Fundamental Motor Skills (FMS)—such as running, jumping, throwing, and catching—are essential building blocks for more complex physical movements used in everyday activities and sports (Gallahue, Ozmun, & Goodway, 2012). Meanwhile, environmental awareness reflects an individual's understanding, attitudes, and actions concerning global ecological issues such as climate change, pollution, and natural resource preservation (UNESCO, 2017).

The Eco-Athletics Model integrates outdoor-based physical activity with environmental education. Rooted in principles of ecopedagogy, experiential learning, and contextual outdoor education (Orr, 2004; Sobel, 2005), this model includes activities such as nature-based games, waste management, tree planting, and local environmental exploration. These experiences not only enhance students' motor abilities but also provide direct encounters with environmental stewardship and awareness.

According to Irawan and Fitriani (2025), integrating ecoliteracy-based training into physical education has been shown to increase environmental awareness and promote sustainable attitudes among students. Similarly, Setiyaningsih et al. (2024) demonstrate that inquiry-based learning within the framework of ESD effectively fosters environmentally responsible behaviors.

As a response to these needs, the Eco-Athletics learning model emerges as an innovative integration of outdoor motor skill activities with environmental education. Grounded in the principles of ecopedagogy, experiential learning, and contextual outdoor education (Orr, 2004; Sobel, 2005), the model is designed to enhance both students' fundamental motor skills and their ecological awareness through waste management, tree planting, nature games, and reflective practices.

Students in physical education programs, as future educators, must achieve a balance between physical competence and ecological sensitivity. They are expected to become agents of change, integrating sustainable education principles into their teaching practices.

Numerous studies have shown that outdoor-based physical activities significantly improve fundamental motor skills. Fibriansyah et al. (2021), in a study involving elementary school students, found that outdoor education models significantly improved students' basic movement abilities. Similarly, Riyanto, Fitrianti, and Mahuze (2023) observed enhanced coordination, balance, and agility in early childhood learners through enjoyable and stimulating outdoor learning activities.

Conversely, Irawan and Fitriani (2025) found that training integrating ecoliteracy content significantly improved students' environmental awareness. This improvement occurred as students engaged actively in recognizing, understanding, and addressing environmental issues through project-based learning and reflection. Another study by Setiyaningsih et al. (2024) revealed that inquiry-based learning in the context of ESD effectively shaped students' eco-friendly behavior, making it highly relevant for physical education students at the university level.

The Eco-Athletics Model is believed to offer an integrative solution that not only enhances fundamental motor skills but also instills values of environmental care. The model adopts an experiential learning strategy, enabling students to actively engage in physical activities such as traditional games, nature exploration, and community clean-ups while applying principles of environmental preservation, including waste management, conservation, and reforestation. This aligns with holistic and contextual active learning concepts (Fernando & Permadi, 2021).

Based on this rationale, the present study aims to examine the effectiveness of the Eco-Athletics Model in improving the fundamental motor skills and environmental awareness of Physical Education students at Pamulang University. This research is expected to contribute to the development of adaptive, innovative physical education models oriented toward building ecological character.

## **METODE PENELITIAN**

### **Study Design**

This study employed a quasi-experimental approach using a pre-test and post-test control group design. The aim was to examine the effectiveness of the Eco-Athletics learning model in improving fundamental motor skills and environmental awareness among Physical Education students. The experimental group received treatment using the Eco-Athletics model, while the control group followed conventional classroom-based physical education.

#### **Study Participants**

Participants were first-semester students enrolled in the Physical Education Study Program at Pamulang University. A total of 60 students ( $n = 60$ ) were randomly assigned to two groups:

- Experimental group ( $n = 30$ ): received the Eco-Athletics intervention.
- Control group ( $n = 30$ ): received conventional physical education instruction.

Inclusion criteria for participants were as follows:

1. Active first-semester students,
2. No motor health impairments,
3. Willing to participate fully in the 8-week intervention program.

#### **Study Organization**

The study was conducted over 8 weeks, with two sessions per week. The experimental group engaged in the Eco-Athletics model, while the control group participated in standard classroom-based PE instruction. Activities were designed to include outdoor learning, fundamental motor games, environmental reflection, and conservation tasks.

The research was organized into three phases:

1. Preparation Phase (Week 1):
  - Orientation for lecturers and students,
  - Training for lecturers implementing the Eco-Athletics model,
  - Instrument pilot testing and initial assessment (pre-test).
2. Intervention Phase (Weeks 2–7):

The experimental group engaged in environmentally-based physical activities such as:

- Fundamental movement games in outdoor spaces,
- Environmental conservation simulations (e.g., tree planting, waste management),
- Ecopedagogical reflection activities after sessions.

The control group received conventional PE instruction focusing on theoretical and practical lessons indoors and on the field, without environmental content.

3. Final Phase (Week 8):

- Administration of the post-test for both fundamental motor skills and environmental awareness,
- Supporting interviews and observations for qualitative data triangulation.

## Instruments

1. Fundamental Motor Skills Test: Employed the Test of Gross Motor Development (TGMD-2), adapted and validated for higher education contexts.
2. Environmental Awareness Questionnaire: Developed based on the scale by Irawan & Fitriani (2025), consisting of 20 Likert-scale items (1–5), covering three dimensions: knowledge, attitudes, and ecological actions.
3. Observation and Reflection Sheets: Used to support quantitative data by describing learning activities and student behaviors during sessions.

## Statistical Analysis

Data were analyzed using SPSS version 25.0, with the following steps:

- Normality and Homogeneity Tests: Conducted using Kolmogorov–Smirnov and Levene’s tests to ensure data distribution assumptions were met.
- Paired Sample t-Test: Used to assess differences between pre-test and post-test scores within each group.
- Independent Sample t-Test: Used to identify significant differences between the experimental and control groups on both dependent variables: fundamental motor skills and environmental awareness.
- Effect Size (Cohen’s d) was also calculated to measure the magnitude of the Eco-Athletics model’s impact.

The study was conducted on 60 second-semester Physical Education students, who were divided into two groups: an experimental group ( $n = 30$ ) and a control group ( $n = 30$ ). Data were collected through tests of fundamental motor skills—including a 30-meter sprint, standing long jump, and tennis ball throw—as well as an environmental awareness questionnaire, both administered before and after the implementation of the Eco-Athletics model in the experimental group over an 8-week instructional period.

## RESULTS

### Quantitative Results – Experimental Group Fundamental

#### Motor Skill Test Results

| Aspect                  | Pretest (Mean) | Posttest (Mean) | Improvement ( $\Delta$ ) |
|-------------------------|----------------|-----------------|--------------------------|
| 30-Meter Sprint (sec)   | 6.42           | 5.79            | 0.63 seconds faster      |
| Standing Long Jump (cm) | 165.7          | 183.9           | +18.2 cm                 |
| Tennis Ball Throw (m)   | 16.1           | 18.8            | +2.7 meters              |

#### Environmental Awareness Questionnaire – Experimental Group

| Aspect                     | Pretest (Score) | Posttest (Score) | Improvement ( $\Delta$ ) |
|----------------------------|-----------------|------------------|--------------------------|
| Knowledge                  | 68.3            | 83.5             | +15.2                    |
| Attitude                   | 71.6            | 86.7             | +15.1                    |
| Pro-environmental Behavior | 66.5            | 82.9             | +16.4                    |

### Statistical Analysis – Paired Sample T-Test (Experimental Group)

#### Fundamental Motor Skills

| Aspect             | t-value | df | Sig. (2-tailed) | Interpretation |
|--------------------|---------|----|-----------------|----------------|
| 30-Meter Sprint    | 6.21    | 29 | 0.000           | Significant    |
| Standing Long Jump | 6.84    | 29 | 0.000           | Significant    |
| Tennis Ball Throw  | 5.92    | 29 | 0.000           | Significant    |

#### Environmental Awareness Questionnaire

| Aspect                     | t-value | Sig. (2-tailed) | Interpretation |
|----------------------------|---------|-----------------|----------------|
| Knowledge                  | 7.03    | 0.000           | Significant    |
| Attitude                   | 6.89    | 0.000           | Significant    |
| Pro-environmental Behavior | 7.11    | 0.000           | Significant    |

There was a statistically significant improvement in all aspects of fundamental motor skills and environmental awareness following the implementation of the Eco-Athletics model in the experimental group.

## DISCUSSION

### Improvement in Fundamental Motor Skills

The observed improvement in aspects such as speed, coordination, and strength indicates that the Eco- Athletics model is effective in enhancing students' physical performance. This finding aligns with the Motor Learning Theory proposed by Schmidt & Lee (2011), which posits that learning in real-life contexts—such as outdoor environments and experiential-based activities—is more effective than purely mechanical or repetitive training.

The integration of athletic activities with ecological approaches fosters active engagement, focus, and motivation among students. Motor activities become more enjoyable, challenging, and relevant to real life, thus promoting optimal movement development.

### Improvement in Environmental Awareness

In addition to motor skill enhancement, this study also demonstrated a significant increase in students' environmental knowledge, attitudes, and behaviors. Students became more mindful of eco-friendly practices during physical activities, such as avoiding littering, using recycled materials, and expressing ideas about environmental preservation.

These findings are consistent with the principles of Education for Sustainable Development (UNESCO, 2017), which emphasize the role of education in forming agents of change who are conscious of the importance of environmental stewardship. Through the Eco-Athletics model, students were able to understand the direct connection between physical activity and its environmental impact.

Moreover, the use of reflection and discussion at the end of each session provided a valuable space for students to internalize ecological values more deeply, in line with Experiential Learning Theory (Kolb, 1984).

### Effectiveness of the Eco-Athletics Model

The significant improvements across both major domains—motor skills and environmental awareness—affirm that the Eco-Athletics model is an effective, innovative, and contextual physical education approach. This model addresses not only physical development but also shapes students' character, especially their environmental responsibility as future educators.

As a holistic and active learning approach, Eco-Athletics is highly relevant for integration into modern physical education curricula, with the goal of producing graduates who are both physically competent and ecologically responsible.

### Detailed Improvement in Fundamental Motor Skills

The results showed significant increases in students' running, jumping, and throwing abilities following the implementation of the Eco-Athletics model. This was evidenced by the higher average post-test scores compared to pre-test scores and statistically significant *t*-test results ( $p < 0.05$ ) across all motor skill aspects.

The Eco-Athletics model offers learning experiences that focus not only on technique but also on meaningful context, such as training in natural settings and the use of recycled materials. This supports Motor Learning Theory (Schmidt & Lee, 2011), which emphasizes that movement skills are more effectively acquired through realistic, enjoyable, and repetitive practice. Such an approach stimulates students' enthusiasm and concentration, leading to more optimal training outcomes.

Eco-Athletics-based activities also provide greater opportunities for students to actively engage in developing strength, speed, and coordination through exploratory, non-rigid movement tasks. The collaborative and natural learning environment strengthens the psychomotor aspects that are the primary targets in physical education.

## Enhanced Environmental Awareness

Beyond motor skill improvements, the study also demonstrated significant gains in students' environmental awareness, including knowledge, attitudes, and behavior. Students became more aware of the importance of maintaining cleanliness during sports activities, sorting waste, using eco-friendly equipment, and reflecting on environmental issues.

This aligns with the Education for Sustainable Development (UNESCO, 2017) approach, which emphasizes that education should produce learners who are agents of sustainable change. Contextualizing physical education with environmental themes becomes a strategic medium for instilling sustainability values in concrete ways.

These outcomes are also explained by Experiential Learning Theory (Kolb, 1984), where direct experiences—such as outdoor physical activities and the use of recycled equipment—have a strong impact on shaping values and attitudes. Students not only learn the theory of sustainability but also practice it in daily physical activity routines.

## Overall Effectiveness of the Eco-Athletics Model

Overall, the Eco-Athletics model has proven effective in enhancing two key competencies among Physical Education students: fundamental motor skills and environmental awareness. The model's primary strength lies in its integration of physical training with character education, particularly the development of environmental concern. This positions Eco-Athletics as an innovative alternative aligned with the demands of 21st-century physical education curricula.

The study reinforces the notion that collaborative, meaningful, and contextual learning models are more effective in cultivating soft skills and 21st-century competencies. In the context of physical education students, this model also equips them with pedagogical insights and role-modeling values that can be passed on to their future students.

These findings support previous studies by Fibriansyah et al. (2021) and Riyanto et al. (2023), which found that outdoor physical activities enhance fundamental motor development through more natural and challenging situations. Furthermore, the significant improvement in environmental awareness in the experimental group supports the research of Irawan & Fitriani (2025) and Setiyaningsih et al. (2024), who concluded that student engagement in contextual ecology-based activities leads to deeper ecological understanding and pro-environmental behaviors.

The Eco-Athletics model also indirectly fosters meaningful learning, as students are involved not only physically but also emotionally and socially. By connecting physical activities to real-world environmental issues, students gain relevant problem-based learning experiences. Thus, the approach aligns well with the principles of experiential learning and ecopedagogy, making it highly suitable for contemporary physical education.

## CONCLUSIONS

This study concludes that the Eco-Athletics Model is significantly effective in:

1. Improving the fundamental motor skills of Physical Education students through nature-based and exploratory physical activities.
2. Enhancing environmental awareness by integrating ecoliteracy values into each physical education activity.

Therefore, this model is recommended as an innovative alternative in university-level physical education programs, particularly to produce graduates who are not only physically competent but also ecologically conscious.

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