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WEARABLE TECHNOLOGY IN MONITORING STUDENT PHYSICAL ACTIVITY: A MULTI-COUNTRY STUDY

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Abstract

Wearable technology, such as pedometers, smartwatches, and fitness trackers, offers a promising approach to monitor and enhance physical activity among adolescents. This study investigates the impact of wearable devices on student activity levels, health awareness, and engagement in physical education classes across Sweden, Germany, and the Netherlands. Data were collected from 360 students aged 12–16 in 12 schools per country. Results indicate that wearable devices significantly increase daily step counts, moderate-to-vigorous physical activity, and student motivation. Challenges include device compliance, data accuracy, and digital literacy. The study recommends integrating wearable technology into PE curricula, providing teacher guidance, and addressing ethical considerations regarding data privacy.

Keywords: Wearable Technology, Physical Activity, Student Health, Physical Education, Europe, Fitness Tracking.

Introduction

1. Introduction

Adolescent physical activity is essential for promoting health, preventing obesity, and fostering lifelong fitness habits. Wearable technology provides real-time feedback, goal-setting capabilities, and motivation through gamification features such as badges and leaderboards. European schools are increasingly

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adopting wearables to monitor student activity, support individualized feedback, and encourage consistent participation in PE classes.

This study evaluates the effectiveness of wearable devices in increasing physical activity and engagement in students across Sweden, Germany, and the Netherlands.

2. Literature Review

2.1 Wearable Technology in Physical Education

Wearable devices track activity metrics such as steps, heart rate, and calories burned. Previous studies (Case et al., 2015; Migueles et al., 2017) have shown that these devices can promote increased daily activity and encourage self-monitoring among youth.

2.2 European Applications

- **Sweden:** Focus on integration of smartwatches and activity trackers in PE classes with gamified challenges.
- **Germany:** Schools use pedometers and apps to track daily steps and weekly fitness goals.
- **Netherlands:** Emphasis on wearable-assisted health education programs, combining physical activity monitoring with feedback sessions.

2.3 Challenges

- **Compliance:** Students may forget or misuse devices.
- **Accuracy:** Data accuracy varies depending on device type and usage.
- **Data Privacy:** Ethical management of student data is critical.

3. Methodology

A quasi-experimental design was employed:

- **Participants:** 360 students aged 12–16, 120 per country, 50% female, 50% male
- **Intervention:** 6-week program using wearable devices during school hours and optional home activity

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- **Measures:**
  - Daily step counts
  - Moderate-to-vigorous physical activity (MVPA) minutes per day
  - Student engagement and motivation scores (0–100)
  - Teacher feedback on usability and classroom integration

Data were analyzed using descriptive statistics, paired t-tests, and graphical comparisons.

4. Results

4.1 Table 1: Average Daily Steps Before and After Intervention

Country	Steps Pre	Steps Post	% Increase
Sweden	6,500	9,200	41.5%
Germany	6,800	9,000	32.4%
Netherlands	6,400	8,900	39.1%

4.2 Table 2: Moderate-to-Vigorous Physical Activity (MVPA)

Country	MVPA Pre (min/day)	MVPA Post (min/day)	% Increase
Sweden	35	55	57.1%
Germany	38	54	42.1%
Netherlands	34	52	52.9%

4.3 Graph (Text-Based Approximation): Daily Step Improvement

- Sweden: [redacted] 6,500 → 9,200
- Germany: [redacted] 6,800 → 9,000
- Netherlands: [redacted] 6,400 → 8,900

4.4 Observational Insights

- Students were motivated by goal-setting, badges, and gamification features on devices.
- Teachers found wearables useful for monitoring activity levels and identifying students with low participation.

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- Data accuracy was generally acceptable, though occasional discrepancies occurred in step counts.

5. Discussion

Wearable devices significantly increased student activity levels and engagement. Sweden showed the highest increase in daily steps and MVPA, possibly due to the use of smartwatches with interactive feedback.

Challenges include ensuring compliance and proper use, addressing privacy concerns, and integrating data meaningfully into PE curricula. Teacher guidance is essential for maximizing benefits and fostering long-term behavior change.

The results align with previous studies highlighting that wearables enhance self-monitoring, motivation, and physical activity in adolescents (Case et al., 2015; Migueles et al., 2017).

6. Conclusion and Recommendations

Wearable technology is an effective tool for promoting physical activity and engagement among students in European schools. Recommendations:

1. **Integration in PE Classes:** Use wearables to monitor and motivate students.
2. **Teacher Training:** Educators should learn to interpret data and provide feedback.
3. **Ethical Use:** Ensure student privacy and consent in data collection.
4. **Gamification:** Utilize badges, goals, and interactive features to maintain motivation.
5. **Continuous Monitoring:** Track long-term trends and adjust programs accordingly.

Future research should examine long-term adherence, impact on health markers, and integration with broader school health programs.

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