

A NEW MODEL IN INTERDISCIPLINARY TEACHING – PE – STEM PROJECT

2023-2-IT02-KA210-SCH-000178106

TEACHER HANDBOOK

INTRODUCTION / FOREWORD (ENGLISH)

This handbook has been prepared within the scope of the **PE–STEM Project** with the aim of supporting teachers in designing and implementing **Physical Education–centered interdisciplinary learning activities**.

The PE–STEM Project promotes an innovative educational approach in which **Physical Education is used as a core learning environment** to connect concepts from Mathematics, Physics, Biology, and Information and Communication Technologies (ICT) through movement, real-life experiences, and active participation.

This document is intended as a **practical guide for teachers**, providing examples, workshop structures, facilitator notes, and ready-to-use materials that can be adapted to different school contexts and student needs.

The PE–STEM Project is **co-funded by the European Union under the Erasmus+ Programme**.
The content of this handbook reflects the views of the project partners only, and the European Commission cannot be held responsible for any use that may be made of the information contained herein.

This publication is **free of charge** and may be used, shared, and adapted for **educational purposes**, provided that appropriate reference is made to the "**A New Model in Interdisciplinary Teaching – PE – STEM"** Project and the Erasmus+ Programme.

By encouraging learning through movement and interdisciplinary collaboration, this handbook aims to contribute to **inclusive, engaging, and meaningful education** that supports both teachers and learners across Europe.

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PE–STEM TEACHER HANDBOOK

Physical Education Centered Interdisciplinary Teaching Guide

This

- ✓ For Math, Physics, Biology, ICT, and Physical Education teachers
- ✓ Clearly explains the PE-centered interdisciplinary approach
- ✓ Session-based structure
- ✓ Suitable for in-service training, in-school workshops, and project dissemination
- ✓ Customizable and adaptable to your school

1. Purpose of This Handbook

This handbook guides teachers on how to design and implement interdisciplinary lessons by placing Physical Education (PE) at the center and integrating Mathematics, Physics, Biology, and ICT meaningfully through movement and real-life contexts.

2. Why PE–STEM Integration Is Needed

Modern education requires students to learn by doing. PE provides an ideal learning environment where abstract STEM concepts become concrete through movement, observation, and experience. This approach increases motivation, inclusion, and long-term understanding.

3. How to Plan a PE–STEM Lesson

Step 1: Identify the PE learning objective.

Step 2: Choose one supporting STEM discipline.

Step 3: Design a movement-based activity.

Step 4: Encourage observation and reflection.

Step 5: Use formative assessment (rubrics, self-assessment).

4. Discipline-Based Integration Examples

PE + Mathematics: Angles, ratio, data through body movement.

PE + Physics: Friction, force, speed using sports examples.

PE + Biology: Exercise, nutrition, human body awareness.

PE + ICT: Unplugged coding through movement-based games.

5. Role of Rubrics in PE–STEM

Rubrics ensure fair and inclusive assessment by focusing on participation, understanding, and process rather than physical ability. They help both teachers and students understand learning expectations clearly.

6. Example Annual PE–STEM Integration Plan

September–October: PE + Mathematics (Angles, Ratios)
November–December: PE + Physics (Friction, Motion)
January–February: PE + Biology (Movement & Nutrition)
March–April: PE + ICT (Unplugged Coding)
May–June: Interdisciplinary PE–STEM Projects

7. School-Wide PE–STEM Roadmap

Phase 1: Teacher awareness and planning meetings.
Phase 2: Pilot PE–STEM lessons.
Phase 3: Sharing best practices among staff.
Phase 4: School-wide integration and sustainability.

PE–STEM MINI DISCIPLINE GUIDES

Physical Education–Centered **Interdisciplinary** *Teaching*

1. MATHEMATICS + PHYSICAL EDUCATION MINI GUIDE

What Does This Integration Explain?

This integration helps students **concretize abstract mathematical concepts** (angles, ratio, data) through **body movement and physical activity**.

Why Mathematics + PE?

- Students often struggle with mathematics when it is taught only on paper
- Movement makes numbers and relationships **visible and meaningful**

What Can Be Done in the Lesson?

- **Angles:**
  - Arm and leg positions
  - Shooting angles in basketball
  - Arm angles in swimming
- **Ratio & Proportion:**
  - Stadium capacity vs city population
  - Athlete–spectator ratio
- **Data:**
  - Time, number of repetitions, success rate

Tip for Teachers

Do not "teach mathematics" directly.
Help students **notice mathematics through movement**.
Calculation is not always necessary; comparison is enough.

2. PHYSICS + PHYSICAL EDUCATION MINI GUIDE

What Does This Integration Explain?

This integration makes the **natural presence of physics in daily life and sports** visible to students.

Why Physics + PE?

- Physics studies motion
- Physical Education **is motion itself**

What Can Be Done in the Lesson?

- **Friction:**
  - Shoe–surface interaction
  - Slipping vs grip
- **Force:**
  - Pushing and pulling
  - Sprint starts
- **Speed & Balance:**

- Acceleration and stopping
- Changing direction

Tip for Teachers

Do not focus on formulas.
Asking "What happened?" and "Why did it happen?" is enough.

3. BIOLOGY + PHYSICAL EDUCATION MINI GUIDE

What Does This Integration Explain?

This integration teaches how the **human body functions through movement** and promotes **healthy lifestyle awareness**.

Why Biology + PE?

- Biology explains living systems
- PE allows students to **experience the living system in action**

What Can Be Done in the Lesson?

- **Effects of Movement:**
  - Heart rate, breathing, fatigue
- **Nutrition & Energy:**
  - How students feel before and after exercise
- **Exercise Diary:**
  - Activity duration
  - Energy and mood tracking

Tip for Teachers

We are not training athletes.
We are developing **body awareness and healthy habits**.

4. ICT (INFORMATION TECHNOLOGY) + PHYSICAL EDUCATION MINI GUIDE

What Does This Integration Explain?

This integration shows that coding is not only about computers, but about **logic, sequencing, and thinking skills**.

Why ICT + PE?

- Coding = algorithmic thinking
- Movement = step-by-step execution

What Can Be Done in the Lesson?

- **Unplugged Coding:**
  - Obstacle courses and stations
  - Robot–programmer roles
- **Algorithms:**
  - Sequencing instructions
- **Debugging:**
  - Finding and fixing errors

Tip for Teachers

The goal is not writing code,
but **thinking like a coder**.

COMMON PRINCIPLES FOR ALL DISCIPLINES

✓ Physical Education always remains **at the center**
✓ Other disciplines play a **supporting role**
✓ Assessment focuses on **process, not performance**
✓ Rubrics are used for fair evaluation
✓ Students are active, teachers are facilitators

KEY MESSAGE OF THE GUIDE

Movement is the common language of all disciplines.
Physical Education is the heart of interdisciplinary learning.

PE–STEM TEACHER WORKSHOP PLAN

Physical Education–Centered Interdisciplinary Workshop for Subject Teachers

Target Group

Mathematics, Physics, Biology, ICT, and Physical Education teachers.

Workshop Objectives

- Understand PE–STEM integration
- Experience movement-based interdisciplinary activities
- Design PE-centered lesson ideas
- Learn process-based assessment using rubrics

Session 1 – Common Ground (45 min)

Introduction to PE–STEM philosophy.
Discussion: Why Physical Education should be the learning core.
Think–Pair–Share activity.

Session 2 – Discipline-Specific Workshops (90 min)

Mathematics: Angles, ratio, data through movement.
Physics: Friction, force, motion in sports.
Biology: Movement, exercise, nutrition.
ICT: Unplugged coding and algorithms.

Session 3 – Assessment & Rubrics (45 min)

Understanding process-based assessment.
Analyzing sample rubrics.
Designing rubric criteria.

Session 4 – Design & Sharing (60 min)

Group presentations of designed activities.
Peer feedback and discussion.

Session 5 – School Integration & Roadmap (30 min)

Planning pilot applications.
Creating a school PE–STEM action plan.

Final Message

Movement is not a break from learning.
It is a powerful learning environment.

PE–STEM READY WORKSHOP MATERIAL PACKAGES

Physical Education–Centered Interdisciplinary Teaching

This Word file contains:

- Separate ready-made workshop packages for 4 subjects:
  Mathematics
  Physics
  Biology
  ICT (Unplugged Coding)
- Clearly explains the PE (Physical Education) centered approach
- Suitable for workshops, in-service training, Erasmus+ dissemination, and in-school use
- Easily:

School logo can be added
Durations can be adapted
Can be duplicated on a subject-by-subject basis

1. Workshop Package for Mathematics Teachers – Mathematics Through Movement

Goal: Concretize mathematical concepts through movement.
Focus: Angles, Ratio & Proportion, Data.

Activities:
- Creating angles with body positions
- Stadium capacity vs city population ratio
- Collecting data from sports performance

Assessment Tool: Process-based rubric.
Key Message: Mathematics is relationship, not calculation.

2. Workshop Package for Physics Teachers – Physics in Motion

Goal: Connect physics concepts with real-life sports experiences.
Focus: Friction, Force, Motion.

Activities:
- Shoe–surface friction experiments
- Sliding vs stopping comparisons
- Sprint start analysis

Assessment Tool: Concept explanation rubric.
Key Message: Physics lives in movement.

3. Workshop Package for Biology Teachers – Biology of Movement

Goal: Develop body awareness and healthy lifestyle habits.
Focus: Movement, Nutrition, Energy.

Activities:
- Pulse measurement before and after exercise
- Short exercise experiments
- Exercise diary and reflections

Assessment Tool: Awareness-based rubric.
Key Message: Health knowledge becomes habit.

4. Workshop Package for ICT Teachers – Unplugged Coding Through PE

Goal: Teach coding logic without computers.
Focus: Algorithm, Sequencing, Debugging.

Activities:
- Coding parkour with cones
- Robot–programmer–tester roles
- Command sequencing and debugging

Assessment Tool: Collaboration and process rubric.
Key Message: Coding is thinking, not typing.

PE–STEM WORKSHOP – FACILITATOR NOTES & WORKSHEETS

GENERAL FACILITATOR GUIDELINES

This workshop aims to help subject teachers rethink their discipline through movement. Do not lecture. Ask questions, encourage movement, and let teachers experience learning as students.

Golden rule: If participants are not moving, learning is limited.

SESSION 1 – INTRODUCTION

Key sentence to say:
"Today we will not teach lessons. We will experience them."

Ask:
- Which topics do students struggle with most?
- Is the difficulty about content or method?
- How can movement change this?

MATHEMATICS WORKSHOP – FACILITATOR NOTES

Do NOT teach formulas.
Activities:
- Create angles with arms and legs.
- Compare which angle feels larger.
- Estimate stadium capacity vs city population.

Key message:
"Mathematics is about relationships, not numbers."

MATHEMATICS WORKSHOP – WORKSHEET

1. Which mathematical concepts did you experience through movement?

2. Why do students struggle with these concepts in class?

3. Write one PE-centered math activity idea.

PHYSICS WORKSHOP – FACILITATOR NOTES

Do NOT start with formulas.

Activities:

- Shoe–surface friction tests.
- Sliding vs stopping discussion.
- Name friction after observation.

Key message:

"Experience first, concept later."

PHYSICS WORKSHOP – WORKSHEET

1. Which physics concepts did you observe today?

2. How did sports help you understand physics?

3. Write one real-life physics problem related to sport.

BIOLOGY WORKSHOP – FACILITATOR NOTES

Focus on body awareness.

Activities:

- Measure pulse before and after movement.
- Discuss breathing and fatigue.
- Introduce exercise diary.

Key message:

"This knowledge is for life, not exams."

BIOLOGY WORKSHOP – WORKSHEET

1. What changes did you feel in your body after movement?

2. Why might students lack this awareness?

3. How would you use an exercise diary in your class?

ICT WORKSHOP – FACILITATOR NOTES

No computers are needed.

Activities:

- One teacher becomes a robot.
- Others give step-by-step commands.
- Debug errors together.

Key message:

"Coding starts in the mind, not on the screen."

ICT WORKSHOP – WORKSHEET

1. Which coding concepts did you experience?

2. What did debugging teach you?

3. Write one PE-centered unplugged coding game idea.

CLOSING MESSAGE

Movement is the common language of all disciplines.
Physical Education is the heart of interdisciplinary learning.

This handbook represents more than a collection of lesson ideas or workshop materials. It reflects a shared belief that learning becomes deeper, more inclusive, and more meaningful when it is experienced through movement.

The PE–STEM Project demonstrates that Physical Education is not separate from academic learning, but a powerful environment in which scientific thinking, problem-solving, collaboration, and self-awareness can naturally develop. By placing movement at the center, teachers can help students connect knowledge with real life, their own bodies, and their everyday experiences.

The approaches and examples presented in this handbook are designed to be flexible and adaptable. Teachers are encouraged to modify them according to their students' needs, school contexts, and local realities. Innovation in education does not require complex technologies; it begins with purposeful design, collaboration, and the courage to try new perspectives.

As an Erasmus+ co-funded initiative, the PE–STEM Project also emphasizes sharing, cooperation, and sustainability. We hope that this handbook will inspire educators to collaborate across disciplines, exchange practices, and continue exploring the educational potential of Physical Education beyond the duration of the project.

Ultimately, the success of this handbook will not be measured by how many activities are implemented, but by how many learners move, think, reflect, and feel more connected to learning.

PE-STE[A]M



A Different Model In InterdIscIplInary TeachIng PhysIcal EducatIon and STEAM

PE-STEAM

2023-2-IT02-KA210-SCH-000178106

Lesson Plans

Teacher's Guide

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    - ICT (Unplugged Coding) through Physical Activity

INTRODUCTION / FOREWORD (ENGLISH)

This handbook has been prepared within the scope of the **PE–STEM Project** with the aim of supporting teachers in designing and implementing **Physical Education–centered interdisciplinary learning activities**.

The PE–STEM Project promotes an innovative educational approach in which **Physical Education is used as a core learning environment** to connect concepts from Mathematics, Physics, Biology, and Information and Communication Technologies (ICT) through movement, real-life experiences, and active participation.

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By encouraging learning through movement and interdisciplinary collaboration, this handbook aims to contribute to **inclusive, engaging, and meaningful education** that supports both teachers and learners across Europe.

Purpose of the PE–STEM Project

A significant proportion of students across Europe lack basic digital and STEM competences. This situation particularly affects students from socio-economically disadvantaged backgrounds or those with special needs, leading to low motivation, an increased risk of early school leaving, and limited opportunities to relate learning to real-life contexts. Project partners observed that students often perceive mathematics and science subjects as difficult or unengaging, while teachers frequently lack effective strategies to integrate STEM topics into everyday teaching practices.

The project aimed to address these challenges by **integrating STEM subjects with Physical Education and gamified activities**, transforming sport and movement into engaging learning environments that foster scientific thinking. Through movement-based and inclusive approaches, the project sought to make learning more attractive, accessible, and closely connected to daily life.

Key objectives of the project included reducing early school leaving, supporting and motivating disadvantaged learners, improving digital literacy, and promoting inclusion and intercultural understanding. By applying innovative methodologies such as Problem-Based Learning, Game-Based Learning, Augmented Reality, and Unplugged Coding, the project aimed to empower both students and teachers, enrich teaching practices, and strengthen European cooperation towards a more inclusive and future-oriented education system.

Physical Education at the Center of Learning

Physical Education is not limited to physical activity alone; it is a powerful learning environment that supports thinking, understanding, and awareness. Learning through movement enables students to transform abstract concepts into concrete experiences, connect knowledge with real life, and actively participate in the learning process. Within this approach, Physical Education is not viewed as an auxiliary subject, but as a central and connecting element that brings different disciplines together and places learning at the heart of action.

Interdisciplinary Teaching Approach

The interdisciplinary teaching approach aims to help students construct knowledge in a holistic way by bringing together different subject areas around a common theme or learning context. In this approach, learning is not confined to the boundaries of a single discipline; instead, students recognize connections between concepts and are able to transfer their learning to real-life situations. Physical Education–centered interdisciplinary practices use movement as a shared learning language, making subjects such as mathematics, science, and information technologies more meaningful, accessible, and applicable.

PE-STE[A]M

A Different Model In InterdIscIplInary TeachIng PhysIcal EducatIon and STEAM

PE-STEAM

2023-2-IT02-KA210-SCH-000178106

PE-MATH

LESSON PLANS



A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

CLIL lesson on angles in mathematics applied to physical education

Authors

Angela Bonofiglio

Summary

This lesson explores the concept of angles and their practical applications in physical education. Students engage in interactive activities to understand and measure angles, enhance spatial awareness, and improve coordination through physical exercises. The lesson also integrates English language skills by encouraging students to describe movements and actions using specific vocabulary.

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Subject (s)

Angles in Motion: Exploring Mathematics in Physical Education.

Real- life questions

Real-life Questions

1. How do angles affect athletic performance in sports like basketball or gymnastics?
2. How can understanding angles improve accuracy in activities like throwing or jumping?
3. Why is measuring angles important for physical movements in sports?

Aims of the lesson

- Understand the concept of angles and their applications in physical education

- Develop linguistic skills in English through describing movements and actions

- Improve coordination and spatial awareness through physical exercises

Connection to STEM careers

1. **Sports Scientists:** Use angle analysis to optimize athletes' movements and performance.
2. **Biomechanical Engineers:** Apply knowledge of angles to design efficient sports equipment and gear.

3. **Physical Therapists:** Assess and improve body movements using angles during rehabilitation.
4. **Mathematicians:** Explore how angle calculations support game strategies and athletic analysis.

Age of students

14-19

Teaching resources (material & online tools)

Materials

1. A ball (for demonstrating movements and angles).
2. A metre stick (for measuring distances and angles).
3. Protractors (optional, for precise angle measurement).
4. Images or diagrams of athletes performing sports movements (optional).

Online Tools

1. **GeoGebra** (www.geogebra.org): For modeling angles visually and interactively.
2. **Khan Academy** (www.khanacademy.org): Offers resources for understanding angles and their applications.
3. **Interactive Sports Apps:** Tools for analyzing angles in sports, such as Dartfish or Hudl.
4. **YouTube Videos:** Tutorials explaining the role of angles in sports and physical movements.

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	**1. Practical Focus: The lesson integrates hands-on activities to explore angles, ensuring both theoretical understanding and practical application. 2. Relevance: Content directly connects mathematics to real-life physical education scenarios, enhancing engagement and comprehension. 3. Linguistic Integration: English language learning is embedded within the activities, focusing on specific vocabulary and communication skills.**
Instruction	The lesson uses a clear structure: introduction, interactive activities, and conclusion, balancing theoretical teaching with practical exercises to keep students engaged.
Personalization of learning	Activities are adaptable to different skill levels, allowing students to explore angles using movements and measurements tailored to their abilities.
Problem and project-based learning (PBL)	Students analyze and apply angles in physical exercises and create solutions to optimize performance, fostering

Elements and criteria	**1. Practical Focus: The lesson integrates hands-on activities to explore angles, ensuring both theoretical understanding and practical application.** **2. Relevance: Content directly connects mathematics to real-life physical education scenarios, enhancing engagement and comprehension.** **3. Linguistic Integration: English language learning is embedded within the activities, focusing on specific vocabulary and communication skills.**
	critical thinking and collaborative problem-solving.
Game Based Learning (GBL)	Incorporates sports-related games and physical challenges to make learning about angles fun and interactive, ensuring deep engagement.
Curriculum implementation	Aligned with mathematics, physical education, and English language curricula, this lesson integrates interdisciplinary learning seamlessly.
Emphasis on STEM topics and competencies	Promotes STEM skills by connecting mathematical concepts to physical movements, encouraging analytical thinking and practical application.
Interdisciplinary instruction	Combines mathematics, physical education, and language learning to provide a holistic educational experience that bridges different disciplines.
Contextualization of STEM teaching	Shows the relevance of angles in sports, making STEM learning meaningful and applicable to everyday situations.
Professionalization of staff	Encourages collaboration among math, PE, and English teachers to deliver content effectively and innovatively.
Highly qualified professionals	Teachers with expertise in mathematics, physical education, and English language instruction are essential for delivering the lesson effectively.
Existence of supporting (pedagogical) staff	Support staff assist in designing and executing the lesson, ensuring inclusivity and access to resources for diverse learners.
Professional development	Staff are encouraged to attend STEM workshops and language integration training to enhance interdisciplinary teaching methods.
School leadership and culture	Fosters a school culture that values creativity, collaboration, and innovative teaching approaches across subjects.
School leadership	Supports educators by providing resources, training, and encouraging teamwork to implement interdisciplinary lessons effectively.
High level of cooperation among staff	Promotes collaboration between math, PE, and language departments to develop cohesive and engaging learning experiences.
Inclusive culture	Ensures activities are accessible to all students,

Elements and criteria	**1. Practical Focus: The lesson integrates hands-on activities to explore angles, ensuring both theoretical understanding and practical application.** **2. Relevance: Content directly connects mathematics to real-life physical education scenarios, enhancing engagement and comprehension.** **3. Linguistic Integration: English language learning is embedded within the activities, focusing on specific vocabulary and communication skills.**
	accommodating different learning needs and styles for an equitable experience.
Connections	Collaboration with sports technology companies or local sports organizations could enhance the lesson by providing real-world insights and tools.
With industry	Students explore real-world applications of angles in careers like sports science and engineering
With parents/guardians	Homework encourages family involvement in discussing angles and physical activities. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Opportunities for collaboration on STEM and CLIL projects. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Guest lectures or resources from universities specializing in sports science or math education. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Integration of local sports facilities and community events to apply angles in physical activities. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	Access to sports facilities and equipment is essential for physical activities related to angles.
Access to technology and equipment	Use of tools like protractors, measurement sticks, and online apps ensures accurate calculation and visualization of angles.
High quality instruction classroom materials	Provides clear diagrams, worksheets, and digital tools to support both mathematical and physical education learning objectives.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
1st Lesson		
Brainstorming and discussion	Introduction (5 minutes) 1. Begin the lesson by asking students if they have already learned about angles in mathematics. 2. Write the word "angle" on the board and ask students to describe what it means to them. 3. Introduce the concept of an angle as a measure of rotation between two lines or planes.	5 min
Discussion and preparation for the next lesson	**Discussion and Preparation for the Next Lesson** 1. **Class Discussion:** Wrap up the lesson by engaging students in reflective dialogue: o "What did you learn about angles and their importance in physical activities?" o "Can you think of other scenarios, outside sports, where angles play a crucial role?" 2. **Preparation for Next Lesson:** Build anticipation for the next lesson: o Introduce the topic, such as *"Next time, we'll explore how geometry shapes sports fields and equipment—why do you think a football field is rectangular, and a running track is oval?"* 3. **Homework Assignment:** Encourage exploration to prepare for the upcoming lesson: o Students can draw and describe a sport-related physical exercise involving angles, noting the angles formed. o Alternatively, ask them to research how geometric shapes influence sports equipment or field designs.	
2nd Lesson		
STEM Subject 1	Activity 1: Angles and Movements (15 minutes) 1. Show students a ball and ask them to describe how they could move it to create different angles. 2. Demonstrate some examples of movements, such as	20 min

Name of activity	Procedure	Time
	throwing the ball upwards at a 45-degree angle or passing it to a teammate at a 90-degree angle. 3. Ask students to work in pairs to create and describe other movements involving different angles.	
STEM Subject 2		
Learning products	1. **Movement Description Charts:** Students create charts illustrating different ball movements and the angles involved, including short written descriptions. 2. **Visual Diagrams:** Students draw diagrams showing the trajectory of the ball during specific movements (e.g., at 45° or 90° angles). 3. **Group Presentations:** Teams present their created movements, explaining the angles and their significance in sports contexts. 4. **Angle Demonstration Videos:** Students record short videos demonstrating ball movements and verbally explaining the angles used. 5. **Creative Storyboards:** Students develop storyboards showcasing different scenarios where angles are applied in sports activities. 6. **Interactive Worksheets:** Students complete worksheets to match different movements with their corresponding angles and descriptions. 7. **Physical Activity Reports:** Students write short reflections or reports summarizing their observations and experiences during the activity. These products encourage creativity, collaboration, and practical understanding of angles in motion.	
3th Lesson		
STEM Subject 1	Activity 2: Measuring Angles (15 minutes) 1. Distribute protractors (if available) or use a metre stick to measure the angles created by students. 2. Ask students to measure and record the angles created during the movements. 3. Discuss with the class how angles can be used to improve athletic performance, such as in football or basketball.	15 min
STEM Subject 2		
Learning	1. **Angle Measurement Charts:** Students create charts	

Name of activity	Procedure	Time
products	recording the angles measured during their activities, including both the movement description and the measurement. 2. **Data Tables:** Develop structured tables that display collected measurements and corresponding observations on how angles affect movements. 3. **Collaborative Reports:** Groups write reports detailing their findings, including measured angles and insights about their role in improving physical performance. 4. **Visual Diagrams:** Drawings or sketches showing the measured angles with labels and explanations about the movements involved. 5. **Reflection Sheets:** Students complete reflection sheets summarizing the process of measuring angles and what they learned about their practical applications. 6. **Interactive Presentations:** Teams present their results to the class, explaining the significance of accurate angle measurements in sports. 7. **Practical Experiment Logs:** Students document their experiments step by step, including the tools used, measurements taken, and conclusions drawn. These products encourage precise measurements, detailed documentation, and meaningful reflections.	
4th Lesson		
STEM Subject 1	Activity 3: Practical Applications (20 minutes) 1. Divide the class into small groups and assign them a series of physical exercises involving angles, such as: - Throwing a ball against a target at a specific angle - Performing a high jump with a 45-degree angle - Creating a formation in the shape of an angle with their bodies 2. Ask groups to work together to perform the exercises and describe the angles involved.	20 min
STEM Subject 2		
Learning products	1. **Performance Logs:** Students document their group exercises step by step, detailing the angles involved in	

Name of activity	Procedure	Time
	each physical activity and reflecting on the results. 2. **Group Demonstrations:** Teams perform their assigned physical exercises for the class, explaining the angles involved and their impact on the outcomes. 3. **Data Comparison Reports:** Groups analyze their exercise results, compare data (e.g., accuracy, distance), and present insights about how angles influenced performance. 4. **Visual Collages:** Students create collages or posters showcasing images of the physical exercises performed, along with written descriptions of the angles used. 5. **Video Documentation:** Groups record videos of their exercises and provide verbal explanations of how specific angles contributed to their movements or successes. 6. **Creative Formations:** Teams design unique formations or movements involving angles, presenting their creativity and mathematical understanding. 7. **Reflection Essays:** Individual students write short essays reflecting on how angles influence physical activities in real-life sports scenarios. These learning products are designed to combine creativity, teamwork, and practical analysis.	
5th Lesson		
STEM Subject 1	Conclusion (5 minutes) 1. Gather the class and ask students to share what they have learned about angles and their applications in physical education. 2. Emphasize the importance of angles in everyday life and sports. 3. Assign a homework task, such as drawing and describing a physical exercise involving angles.	5 min
STEM Subject 2		
Learning products	**Learning Products** 1. **Class Summary Chart:** Create a collaborative chart summarizing key learnings about angles and their applications in physical	

Name of activity	Procedure	Time
	education. 2. **Reflection Essays:** Students write individual reflections on what they learned, including how they can use angles in sports and everyday life. 3. **Group Discussion Notes:** Compile notes from the final class discussion, highlighting student insights and questions. 4. **Visual Infographics:** Design infographics that summarize the importance of angles in physical movements and sports strategies. 5. **Personal Goal Sheets:** Students outline their personal goals or ideas for applying angles in future sports or physical activities. 6. **Creative Posters:** Students create posters emphasizing the significance of angles in sports, incorporating drawings or diagrams. 7. **Feedback Forms:** Students complete feedback forms sharing their experiences and thoughts about the lesson and how it can be improved. These learning products help students consolidate their understanding and reflect meaningfully on the topic	

Assessment

- Observe students during the activities and assess their understanding of angles and their applications in physical education.

- Review homework assignments to assess their ability to describe and apply angles in different contexts.

- Use a rubric to assess the accuracy and completeness of students' descriptions and drawings.

Final assessment

- Students create a project demonstrating their understanding of angles in physical education by:
    1. Designing a physical exercise or sports movement involving specific angles.

2. Providing measurements and a visual or written explanation of the angles used.
3. Explaining how angles enhance performance or accuracy in their chosen activity.

Student feedback

- Students complete a feedback form or survey addressing:
  - What they enjoyed most and least about the lesson.
  - How comfortable they feel understanding and applying angles.
  - Suggestions for improving future lessons.

Teacher feedback

- Teachers reflect on the lesson by considering:
  - Were students engaged and able to connect angles to physical movements?
  - Did the integration of language and mathematics enhance understanding?
  - What could be improved in the lesson structure or activities for better outcomes?

Annex 1

1. **Sample Worksheets:** Provide worksheets with examples of angles in sports and practice questions for students to measure and describe.
2. **Activity Instructions:** Step-by-step guides for each activity, including required materials and objectives.
3. **Angle Diagrams:** Templates or pre-drawn diagrams of movements with angles labeled, for students to analyze or replicate.
4. **Sports Examples:** Images or videos showing professional athletes using angles in their performance (e.g., basketball shots, gymnastics).
5. **Vocabulary Lists:** Key terms in English related to angles and their applications, to support language integration.
6. **Reflection Prompts:** Pre-designed prompts to guide students' reflections and journal entries.

A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN – PE-MATH

Title

The History of Angles in Mathematics and Their Application in Physical Education

Authors

Francesco Mannarino

Summary

The lesson explores the historical development of angles in mathematics, from their origins in ancient civilizations to their role in geometry, and demonstrates how angles are applied in physical education. By connecting mathematical concepts with sports and movement, students learn to identify and analyze angles in real-life activities.

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Subject (s)

Mathematics and Physical Education.

Real- life questions

1. How do angles influence the accuracy of a soccer pass or shot?

2. What is the ideal release angle for throwing a javelin or shooting a basketball?
3. How can understanding body angles improve performance in gymnastics or dance?

Aims of the lesson

By the end of the lesson, students will be able to:

1. Explain the historical development of angles in mathematics.
2. Understand the relevance of angles in physical movements and sports.
3. Analyze and apply angles in physical education activities.

Connection to STEM careers

Connection to STEM Careers: Understanding angles bridges mathematics with real-world applications in STEM fields. For example:

- **Engineering:** Designing structures or sports equipment relies on precise calculations of angles for safety and efficiency.
- **Biomechanics:** Experts analyze body angles to optimize athletic performance and reduce injury risks.
- **Computer Science:** Simulation and coding of physical movements in video games or sports analytics often require knowledge of geometry.
- **Sports Science:** Professionals study angles to develop training methods and tools for athletes.

This connection emphasizes how concepts of angles inspire innovation and problem-solving across multiple STEM disciplines.

Age of students

14-19

Teaching resources (material & online tools)

Materials:

- Whiteboard and markers for drawing and explaining angles.
- Protractors for measuring and demonstrating angles during activities.
- Pre-recorded sports videos to analyze angles in real-life movements.
- Cones or markers to create paths or setups for interactive exercises.
- Worksheets or handouts summarizing key concepts about angles and their applications.

Online Tools:

- **GeoGebra:** A free, interactive geometry software to explore and visualize angles.
- **YouTube:** For sports analysis videos and tutorials showcasing the role of angles in sports.
- **Khan Academy:** A great resource for additional lessons and practice on geometry and angles.
- **Sports Tracker or Similar Apps:** Use mobile apps to measure movement angles or analyze sports techniques.

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	The project focuses on integrating mathematical concepts of angles with physical education, creating a multidisciplinary approach that engages students in real-world applications.
Instruction	Lessons are designed to balance theory and practice, leveraging interactive activities and visual demonstrations to engage students effectively.
Personalization of learning	Instruction is tailored to students' skill levels and interests, incorporating examples from sports they are passionate about to make learning meaningful.
Problem and project-based learning (PBL)	Students work on practical tasks, such as analyzing angles in sports movements or designing paths based on specified angles, encouraging critical thinking and problem-solving.
Game Based Learning (GBL)	Sports and physical activities are gamified, using games like angle hunts and sport simulations to make learning engaging and fun.
Curriculum implementation	The project aligns with both mathematics and physical education curricula, emphasizing collaboration across disciplines.
Emphasis on STEM topics and competencies	The project integrates mathematics with real-life applications in sports science, promoting STEM skills like critical thinking, analysis, and innovation.
Interdisciplinary instruction	Lessons combine mathematics with physical education, biomechanics, and sports science to create a cohesive learning experience.
Contextualization of STEM teaching	Teaching is grounded in practical, real-world contexts, showing how angles are essential in sports and physical activities.
Professionalization of staff	Teachers receive guidance and resources to effectively combine STEM topics with physical education principles.
Highly qualified professionals	Educators are trained in both mathematics and physical education, ensuring expertise in interdisciplinary teaching.
Existence of supporting (pedagogical) staff	Collaborative efforts with assistants and specialists in sports science or biomechanics support the implementation of the project.
Professional development	Teachers participate in workshops to improve their skills in integrating STEM concepts with physical activities.
School leadership and culture	School leadership fosters a culture of innovation and interdisciplinary collaboration, encouraging projects that blend STEM with other fields.
School leadership	Leadership actively supports the integration of STEM

Elements and criteria	The project focuses on integrating mathematical concepts of angles with physical education, creating a multidisciplinary approach that engages students in real-world applications.
	topics, providing resources and opportunities for professional growth.
High level of cooperation among staff	Teachers from mathematics and physical education departments collaborate to create cohesive lesson plans and activities.
Inclusive culture	The project embraces diversity, ensuring all students, regardless of ability, can participate and benefit from the activities.
Connections	The lesson is adaptable to different learning needs and styles, making it accessible to all students.
With industry	Partnerships with sports science organizations to provide insights and resources.
With parents/guardians	Engagement with families through events demonstrating the project's applications. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Collaboration with other institutions to share resources and ideas. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Access to research and expertise in biomechanics and STEM education. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Involvement in community sports events to showcase the educational benefits of the project. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	Modern facilities, including gymnasiums and technology-equipped classrooms, support the project's activities.
Access to technology and equipment	Tools like protractors, measurement apps, and simulation software enhance the learning experience.
High quality instruction classroom materials	Detailed worksheets, video analysis tools, and interactive software provide engaging and effective learning resources.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
	1st Lesson	
Brainstorming and discussion	1. **Introduction** (5 minutes) o Briefly introduce the concept of angles in mathematics (e.g., their measurement in degrees, types like acute, obtuse, right). o Share a fun fact: Ancient civilizations like the Babylonians and Greeks heavily contributed to the study of angles.	5 min
Discussion and preparation for the next lesson	**Discussion and Preparation for the Next Lesson:** At the end of the lesson, engage students in a reflective discussion about the significance of angles in both mathematics and sports. Encourage them to share their observations from the interactive activities and real-life applications explored during the lesson. Prompt questions like: • What surprised you the most about the role of angles in physical education? • Can you think of other activities or professions where angles might be important? To prepare for the next lesson, introduce the idea of expanding the study of angles into related STEM areas, such as physics (trajectory and force) or engineering (design and construction). Share a teaser activity or question that connects angles with these new topics—for example: "How does understanding angles help athletes perform better in jumping or throwing events?" Provide students with optional pre-reading or research tasks, such as finding examples of angles in sports or exploring famous discoveries related to geometry. This ensures continuity in learning and builds anticipation for the next session.	
	2nd Lesson	
STEM Subject 1	1. **Historical Context** (10 minutes) o Explain the origins: How the Babylonians used angles in astronomy, dividing a circle	10 min

Name of activity	Procedure	Time
	into 360 degrees. ○ Mention Euclid's "Elements" as a cornerstone of geometry, where angles play a significant role. ○ Discuss practical uses in early times, such as architecture and navigation.	
STEM Subject 1		
Learning products	*Learning Products:* 1. ***Timeline Chart:*** *A visual timeline highlighting key milestones in the history of angles, from Babylonian astronomy to Euclidean geometry.* 2. ***Illustrated Booklet:*** *A short, engaging booklet featuring historical figures like Euclid and their contributions to the study of angles.* 3. ***Video Presentation:*** *A creative video summarizing the evolution of angles in mathematics, including their practical uses in ancient architecture and navigation.* 4. ***Interactive Quiz:*** *A digital quiz testing knowledge about historical developments, mathematicians, and real-world applications of angles.* 5. ***Historical Role-Play Activity:*** *Students act as mathematicians like Euclid or Pythagoras, presenting their discoveries about angles to the class.*	
3rd Lesson		
STEM Subject 2	1. **Angles in Physical Education** (15 minutes) ○ **Connection to Movement:** Highlight how angles are fundamental in analyzing and improving movements in sports (e.g., shooting a basketball involves a specific release angle). ○ **Sports Examples:** ▪ Soccer: Kicking angles for passes and shots. ▪ Gymnastics: Body angles for balance and rotation. ▪ Track and Field: Throwing angles in javelin or discus.	15 min
STEM Subject 2		
Learning products	1. ***Sports Angle Analysis Report:*** *Students create a report analyzing the angles involved in specific sports movements (e.g., the release angle in basketball or the trajectory of a soccer pass).* 2. ***Interactive Poster:*** *A visual representation of how different angles affect performance in sports, incorporating diagrams and explanations.* 3. ***Video Demonstration:*** *A student-produced video demonstrating the use of angles in various sports activities, such as gymnastics, track and field, or tennis.*	

Name of activity	Procedure	Time
	4. ***Simulation Game:*** *Students design and play a simple game where success depends on applying the correct angles (e.g., aiming and shooting with specific angles).* 5. ***Physical Experiment Worksheet:*** *A guided worksheet for students to record and analyze angles during an actual sports activity, using tools like protractors or apps.*	
4th Lesson		
STEM Subject 1	1. **Interactive Activity** (20 minutes) o **Angle Hunt in Sports:** Have students observe a pre-recorded sports clip and identify different angles in action (e.g., knee bending, arm stretching). o **Group Exercise:** Set up cones in a gym or open area and ask students to create paths based on specified angles (e.g., 45°, 90°).	20 min
STEM Subject 2		
Learning products	**Learning Products** related to the "Interactive Activity": 1. **Sports Angle Map:** A collaborative diagram created by students during the activity, showing the paths and angles they designed with cones or markers. 2. **Movement Analysis Chart:** A detailed record of angles observed in the sports video, highlighting how each angle contributes to movement efficiency. 3. **Group Presentation:** Teams present their findings from the angle hunt, explaining the significance of the angles they identified in sports movements. 4. **Video Project:** A compilation of clips capturing the interactive activity, showcasing students creating and analyzing angles in physical settings. 5. **Reflective Journal:** Students document their experiences, insights, and observations from the activity, connecting their learning to real-life applications.	
5th Lesson		
STEM Subject 1	1. **Conclusion and Reflection** (10 minutes) o Recap the historical and practical significance of angles. o Ask students to share one sport or physical activity where they think angles are important. o Optional homework: Research one historical	10 min

Name of activity	Procedure	Time
	mathematician who contributed to the study of angles and how their work influences modern sports science.	
STEM Subject 2		
Learning products	***Learning Products*** *related to the "Conclusion and Reflection":* 1. ***Reflection Journal:*** *A personal journal where students write about their learnings, observations, and how angles connect to their daily activities or sports interests.* 2. ***Group Discussion Summary:*** *A collaborative document summarizing the insights shared during the reflection discussion, highlighting key takeaways.* 3. ***Future Applications Mind Map:*** *Students create a mind map illustrating how understanding angles can be applied in various STEM fields and sports activities.* 4. ***Feedback Form:*** *Students complete a form assessing the lesson and sharing suggestions or ideas for future learning.* 5. ***Quote Poster:*** *Students create a poster with an inspiring quote or concept they learned about angles, accompanied by a relevant illustration.*	

Assessment

Assessment

1. **Formative Assessment:**
   - Observe students during interactive activities and group discussions, noting their engagement and understanding.
   - Review their work on the Sports Angle Analysis Report or other learning products for accuracy and creativity.
2. **Performance Assessment:**
   - Evaluate students' ability to apply the concept of angles in physical activities, such as the Angle Hunt or designing paths with cones.

Final assessment

- A short written quiz covering the historical context and applications of angles in sports.
- A practical task where students must analyze or create angles in a sports scenario, demonstrating their comprehension.

Student feedback

Student Feedback

- Collect feedback through an anonymous survey or digital form, asking questions like:
  - What part of the lesson did you enjoy the most?
  - How well do you feel you understood the role of angles in physical education?
  - What would you like to learn more about in future lessons?

Teacher feedback

Teacher Feedback

- **Reflect on the lesson's success by considering:**
  - **Student engagement and participation levels.**
  - **Areas where students excelled or faced difficulties.**
  - **Suggestions for improving interdisciplinary teaching methods in future lessons.**

Annex 1

Include supplementary materials, such as:

- **Historical Timelines:** Charts or handouts summarizing the history of angles.
- **Worksheets:** Templates for analyzing angles in sports videos or activities.
- **Resources List:** Links to online tools (e.g., GeoGebra, Khan Academy) and recommended readings.
- **Lesson Plans:** Detailed outlines of activities and discussion topics for teacher use.
- **Visual Aids:** Diagrams or images demonstrating angles in sports and movement analysis.

A New Model in Interdisciplinary Teaching – PE - STEM

PHYSICAL EDUCATION LESSON PLAN – PE-ANGLES

Lesson Information

- **Teacher: Nagehan Afşar-İzmir Turkiye**
- **Subject:** Physical Education
- **Topic:** Angles
- **Grade Level:** Grade 9 (Ages 14–15)
- **Duration:** 40 minutes
- **Lesson Area:** Gym / Schoolyard

Lesson Aim

The aim of this lesson is to help students:

- Recognize angles through **body positions and movement**
- Understand how **arm, leg, and body angles** affect sports performance
- Realize the relationship between **correct angle = more effective movement**

Learning Outcomes

Students will be able to:

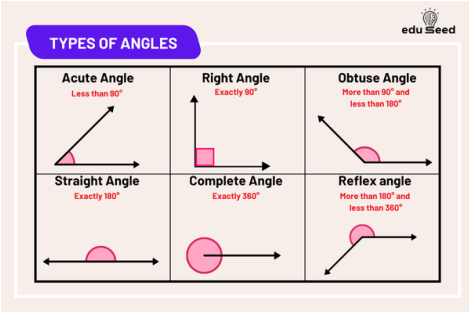
- Demonstrate **acute, right, and obtuse angles** using their bodies
- Recognize how angles change during sports movements

- Verbally explain how angles influence movement quality and performance

Materials Needed

- Basketball / ball
- Cones
- Stopwatch
- A4 **Angle Cards** (ACUTE – RIGHT – OBTUSE)
- (Optional) smartphone/tablet for observation

PART 1 – WARM-UP AND FOCUS ON ANGLES (0–8 min)

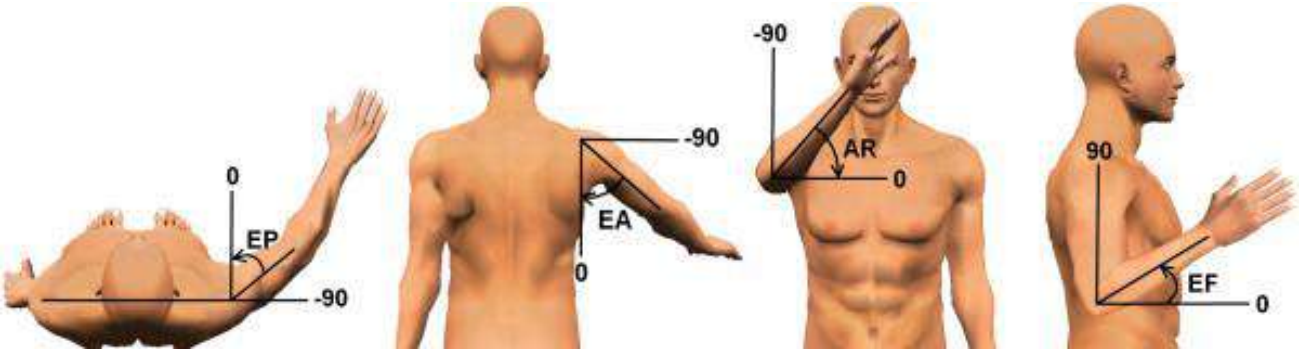


Purpose

To prepare the body for the lesson and connect the concept of "angle" to movement.

Implementation

1. **3 minutes of light jogging** around the gym or schoolyard
2. **Dynamic stretching**:
    - Arm circles (small → large angles)
    - Leg opening and closing
    - Knee and hip angle awareness
3. Teacher asks:



"Does the movement change when we open our arms a little or a lot?"

Students are shown **ACUTE – RIGHT – OBTUSE** cards and asked to model them using their bodies.

PART 2 – SHOWING ANGLES WITH THE BODY (8–15 min)

Purpose

To make angle types concrete through body movement.

Implementation

Students stand in a semicircle.

Teacher gives commands:

- "**ACUTE ANGLE**" → Arms slightly open
- "**RIGHT ANGLE**" → One arm up, one arm sideways
- "**OBTUSE ANGLE**" → Arms wide open

Then using legs:

- Squat position → knee angle
- Side lunges → hip angle

Teacher emphasis:

"Angles are not only on paper; they are constantly present in our bodies."

PART 3 – SPORTS APPLICATIONS (15–32 min)

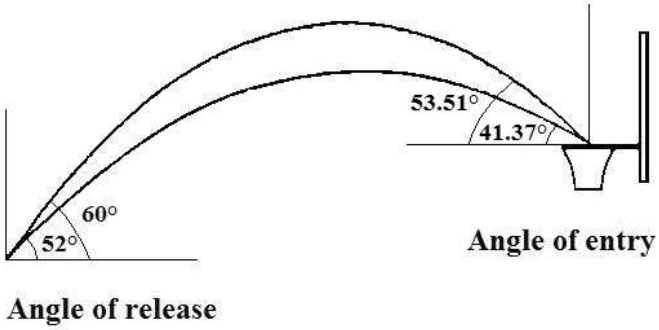
Students are divided into **3 groups** (each station ~5 minutes).

STATION 1 – Basketball: Shooting Angle

Purpose:
To observe how arm and ball angles affect shooting results.

Implementation:

1. Students shoot from the same spot using:
    - Low angle (flatter shot)



- Medium angle
- High angle (higher arc)

2. Group observes:
   - Which shot goes in more easily?
   - Which shot lands more softly in the hoop?

Guiding question:

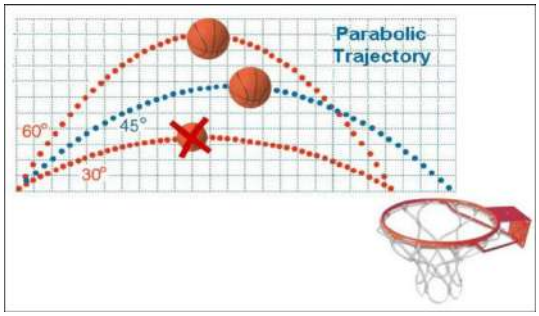
"Why does the result change when the angle changes?"

STATION 2 – Swimming (Dryland): Arm Angle

Purpose:
To understand how arm entry and pull angle affect efficiency in swimming.

Implementation (dryland):





1. Student extends the arm forward using:

- Acute angle
- Medium angle
- Obtuse angle

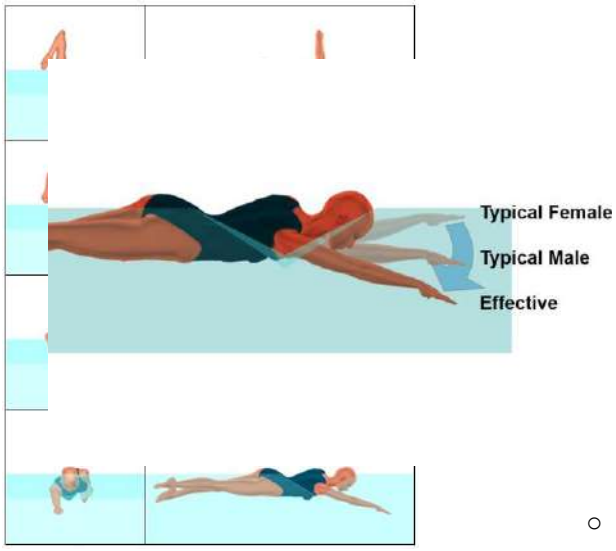
2. Students compare:
   - Which angle feels stronger?
   - Which feels more balanced?

Key point:

"In swimming, the wrong angle means wasted effort."

STATION 3 – Athletics: Sprint Start Angle

Purpose:



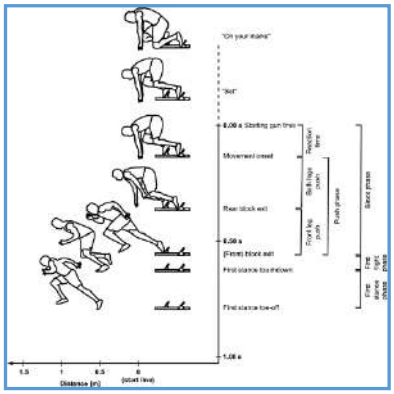
To understand how body angle affects acceleration.

Implementation:

1. Student performs a sprint start with:
   - A lower body angle (leaning forward)
   - A higher body angle (more upright)
2. Group observes:
   - Which start feels faster?
   - Which feels more controlled?

Guiding question:

"In which direction should our body apply force when accelerating?"



PART 4 – REFLECTION AND CLOSURE (32–40 min)

Group Sharing



Each group completes one sentence:

- "In basketball, angles are important because…"
- "In swimming, arm angle changes…"
- "In sprinting, body angle affects…"

Exit Ticket

Teacher asks:

"Today I understood that angles are important in sports because _____."

Assessment (Quick & Practical)

Teacher observes:

- Can the student demonstrate angles with their body?
- Does the student recognize angle differences during movement?
- Does the student follow safety rules?

Key Message of the Lesson

"Sport is not only about strength, but also about the right angle."

RUBRIC

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
Understanding of Angles Through Movement	Clearly and correctly demonstrates acute, right, and obtuse angles using body positions without guidance.	Demonstrates angle types correctly with minor guidance.	Demonstrates some angles correctly but shows confusion between types.	Has difficulty demonstrating angle types even with guidance.
Application of Angles in Sports Movements	Consistently applies correct body/arm angles during sports activities and explains their effect on performance.	Applies angles correctly in most activities; explanation is partially clear.	Applies angles inconsistently; limited understanding of their effect.	Does not apply angle awareness during sports activities.
Movement Quality and Body Control	Movements are controlled, balanced, and show clear awareness of body positioning.	Movements are mostly controlled with minor balance or posture issues.	Movements show limited control or inconsistent posture.	Movements lack control; body positioning is unsafe or ineffective.
Participation and Effort	Actively participates in all activities with high effort and enthusiasm.	Participates regularly with good effort.	Participates inconsistently or with low effort.	Rarely participates or avoids activities.
Observation and Reflection	Clearly explains how changing angles affects movement and sports performance using examples.	Explains angle effects with basic examples.	Provides limited or unclear explanation.	Unable to explain the role of angles in sports.
Collaboration and Respect	Works cooperatively, respects peers, follows rules, and supports group	Usually cooperative and respectful with minor reminders.	Occasionally disrupts group work or needs reminders.	Does not cooperate or follow rules; affects group safety.

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
	work.			
Safety Awareness	Always follows safety rules and encourages others to do the same.	Usually follows safety rules.	Sometimes forgets safety rules.	Frequently ignores safety rules, causing risk.

Teacher Notes

- This rubric is designed for **process-based assessment**, not athletic performance.
- Focus is on **angle awareness, movement quality, and participation**, not speed or strength.
- Roles such as **observer, timekeeper, or recorder** should be valued equally for inclusivity.

A New Model in Interdisciplinary Teaching PE - STEM

Title

Angles in Nature and Sports

Authors

Tatyana Nikolova

Summary

In this STEAM lesson, students will explore the connection between nature and sports through the study of angles. Through discussion, theoretical explanation, and hands-on activities, they will understand how angles influence movement—both in the world of plants and animals and in various sports.
They will learn that the optimal angle is key to efficiency — for example, in the flight of a bird, the jump of a frog, a soccer kick, or a basketball shot. Students will measure angles in natural and sports-related environments and draw conclusions about their importance. Through observation, measurement, and analysis, they will develop skills for applying mathematical knowledge to real-life situations.

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Subject (s)

This STEAM lesson integrates multiple disciplines to provide students with a comprehensive and engaging learning experience. The chosen subjects support the lesson's goals both from a scientific-mathematical perspective and a creative, physical, and observational one.

Mathematics

Mathematics is at the core of the lesson. Students learn to measure and analyze angles and understand their impact on motion.

Science

Science offers a framework for understanding natural phenomena such as bird flight, water flow, and animal locomotion—many of which depend on angles and forces.

Technology (optional/indirect)

Technology supports observation and analysis. Digital tools and multimedia resources enrich the understanding of movement and design inspired by nature.

Arts

Arts encourage creative thinking and help visualize abstract concepts. Students express their understanding through drawing, modeling, or visual representation.

Physical Education (PE)

Sports offer a real-life context where angle-based movement can be experienced and tested. PE links theoretical knowledge with kinesthetic learning.

Environmental Studies / Nature Observation

Nature serves as a living laboratory. Students observe and measure real-life examples of how angles influence growth and movement in the natural world.

Interdisciplinary Value and Enrichment

Subjects beyond traditional STEM—such as Art, PE, and Environmental Studies—greatly enhance the lesson by encouraging teamwork and active participation, creative expression and visual analysis, real-world observation and hands-on engagement.

These connections ensure that students not only understand mathematical and scientific concepts but also apply them meaningfully in their environment and daily activities.

Real- life questions

1. Why do basketball players often shoot at the hoop at a specific angle? How does this increase their chance of scoring?
2. What is the best angle to pass a soccer ball if you want it to fly over the defenders but still reach your teammate accurately?
3. When a skier goes down a slope, how does the angle of the slope affect their speed? How would you compare this to an animal running downhill?
4. If a tree grows at an angle toward the sunlight, how can we measure its angle of inclination? What does this tell us about its environment?
5. Which animals use specific limb angles to move faster or jump farther? Can we observe similar movements in sports?
6. When do you use knowledge of angles in your everyday life, even without realizing it? For example—when throwing an object, riding a bike, or lifting something?

Aims of the lesson

Educational Objectives:

- Students will understand the connection between angles in nature and sports.
- They will measure and analyze angles in sports movements and natural phenomena.
- They will draw parallels between adaptations in living organisms and sports strategies related to angles and movement.

Connection to STEM careers

Biomechanist

Studies human and animal motion. Works with athletes to improve performance by analyzing angles in joints during jumps, throws, or sprints.

Civil/Structural Engineer

Designs buildings, bridges, and ramps using precise angles and calculations to ensure safety, balance, and efficient force distribution.

Physical Education Teacher / Sports Coach

Teaches techniques involving body positioning and movement. Uses knowledge of angles to improve athletic performance and prevent injuries.

Robotics Engineer / Programmer

Creates robots that mimic animal movement. Programs joint angles and motion paths inspired by nature to achieve balance, efficiency, and flexibility.

Ecologist / Wildlife Researcher

Observes how animals move, orient themselves using the sun, or navigate different terrains. Measures angles in natural environments to understand adaptations and behavior.

Age of students

14-19

Teaching resources (material & online tools)

Materials:

- Protractors
- Measuring tapes
- Masking tape or chalk for marking the field
- Balls (basketball, soccer, volleyball)
- Cones
- Pictures or videos of animals in motion

Online tools:

https://www.youtube.com/watch?v=tP2TWhDVPVY

21st century skills

1. **Critical Thinking and Problem Solving**

- Students analyze real-life movement situations and draw conclusions based on observation and angle measurement.

2. **Creativity and Innovation**

- They use art to visualize concepts, design their own sketches or models of natural and sports-related movements.

3. **Communication**

- Students work in teams, share their observations, present measurement results, and explain their reasoning.

4. **Collaboration**

- Group and pair activities encourage shared problem solving and mutual responsibility.

5. **Information and Media Literacy**

- Use of videos, images, and digital tools helps students observe motion and understand angle-related concepts more effectively.

6. **Civic and Environmental Awareness**

- The lesson encourages them to observe nature closely, value its patterns, and understand how natural knowledge is applied in modern technology and sports.

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	How is this criterion addressed in the learning scenario
Instruction	
Personalization of learning	Students choose examples from their own sports or nature experience; observations and measurements are based on their environment.
Problem and project-based learning (PBL)	Tasks such as identifying the most effective angle for a jump or pass are solved through experimentation and analysis.
Game Based Learning (GBL)	Sports activities include game elements—accuracy contests, jumping challenges, and angle-based ball passes.
Curriculum implementation	
Emphasis on STEM topics and competencies	Focus on angles, motion, observation, and data analysis—combining math, science, tech, and PE.
Interdisciplinary instruction	The lesson integrates math, science, PE, arts, and technology.
Contextualization of STEM teaching	Based on real-life scenarios from sports and nature—making learning relevant and meaningful.
Professionalization of staff	
Highly qualified professionals	Collaboration between math, science, PE, and arts teachers, supported by pedagogical staff.
Existence of supporting (pedagogical) staff	Involvement of assistant teachers or counselors, especially in practical tasks.
Professional development	Teachers apply STEAM approaches and experiential, cross-curricular methods.
School leadership and culture	
School leadership	Encourages and supports innovative interdisciplinary teaching.
High level of cooperation among staff	Teachers plan and deliver the lesson collaboratively across subjects.
Inclusive culture	Activities are designed to suit diverse learning styles and ability levels.
Connections	
With industry	Possible guest talks from coaches or biomechanics experts.
With parents/guardians	Parents can contribute real-life sports examples or support field activities.
With other schools and/or educational platforms	Sharing of practices and results across school networks.
With universities and/or research centers	Links to faculties of sport science, biology, or engineering.
With local communities	Outdoor learning in parks or sports areas; connections to local environments.
School infrastructure	
Access to technology and equipment	Use of protractors, mobile apps for measurement, videos, and

Elements and criteria	How is this criterion addressed in the learning scenario
	digital tools.
High quality instruction classroom materials	Worksheets, photos, measuring tools, balls, cones, and visual resources.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
1st Lesson		
Brainstorming and discussion	Students share initial ideas on how nature and sports are connected through angles. They discuss: • Bird flight angles • Animal limb movement • Tree inclination and natural slopes • Soccer kick angles, skiing posture, jumping technique **Learning product:** Mind map or group notes on nature-sport connections. Students identify real-life situations involving angles.	45 min
Discussion and preparation for the next lesson	How can we apply knowledge about angles in nature and sports?	
2nd Lesson		
STEM Subject 1	Students: • Review basic angle types and properties • Measure angles in diagrams and real objects • Analyze ideal angles in sports like basketball (45° shot), football (passing arcs) • Solve simple real-life angle problems	45 min.
Learning products	Worksheets with measured angles and mathematical problem solving. Diagrams of sport movements with angles	
3rd Lesson		
STEM Subject 2	Students explore: • Inclination of tree branches, plant growth toward light	45 min

Name of activity	Procedure	Time
	• Flow of water on slopes (gravity & angle connection) • Observation of animal motion (jumps, takeoff, speed on slopes) • Outdoor angle measurements with protractors	
Learning products	Nature journal or photo-log with measured angles and explanations. Reflection on how nature uses angles efficiently.	
4th Lesson		
STEM Subject 3/non-STEM subject	**PE**: Students test different movements (jumps, throws, passes) under varying angles; record performance **Arts**: Sketch motion sequences of animals and athletes; illustrate how body angles affect motion	45 min
Learning products	*Infographic or poster combining measured data, drawings, and conclusions on the most effective angles.*	

Assessment

Formative assessment through observation, participation, and worksheets

Final assessment

Students complete a creative presentation or written report comparing angles in nature and sports
Rubric-based evaluation focusing on understanding, application, teamwork, and creativit

Student feedback

Students reflect on:

- What surprised them about the connection between nature and sports
- Which activity they found most engaging
- How they now observe movement differently in everyday life

Teacher feedback

Teachers comment on:

- Student engagement across STEM and non-STEM areas
- Effectiveness of cross-disciplinary teaching
- Suggestions for extending the lesson (e.g., field trips, expert talks)

Annex

Annex 1: STEM Angle Worksheet (Mathematics)
Objective: Practice measuring angles and applying angle knowledge in sports-related situations.

No.	Sports situation or image	Estimated angle (before measuring)	Measured angle (with protractor)	Type of angle (acute, right, obtuse, full)	How does the angle affect the movement?
1	Basketball shot				
2	Soccer pass				
3	Long jump takeoff				
4	Free choice (another sport)				

Annex 2: Outdoor Angle Measurement Log (Science/Environmental Studies)
Objective: Observe and measure angles in the natural environment and analyze their significance.

No.	Natural object	Location of observation	Approximate angle	Measured angle	What does this angle tell us?
1	Branch inclination on a tree				
2	Grass/plant bent by the wind				
3	Shadow angle (sunlight direction)				
4	Other observed natural element				

Annex 3: PE Performance Tracker (Physical Education)
Objective: Test movements with different angles and measure their effectiveness.

No.	Exercise	Tested movement angle	Performance (measurement/success)	Most effective angle	Student's comment
1	Soccer pass		Distance / accuracy		

No.	Exercise	Tested movement angle	Performance (measurement/success)	Most effective angle	Student's comment
2	Long jump		Jump length		
3	Basketball shot		Hit or miss		

Rubric for assessing student performance in the **STEAM Lesson on Angles in Nature and Sports**:

Criteria	Excellent (4 pts)	Good (3 pts)	Satisfactory (2 pts)	Needs Improvement (1 pt)
Understanding of Angles in Nature & Sports	Clearly explains and connects angles to natural and sports movements with multiple examples.	Demonstrates good understanding with some minor gaps in explanations.	Shows basic understanding but struggles to connect angles to real-world examples.	Limited understanding of angles; unable to make connections to nature or sports.
Measurement & Data Collection	Accurately measures angles using protractors, records data systematically, and interprets results.	Measures angles with minor errors but mostly accurate interpretations.	Struggles with measurement accuracy and consistency in data collection.	Data is incomplete, inaccurate, or not recorded properly.
Application of Concepts	Effectively applies angle concepts in both sports and nature-based experiments, drawing logical conclusions.	Applies angle concepts with some understanding but minor errors in interpretation.	Attempts application but has difficulty in making clear conclusions.	Does not apply angle concepts correctly or fails to complete the task.
Sports & Nature Experimentation	Conducts experiments thoughtfully, tests multiple angles, and records observations systematically.	Completes experiments correctly but with minor inconsistencies in execution or recording.	Attempts experiments but lacks precision in angle application or recording.	Does not conduct experiments properly or records little to no data.
Use of Real-World Examples	Provides detailed real-world examples of angles in sports and nature with	Provides some relevant examples but with limited depth in	Gives few or unclear examples with minimal connection to	Does not provide real-world examples or explanations.

Criteria	Excellent (4 pts)	Good (3 pts)	Satisfactory (2 pts)	Needs Improvement (1 pt)
	strong explanations.	explanation.	angles.	
Teamwork & Collaboration	Works effectively in a team, actively contributing ideas and supporting group work.	Participates well but needs occasional encouragement in teamwork.	Contributes but relies on others for most tasks.	Minimal participation or disrupts group work.
Presentation & Communication	Clearly presents findings, using data and logical explanations to support conclusions.	Presents results adequately but lacks depth in reasoning.	Presentation is somewhat disorganized, missing key points.	Presentation is unclear, incomplete, or lacks key information.
Engagement & Participation	Fully engaged in discussions, experiments, and asks insightful questions.	Participates well but may need occasional prompting.	Shows limited engagement; participates only when required.	Little to no participation or engagement.

A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

CLIL lesson on ratio and proportion in mathematics applied to physical education

Authors

Angela Bonofiglio

Summary

This lesson introduces students to ratios and proportions, highlighting their significance in physical education. Through interactive activities such as movement demonstrations, fitness course designs, and scavenger hunts, students explore how proportions enhance athletic performance, prevent injuries, and support problem-solving skills.

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Subject (s)

CLIL Lesson: Fit for Proportions: Applying Ratios and Proportions in Physical Education.

Real- life questions

1. How can proportions help athletes train more effectively?

2. How are ratios used to design sports equipment or fitness routines?
3. What role do proportions play in reducing injuries during physical activities?

Aims of the lesson

- Understand the concept of ratios and proportions and their applications in physical education

- Develop linguistic skills in English through describing physical exercises and movements

- Improve problem-solving skills through practical activities

Connection to STEM careers

1. **Sports Scientists:** Use proportions to analyze physical performance and optimize training methods.
2. **Engineers:** Apply ratios in designing sports equipment and calculating structural efficiency.
3. **Data Analysts:** Interpret proportions in sports metrics to predict performance trends.
4. **Health Professionals:** Use ratios to plan proportional exercises during rehabilitation and therapy.

Age of students

14-19

Teaching resources (material & online tools)

Materials

1. *Measuring tapes for distance and spacing calculations.*
2. *Cones or markers for fitness course design.*
3. *Calculators (optional) for precise proportional measurements.*
4. *Images or diagrams of athletes performing sports activities (optional).*

Online Tools

1. *GeoGebra (www.geogebra.org): For modeling ratios and proportions interactively.*
2. *Khan Academy (www.khanacademy.org): Resources for understanding ratios and proportions in practical contexts.*
3. *Google Sheets or Excel: For recording and analyzing proportions during activities.*
4. *Sports Apps: Tools like Hudl for analyzing athletic performance data proportionally.*

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	1. Engagement: Activities focus on hands-on exploration of ratios and proportions, promoting active participation. 2. Relevance: The lesson ties mathematical concepts to physical education, ensuring students understand the practical value of their learning. 3. Language Integration: Encourages the use of English vocabulary related to proportions, enhancing linguistic and subject-based learning.
Instruction	The lesson is structured in a clear, step-by-step format that balances theoretical explanations with practical, interactive activities.
Personalization of learning	Tasks and activities are adaptable for varying levels of mathematical understanding and physical ability, ensuring inclusivity and engagement for all students.
Problem and project-based learning (PBL)	The lesson incorporates PBL through activities such as designing proportional fitness courses and scavenger hunts, encouraging students to solve real-world problems collaboratively.
Game Based Learning (GBL)	Uses games like the proportional scavenger hunt and fitness challenges to make learning engaging and dynamic.
Curriculum implementation	The lesson integrates mathematics, physical education, and language learning, aligning with interdisciplinary education goals and STEM standards.
Emphasis on STEM topics and competencies	Promotes STEM skills like measurement, calculation, and application of proportions to real-life scenarios, fostering problem-solving and critical thinking abilities.
Interdisciplinary instruction	Combines mathematics and physical education while integrating English language learning, offering a holistic approach to understanding proportions.
Contextualization of STEM teaching	Links abstract mathematical concepts to concrete applications in sports and fitness, demonstrating the real-life importance of proportions.
Professionalization of staff	Encourages teachers from different disciplines to collaborate, blending expertise in math, PE, and English to deliver the lesson effectively.
Highly qualified professionals	Requires skilled instructors in mathematics, physical education, and language teaching to ensure a high-quality, interdisciplinary learning experience.
Existence of supporting (pedagogical) staff	Pedagogical staff can assist by adapting activities for diverse learning needs and providing additional resources for struggling students.
Professional development	Teachers are encouraged to attend STEM-focused workshops and interdisciplinary teaching seminars to refine their skills and strategies.

Elements and criteria	**1. Engagement: Activities focus on hands-on exploration of ratios and proportions, promoting active participation.** **2. Relevance: The lesson ties mathematical concepts to physical education, ensuring students understand the practical value of their learning.** **3. Language Integration: Encourages the use of English vocabulary related to proportions, enhancing linguistic and subject-based learning.**
School leadership and culture	Promotes a culture that values interdisciplinary learning and supports innovative teaching practices through collaboration and resource allocation.
School leadership	Provides necessary resources, fosters teamwork among educators, and encourages the integration of STEM topics in lessons across subjects.
High level of cooperation among staff	Requires collaboration among mathematics, PE, and English teachers to ensure the lesson is cohesive, engaging, and effective.
Inclusive culture	Activities are designed to be accessible to all students, regardless of their physical or mathematical abilities, fostering a supportive and inclusive environment.
Connections	The lesson is adaptable to different learning needs and styles, making it accessible to all students.
With industry	Highlights applications of proportions in sports science, engineering, and health-related careers, inspiring students to explore STEM pathways.
With parents/guardians	Engages families by encouraging discussions about proportions in everyday life through homework and activities. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Opportunities for collaborative STEM or CLIL projects between schools. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Partnerships for guest lectures or resources that deepen understanding of ratios and proportions. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Involves local sports facilities or events to apply learning in real-world contexts. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge

Elements and criteria	**1. Engagement: Activities focus on hands-on exploration of ratios and proportions, promoting active participation.** **2. Relevance: The lesson ties mathematical concepts to physical education, ensuring students understand the practical value of their learning.** **3. Language Integration: Encourages the use of English vocabulary related to proportions, enhancing linguistic and subject-based learning.**
	and develop innovative approaches.
School infrastructure	Access to gymnasiums, sports fields, and necessary tools enhances the learning experience by providing an appropriate environment for practical activities.
Access to technology and equipment	Measuring tools like tapes, cones, and calculators are crucial, alongside optional digital platforms for recording and analyzing data.
High quality instruction classroom materials	Includes worksheets, diagrams, and visual aids to ensure clear understanding of ratios and proportions and their applications in physical education.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
	1st Lesson	
Brainstorming and discussion	Introduction (5 minutes) 1. Begin the lesson by asking students if they have already learned about ratios and proportions in mathematics. 2. Write the words "ratio" and "proportion" on the board and ask students to describe what they mean. 3. Introduce the concept of ratios and proportions as a way to describe relationships between quantities.	5 min
Discussion and preparation for the next lesson	**Discussion and Preparation for the Next Lesson** 1. **Class Discussion:** ○ Conclude the lesson by inviting students to share their thoughts on how proportions are used in physical activities.	

Name of activity	Procedure	Time
	○ Pose reflective questions, such as: ▪ "What surprised you the most about proportions in sports?" ▪ "Can you think of other activities where proportions might be useful?" 2. **Preparation for Next Lesson:** ○ Introduce the topic of the next lesson, such as *"In the next session, we'll explore how geometry is used in designing sports fields and equipment. Why do you think proportions are important in these designs?"* 3. **Homework Assignment:** ○ Ask students to design a simple exercise routine using proportions (e.g., different running distances or jumping heights) and provide a written explanation of their proportions.	
2nd Lesson		
STEM Subject 1	Activity 1: Proportions in Movement (15 minutes) 1. Divide the class into small groups and ask them to create a series of movements that demonstrate proportions, such as: - Jumping a certain distance and then jumping half that distance - Running a certain speed and then running at half that speed 2. Ask groups to measure and record the distances and speeds used in their movements. 3. Discuss with the class how proportions are used in physical education to improve performance and reduce injury.	15 min
STEM Subject 1		
Learning products	***Learning Products for Activity 1: Proportions in Movement*** 1. ***Movement Logs:*** *Students record their movements, including the distances and speeds, and calculate the proportions observed.* 2. ***Visual Graphs:*** *Create bar graphs or pie charts comparing the original and proportional distances or speeds for their movements.*	

Name of activity	Procedure	Time
	3. ***Group Presentations:*** *Groups present their findings, explaining how they used proportions to plan and demonstrate their movements.* 4. ***Reflection Sheets:*** *Students write short reflections on how proportions can improve accuracy and performance in physical activities.* 5. ***Video Demonstrations:*** *Groups record their proportional movements, providing verbal descriptions of the ratios involved.*	
3rd Lesson		
STEM Subject 2	Activity 2: Designing a Fitness Course (20 minutes) 1. Ask students to design a fitness course that incorporates proportions, such as: - A series of cones spaced at increasingly shorter distances - A set of hurdles with gradually increasing heights 2. Encourage students to use measuring tapes and calculators to ensure that their course is proportional. 3. Allow students to test their courses and provide feedback to their peers.	20 min
STEM Subject 2		
Learning products	***Learning Products for Activity 2: Designing a Fitness Course*** 1. ***Fitness Course Maps:*** *Students create detailed maps of their proportional fitness courses, labeling distances, heights, and other measurements.* 2. ***Instruction Manuals:*** *Groups write step-by-step instructions for completing their courses, emphasizing how proportions are applied.* 3. ***Peer Feedback Reports:*** *Students evaluate each other's fitness courses, focusing on proportionality and creativity in the design.* 4. ***Course Demonstration Videos:*** *Groups record themselves or their peers testing the fitness courses and discussing the proportional elements.* 5. ***Analysis Reports:*** *Groups analyze the results from testing the courses, discussing the success and challenges of applying proportions.*	
4th Lesson		
STEM Subject 1	Activity 3: Proportional Scavenger Hunt (15 minutes) 1. Create a scavenger hunt that requires students to find examples of proportions in the gym or playground, such as: - A set of stairs with proportional step heights - A basketball hoop with a proportional rim height 2. Ask students to record their findings and calculate the proportions used in each example.	15 min

Name of activity	Procedure	Time
STEM Subject 2		
Learning products	**Learning Products for Activity 3: Proportional Scavenger Hunt** 1. **Proportion Journals:** Students document their findings from the scavenger hunt, including measurements and calculated proportions for each example. 2. **Photo Collections:** Students capture photos of the proportional items they identified and annotate them with explanations of the ratios observed. 3. **Comparison Charts:** Develop charts comparing the different proportional examples discovered during the scavenger hunt. 4. **Class Presentations:** Groups share their scavenger hunt results, explaining the importance of each proportional example in sports or physical activity. 5. **Creative Posters:** Students design posters summarizing their scavenger hunt discoveries, incorporating visuals and proportional calculations.	
4th Lesson		
STEM Subject 1	Conclusion (5 minutes) 1. Gather the class and ask students to share what they have learned about proportions and their applications in physical education. 2. Emphasize the importance of proportions in everyday life and sports. 3. Assign a homework task, such as designing a proportional fitness course or researching how proportions are used in professional sports.	5 min
STEM Subject 2		
Learning products	***Learning Products for Conclusions*** 1. ***Reflection Essays:*** *Students write essays summarizing what they learned about proportions and how these concepts can be applied in sports and beyond.* 2. ***Class Discussion Summaries:*** *Collaboratively create a summary document that captures the key takeaways from the lesson.* 3. ***Proportion Infographics:*** *Students design infographics illustrating the importance of proportions in physical education and daily life.* 4. ***Future Learning Plans:*** *Students outline what they'd like to explore next related to proportions, sports, or STEM topics.*	

Name of activity	Procedure	Time
	5. ***Feedback Forms:*** *Collect feedback from students about what they enjoyed in the lesson and any suggestions for improvement.*	

Assessment

- Observe students during the activities and assess their understanding of proportions and their applications in physical education.

- Review homework assignments to assess their ability to apply proportions to real-world scenarios.

- Use a rubric to assess the accuracy and completeness of students' calculations and designs.

Final assessment

Students complete a project where they:

1. Design a proportional fitness activity (e.g., using distances, heights, or times).
2. Provide precise measurements and calculate the proportions used.
3. Present their work visually (through diagrams or videos) and explain their reasoning in written or spoken English.

Student feedback

- Students fill out feedback forms answering:
    - What they enjoyed about the lesson activities.
    - Which aspects of ratios and proportions they found most challenging or interesting.
    - Suggestions for making the lesson more engaging or clearer.

Teacher feedback

Teachers reflect on the lesson by considering:

- How effectively the students grasped the connection between proportions and physical activities.
- Whether students were able to integrate mathematical concepts into practical exercises.
- Adjustments needed for future lessons to improve clarity and engagement.

Annex 1

1. **Sample Worksheets:** Include practice problems related to ratios and proportions, such as calculating distances or designing proportional exercises.
2. **Fitness Course Templates:** Provide templates for creating proportional fitness courses, with example designs for inspiration.
3. **Visual Aids:** Use diagrams, images of athletes, or proportional fitness scenarios to guide understanding.
4. **Measurement Guidelines:** Step-by-step instructions on how to use measuring tapes and other tools accurately for proportional tasks.
5. **Key Vocabulary List:** A list of important terms in English, such as "ratio," "proportion," "measurement," and "calculation," with definitions and example sentences.
6. **Rubrics for Assessment:** A detailed rubric to assess student projects based on creativity, accuracy, understanding of proportions, and language use.

A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

The History of Ratio and Proportion in Mathematics Applied to Physical Education

Authors

Francesco Mannarino

Summary

The lesson explores the historical development of mathematical concepts, such as ratio and proportion, and examines their practical applications in physical education. From Ancient Greece to modern sports science, these concepts have played a crucial role in understanding performance metrics and designing balanced training methods.

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Subject (s)

The History of Ratio and Proportion in Mathematics Applied to Physical Education.

Real- life questions

1. How can ratios help create fair teams in sports or relay races?
2. Why is the proportion of strength-to-weight important in activities like gymnastics or climbing?
3. How can understanding proportions improve an athlete's performance in their training routines?

Aims of the lesson

Students will understand the historical development of ratio and proportion in mathematics and explore how these concepts are applied in physical education activities and sports.

Connection to STEM careers

Understanding ratio and proportion is foundational for many STEM careers, particularly those that intersect with sports and physical education. For example:

1. **Sports Scientists** use these mathematical principles to analyze athletes' biomechanics and optimize training programs.
2. **Engineers** apply ratios when designing sports equipment, ensuring it meets safety and performance standards.
3. **Data Analysts** in sports rely on proportional data to assess player statistics, game strategies, and performance metrics.
4. **Biophysicists** study the proportional relationships in human motion and muscle dynamics to improve athletic performance and prevent injuries.

By exploring these connections, students can see how math concepts open doors to exciting and impactful careers.

Age of students

14-19

Teaching resources (material & online tools)

Materials

1. Whiteboard and markers (for illustrating concepts like ratios and proportions).
2. Graph paper or printed ratio and proportion worksheets.
3. Sports equipment (e.g., stopwatches, measuring tapes, cones) for physical activity experiments.
4. Handouts or infographics summarizing the history of ratio and proportion.

Online Tools

1. **GeoGebra** (www.geogebra.org): For visualizing and solving ratio and proportion problems interactively.
2. **Desmos** (www.desmos.com): A user-friendly online graphing tool to demonstrate proportional relationships.

3. **Khan Academy** (www.khanacademy.org): Videos and exercises about ratios and proportions.
4. **PE Planning Websites** (e.g., https://www.pecentral.org): For integrating mathematics into physical education lesson plans.

These materials and tools will provide both hands-on and digital learning opportunities for the students.

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	The lesson incorporates interactive activities, historical insights, and practical applications of mathematics, ensuring engagement and understanding.
Instruction	Instruction combines direct teaching, collaborative group tasks, and real-life scenarios to contextualize concepts and encourage active learning.
Personalization of learning	Activities are adaptable to various skill levels, allowing students to engage with content based on their personal interests and abilities, such as specific sports or mathematical challenges.
Problem and project-based learning (PBL)	Students tackle practical problems, like designing balanced teams or analyzing proportions in sports, fostering critical thinking and real-world problem-solving skills.
Game Based Learning (GBL)	Integrates sports-related games to demonstrate ratios and proportions, providing hands-on experience and enhancing engagement through fun activities.
Curriculum implementation	The lesson aligns with math and physical education standards, seamlessly integrating STEM topics into interdisciplinary learning.
Emphasis on STEM topics and competencies	Focuses on mathematical concepts and their applications in physical science, fostering STEM skills like analysis, calculation, and critical thinking.
Interdisciplinary instruction	Merges mathematics with physical education to provide a holistic understanding, emphasizing the interconnected nature of disciplines.
Contextualization of STEM teaching	Shows the relevance of STEM concepts in everyday life by applying ratio and proportion to sports and physical activities.
Professionalization of staff	Encourages staff to develop expertise in interdisciplinary teaching methods and STEM education strategies.
Highly qualified professionals	Facilitators should have knowledge of both mathematics

Elements and criteria	The lesson incorporates interactive activities, historical insights, and practical applications of mathematics, ensuring engagement and understanding.
	and physical education, ensuring effective delivery of the lesson.
Existence of supporting (pedagogical) staff	Pedagogical staff assist in tailoring activities to diverse learning needs and providing additional resources.
Professional development	Teachers are encouraged to attend STEM and physical education workshops for continuous learning and skill enhancement.
School leadership and culture	Promotes a culture that values innovative teaching, interdisciplinary approaches, and STEM education.
School leadership	Supports teachers through resources, training, and fostering a collaborative environment that encourages creativity in lesson planning.
High level of cooperation among staff	Facilitates teamwork among math, science, and PE teachers to create well-rounded interdisciplinary lessons.
Inclusive culture	Ensures that activities are accessible and engaging for all students, regardless of background or ability, promoting inclusivity.
Connections	The lesson is adaptable to different learning needs and styles, making it accessible to all students.
With industry	Students explore how ratio and proportion are used by sports scientists, engineers, and analysts in professional fields.
With parents/guardians	Homework assignments and sports examples encourage discussions with parents, fostering family involvement in learning. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Collaboration with schools specializing in STEM or sports education enriches the learning experience. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Partnerships for guest lectures and advanced resources strengthen the academic connection. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Activities integrate community sports facilities and encourage real-life applications of the concepts taught. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.

Elements and criteria	The lesson incorporates interactive activities, historical insights, and practical applications of mathematics, ensuring engagement and understanding.
School infrastructure	Ensuring access to well-equipped facilities, like gyms and laboratories, for practical and hands-on activities.
Access to technology and equipment	Interactive tools like GeoGebra or Desmos and physical equipment such as stopwatches and measuring tapes ensure effective learning.
High quality instruction classroom materials	Printed handouts, infographics, and digital resources enhance the educational experience, providing clarity and depth to the lesson.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
	1st Lesson	
Brainstorming and discussion	**Introduction (10 minutes)** 1. **Engaging Question:** Start with a question to pique curiosity: "How can mathematical concepts like ratio and proportion shape our physical performance?" 2. **Definition:** Briefly explain what ratio and proportion are: o A *ratio* is a comparison of two quantities, e.g., 2:1. o *Proportion* expresses that two ratios are equal, e.g., 2:1 = 4:2.	10 min
Discussion and preparation for the next lesson	**Discussion and Preparation for the Next Lesson** 1. **Class Discussion:** Conclude the lesson by encouraging students to share their thoughts: o What did they find most surprising about the connection between mathematics and physical education? o How do they think these concepts could be applied in other areas of life or careers? 2. **Preparation for Next Lesson:** Introduce the topic of	

Name of activity	Procedure	Time
	the next lesson to build curiosity: o For example, "In the next lesson, we'll explore how geometry is used in designing sports fields and equipment. Ever wondered why a basketball court has specific dimensions? Stay tuned!" 3. **Homework Assignment:** To prepare for the next lesson, students could: o Research a sport of their choice and identify how mathematics (ratios, geometry, etc.) is used in its rules, strategies, or design. o Bring a small object related to their chosen sport for a hands-on geometry activity.	
2nd Lesson		
STEM Subject 1	**History of Ratio and Proportion (15 minutes)** 1. **Ancient Origins:** Discuss how ratio and proportion date back to Ancient Greece, focusing on Euclid's Elements, which laid the foundation for geometry and ratios. 2. **Applications in Art & Science:** Mention how Renaissance artists used ratios for perspective in painting, and later scientists used proportions in physics and biology. 3. **Evolution in Sports:** Highlight the 20th-century integration of math into sports science, tracking athlete performance and optimizing training regimes.	15 min
STEM Subject 1		
Learning products	*Learning Products* 1. ***Student Presentations:*** *Groups can create short presentations showcasing how ratio and proportion are applied in a specific sport, using visuals and examples.* 2. ***Written Reflections:*** *Individual essays or journal entries where students share insights on the historical significance and modern-day applications of ratio and proportion.* 3. ***Visual Models:*** *Diagrams or graphs illustrating proportional relationships in physical activities (e.g., speed and distance in a race).* 4. ***Interactive Worksheets:*** *Problem-solving exercises where students calculate ratios or proportions based on sports scenarios provided.* 5. ***Creative Posters:*** *Designing posters highlighting the historical evolution of ratio and proportion and their relevance to physical education.*	

Name of activity	Procedure	Time
	6. ***Group Projects:*** *Collaborative task to develop training plans or sports strategies using mathematical principles discussed in class.* *These products offer students opportunities to demonstrate understanding through various formats—encouraging creativity, collaboration, and critical thinking.*	
3rd Lesson		
STEM Subject 2	**Application in Physical Education (20 minutes)** 1. **Sports & Ratio:** o Examples: The ratio of strength-to-weight is crucial in gymnastics; proportions guide the design of relay races. o Discuss how mathematical models help maintain balance in training exercises. 2. **Interactive Activity:** o Group the students and provide them with sports scenarios (e.g., designing a balanced relay team using proportions of speed and endurance). Let them calculate optimal results.	20 min
STEM Subject 2		
Learning products	**Learning Products** 1. **Performance Analysis Reports:** Students create reports where they calculate ratios (e.g., speed-to-time or strength-to-weight) based on their physical activities and analyze the results. 2. **Exercise Plans:** Students design personalized training plans using proportional relationships, such as balancing intensity and duration for optimal performance. 3. **Sports Simulations:** Groups present case studies or simulations that apply ratios to real sports situations, like team compositions or equipment design. 4. **Interactive Charts and Graphs:** Students visually represent data collected during PE activities (e.g., heart rate, distance, and time), showcasing proportional relationships. 5. **Creative Videos:** Teams produce short videos illustrating how mathematical concepts like ratio and proportion enhance physical performance in specific sports. 6. **Group Demonstrations:** Live demonstrations or skits where students explain ratio and proportion through physical activities, making the math visible in motion. 7. **Project Portfolios:** A compilation of all their work during the unit, including calculations, reflections, and creative outputs, to showcase their understanding. These learning products will help students connect theoretical knowledge to practical applications, making the lesson both meaningful and engaging	
4th Lesson		

Name of activity	Procedure	Time
STEM Subject 1	**Reflection & Wrap-up (15 minutes)** 1. **Discussion:** Ask students: "What surprised you about the connection between mathematics and physical activities?" 2. **Homework:** Assign a task to research one more example of how ratio and proportion influence a sport they enjoy.	15 min
STEM Subject 2		
Learning products	**Learning Products** 1. **Group Reflections:** Students share their thoughts and insights in small groups and compile a summary of key takeaways from the lesson. 2. **Class Discussion Notes:** A collective list of ideas and discoveries discussed during the wrap-up phase, highlighting connections between mathematics and physical education. 3. **Personal Reflection Journals:** Students write short entries explaining how the lesson changed their perspective on the importance of math in sports and everyday life. 4. **Future Learning Plans:** Students outline personal goals or questions for further exploration, preparing them for the next lesson. 5. **Creative Summaries:** Design infographics or visual mind maps summarizing the history, applications, and reflections on ratio and proportion. 6. **Peer Feedback Forms:** Students provide constructive feedback to peers on group activities, encouraging collaboration and improvement. These learning products help reinforce the concepts discussed and ensure a meaningful takeaway for each student.	

Assessment

- **Formative Assessments:**
  - Monitor group activities and discussions to check students' understanding of ratio and proportion concepts.
  - Observe individual participation during problem-solving tasks and physical demonstrations.
- **Summative Assessments:**
  - Evaluate completed worksheets, reflection journals, and group presentations for accuracy and creativity.

Final assessment

- Students create a project or presentation demonstrating how they applied ratio and proportion to a specific physical activity or sport.
- The final assessment should include calculations, visual representations (e.g., graphs, diagrams), and a written explanation of their work.

Student feedback

- Students complete an anonymous feedback form addressing:
  - What they enjoyed most about the lesson.
  - What could be improved or clarified in future lessons.
  - How confident they feel about applying ratio and proportion in real-life contexts.

Teacher feedback

- Teachers reflect on the lesson's effectiveness by evaluating:
  - Student engagement and participation.
  - Whether learning objectives were met.
  - Suggestions for refining instructional strategies for future lessons.

Annex 1

- **Sample Worksheets:** Include example ratio and proportion problems related to physical education.
- **Infographic Templates:** Provide a template for students to visualize their data.
- **References:** List any resources or websites used during the lesson.
- **Activity Guidelines:** Detailed steps for conducting group tasks and physical demonstrations.

New Model in Interdisciplinary Teaching – PE - STEM
PHYSICAL EDUCATION LESSON PLAN
PE-RATIO AND PROPORTION

Theme: Stadiums as Symbols of the City





Lesson Information

- **Teacher: Nagehan Baykan Afşar**
- **Subject:** Physical Education
- **Topic:** Ratio and Proportion
- **Theme:** Stadiums as city symbols
- **Grade Level:** Grade 9 (Ages 14–15)
- **Duration:** 40 minutes
- **Lesson Area:** Gym / Schoolyard

Lesson Aim

The aim of this lesson is to help students:

- Understand **ratio and proportion through real-life sports culture**
- Compare a stadium's capacity with the **population of a city**
- Realize that **numbers gain meaning when they are compared**, not when they stand alone

Learning Outcomes

Students will be able to:

- Interpret the ratio between **stadium capacity and city population**
- Explain the concept of ratio **verbally and visually**
- Recognize the role of stadiums as **symbols of a city's identity**

Materials Needed

- Cones
- Field markings / floor tape
- A4 **Information Cards** (population – capacity data)
- Board / flip chart
- (Optional) projector or images

PART 1 – INTRODUCTION TO THE THEME: WHAT IS A STADIUM? (0–8 min)

Purpose

To introduce stadiums not only as sports venues but as **symbols of cities**.

Teacher Input (short and interactive)

- "A stadium is not only a place where matches are played."
- "It is a meeting point, a memory space, and a symbol of a city."

Izmir Example

Gürsel Aksel Stadium (Izmir – Göztepe)

- Approx. **20,000 spectator capacity**
- Izmir population ≈ **4,500,000**

Teacher asks:

"What fraction of Izmir's population could fit into this stadium?"

No calculation yet — **only reasoning and estimation**.

PART 2 – EXPERIENCING RATIO THROUGH MOVEMENT (8–15 min)

Purpose

To transform ratio from abstract numbers into **space and people**.

Activity: "Mini City – Mini Stadium"

1. The activity area is divided into two zones:
    - **Large area = City (Izmir)**
    - **Small area = Stadium**
2. All students represent the **city population**.
3. Teacher says:
    - "Now, how many of you can enter the stadium?"
4. About **one fifth** of the students move into the stadium zone.

Guiding questions:

- "Could everyone fit into the stadium?"
- "Is the stadium a small or large part of the city population?"

Teacher emphasis:

"This relationship is called a RATIO."

PART 3 – MOVEMENT-BASED APPLICATIONS: RATIO STATIONS (15–32 min)

Students are divided into **3 groups**.

STATION 1 – Capacity Ratio

Purpose:
To understand the relationship between stadium capacity and city population.

Activity:

- 10 students = city
- 2 students = stadium

Students express verbally:

"Out of every 10 people, only 2 can enter the stadium."

Guiding question:

"Does this ratio represent a large or a small stadium?"

STATION 2 – Stand Occupancy Ratio

Purpose:
To understand the ratio of filled vs. empty seats.

Activity:

- 5 cones represent stands
- 3 cones = occupied
- 2 cones = empty

Guiding questions:

- "What proportion of the stands is full?"

- "How does this ratio affect the match atmosphere?"

STATION 3 – Spectator / Athlete Ratio

Purpose:
To compare the number of athletes with the number of spectators.

Activity:

- 2 students = athletes
- 10 students = spectators

Guiding question:

"How many people are the athletes performing for?"

Key message:

"Sport is an activity where a few athletes perform for many people."

PART 4 – REFLECTION AND CLOSURE (32–40 min)

Group Sharing

Each group completes one sentence:

- "The ratio between stadium capacity and city population is…"
- "Without ratios, these numbers would not mean much."

Exit Ticket

Teacher asks:

"Today I understood that ratio and proportion are important in sports because …"

Assessment (Physical Education Focused)

Teacher observes:

- Can the student explain ratio verbally?

- Can the student relate people and space correctly?
- Does the student participate actively and safely?

RUBRIC

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
Understanding of Ratio Through Movement	Clearly understands and explains ratio using people, space, and movement examples.	Understands ratio and explains it with basic examples.	Shows partial understanding of ratio; explanations are limited.	Has difficulty understanding ratio even with support.
Application of Ratio in Stadium Context	Accurately relates stadium capacity to city population and explains the relationship clearly.	Relates capacity and population with minor inaccuracies.	Recognizes the relationship but struggles to explain it clearly.	Cannot relate stadium capacity to city population.
Participation in Activities	Actively and enthusiastically participates in all activities and stations.	Participates regularly with good effort.	Participates inconsistently or with low energy.	Rarely participates or avoids activities.
Use of Space and Body Awareness	Uses space correctly to represent ratios and follows instructions precisely.	Uses space mostly correctly with small errors.	Sometimes uses space incorrectly or needs reminders.	Uses space incorrectly and disrupts the activity.
Observation and Verbal Explanation	Clearly explains observations using ratio language (e.g., "out of every…").	Explains observations using simple ratio expressions.	Gives limited or unclear explanations.	Unable to explain observations related to ratio.
Collaboration	Works	Usually	Occasionally	Does not

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
and Respect	cooperatively, respects peers, and supports group tasks consistently.	cooperative and respectful with minor reminders.	disrupts group work or needs reminders.	cooperate or respect group rules.
Safety Awareness	Always follows safety rules and helps others stay safe.	Usually follows safety rules.	Sometimes forgets safety rules.	Frequently ignores safety rules and creates risk.

Key Message of the Lesson

“Ratio is the story behind numbers.”
“Stadiums show how big a city’s heart is.”

Title

Calculating Speed. Speed in Sports

Authors

Tatyana Nikolova

Summary

This interdisciplinary STEAM lesson engages students in exploring the concept of speed through dynamic, real-life examples from the world of sports. By integrating physics, mathematics, ICT, and physical education, the lesson enables students to understand the fundamental relationship between distance, time, and speed using the formula $v = s / t$. Learners participate in hands-on experiments, where they measure distances, record time, and calculate speed in various athletic scenarios such as sprinting, walking, or throwing. Through collaboration and data analysis, they compare results, discuss the influence of technique and physical conditions, and draw conclusions. The lesson also connects scientific concepts to real-world applications, enhancing students' analytical and problem-solving skills while promoting teamwork and an appreciation for physical activity. By linking theory to practice, the lesson highlights the role of speed in sports performance and its relevance in STEM careers such as sports science, biomechanics, engineering, and data analysis.

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Subject (s)

- **Physics** – Understanding the concept of speed (v = s/t), units of measurement, and forces.
- **Mathematics** – Data collection, use of proportions, unit conversion, and data analysis.
- **Physical Education (PE)** – Real-life application through sports activities.
- **ICT** – Use of digital tools (timing apps, video analysis).
- **English Language** – Presenting results and team discussion in English.

Link to Non-STEM Subjects:

- **English** enhances communication, collaboration, and presentation skills, essential in group work and scientific reporting.
- **PE** brings contextualization and engagement, supporting physical wellness and interdisciplinary learning.

Real- life questions

- How do athletes increase their speed?
- What role does speed play in different sports?
- How can technology help measure and improve performance?

- How does understanding speed impact safety and success in sports?

Aims of the lesson

- *Understand and apply the formula for speed: v = s / t.*
- *Demonstrate the relationship between distance, time, and speed through real sports activities.*
- *Develop proportional reasoning when comparing speeds and distances.*
- *Enhance teamwork and digital literacy.*

Connection to STEM careers

Students will explore connections to careers such as:

- *Sports Analyst*
- *Biomechanics Expert*
- *Sports Engineer*
- *Data Scientist in Athletics*
- *Physical Therapist*
- *Fitness Coach*

Activities demonstrate how physics and math are applied in sports technology, performance analysis, and health sciences.

Age of students

14-19

Teaching resources (material & online tools)

Materials:

- *Measuring tapes (20–50 m)*
- *Stopwatches or mobile timing apps*
- *Sports equipment (balls, cones, jump rope)*
- *Data recording tables (printed or digital)*
- *Printed worksheets (see Annex)*

Online Tools:

- *Google Sheets or Excel (for data analysis)*
- *Stopwatch/timer apps*
- *Slow-motion video apps (e.g. Hudl Technique)*
- *Kahoot/Quizizz for recap quizzes*

21st century skills

1. Critical Thinking and Problem Solving

- Students analyze data, interpret results, and reflect on influencing factors.
- Apply physics concepts to real-life scenarios.

2. Communication and Collaboration

- Work in teams during practical experiments and group presentations.

- Engage in discussions, compare findings, and share insights.

3. Creativity and Innovation

- Explore creative strategies for improving performance or measuring speed.
- Design custom challenges or adapt the tasks to different sports.

4. Digital Literacy

- Use timing apps, online tools, or software to support data collection and analysis.
- Optionally, prepare digital presentations or reports.

5. Initiative and Entrepreneurship

- Take active roles in planning, executing, and evaluating their own experiments.
- Identify real-world applications of the learned concepts.

6. Social and Interpersonal Skills

- Build respect, teamwork, and active listening in group settings.
- Foster inclusive and supportive classroom culture.

7. Life and Career Skills

- Understand how physics and sports connect to careers such as athletic coaching, sports analytics, and biomechanics.
- Encourages interest in applied sciences and STEM career paths.

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	How is this criterion addressed in the learning scenarioa
Instruction	
Personalization of learning	Tailoring activities to students' individual needs, interests, or abilities.
Problem and project-based learning (PBL)	Engaging students in solving real-world problems or completing meaningful projects.
Game Based Learning (GBL)	Using games or competitive elements to motivate learning and enhance engagement.
Curriculum implementation	
Emphasis on STEM topics and competencies	Focusing on key concepts and skills from Science, Technology, Engineering, and Mathematics.
Interdisciplinary instruction	Integrating content and methods from multiple subjects to provide a holistic learning experience.
Contextualization of STEM teaching	Connecting theoretical STEM knowledge with real-life situations and practical applications.
Professionalization of staff	
Highly qualified professionals	Involvement of skilled and trained teachers in lesson delivery.
Existence of supporting (pedagogical) staff	Collaboration with assistant teachers, mentors, or coordinators.
Professional development	Opportunities for continuous training and upskilling of educators.
School leadership and culture	
School leadership	Support from school leaders for innovative teaching practices and resources.
High level of cooperation among staff	Strong collaboration and communication between teachers

Elements and criteria	How is this criterion addressed in the learning scenarioa
	across subjects.
Inclusive culture	Ensuring that all students feel valued and are given equal opportunities to participate and succeed.
Connections	
With industry	Cooperation with companies or professionals to enrich learning with real-world insight.
With parents/guardians	Engaging families in the educational process through communication or activities.
With other schools and/or educational platforms	Collaboration between schools or via digital learning platforms.
With universities and/or research centers	Involvement of higher education institutions for expertise or mentorship.
With local communities	Connecting learning to community initiatives, spaces, or events.
School infrastructure	
Access to technology and equipment	Availability of tools, devices, and internet connectivity to support learning.
High quality instruction classroom materials	Use of engaging, accurate, and varied educational materials.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
1st Lesson		
Brainstorming and discussion	Brainstorming: What affects speed? Examples from sports. Small group discussion.	30 min
Discussion and preparation for the next lesson	Introduction to speed formula (v = s/t), units, and proportions. Students prepare experiment setups.	15 min
2nd Lesson		
STEM Subject 1	**Physics + Math** – Practical experiments: Measure 20 m; time walk/run/ball throw; record data Group work: Calculate speed and proportions, graph results, discuss variability	45 min

Name of activity	Procedure	Time
Learning products	*Speed calculations table, bar charts comparing results*	
3rd Lesson		
STEM Subject 2	**PE + ICT** – Repeat experiments with variations (ball roll, jumps). Record slow-mo video for technique analysis Analyze footage using apps; reflect on technique vs. speed	45 min
Learning products	Annotated videos, observations, team reflections	
4th Lesson		
STEM Subject 3/non-STEM subject	English + STEM Integration – Present group findings, discuss factors influencing results Final quiz via Kahoot; Homework task: Observe a sports event and calculate speed of an object/athlete	45 min
Learning products	*Group presentations, quiz results, homework reflection*	

Assessment

- **Formative:**
  - **Observation during activities**
  - **Peer feedback in groups**
  - **Exit tickets ("What did I learn today?")**

Final assessment

- **Speed calculation worksheet**
- **Group presentation rubric (clarity, accuracy, teamwork)**
- **Final quiz results**

Student feedback

Collected via Google Forms: "What was most engaging? What would you improve?"

Teacher feedback

Reflections on student engagement, interdisciplinary collaboration, and suggested improvements

Annex

Worksheet 1: Measuring and Calculating Speed

Student Name: _____
Group: _____
Date: _____

№	Type of Activity (running, throwing, etc.)	Distance Covered (m)	Time Measured (sec)	Calculated Speed (v=s/t) (m/s)	Notes/ Observations
1					
2					
3					

Worksheet 2: Proportions and Comparisons
Student Name: _____
Group: _____
Date: _____
Task 1: Speed Comparison

1. Athlete A runs 100 meters in 12 seconds.
   ➤ Their speed is: _____ m/s
2. Athlete B runs 150 meters in 15 seconds.
   ➤ Their speed is: _____ m/s

Who is faster? Why?

_____

Task 2: Proportional Reasoning
A student runs 20 meters in 4 seconds. How long would it take them to run 50 meters at the same speed?
Solution:

- Formula: time = _____
- Answer: _____ seconds

Worksheet 3: Reflection and Analysis
Student Name: _____

1. Which activity did you perform the fastest? Why do you think so?

---

2. What affected your speed the most? (Tick one or more)

☐ Distance
☐ Technique
☐ Fatigue
☐ Type of activity
☐ Other: _____

---

3. If you wanted to improve your speed, what would you change?

---

4. What did you learn about the connection between **physics and sports**?

Rubric for STEAM Lesson - Calculating Speed in Sports

Criteria	Excellent (4 pts)	Good (3 pts)	Satisfactory (2 pts)	Needs Improvement (1 pt)
Understanding of Speed Concepts	Clearly explains speed, distance, and time relationships. Applies formula correctly in all instances.	Demonstrates good understanding but may make minor errors in explanations or calculations.	Shows basic understanding but struggles with applying the formula or explaining concepts.	Limited understanding of speed; unable to apply formula correctly.
Data Collection & Accuracy	Accurately measures time and distance, records data neatly, and ensures consistency.	Minor errors in measurements or data recording but overall accurate.	Some inconsistencies in data collection, affecting results.	Data is incomplete, inaccurate, or not recorded properly.
Calculation & Application of Formula	Applies the speed formula correctly in all cases, showing clear and precise calculations.	Mostly correct application but with minor miscalculations.	Struggles with applying the formula, with frequent mistakes.	Unable to apply formula correctly or does not attempt calculations.
Analysis & Discussion	Effectively compares results, discusses influencing factors, and provides insightful conclusions.	Discusses results logically, with some understanding of factors affecting speed.	Limited discussion with minimal analysis of speed variations.	No meaningful discussion or analysis of results.
Teamwork & Collaboration	Works effectively in a team, taking initiative and supporting group work.	Participates actively but may need some guidance in teamwork.	Contributes to group but relies on others for most tasks.	Minimal participation or disrupts group work.
Presentation &	Clearly presents	Presents results	Presentation is	Presentation is

Criteria	Excellent (4 pts)	Good (3 pts)	Satisfactory (2 pts)	Needs Improvement (1 pt)
Communication	findings with well-organized data and logical explanations.	adequately with some minor gaps in clarity.	disorganized, missing some key points.	unclear or incomplete.
Engagement & Participation	Fully engaged in activities, asks insightful questions, and actively participates.	Participates well but may need occasional encouragement.	Shows limited engagement; participates only when prompted.	Little to no participation or engagement.

A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

CLIL lesson on statistical analysis in mathematics applied to physical education

Authors

Angela Bonofiglio

Summary

This lesson explores statistical concepts and data analysis, highlighting their application in physical education. Through hands-on activities, students collect, organize, interpret, and present sports data, enhancing critical thinking, linguistic skills in English, and understanding of athletic performance.

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Subject (s)

CLIL Lesson: Sports Statistics: Understanding and Analyzing Data in Physical Education.

Real- life questions

1. How can statistics help athletes improve their performance?
2. How are trends and patterns in sports data used to make strategic decisions?
3. What role does data analysis play in injury prevention and fitness optimization?

Aims of the lesson

- Understand the concept of statistics and data analysis in physical education

- Develop linguistic skills in English through describing and interpreting sports data

- Improve critical thinking skills through data analysis and interpretation

Connection to STEM careers

1. **Sports Analysts:** Use statistics to evaluate performance and plan strategies.

2. **Data Scientists:** Analyze trends and patterns in athletic data to provide actionable insights.
3. **Biomechanical Engineers:** Apply data analysis to design optimized sports equipment.
4. **Health Professionals:** Use statistics for rehabilitation programs and fitness assessments.

Age of students

14-19

Teaching resources (material & online tools)

Materials

1. Sports data sets (e.g., football, basketball, tennis).
2. Calculators for statistical calculations.
3. Computers with spreadsheet software (e.g., Excel) for data organization and visualization.
4. Graph paper for creating visual representations of data.

Online Tools

1. **Excel or Google Sheets:** For data organization and graph creation.
2. **Khan Academy** (www.khanacademy.org): Resources for learning statistical concepts.
3. **Sports Analytics Platforms:** Tools like Hudl for real-time analysis of sports data.
4. **GeoGebra** (www.geogebra.org): Interactive modeling of statistical graphs and trends.

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	1. **Interactive Learning: The lesson focuses on hands-on exploration of sports data, fostering both engagement and deeper understanding.** 2. **Relevance to Real Life: By connecting statistics to sports, students see the practical applications of mathematical concepts.** 3. **Integration of Language Skills: Students use English vocabulary to describe, interpret, and present sports data, improving communication skills.**
Instruction	The lesson uses structured instruction, including data collection, interpretation, and presentation phases, ensuring clarity and progression of learning.
Personalization of learning	Activities are adaptable to students' abilities and interests, allowing for differentiated learning experiences based on the complexity of data sets and tasks.

Elements and criteria	1. Interactive Learning: The lesson focuses on hands-on exploration of sports data, fostering both engagement and deeper understanding. 2. Relevance to Real Life: By connecting statistics to sports, students see the practical applications of mathematical concepts. 3. Integration of Language Skills: Students use English vocabulary to describe, interpret, and present sports data, improving communication skills.
Problem and project-based learning (PBL)	Students engage in data analysis projects that mimic real-life problem-solving in sports statistics, encouraging collaboration and critical thinking.
Game Based Learning (GBL)	Students explore statistical concepts interactively, using sports-related data sets to make learning engaging and directly linked to real-world scenarios.
Curriculum implementation	The lesson aligns mathematics, physical education, and language learning curricula, integrating these disciplines into a coherent educational experience.
Emphasis on STEM topics and competencies	Focuses on data collection, analysis, and interpretation, promoting foundational STEM competencies like critical thinking, problem-solving, and statistical reasoning.
Interdisciplinary instruction	Combines mathematics, physical education, and English language instruction, encouraging students to connect concepts across these fields.
Contextualization of STEM teaching	Links statistical concepts to sports, helping students understand the importance of STEM skills in physical education and athletic performance.
Professionalization of staff	Encourages interdisciplinary collaboration among teachers from different fields to deliver a lesson that integrates math, physical education, and language learning.
Highly qualified professionals	Teachers with expertise in mathematics, data analysis, physical education, and English language instruction are essential to ensure effective delivery of the lesson.
Existence of supporting (pedagogical) staff	Pedagogical staff can provide additional assistance, ensuring all students understand and engage with the material, especially those requiring extra support.
Professional development	Teachers are encouraged to attend workshops on STEM teaching methods and interdisciplinary education, equipping them to deliver innovative lessons.
School leadership and culture	Fosters a culture that values innovation, STEM education, and cross-disciplinary collaboration, creating an environment where lessons like this thrive.
School leadership	Provides teachers with resources, training, and opportunities for collaboration, encouraging the integration of STEM topics into regular curricula.

Elements and criteria	1. Interactive Learning: The lesson focuses on hands-on exploration of sports data, fostering both engagement and deeper understanding. 2. Relevance to Real Life: By connecting statistics to sports, students see the practical applications of mathematical concepts. 3. Integration of Language Skills: Students use English vocabulary to describe, interpret, and present sports data, improving communication skills.
High level of cooperation among staff	Facilitates teamwork among teachers from math, physical education, and language departments to ensure a cohesive and engaging lesson.
Inclusive culture	Designs activities to be accessible to all students, ensuring inclusivity in both physical and academic aspects of the lesson.
Connections	The lesson is adaptable to different learning needs and styles, making it accessible to all students.
With industry	Highlights real-world applications of sports statistics in careers like sports analytics and engineering.
With parents/guardians	Engages parents by encouraging students to discuss sports-related statistics at home. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Opportunities to share projects or collaborate on STEM-based educational activities. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Access to resources or guest lectures from experts in sports science and data analysis. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Encourages the use of local sports facilities or data to make learning relatable and grounded in the community. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	Access to appropriate technology, such as computers and software for data analysis, as well as facilities for physical activities, enhances the learning experience.
Access to technology and equipment	Use of calculators, computers with spreadsheet software, and graph paper ensures students can perform data analysis and create visual representations effectively.
High quality instruction classroom	Includes detailed sports data sets, example graphs, and

Elements and criteria	**1. Interactive Learning: The lesson focuses on hands-on exploration of sports data, fostering both engagement and deeper understanding.** **2. Relevance to Real Life: By connecting statistics to sports, students see the practical applications of mathematical concepts.** **3. Integration of Language Skills: Students use English vocabulary to describe, interpret, and present sports data, improving communication skills.**
materials	worksheets to support student understanding and engagement.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
	1st Lesson	
Brainstorming and discussion	Introduction (5 minutes) 1. Begin the lesson by asking students if they have already learned about statistics and data analysis in mathematics. 2. Write the words "statistics" and "data analysis" on the board and ask students to describe what they mean. 3. Introduce the concept of statistics and data analysis in physical education, highlighting their importance in understanding athletic performance.	5 min
Discussion and preparation for the next lesson	**Discussion and Preparation for the Next Lesson** 1. **Class Discussion:** o Wrap up the lesson with reflective questions, such as: ▪ "What was the most surprising trend or pattern you discovered in the data?" ▪ "How can data analysis help athletes and coaches make better decisions?" o Encourage students to share any questions or insights they found during the activities.	

Name of activity	Procedure	Time
	2. **Preparation for Next Lesson:** o Introduce the next topic, such as *"Next time, we'll explore how mathematical modeling is used to analyze game strategies—what types of data do you think are important for team sports?"* 3. **Homework Assignment:** o Assign a sports data set for students to analyze and ask them to create a graph visualizing trends or patterns. o Alternatively, ask students to research how statistics are used in a specific sport or team they enjoy.	
2nd Lesson		
STEM Subject 1	Activity 1: Collecting and Organizing Data (15 minutes) 1. Divide the class into small groups and assign each group a sports data set (e.g. football, basketball, tennis). 2. Ask groups to collect and organize the data, using calculators and computers to calculate means, medians, and modes. 3. Encourage students to use spreadsheet software to create tables and graphs to visualize the data.	15 min
STEM Subject 1		
Learning products	***Learning Products for Activity 1: Collecting and Organizing Data*** 1. ***Data Tables:*** *Students create organized tables displaying the collected sports data, including calculated means, medians, and modes.* 2. ***Spreadsheet Outputs:*** *Use spreadsheet software to generate clean and visually appealing tables for better organization.* 3. ***Comparative Charts:*** *Students design comparative bar or line graphs to illustrate trends in their data.* 4. ***Reflection Logs:*** *Write short logs detailing the process of organizing the data and the challenges they faced.* 5. ***Data Visualization Infographics:*** *Create infographics summarizing key data points, enhancing comprehension through visuals.*	
3rd Lesson		
STEM Subject 2	Activity 2: Interpreting Data (20 minutes) 1. Ask groups to interpret their data, using statistical	20 min

Name of activity	Procedure	Time
	concepts to analyze trends and patterns. 2. Encourage students to use graph paper to create graphs and charts to visualize their findings. 3. Circulate around the room to assist groups and facilitate discussion.	
STEM Subject 2		
Learning products	***Learning Products for Activity 2: Interpreting Data*** 1. ***Analysis Reports:*** *Students write reports interpreting their data, explaining trends, patterns, and significant insights.* 2. ***Graph Creations:*** *Use graph paper or digital tools to create detailed graphs and charts showing their statistical findings.* 3. ***Group Discussion Summaries:*** *Summarize group interpretations and discussions about the data's implications.* 4. ***Visual Storyboards:*** *Design storyboards to narrate trends in the data creatively, using visuals and brief descriptions.* 5. ***Statistical Predictions:*** *Make predictions about future performance trends based on the analyzed data.*	
4th Lesson		
STEM Subject 1	Activity 3: Presenting Findings (15 minutes) 1. Ask each group to present their findings to the class, using statistical language to describe their results. 2. Encourage students to use visual aids, such as graphs and charts, to support their presentations. 3. Allow time for questions and discussion.	15 min
STEM Subject 2		
Learning products	**Learning Products for Activity 3: Presenting Findings** 1. **Group Presentations:** Deliver engaging presentations using graphs, charts, and infographics to explain findings clearly. 2. **Slide Decks:** Use PowerPoint or similar tools to create polished and professional slides supporting their presentations. 3. **Peer Feedback Forms:** Groups evaluate each other's presentations using feedback forms to assess clarity and creativity. 4. **Discussion Summaries:** Compile summaries of class discussions after each presentation, highlighting key insights.	

Name of activity	Procedure	Time
	5. **Video Recordings:** Record presentations for reflection and review, helping students improve presentation skills.	
5th Lesson		
STEM Subject 1	Conclusion (5 minutes) 1. Gather the class and ask students to reflect on what they have learned about statistics and data analysis in physical education. 2. Emphasize the importance of statistical analysis in understanding athletic performance and making informed decisions. 3. Assign a homework task, such as analyzing a sports data set or creating a sports-related graph.	5 min
STEM Subject 2		
Learning products	**Learning Products for Conclusions** 1. **Reflection Essays:** Write essays summarizing what they've learned about statistics and its applications in sports. 2. **Collaborative Summary Charts:** Create a class chart or poster summarizing key takeaways and trends from the lesson. 3. **Feedback Forms:** Students provide feedback on the lesson, sharing what they enjoyed and areas for improvement. 4. **Future Learning Plans:** Outline areas they'd like to explore further, such as statistical modeling or sports-specific analytics. 5. **Creative Posters:** Design posters emphasizing the importance of data analysis in sports, incorporating graphs or examples.	

Assessment

- Observe students during the activities and assess their understanding of statistical concepts and data analysis.

- Review homework assignments to assess their ability to apply statistical concepts to real-world scenarios.

- Use a rubric to assess the accuracy and completeness of students' presentations and written reports.

Final assessment

Students complete a comprehensive project where they:

1. Select a sports data set and organize it into tables and graphs.
2. Analyze trends and patterns, calculating statistical measures (mean, median, mode).
3. Present their findings in a visual format, such as a slideshow or infographic, supported by a written report explaining their analysis

Student feedback

Students provide feedback through a form or survey, reflecting on:

- Which activities were most engaging and why.
- Any challenges they faced while learning statistical concepts.
- Suggestions for improving the lesson or making activities more effective.

Teacher feedback

Teachers reflect on the lesson's success by asking:

- Did students effectively grasp statistical concepts and apply them to sports data analysis?
- Was the integration of language skills in interpreting and presenting data effective?
- What adjustments could be made to enhance clarity or engagement in future lessons?

Annex 1

1. **Sports Data Sets:** Provide pre-selected data sets (e.g., player statistics, game scores) for students to analyze.
2. **Worksheet Templates:** Include templates for organizing data and performing calculations (mean, median, mode).

3. **Graphing Guidelines:** Instructions for creating various types of graphs, such as bar graphs or scatter plots, both manually and digitally.
4. **Visual Aids:** Example graphs and charts illustrating trends or patterns in sports data.
5. **Vocabulary Lists:** Key English terms related to statistics (e.g., mean, median, mode, trend, data analysis) with definitions.
6. **Rubrics:** Detailed rubrics for evaluating student presentations and written reports based on clarity, accuracy, and creativity.

A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

The History of Statistical Analysis in Mathematics Applied to Physical Education

Authors

Francesco Mannarino

Summary

The lesson explores the evolution of statistical analysis, from its origins in ancient record-keeping to its modern-day applications in sports and physical education. Students learn how statistics enhance performance tracking, injury prevention, and team strategy development, bridging the gap between mathematics and physical activities.

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Subject (s)

The History of Statistical Analysis in Mathematics Applied to Physical Education.

Real- life questions

1. How do coaches and sports scientists use statistics to evaluate player performance?
2. How can statistical analysis help reduce injuries in athletes?
3. What role does data play in predicting success in sports and physical education?

Aims of the lesson

Students will explore the historical development of statistical analysis in mathematics and understand its applications in monitoring and improving physical education and sports performance.

Connection to STEM careers

1. **Sports Analysts:** Use statistical tools to interpret player and team performance metrics, contributing to game strategies and training plans.
2. **Data Scientists:** Develop predictive models for sports performance and injury prevention, bridging math and technology.
3. **Engineers:** Apply statistical methods in designing innovative sports equipment and facilities.
4. **Health Professionals:** Analyze physical activity data to promote wellness and prevent injuries in athletes.

Age of students

14-19

Teaching resources (material & online tools)

Materials

1. Graph paper or notebooks for manual data recording and analysis.
2. Sports performance data (e.g., speed, distance, heart rates) for activities.
3. Infographics or charts demonstrating historical development and applications of statistics.
4. Calculators or statistical software for data analysis tasks.

Online Tools

1. **Excel or Google Sheets:** For organizing and analyzing sports-related statistical data.
2. **Sports Performance Apps:** Tools like Hudl or Dartfish for real-time analysis of athletes' data.
3. **Khan Academy Statistics Courses:** Online resources for understanding statistical concepts.
4. **Sports Data Platforms:** Access to databases like FIFA or NBA stats for educational purposes.

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	1. Focus on hands-on activities and data analysis to enhance understanding. 2. Use of real-world sports data to ensure relevance and application. 3. Emphasis on critical thinking, collaboration, and communication skills.
Instruction	The lesson combines direct teaching with collaborative group tasks, promoting both theoretical and practical understanding of statistical analysis in physical education.
Personalization of learning	Activities and data sets are tailored to meet the diverse interests and abilities of students, ensuring engagement and accessibility for all.
Problem and project-based learning (PBL)	Students solve real-life problems by analyzing sports data, fostering problem-solving, and teamwork skills.
Game Based Learning (GBL)	Incorporates games where students use statistics to evaluate performance or predict outcomes, ensuring learning through fun and interactive experiences.
Curriculum implementation	Aligned with math, physical education, and STEM

Elements and criteria	1. Focus on hands-on activities and data analysis to enhance understanding. 2. Use of real-world sports data to ensure relevance and application. 3. Emphasis on critical thinking, collaboration, and communication skills.
	learning standards, integrating statistical analysis seamlessly into interdisciplinary education.
Emphasis on STEM topics and competencies	Promotes skills in data collection, analysis, and interpretation, foundational for STEM education and careers.
Interdisciplinary instruction	Connects mathematics and physical education, providing a comprehensive understanding of how these fields interact.
Contextualization of STEM teaching	Demonstrates the relevance of statistical analysis in sports and everyday physical activities to make the content meaningful and relatable.
Professionalization of staff	Encourages staff to collaborate and develop expertise in interdisciplinary teaching methods, integrating math and physical education.
Highly qualified professionals	Requires knowledgeable teachers in mathematics and physical education to deliver content effectively and engagingly.
Existence of supporting (pedagogical) staff	Pedagogical staff offer additional guidance and resources to ensure all students can participate and succeed.
Professional development	Teachers are encouraged to attend workshops on integrating STEM and sports education for continuous learning and improvement.
School leadership and culture	Fosters a school environment that values collaboration, innovation, and interdisciplinary learning.
School leadership	Supports teachers by providing training, resources, and a conducive atmosphere for experimentation and creativity in teaching.
High level of cooperation among staff	Encourages teamwork among teachers from different disciplines to design effective and engaging lessons.
Inclusive culture	Activities are designed to be accessible to all students, ensuring that diverse learning needs are met in an inclusive environment.
Connections	The lesson is adaptable to different learning needs and styles, making it accessible to all students.
With industry	Introduces students to careers in sports analytics, engineering, and health sciences.
With parents/guardians	Encourages discussions at home through homework or activities that involve real-life applications of statistics. Encourage parents to join activities like family sports events, collaborative English games, or storytelling

Elements and criteria	1. Focus on hands-on activities and data analysis to enhance understanding. 2. Use of real-world sports data to ensure relevance and application. 3. Emphasis on critical thinking, collaboration, and communication skills.
	sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Opportunities for collaborative projects or sharing best practices. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Partnerships for expert guest lectures or access to research resources. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Involves community sports teams or local facilities to demonstrate the application of statistical analysis. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	Access to both sports facilities and technology tools is essential for conducting engaging and practical activities.
Access to technology and equipment	Use of devices like computers, tablets, and statistical software ensures accurate data analysis and visualization.
High quality instruction classroom materials	Includes detailed handouts, data sets, and interactive tools to support student learning and engagement.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
	1st Lesson	
Brainstorming and discussion	**Introduction (10 minutes)** 1. **Engaging Question:** Start with a thought-provoking question: "Have you ever wondered how coaches decide which athlete has the best performance or how	10 min

Name of activity	Procedure	Time
	team strategies are optimized?" 2. **Definition:** Briefly explain what statistical analysis is: o The collection, organization, interpretation, and presentation of numerical data. **Relevance:** Highlight how statistics are used in physical education and sports for performance tracking, injury prevention, and team analysis.	
Discussion and preparation for the next lesson	**Discussion and Preparation for the Next Lesson** 1. **Class Discussion:** Wrap up the lesson by asking thought-provoking questions to consolidate learning: o "What surprised you most about how statistics are applied in sports?" o "Can you think of other ways statistics could improve physical activities or sports strategies?" 2. **Preparation for Next Lesson:** Introduce the topic of the upcoming lesson to pique curiosity: o For example, "In the next lesson, we'll explore how geometry is used in designing sports fields and equipment—have you ever wondered why football fields or tennis courts have specific dimensions?" 3. **Homework Assignment:** Prepare students for the next lesson by assigning tasks: o Research one example of how geometry shapes sports equipment or playing fields. o Bring a small item related to a sport (e.g., a ball or racket) for hands-on geometry activities in the next session. This structure ensures the students are engaged, curious, and ready to build on their learning journey.	
2nd Lesson		
STEM Subject 1	**History of Statistical Analysis (15 minutes)** 1. **Early Developments:** o Explain how statistics originated in Ancient Egypt and Babylon, with records kept for	15 min

Name of activity	Procedure	Time
	administrative purposes. o Discuss 17th-century advancements: John Graunt, the founder of demographic statistics, and his influence on data recording methods. 2. **19th Century Applications in Sports:** o Early use of statistical analysis to compare athletes' performances. 3. **20th and 21st Century Modernization:** o Introduction of advanced statistical tools and technology for analyzing player performance, injury rates, and game strategies. o Development of predictive analytics to forecast player and team success rates.	
STEM Subject 1		
Learning products	***Learning Products*** 1. ***Infographics:*** *Students create visual representations summarizing the historical milestones of statistical analysis and its relevance to sports and physical education.* 2. ***Group Presentations:*** *Teams develop short presentations or skits illustrating how statistical methods have been applied in sports across different periods in history.* 3. ***Research Papers:*** *Individual students write essays discussing the evolution of statistical analysis and its contributions to modern sports science.* 4. ***Case Studies:*** *Groups analyze historical sports data to identify trends and draw insights, showcasing their understanding of statistical principles.* 5. ***Creative Timelines:*** *Students design illustrated timelines highlighting key events and figures in the history of statistical analysis.* 6. ***Poster Designs:*** *Design posters explaining specific statistical concepts and their applications in physical education.* 7. ***Interactive Media:*** *Students develop digital content, such as videos or slideshows, connecting the historical development of statistics to real-life sports examples.* *These learning products will engage students creatively while deepening their understanding of the topic.*	
3rd Lesson		
STEM Subject 2	**Applications in Physical Education (20 minutes)** 1. **Performance Tracking:** o Discuss how statistics are used to monitor fitness levels, heart rates, and endurance during physical education activities.	20 min

Name of activity	Procedure	Time
	2. **Injury Prevention:** o Explore how injury data is analyzed to create safer training programs. 3. **Team and Game Analysis:** o Explain how statistical data is used to develop team strategies and assess opponents. **Interactive Activity:** Divide the class into groups and provide real-world sports data (e.g., player statistics or team performance data). Assign each group to analyze the data and present key insights, such as identifying trends or making predictions.	
STEM Subject 2		
Learning products	*Learning Products* 1. ***Data Analysis Reports:*** *Students analyze real or simulated physical activity data (e.g., heart rate, speed, or endurance) and produce reports summarizing their findings using statistical methods.* 2. ***Training Plans:*** *Groups design training programs or strategies based on statistical data, optimizing performance for specific sports or physical activities.* 3. ***Visual Presentations:*** *Students create charts, graphs, or infographics demonstrating how statistical analysis improves decision-making in sports and physical education.* 4. ***Case Studies:*** *Teams explore real-life examples of sports analytics, such as predicting team performance or analyzing injury patterns, and present their conclusions.* 5. ***Interactive Demonstrations:*** *Groups conduct live exercises (e.g., measuring running times) and use statistics to evaluate and compare results.* 6. ***Digital Projects:*** *Create videos or slideshows illustrating the application of statistical analysis in different sports and its impact on athletes' performance.* 7. ***Performance Dashboards:*** *Students use tools like Excel or Google Sheets to create dashboards tracking key metrics for a chosen sport or activity.* 8. ***Creative Portfolios:*** *Compile all outputs from the lesson (reports, graphs, training plans, and reflections) into a cohesive portfolio showcasing their learning journey.* *These products provide hands-on, creative, and analytical ways for students to demonstrate their understanding and application of statistics in physical education.*	
4th Lesson		
STEM Subject 1	**Reflection and Wrap-Up (15 minutes)** 1. **Discussion:** Engage students in a conversation: o How has statistical analysis influenced the way sports are played today? o What other areas of life rely heavily on	15 min

Name of activity	Procedure	Time
	statistics? 2. **Homework:** Assign students a task to research one statistical technique used in sports and summarize its impact.	
STEM Subject 2		
Learning products	**Learning Products** 1. **Individual Reflections:** Students write short essays or journal entries about their main takeaways from the lesson and how they can apply statistical analysis in sports or daily life. 2. **Group Summary Reports:** Teams compile a summary of the class discussion, highlighting key concepts and insights shared by peers. 3. **Visual Representations:** Students create posters, diagrams, or infographics summarizing the connections between mathematics, statistics, and physical education. 4. **Feedback Forms:** Students complete feedback forms detailing what they found engaging and what areas they'd like to explore further, fostering a reflective learning process. 5. **Creative Outputs:** Design a short story or video that narrates how statistics changed the world of sports, connecting the lesson to real-life applications. 6. **Next Steps Outline:** Students draft ideas or goals for the upcoming lesson, building anticipation and encouraging active engagement. 7. **Class Reflection Board:** Collaborate to create a shared board where students post sticky notes with their reflections, questions, and suggestions for the next lesson. These products aim to solidify learning, encourage collaboration, and foster meaningful reflection among students.	

Assessment

- **Formative Assessments:**

    - Observe student participation during group discussions and data analysis activities.
    - Check understanding through in-class problem-solving tasks and short quizzes.
- **Summative Assessments:**
    - Evaluate group presentations, individual essays, or research projects for accuracy, creativity, and depth of analysis.

Final assessment

- Students submit a project analyzing a specific set of sports or physical activity data. The project should include:
    1. Statistical calculations (e.g., averages, percentages).
    2. Visual representations (e.g., graphs, charts).
    3. A written explanation linking their findings to real-life applications in sports or physical education.

Student feedback

- Use a feedback form or an interactive tool to gather student opinions on:
    - The clarity and engagement of the lesson.
    - What they enjoyed the most and areas for improvement.
    - Their confidence in applying statistical concepts to practical scenarios.

Teacher feedback

- Reflect on the lesson's effectiveness by asking:
    - Were learning objectives achieved?
    - Did students actively engage and demonstrate understanding?
    - What can be adjusted to improve future lessons on similar topics?

Annex 1

1. **Sample Data Sets:** Provide example sports data (e.g., player performance stats or activity metrics) for practice.
2. **Worksheets:** Include statistical exercises related to the concepts covered in the lesson.
3. **Infographic Templates:** Design templates for students to create visual summaries of their learning.
4. **Supplementary Materials:** Links to relevant videos, articles, or tools to deepen understanding.
5. **Activity Guidelines:** Step-by-step instructions for group tasks, problem-solving exercises, and presentations.

A New Model in Interdisciplinary Teaching – PE - STEM

PHYSICAL EDUCATION LESSON PLAN – PE-DATA

Theme: Olympic Games – Sport Through Data







Lesson Information

- **Teacher: Nagehan Baykan Afşar**
- **Subject:** Physical Education
- **Topic:** Data (Veri)
- **Theme:** Olympic Games
- **Grade Level:** Grade 9 (Ages 14–15)
- **Duration:** 40 minutes
- **Lesson Area:** Gym / Schoolyard

Lesson Aim

The aim of this lesson is to help students:

- Understand that **data is an essential part of sport**
- Recognize how **time, distance, scores, repetitions, and results** are recorded and compared

- Experience collecting and interpreting **simple sports data through movement**
- Realize that Olympic success is built on **measured performance**

Learning Outcomes

Students will be able to:

- Identify different types of sports data (time, distance, score, count)
- Collect basic performance data during physical activities
- Compare and interpret data using simple statements
- Recognize the role of data in Olympic sports

Materials Needed

- Cones
- Stopwatch
- Measuring tape or marked distances
- Data recording sheets (simple tables)
- Board / flip chart

PART 1 – INTRODUCTION: WHAT ARE THE OLYMPIC GAMES? (0–8 min)

Purpose

To introduce the Olympic Games and connect them to the concept of data.

Teacher Input (Short & Interactive)

- "The Olympic Games are the world's biggest sports event."
- "Athletes from many countries compete to be the **fastest, strongest, or highest**."

Key facts (brief):

- First modern Olympics: **1896**
- Held every **4 years**
- Athletes compete under the motto:
  'Faster – Higher – Stronger'

Teacher question:

"How do we know who is faster or stronger?"

Transition:

"We know it because of DATA."

PART 2 – WHAT IS DATA IN SPORT? (8–15 min)

Purpose

To help students recognize data as part of every sports activity.

Guided Discussion

Teacher writes on the board:

Sports Data Examples

- Time (seconds)
- Distance (meters)
- Score (points/goals)
- Repetitions (counts)

Teacher asks:

- "In a 100 m race, what data do we collect?"
- "In long jump, what data matters most?"
- "In basketball, what data shows success?"

Teacher emphasis:

"If sport had no data, there would be no winners, records, or progress."

PART 3 – MOVEMENT-BASED DATA STATIONS (15–32 min)

Students are divided into **3 groups**.

STATION 1 – Speed Data (Athletics)

Purpose:
To collect and compare **time data**.

Activity:

- Students run a **20-meter sprint**
- One student runs, one times, one records
- Each student completes one run

Data collected:

- Time (seconds)

Guiding questions:

- "Who was faster?"
- "How do we know?"

Message:

"Speed is understood through time data."

STATION 2 – Strength Data (Repetitions)

Purpose:
To collect **count data**.

Activity:

- Students perform **squats or push-ups for 30 seconds**
- Partner counts repetitions

Data collected:

- Number of repetitions

Guiding questions:

- "Who completed more repetitions?"
- "What does this number tell us?"

Message:

"Strength and endurance can be measured with numbers."

STATION 3 – Accuracy Data (Target Activity)

Purpose:
To collect **score data**.

Activity:

- Students throw a ball at a target (cone or hoop)
- 5 attempts per student
- Hits are recorded

Data collected:

- Number of successful hits

Guiding questions:

- "Who was more accurate?"
- "How does data show improvement?"

Message:

"Accuracy becomes visible through data."

PART 4 – REFLECTION AND CLOSURE (32–40 min)

Group Discussion

Each group answers:

- "Which data was easiest to collect?"
- "Which data helped us compare performance best?"

Exit Ticket

Teacher asks students to complete:

"Today I learned that data is important in sport because _____."

Assessment (Physical Education Focused)

Teacher observes:

- Student participation and effort
- Ability to collect and record data
- Ability to explain results using data language
- Safe and cooperative behavior

Key Message of the Lesson

"Sport without data is just movement."
"Data turns movement into performance."

Optional Extension

- Compare Olympic records with students' results
- Create a simple class data chart next lesson
- Discuss how athletes use data to improve performance

RUBRIC

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
Understanding of Data in Sport	Clearly explains what data is and why it is essential in sports and Olympic competitions.	Explains data in sport with basic understanding.	Shows limited understanding of data in sport.	Does not understand the role of data in sport.
Data Collection During Activities	Accurately collects and records data (time, repetitions, score) independently.	Collects data correctly with minor support.	Collects data with errors or frequent support.	Unable to collect or record data correctly.
Use of Data to Compare Performance	Clearly compares performances using data (faster, more, higher, better).	Uses data to compare performance at a basic level.	Attempts to compare data but explanations are unclear.	Does not use data to compare performance.
Participation and Effort	Actively participates in all activities with high effort and motivation.	Participates regularly with good effort.	Participates inconsistently or with low effort.	Rarely participates or avoids activities.
Accuracy and Responsibility	Measures, counts, or times carefully and responsibly.	Usually careful when collecting data.	Sometimes careless when measuring or counting.	Shows no responsibility in data collection.
Collaboration and Respect	Works cooperatively,	Works well with peers with	Needs reminders to	Does not cooperate or

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
	respects peers, and fulfills assigned roles (runner, timer, recorder).	minor reminders.	cooperate or stay on task.	respect group roles.
Safety Awareness	Always follows safety rules and ensures others do the same.	Usually follows safety rules.	Sometimes ignores safety rules.	Frequently ignores safety rules and creates risk.

I can…	Always (4)	Mostly (3)	Sometimes (2)	Not yet (1)
understand what "data" means in sports (time, score, distance, repetitions).	○	○	○	○
collect data correctly during activities (timing, counting, recording).	○	○	○	○
use data to compare performances (faster, more, better).	○	○	○	○
participate actively in all activities.	○	○	○	○
do my role responsibly (runner, timer, counter, recorder).	○	○	○	○
work well with my group and respect others.	○	○	○	○
follow safety rules during the lesson.	○	○	○	○

Reflection (Short Answer)

One thing I learned about data in sports today:

.....

One activity where data helped me understand performance better:

.....

One thing I can improve next time:

.....

Student Statement

☐ I did my best in today's lesson.
☐ I understand why data is important in sports and the Olympic Games.

Student Signature: _____

Title

Trajectory and Types of Motion Based on Speed and Path (in Sports Context)

Authors

Tatyana Nikolova

Summary

This integrated STEAM lesson engages students in exploring the concepts of trajectory and different types of motion—linear, curvilinear, uniform, and non-uniform—through the dynamic context of sports. By analyzing the motion of balls and pucks in games like basketball, soccer, and tennis, students connect theoretical physics and mathematical concepts (such as speed, force, and angles) with real-world scenarios. Through hands-on experiments, digital simulations, and teamwork, they develop critical thinking, collaboration, and digital literacy skills. The lesson fosters interdisciplinary learning by integrating physics, mathematics, ICT, physical education, and elements of art to visualize motion paths and understand the impact of angles in movement.

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Subject (s)

Physics *– The core subject for understanding types of motion (linear, curvilinear, uniform, non-uniform) and trajectories. Students apply concepts like speed, acceleration, force, and* ***angles of motion/impact****.*

Mathematics *– Used for calculations related to speed, time, distance, and for analyzing* ***angles*** *and trajectory geometry.*

Physical Education (PE) *– Provides real-life, practical context through sports.*

ICT (Information and Communication Technology) *– For using simulations (e.g., PhET), video analysis, and digital measuring tools.*

Art *– Helps in visualizing trajectories and angles through drawing, graphs, and spatial reasoning.*

Reason for subject selection: Physics and math provide the theoretical foundation, ICT supports digital simulations and analysis, PE brings real-life application, and Art enhances creativity and visual understanding — all contributing to a comprehensive learning experience.

Real- life questions

How do balls move in different sports?
What angle gives the best chance of scoring a goal or a basket?
What forces affect a ball's trajectory under various conditions?
Can math help predict whether a shot will go in?

Aims of the lesson

Students will understand and differentiate between linear, curvilinear, uniform, and non-uniform motion.
They will apply this knowledge to real-life sports examples.
*Students will connect physics principles with **angle of motion/impact**.*
They will build collaboration, critical thinking, and digital skills.
Students will:

- Relate trajectory and movement to scientific principles like force, angle, and velocity.
- Demonstrate their understanding through simulations, experiments, visualizations, and analysis.
- Apply knowledge from multiple subjects in a real-world context.

Connection to STEM careers

Skills developed through this lesson relate to:

- **Engineering** (motion analysis, trajectory optimization)
- **Sports Science**
- **Data & Simulation Analysis**
- **Mathematical Modeling**
- **STEM Education**

Potential Careers:

- Sports Analyst
- Physicist/Engineer
- Robotics Specialist
- STEM Teacher
- Sports Equipment Designer

Age of students

14-19

Teaching resources (material & online tools)

Materials:

- Sports balls (basketball, soccer ball, tennis ball, etc.)
- Videos of sports actions
- Observation sheets
- White/blackboards

Online tools:

- PhET Simulations
- Sports movement video analysis (e.g., YouTube)
- Science Buddies Experiment
- Drawing software (e.g., GeoGebra)
- Video clips of sports movements (e.g., ball kick, disc throw).
  https://www.sciencebuddies.org/science-fair-projects/project-ideas/Sports_p036/sports-science/how-far-can-you-throw-or-kick-a-ball?fave=yes&isb=c2lkOjI5LGlhOlBoeXMscDoxLHJpZDo2ODI4NTg4&from=TSW
  https://www.geeksforgeeks.org/real-life-applications-of-projectile-motion/

https://www.youtube.com/watch?v=XQlcvGu8DOk

21st century skills

Skills enhanced by this lesson:

- *Critical thinking and problem-solving*
- *Communication and collaboration*
- *Creativity and innovation*
- *Digital literacy*
- *Leadership and initiative*

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	How is this criterion addressed in the learning scenarioa
Instruction	
Personalization of learning	Students choose the sport and experiment – allowing individual interest-based learning.
Problem and project-based learning (PBL)	Real-world context (sports), students experiment, analyze, and solve problems.
Game Based Learning (GBL)	No explicit games, but the sports theme and team competition simulate game-like engagement.
Curriculum implementation	
Emphasis on STEM topics and competencies	Strong integration of physics, math (speed, trajectory), tech (simulations), and some engineering thinking.
Interdisciplinary instruction	Physics, PE, tech, math, and elements of digital literacy are connected.
Contextualization of STEM teaching	Students learn abstract scientific content via familiar, engaging real-life situations (sports).
Professionalization of staff	
Highly qualified professionals	Teacher must have background in STEM and be tech-savvy.
Existence of supporting (pedagogical) staff	Could be beneficial for classroom management or inclusion, especially with younger students.
Professional development	Integration of digital tools and STEAM suggests ongoing teacher development or training.
School leadership and culture	
School leadership	Such a lesson usually requires leadership support for access to equipment and planning time.
High level of cooperation among staff	Partially Could be enhanced by interdisciplinary teaching with other subject teachers.
Inclusive culture	Teamwork, variety of tasks and choice create inclusive opportunities.
Connections	
With industry	Partially Invite a coach, parent-athlete, or connect with a university lecturer.
With parents/guardians	Engaging families in the educational process through communication or activities.

Elements and criteria	How is this criterion addressed in the learning scenarioa
With other schools and/or educational platforms	Collaboration between schools or via digital learning platforms.
With universities and/or research centers	Involvement of higher education institutions for expertise or mentorship.
With local communities	Connecting learning to community initiatives, spaces, or events.
School infrastructure	
Access to technology and equipment	Lesson uses tablets/computers, video, simulations – tech-integrated.
High quality instruction classroom materials	Balls, observation tools, digital resources – excellent range.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
1st Lesson		
Brainstorming and discussion	How do balls move? Types of motion. Sports video analysis.	45 min
Discussion and preparation for the next lesson	Group work – choose a sport for analysis.	
2nd Lesson		
STEM Subject 1	**Physics & Math**: Conduct experiments, measure trajectories and angles.	45 min
Learning products	*Measurement tables, trajectory sketches, video recordings*	
3rd Lesson		
STEM Subject 2	ICT: Use simulations to explore how angles affect trajectory. Art: Visualization – draw trajectories and analyze angles.	45 min
Learning products		

Name of activity	Procedure	Time
	Posters, presentations, digital graphics	
4th Lesson		
STEM Subject 3/non-STEM subject	**PE + Reflection**: Practical demonstrations outdoors, real-world analysis of motion and angles. **Final presentations**: Group conclusions and open discussion.	45 min
Learning products	*Presentations, posters, videos, group reports*	

Assessment

Formative: Observation during group work, in-lesson questioning.
Summative: Presentations, visualizations of motion and angles, personal reflections.

Final assessment

- Application of scientific concepts in real-world sports context
- Analysis of different types of motion and angles
- Teamwork and communication
- Use of digital tools and simulations

Student feedback

- Students reflect on what they learned, what they found interesting or challenging.
- Short surveys or feedback forms.

Teacher feedback

- Teachers evaluate student engagement, understanding, and progression.
- Comments on which methods and resources worked best.

Annex 1

Worksheet: Motion and Trajectory Analysis in Sports
Student Name: _____
Team: _____ | Date: _____
1. Sport and Observation Situation:
Choose a sport and describe the specific situation (e.g., pass, kick, throw):

---

2. Type of Motion:

Check the type of motion observed:

☐ Linear Motion

☐ Curvilinear Motion

☐ Uniform Motion

☐ Non-uniform Motion

Explain your choice:

3. Trajectory:

Draw or describe the trajectory of the ball/object:

(Attach a sketch if possible)

Is there an angle of motion or deflection?

☐ Yes

☐ No

If yes, approximate angle: _____°

4. Speed Analysis:

How does the speed change during the motion?

☐ Constant

☐ Increases

☐ Decreases

☐ Varies unpredictably

Which forces influence the motion (e.g., gravity, friction, air resistance)?

5. Connection to Theory:

Connect what you observed to what you've learned:

Which physical and mathematical principles apply here?

6. Conclusion:

What did you learn from this observation?

Attachment:

If you have a sketch, graph, or screenshot – attach it here.

Rubric for assessing student performance in the **STEAM Lesson on Types of Motion in Sports**:

Criteria	Excellent (4 pts)	Good (3 pts)	Satisfactory (2 pts)	Needs Improvement (1 pt)
Understanding of Motion Concepts	Clearly explains and differentiates between linear, curvilinear, uniform, and non-uniform motion.	Demonstrates good understanding with minor errors in differentiation or explanation.	Shows basic understanding but struggles to apply or differentiate motion types.	Limited understanding of motion concepts; unable to distinguish types of motion.
Application of Motion in Sports	Accurately identifies and explains how different motions appear in sports with real examples.	Identifies most motions correctly but lacks depth in explanations.	Identifies some motions but has difficulty linking them to real examples.	Unable to identify or explain motions in sports effectively.
Experimental Skills & Data Collection	Conducts experiments carefully, takes precise measurements, and records data systematically.	Completes experiments with some minor measurement errors or inconsistencies.	Struggles with data collection or measurement accuracy.	Data is incomplete, inaccurate, or not recorded properly.
Use of Technology & Simulations	Effectively uses simulation tools to analyze motion and extracts meaningful insights.	Uses technology correctly but struggles with full interpretation of results.	Uses technology but with difficulty in drawing conclusions.	Does not utilize or misuses technology in the activity.
Analysis & Reflection	Provides insightful analysis connecting experimental results with	Connects results with theory but with minor gaps in reasoning.	Attempts to analyze results but lacks clear connections to concepts.	No meaningful analysis or reflection on motion types.

Criteria	Excellent (4 pts)	Good (3 pts)	Satisfactory (2 pts)	Needs Improvement (1 pt)
	theoretical motion concepts.			
Teamwork & Collaboration	Works effectively in a team, actively contributing and supporting group efforts.	Participates well but requires occasional guidance in teamwork.	Contributes but relies on others for most tasks.	Minimal participation or disrupts group work.
Presentation & Communication	Clearly presents findings, using data and logical explanations to support conclusions.	Presents results adequately with minor gaps in clarity.	Presentation is somewhat disorganized, missing key points.	Presentation is unclear, incomplete, or lacks key information.
Engagement & Participation	Fully engaged in activities, asks insightful questions, and actively participates.	Participates well but may need occasional encouragement.	Shows limited engagement; participates only when prompted.	Little to no participation or engagement.

PE-STE[A]M

A Different Model In InterdIscIplInary TeachIng PhysIcal EducatIon and STEAM

PE-STEAM

2023-2-IT02-KA210-SCH-000178106

PE-PHYSIC LESSON PLANS



A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

CLIL Lesson Plan: Friction in Physical Education

Authors

Angela Bonofiglio

Summary

This CLIL lesson plan uses physical education to introduce students to the concept of friction, its importance in sports, and its application in real-world scenarios. Students will learn key vocabulary related to friction in English, conduct experiments on different surfaces to observe the force's effects, and connect theory to practical situations like running, ice skating, and basketball. The lesson incorporates hands-on activities, group discussions, and role-play exercises to deepen understanding while enhancing English proficiency. Through this interdisciplinary approach, students will explore how friction influences movement and performance in various physical activities.

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Subject (s)

Understanding Friction Through Physical Education

Real- life questions

- Have you ever experienced slipping or falling while playing sports or walking? What caused it, and how did friction play a role?

- Why do you think athletes use specific shoes or equipment for their sports? How does friction influence their choices?

- Can you think of an example where friction helped you move safely or perform better in an activity or sport?

- How would your daily activities change if surfaces around you had much less or much more friction?

- In your opinion, how can understanding friction benefit athletes in optimizing their performance and preventing injuries?

Aims of the lesson

- **Cognitive Aim:** To help students understand the concept of friction and its impact on physical activities like running, movement, and sports.

- **Linguistic Aim:** To improve students' ability to explain the concept of friction in English, using appropriate vocabulary such as "force," "resistance," and "surface."

- **Practical Aim:** To provide students with hands-on experience in exploring how friction works through experiments and real-life activities, enhancing their practical understanding of the topic.

Connection to STEM careers

Understanding friction is fundamental for several STEM careers:

1. **Engineering:** Civil, mechanical, and materials engineers apply friction principles when designing vehicles, buildings, roads, and sports equipment for safety and efficiency.
2. **Physics Research:** Physicists study friction's underlying mechanics to contribute to advancements in nanotechnology, robotics, and energy-efficient materials.
3. **Biomechanics:** Specialists analyze friction's role in human movement to improve athletic performance, prosthetics, and rehabilitation methods.
4. **Material Science:** Scientists develop new materials with specific frictional properties for industrial, medical, and sports applications.
5. **Sports Science and Technology:** Experts design equipment and surfaces that optimize friction for athletes, improving performance and reducing injury risks.

Age of students

14-19

Teaching resources (material & online tools)

Materials:

- Smooth surfaces (e.g., tiles, mats).
- Rough surfaces (e.g., carpet, rubber mats).
- Sports shoes and sneakers.
- A ball for optional activities.
- Markers and charts for vocabulary and demonstrations.

Online tools:

- Interactive friction simulators (e.g., PHET Interactive Simulations).
- Educational videos explaining friction and its applications in sports.
- Virtual labs to simulate friction experiments.
- Online quizzes to assess friction-related concepts.

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	How is this criterion addressed in the learning scenario
Instruction	The lesson uses clear and interactive methods, including demonstrations, discussions, and experiments, to ensure students grasp the concept of friction effectively.
Personalization of learning	Students relate the concept of friction to their own experiences and engage in activities tailored to their interests and physical abilities.
Problem and project-based learning (PBL)	Students undertake projects like designing sport-specific shoes, applying their knowledge of friction to solve real-world challenges.
Game Based Learning (GBL)	Interactive experiments and role-play scenarios add an element of fun while reinforcing learning objectives.
Curriculum implementation	The lesson aligns with educational standards, combining STEM topics with physical education to meet learning goals.
Emphasis on STEM topics and competencies	The lesson highlights friction as a key STEM concept, integrating physics, material science, and biomechanics.
Interdisciplinary instruction	The lesson combines physics, physical education, and language learning (English), offering a multidisciplinary approach.
Contextualization of STEM teaching	Real-life examples, such as friction in sports and daily activities, make STEM concepts relatable and engaging for students.
Professionalization of staff	Teachers are provided with structured lesson plans, resources, and guidelines to deliver the session effectively.
Highly qualified professionals	Requires educators with expertise in physics and physical education to guide students in both theoretical and practical aspects.
Existence of supporting (pedagogical) staff	Pedagogical staff may assist in preparing materials, supervising activities, and ensuring inclusivity.
Professional development	Teachers gain insights into interdisciplinary teaching methods and innovative STEM applications through the lesson plan.
School leadership and culture	Promotes a supportive environment that values collaboration and the integration of STEM into various subjects.
School leadership	Encourages the adoption of innovative and interdisciplinary lesson plans to enrich the curriculum.
High level of cooperation among staff	Teachers and staff work together to prepare resources, share expertise, and ensure lesson success.
Inclusive culture	The lesson is adaptable to diverse learning needs, ensuring all students can participate and benefit equally.
Connections	The lesson uses clear and interactive methods, including demonstrations, discussions, and experiments, to ensure

Elements and criteria	How is this criterion addressed in the learning scenario
	students grasp the concept of friction effectively.
With industry	Students relate the concept of friction to their own experiences and engage in activities tailored to their interests and physical abilities.
With parents/guardians	Students undertake projects like designing sport-specific shoes, applying their knowledge of friction to solve real-world challenges. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Interactive experiments and role-play scenarios add an element of fun while reinforcing learning objectives. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	The lesson aligns with educational standards, combining STEM topics with physical education to meet learning goals. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	The lesson highlights friction as a key STEM concept, integrating physics, material science, and biomechanics. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	The lesson combines physics, physical education, and language learning (English), offering a multidisciplinary approach.
Access to technology and equipment	Real-life examples, such as friction in sports and daily activities, make STEM concepts relatable and engaging for students.
High quality instruction classroom materials	Teachers are provided with structured lesson plans, resources, and guidelines to deliver the session effectively.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
1st Lesson		
Brainstorming and discussion	**1. Introduction (10 minutes)** **- Start the lesson with a simple question:** **"Have you ever slipped or fallen while running or playing sports?"** **This engages students by connecting to their personal experiences.** **- Introduce the concept of friction:** **"Friction is the force that happens when two surfaces touch. It can either slow things down or help us stop."** **Discuss friction in daily life: When running on a smooth surface, we slip. On rough surfaces, we can grip better.** **- Key Vocabulary Practice:** **Write key terms on the board and ask students to match them with definitions.**	10 min
Discussion and preparation for the next lesson	To wrap up the introduction, students will discuss how friction affects their own daily movements and sports activities. They will reflect on examples of slipping or maintaining grip on different surfaces, using newly learned vocabulary. As preparation for the next lesson, students will be assigned to observe and document instances where friction is evident in their environment. These observations will serve as the basis for further exploration and experiments in upcoming classes, deepening their understanding of the concept.	
2nd Lesson		
STEM Subject 1	2. Theory Explanation (10 minutes) - Visual Demonstration: Use two surfaces: one smooth (e.g., tile) and one rough (e.g., carpet). Ask students to walk on each surface and feel the difference. Discuss how the rough surface creates more friction, which helps in stopping or moving with control.	10 min

Name of activity	Procedure	Time
	- Explain the role of friction in sports: In basketball, running shoes provide grip (friction) to avoid slipping. In ice skating, there's less friction, allowing smooth, fast motion. 3. Practical Activity: Friction in Action (15 minutes)	
STEM Subject 1		
Learning products	- ***Comparison Chart:*** *Students create a chart comparing the effects of friction on smooth vs. rough surfaces, based on their observations during the demonstration.* - ***Reflection Notes:*** *Individual reflections where students explain, in their own words, how different surfaces influence movement and provide real-life examples.* - ***Vocabulary Applications:*** *Students use the key terms (e.g., friction, surface, resistance) in short sentences or explanations related to their experiences during the activity.* - ***Role-Play Summaries:*** *Groups summarize their visual demonstrations of walking or moving on different surfaces, highlighting the role of friction and its applications in sports.*	
3rd Lesson		
STEM Subject 2	3. Practical Activity: Friction in Action (15 minutes) - Experiment with Friction: Divide students into small groups. Ask each group to test different surfaces (smooth vs. rough) by running or sliding over them. Have students describe the differences they feel and observe how friction affects their movement. Encourage students to use the new vocabulary to describe their experiences. - Discussion: After the experiment, gather the students and ask them: Which surface did you find easier to move on? Why? Why do athletes wear specific shoes for different sports (e.g., football, basketball, running)?	15 min

Name of activity	Procedure	Time
STEM Subject 2		
Learning products	-**Surface Analysis Report:** Students document their observations and comparisons of frictional effects on different surfaces (smooth vs. rough) during the activity. - **Group Reflection Notes:** Teams compile their findings, describing how friction influenced their movement and the performance on various surfaces. - **Vocabulary Application:** Students use newly learned terms like "grip," "slip," and "surface" to describe their experiment outcomes in written or verbal summaries. - **Visual Diagrams:** Students create diagrams or sketches to illustrate how friction impacted their movement on different surfaces, linking it to practical sports examples.	
4th Lesson		
STEM Subject 1	4. Group Activity: Friction and Performance (5 minutes) - Role-play scenarios: Give each group a different sport (e.g., soccer, running, cycling). Ask them to discuss how friction affects performance in that sport and present their ideas to the class.	5 min
STEM Subject 2		
Learning products	1. **Sport-Specific Presentations:** Groups create and deliver short presentations on how friction influences performance in their assigned sports (e.g., soccer, running, cycling). 2. **Performance Analysis Report:** Students compile their discussions into a written report detailing how friction affects movement, safety, and performance in their chosen sport. 3. **Role-Play Demonstrations:** Groups act out scenarios to illustrate the role of friction in their sport, using props or visual aids for clarity. 4. **Comparison Charts:** Students design charts to compare how friction impacts various sports, highlighting differences between equipment, surfaces, and techniques.	
6th Lesson		

Name of activity	Procedure	Time
STEM Subject 1	5. Conclusion (5 minutes) - Summarize the lesson: Review key concepts: "Friction can slow us down or help us grip. The more friction there is, the more control we have over our movements." Exit ticket: Ask students to write down one sport where friction is important and explain why.	5 min
STEM Subject 2	Homework/Extension: Research Assignment: • Ask students to find an example from a sport or activity where friction plays a key role and prepare a short presentation or report in English.	-
Learning products	◎ **Exit Tickets:** Students write down one sport where friction is important and explain its role, summarizing their understanding of the lesson. ◎ **Summary Posters:** Groups create visual summaries of the key concepts discussed in the lesson, emphasizing the importance of friction in sports and movement. ◎ **Reflection Notes:** Individual reflections where students describe how their perception of friction has changed and share their favorite activity or experiment from the lesson. ◎ **Vocabulary Application:** Students use the learned terms in sentences or short paragraphs to explain friction-related scenarios discussed in class.	

Assessment

- Informal assessment during practical activity based on participation and use of vocabulary.

- Formative assessment through the exit ticket to check understanding.

- Group presentations on how friction affects performance in sports.

This lesson integrates both the physical concept of friction with practical applications in sports, helping students understand and experience the concept in action while using English in the context of physical education.

Final assessment

- **Comprehensive Report:** Students submit a detailed written report analyzing how friction impacts movement and sports, showcasing their theoretical understanding and practical observations.

- **Experiment Findings Presentation:** Students present their experiment results, explaining the role of surface types and material properties in frictional effects.

- **Scenario-Based Problem Solving:** Students are given real-world scenarios involving friction (e.g., designing a running shoe or a safe playground surface) and provide well-reasoned solutions.

- **Group Evaluation:** Teams are assessed on their collaboration and ability to connect theoretical concepts with practical applications during their group presentations or role-play activities.

- **Vocabulary Mastery Test:** Students are evaluated on their ability to use key terms (e.g., friction, grip, resistance) accurately in context, both written and verbal.

Student feedback

- Students fill out reflection forms or surveys to express their thoughts on the activities, experiments, and overall lesson, highlighting what they found engaging or challenging.

- Peer feedback within group activities is collected to evaluate teamwork and collaborative contributions.

- Suggestions are gathered on how the lesson could be improved or adjusted to better meet their learning needs and interests.

Teacher feedback

- Teachers document their observations on student engagement, participation, and understanding during the lesson activities.

- Reflection notes are created on the effectiveness of the lesson plan in achieving cognitive, linguistic, and practical objectives.

- Feedback is shared with colleagues or school leaders to refine interdisciplinary teaching methods and improve future lesson plans.

Annex 1

Annex 1 includes additional resources and materials to support the learning process:

1. **Experiment Instructions:** Detailed guides for conducting friction-related experiments, including required materials and step-by-step procedures.
2. **Key Vocabulary List:** A comprehensive list of friction-related terms with definitions in English and their Italian translations.
3. **Reflection Worksheet:** A template for students to document their observations and reflections during experiments and activities.
4. **Assessment Rubrics:** Rubrics for evaluating student performance in group activities, individual reports, and presentations.
5. **Additional Reading Materials:** Short articles or resources about the role of friction in sports and daily life.
6. **Illustration Templates:** Blank templates for students to create diagrams, charts, or visual explanations of friction concepts.
7. **Glossary of STEM Careers:** A brief overview of careers connected to the study and application of friction in engineering, physics, and sports science.

A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

The History of Friction and Its Application in Physical Education

Authors

Francesco Mannarino

Summary

This lesson plan introduces students to the concept of friction, its historical development, and its applications in physical education and sports. By examining key scientific discoveries from Galileo to Coulomb, students will learn how friction influences surfaces, materials, and movement dynamics. The lesson includes hands-on demonstrations, real-life examples such as running, cycling, and ice skating, and discussions on optimizing performance through an understanding of friction. Students will reflect on its impact on sports and complete assignments to further explore friction in various activities

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Subject (s)

Exploring the Role of Friction in Physics and Physical Education.

Real- life questions

- How does the friction between your shoes and different surfaces affect your movement while playing sports or running?
- What changes would you notice in your performance if you wore shoes with less friction for a specific sport or activity?
- Can you think of an example where too much or too little friction caused a challenge in your daily activities or sports? How did you adapt?
- Why might athletes choose specific equipment or surfaces to optimize friction for their performance?
- How does understanding friction help you in preventing injuries during physical activities or improving your technique?

Aims of the lesson

Students will learn about the history of friction and how it affects physical performance. They will understand the importance of surfaces, materials, and contact areas in both physics and physical education, particularly in sports and movement.

Connection to STEM careers

Understanding friction opens up pathways to several STEM careers. Engineers often work with friction principles to design safer roads, vehicles, and sports equipment. Material scientists study friction to develop innovative materials with properties tailored for specific applications, such as athletic shoes or high-performance tires. Physicists explore the mechanics of friction in microscopic and macroscopic systems, contributing to advancements in robotics and machinery. Additionally, biomechanics specialists analyze human movement and the role of friction to improve athletic performance or develop prosthetics and rehabilitation tools. Careers in STEM continue to thrive on the foundation of understanding forces like friction!

Age of students

14-19

Teaching resources (material & online tools)

Materials:

- Wooden board, metal block, rubber block, and a scale for the friction experiment.
- Basketball or soccer ball for surface demonstration.
- Various surfaces (grass, carpet, concrete) for practical walking or running examples.

Online tools:

- Simulators for friction and force (e.g., PHET Interactive Simulations).
- Online videos explaining friction concepts and real-life applications.
- Virtual labs to measure friction across different materials and surfaces.

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	How is this criterion addressed in the learning scenario
Instruction	The lesson is designed to include both theoretical concepts and practical demonstrations, ensuring students grasp the applications of friction.
Personalization of learning	The lesson is designed to include both theoretical concepts and practical demonstrations, ensuring students grasp the applications of friction.
Problem and project-based learning (PBL)	Students reflect on personal experiences with friction in sports or daily life and work on individual research or design tasks like creating sport-specific shoes.
Game Based Learning (GBL)	Students engage in a design challenge to create shoes for a specific sport, considering the role of friction in performance and safety.
Curriculum implementation	Interactive experiments, like walking on different surfaces and testing materials, make learning fun and engaging.
Emphasis on STEM topics and	The lesson aligns with the curriculum by integrating

Elements and criteria	How is this criterion addressed in the learning scenario
competencies	physics concepts with real-world applications in physical education and STEM subjects.
Interdisciplinary instruction	Key STEM topics, such as forces, material properties, and mathematical formulas, are explored with hands-on activities and calculations.
Contextualization of STEM teaching	Combines physics with physical education, engineering concepts, and material science for a holistic learning experience.
Professionalization of staff	Links STEM concepts to everyday activities and sports, helping students relate the material to their interests and experiences.
Highly qualified professionals	Teachers are equipped with clear instructions, activities, and resources to effectively deliver the lesson.
Existence of supporting (pedagogical) staff	Requires teachers with expertise in physics and physical education to guide students through theoretical and practical aspects.
Professional development	Support staff can assist with organizing materials, supervising activities, or aiding students during experiments.
School leadership and culture	The lesson encourages teachers to explore innovative teaching methods and interdisciplinary approaches.
School leadership	Promotes a culture of collaboration and interdisciplinary teaching through STEM-focused activities.
High level of cooperation among staff	Supports the integration of STEM concepts into the curriculum and encourages innovative teaching practices.
Inclusive culture	Teachers and staff work together to prepare materials, plan demonstrations, and ensure students are actively engaged.
Connections	The lesson is adaptable to different learning needs and styles, making it accessible to all students.
With industry	The lesson is designed to include both theoretical concepts and practical demonstrations, ensuring students grasp the applications of friction.
With parents/guardians	Students reflect on personal experiences with friction in sports or daily life and work on individual research or design tasks like creating sport-specific shoes. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Students engage in a design challenge to create shoes for a specific sport, considering the role of friction in performance and safety. Collaborate with other schools and platforms through shared projects, workshops, or

Elements and criteria	How is this criterion addressed in the learning scenario
	exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Interactive experiments, like walking on different surfaces and testing materials, make learning fun and engaging. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	The lesson aligns with the curriculum by integrating physics concepts with real-world applications in physical education and STEM subjects. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	Key STEM topics, such as forces, material properties, and mathematical formulas, are explored with hands-on activities and calculations.
Access to technology and equipment	Combines physics with physical education, engineering concepts, and material science for a holistic learning experience.
High quality instruction classroom materials	Links STEM concepts to everyday activities and sports, helping students relate the material to their interests and experiences.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
	1st Lesson	
Brainstorming and discussion	**Introduction (10 minutes)** • **What is Friction?** o Friction is the force that resists the motion of one object sliding against another. It plays a crucial role in how we move, how we play sports, and how objects interact with surfaces. • **Real-Life Examples in Physical Education:** o Walking, running, swimming, cycling, and	10 min

Name of activity	Procedure	Time
	sports like soccer, basketball, and ice skating all involve friction. ○ **Example in PE:** The friction between your shoes and the ground helps you maintain grip while running or jumping.	
Discussion and preparation for the next lesson	To conclude the introduction, students will discuss how friction affects their daily activities or sports experiences. They will share observations on how different surfaces and materials impact their movements or performance. For homework, they will be tasked with observing and documenting examples of friction in their surroundings (e.g., walking on different surfaces or using specific sports equipment). These insights will serve as a foundation for the next lesson, where they will explore advanced friction concepts and participate in hands-on experiments.	
2nd Lesson		
STEM Subject 1	**Part 1: History of Friction (15 minutes)** • **Ancient Understanding:** ○ Ancient civilizations, such as the Greeks and Romans, recognized that some force resists the motion of objects but did not understand it in scientific terms. ○ **Friction** comes from the Latin word *fricare*, meaning "to rub." • **Galileo Galilei (Late 1500s):** ○ Galileo's observations were crucial. He discovered that friction was not simply a constant force, but could vary depending on the conditions of the surface. • **Amontons' Laws (1699):** ○ **Guillaume Amontons** formulated two important laws of friction: 1. Friction is directly proportional to the normal force (the perpendicular force pressing the two surfaces together). 2. Friction is independent of the contact	15 min

Name of activity	Procedure	Time
	area (in the case of dry friction). • **Coulomb's Law (1785):** o **Charles-Augustin de Coulomb** refined Amontons' ideas and introduced the concept of the coefficient of friction, which depends on the materials involved. • **Modern Developments:** o Today, friction is understood to involve both microscopic surface interactions and the materials in contact, such as metals, rubber, or textiles.	
STEM Subject 1		
Learning products	- ***Historical Timeline:*** *Students create a visual timeline highlighting key milestones in the understanding of friction, including contributions from Galileo, Amontons, and Coulomb.* - ***Illustrated Concepts:*** *Students design diagrams or illustrations to explain laws of friction, such as Amontons' laws or Coulomb's law, with examples of their application.* - ***Short Presentation:*** *Groups prepare a short presentation or poster summarizing the historical development of friction and its importance in physics and everyday life.* - ***Reflection Notes:*** *Individual reflections on how the historical understanding of friction has influenced modern applications, particularly in sports or engineering.*	
3rd Lesson		
STEM Subject 2	**Part 2: Friction in Physics (15 minutes)** **Key Concepts:** 1. **Surfaces and Material Types:** o Friction depends on the roughness of the surfaces and the materials they are made of. ▪ **Rough Surfaces:** More irregularities lead to higher friction because there is more surface area in contact. ▪ **Smooth Surfaces:** Fewer irregularities lead to less friction. ▪ Example: Rubber on asphalt (high friction) vs. ice on steel (low friction). 2. **Material Properties:**	15 min

Name of activity	Procedure	Time
	○ Different materials generate different amounts of friction. This is important in both physics and physical education, as the materials used in shoes, sports equipment, and playing surfaces affect performance. ▪ Example: A rubber sole on a track shoe is designed to maximize grip, while a smooth leather surface (like a basketball court) allows controlled sliding. 3. **Contact Area:** ○ Contrary to intuition, in many cases, the frictional force does not depend on the contact area. Instead, it is determined by the normal force and the type of materials in contact. ○ **Example:** A wide tire on a bicycle versus a thin tire. Both tires have similar friction when considering the material, but a wider tire will distribute the weight over a larger area, reducing the pressure at the point of contact. 4. **Normal Force:** ○ The normal force is the force perpendicular to the surface that pushes back against the object. It directly affects friction. ○ **Formula for Friction:** $Ff=\mu Fn$ where: ▪ Ff is the frictional force, ▪ μ is the coefficient of friction, Fn is the normal force.	
STEM Subject 2		
Learning products	- ***Material Analysis Chart:*** *Students create a chart comparing the frictional properties of various materials, such as rubber, metal, and wood, based on the classroom experiments.* - ***Force and Friction Calculations:*** *Students perform calculations using the friction formula $$Ff = μFn$$ and record their findings in a structured table or report.* - ***Interactive Models:*** *Students design models or simulations to demonstrate how surface roughness and*	

Name of activity	Procedure	Time
	material properties affect friction. *- **Practical Observation Notes:** Individual documentation of observations from walking on different surfaces or testing friction with various objects during experiments.*	
	4th Lesson	
STEM Subject 1	**Part 3: Application of Friction in Physical Education (15 minutes)** **Friction in Sports and Movement:** 1. **Running:** o **Friction between shoes and the ground** is essential for grip when running. Track shoes, for instance, are designed with a specific amount of friction to help runners accelerate without slipping. o On a **slippery surface** (like ice), low friction can make running dangerous, which is why athletes wear special shoes or use different techniques for winter sports. 2. **Swimming:** o Water creates resistance (a form of friction) that affects the swimmer's speed. Swimmers try to reduce drag by streamlining their bodies and wearing specially designed swimsuits to decrease friction with the water. 3. **Cycling:** o The friction between **bike tires and the road** determines how much grip the tires have. The materials used in tires (rubber, for example) and their tread pattern are designed to optimize friction for different conditions (e.g., wet vs. dry roads). o **Mountain bike tires** have more grip because they are wider and have deeper treads, while **road bike tires** are smoother for higher speeds on paved surfaces. 4. **Sports Surfaces:** o The **friction of the playing surface** affects sports performance. For instance:	15 min

Name of activity	Procedure	Time
	▪ **Basketball courts**: Typically have a smooth but textured surface for controlled slides and jumps. ▪ **Football fields**: Artificial turf has higher friction compared to grass, which can lead to different movement dynamics. 5. **Ice Skating:** o Ice skates rely on **low friction** to glide easily over the ice. The pressure from the skates creates a thin layer of water beneath the blade, reducing friction and allowing for smooth movement. 6. **Skiing:** o Skiers use specially designed skis with low friction to glide smoothly on snow, but they also rely on the friction between the skis and the snow to control their speed and direction.	
STEM Subject 2		
Learning products	- ***Sports Equipment Analysis:*** *Students create a report or presentation analyzing how friction impacts the design and performance of sports equipment like shoes, tires, or surfaces.* - ***Sport-Specific Case Study:*** *Groups explore a particular sport (e.g., ice skating, basketball, skiing) and document how friction plays a role in its performance, safety, and techniques.* - ***Interactive Demonstration Videos:*** *Students produce short videos demonstrating how friction affects movement in various sports, using real-life examples and experiments conducted in class.* - ***Problem-Solving Activity:*** *Students solve real-world scenarios related to friction in sports, like designing equipment or surfaces for optimal performance and safety.*	
5th Lesson		
STEM Subject 1	**Part 4: Classroom Demonstrations (10 minutes)** 1. **Friction Experiment:** o **Materials:** A wooden board, a metal block, a rubber block, a scale. o **Activity:** Students can slide different objects (wood, rubber, metal) along the board and measure how much force is required to overcome the friction. This shows how	10 min

Name of activity	Procedure	Time
	material and surface roughness affect friction. 2. **Practical Demonstration:** o **Walking on Different Surfaces:** Have students walk or run on different surfaces (e.g., grass, carpet, concrete) and discuss how friction changes the effort required to move. o **Sports Example:** Use a basketball or soccer ball and demonstrate how friction changes when dribbling on different surfaces (smooth wood floor vs. turf).	
STEM Subject 2		
Learning products	-***Experiment Results Report:*** *Students document their findings from the friction experiment, including observations about how different materials interact with surfaces.* - ***Group Presentations:*** *Teams prepare short presentations showcasing their demonstrations, such as walking on different surfaces or dribbling sports balls, and explain the role of friction in each activity.* - ***Demonstration Visuals:*** *Students create visual aids, like charts or videos, to explain how the practical activities reflect the scientific principles of friction.* - ***Reflections on Learning:*** *Individual written reflections on how classroom demonstrations enhanced their understanding of friction and its applications in physical education.*	
6th Lesson		
STEM Subject 1	**Conclusion and Discussion (5 minutes)** • **Key Takeaways:** o Friction is an essential force in physical activities, and it depends on materials, surface roughness, and contact area. o Understanding how friction works can help athletes optimize their performance and reduce the risk of injury by choosing the right equipment and adjusting techniques to the environment. • **Reflection Questions:** 1. Why is friction so important in sports like basketball or soccer? 2. How do different materials (e.g., rubber, leather,	5 min

Name of activity	Procedure	Time
	metal) affect friction in sports? 3. What can athletes do to reduce friction when they need to move faster (e.g., swimming, running, skiing)?	
STEM Subject 2	**Homework/Follow-up:** • **Research Assignment:** Ask students to research a sport and explain how friction affects performance in that sport. They should describe the types of surfaces and materials used in the sport and how friction is controlled or utilized for better results. • **Design Challenge:** Students design a pair of shoes for a specific sport (e.g., soccer, basketball, running) considering how friction needs to be optimized for that activity.	-
Learning products	- **Reflection Essays:** Students write a short essay summarizing key takeaways about friction and its role in sports and daily activities. - **Group Discussions Summary:** Teams compile their discussion insights on the importance of friction in physical education and share their ideas for optimizing sports techniques. - **Homework Contributions:** Students bring completed homework assignments, such as observations of friction in their environment, to contribute to the next lesson. - **Visual Concept Maps:** Students create concept maps to organize their understanding of friction and its applications, connecting it to STEM topics and real-life scenarios.	

Assessment

- **Formative Assessment:**
  - **Monitor student participation during discussions and experiments to gauge their understanding of friction concepts.**
  - **Review group activities and timelines to check comprehension of the historical and scientific principles.**
- **Summative Assessment:**

- **Evaluate individual essays and reports for depth of understanding and application of friction in sports and physical activities.**
- **Assess the quality and creativity of student-created presentations, visual aids, and case studies.**

- Practical Assessment:

- **Observe how accurately students perform calculations using friction formulas during hands-on activities.**
- **Test their ability to design solutions or analyze real-world scenarios related to friction in sports or movement.**

- Peer Assessment:

- **Encourage students to provide feedback on each other's presentations and experiments, fostering collaboration and critical thinking.**

Final assessment

- **Comprehensive Report:** Students submit a detailed report or essay analyzing the role of friction in physical activities, showcasing their understanding of theoretical concepts and real-life applications.

- **Experiment Analysis:** Students present their findings and interpretations from hands-on experiments, evaluating how material properties and surface conditions affect friction.

- **Group Presentation:** Teams deliver a final presentation on a sport or scenario where friction plays a critical role, demonstrating interdisciplinary connections and STEM competencies.

- **Problem-Solving Task:** Students complete a scenario-based task, such as designing equipment or surfaces optimized for friction, applying their knowledge creatively and practically.

Student feedback

- Students complete a survey or reflection form to share their thoughts on the lesson's activities and their understanding of friction.

- They provide suggestions for improving the experiments or discussions to make the learning experience even more engaging.

- Peer feedback is collected during group activities to evaluate collaboration and contributions.

Teacher feedback

- Teachers reflect on the effectiveness of the lesson plan in achieving its objectives.

-They document observations on student engagement and understanding during activities and discussions.

- Feedback is shared with colleagues or school leadership to improve interdisciplinary and STEM-focused teaching approaches.

Annex 1

Annex 1 may contain additional resources, templates, or materials to support the implementation of the lesson plan. Examples might include:

1. **Historical Timeline Template:** A blank template for students to fill in key events in the history of friction.
2. **Experiment Instructions:** Detailed step-by-step guides for conducting friction experiments in the classroom.
3. **Reflection Worksheet:** A worksheet with prompts to help students document their observations and reflections on friction.
4. **Evaluation Rubric:** A rubric for teachers to assess student presentations, reports, and participation in activities.
5. **Glossary of Terms:** A glossary with definitions of key terms, such as "normal force," "coefficient of friction," and "contact area."

A New Model in Interdisciplinary Teaching PE - STEM

PE&PHYSIC – FRICTION FORCE

Theme: Friction in Sports – Physics in Real Life





Lesson Information

- **Subject:** Physics
- **Topic:** Friction Force
- **Grade Level:** Grade 9 (Lise 1)
- **Duration:** 40 minutes
- **Lesson Area:** Classroom + schoolyard/gym (if available)

Lesson Aim

The aim of this lesson is to help students:

- Understand **friction force** through **real-life sports examples**
- Recognize that friction can be **useful or harmful** depending on the situation
- Apply physics concepts to **daily life and sports performance**
- Develop problem-solving skills using real-world contexts

Learning Outcomes

Students will be able to:

- Define friction force in their own words
- Identify situations where friction is **increased or reduced**
- Explain the role of friction in different sports
- Relate friction to real-life problems and solutions

Materials Needed

- Different types of shoes (sports shoe, smooth sole shoe – optional)
- Small objects (eraser, book)
- Board / projector
- Short sports videos or images (optional)

PART 1 – ENGAGING INTRODUCTION: WHY DON'T WE SLIP? (0–7 min)

Purpose

To activate prior knowledge and connect physics to daily life.

Teacher Prompt

Ask students:

"Why don't athletes slip when they suddenly stop or change direction?"

Demonstration (if possible):

- Slide a book on a smooth desk
- Then press it down or change surface (cloth under it)

Teacher asks:

"What changed? Why did it stop more easily?"

Transition:

"The answer is **friction force**."

PART 2 – WHAT IS FRICTION FORCE? (7–15 min)

Short Explanation

- Friction is a force that **resists motion** between two surfaces in contact.

- It always acts **opposite to the direction of motion**.

Teacher highlights:

- More friction → more control, less slipping
- Less friction → easier movement, more speed

Key idea:

"In sports, the goal is not to eliminate friction, but to **control it**."

PART 3 – FRICTION IN 5 DIFFERENT SPORTS (15–30 min)

Students listen, discuss, and answer short guiding questions.

1. Athletics (Running)

Where is friction?

- Between running shoes and track/ground

Real-life problem:

- Too little friction → slipping at start
- Too much friction → slower movement

Solution:

- Spikes and special sole designs

Guiding question:

"Why do sprinters use spiked shoes?"

2. Football (Soccer)

Where is friction?

- Between cleats and grass
- Between ball and foot

Real-life problem:

- Wet grass reduces friction → players slip

Solution:

- Studded shoes, different sole lengths

Guiding question:

"Why do players change shoes in rainy matches?"

3. Skiing

Where is friction?

- Between skis and snow

Real-life problem:

- Too much friction → cannot slide

Solution:

- Waxing skis to **reduce friction**

Guiding question:

"Why do skiers want less friction than runners?"

4. Cycling

Where is friction?

- Between tires and road
- Air resistance (related concept)

Real-life problem:

- Low friction → loss of balance
- High friction → more effort needed

Solution:

- Tire design, tire pressure

Guiding question:

"Why are bicycle tires not completely smooth?"

5. Basketball

Where is friction?

- Between shoes and court floor
- Between ball and hands

Real-life problem:

- Dusty floor → reduced friction → slipping

Solution:

- Cleaning the court, special shoe soles

Guiding question:

"Why do players wipe their shoes during the game?"

PART 4 – THINK–PAIR–SHARE ACTIVITY (30–36 min)

Students work in pairs.

Task:

- Choose **one sport**
- Identify:
    1. Where friction occurs
    2. What happens if friction is too high
    3. What happens if friction is too low

Pairs share one idea with the class.

PART 5 – REFLECTION AND CLOSURE (36–40 min)

Exit Ticket

Students complete:

"In sports, friction is important because _____."

Key Message of the Lesson

"Friction is not an enemy in sports; it is a tool."
"Performance depends on controlling friction."

Assessment

Teacher observes:

- Participation in discussions
- Ability to relate friction to real-life sports problems
- Use of correct physics terms

Optional Extensions

- Simple experiment: different surfaces & sliding distance
- Homework: Find a sport where friction is reduced on purpose
- Short video analysis of athletes slipping or stopping

RUBRIC

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
Understanding of Friction Force	Clearly explains friction force using correct physics terms and real-life sports examples.	Explains friction with basic accuracy and examples.	Shows partial understanding; explanations are limited.	Does not understand friction force.
Identifying Friction in Sports	Correctly identifies friction in all discussed sports and explains its role.	Identifies friction in most sports with minor errors.	Identifies friction in some sports but struggles to explain it.	Cannot identify friction in sports contexts.
Problem–Solution Reasoning	Clearly explains what happens when friction is too high or too low and suggests realistic solutions.	Explains problems and solutions at a basic level.	Identifies problems but solutions are unclear.	Cannot relate friction to problems or solutions.
Use of Scientific Language	Consistently uses correct terms (friction, surface,	Uses scientific terms with	Uses limited scientific vocabulary.	Does not use scientific language.

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
	motion, resistance).	minor mistakes.		
Participation and Engagement	Actively participates in discussions and activities.	Participates regularly.	Participates inconsistently.	Rarely participates.
Collaboration and Respect	Works cooperatively, listens to peers, and respects ideas.	Usually cooperative with minor reminders.	Needs reminders to cooperate.	Does not cooperate or respect others.
Safety Awareness	Always follows safety rules during activities and demonstrations.	Usually follows safety rules.	Sometimes ignores safety rules.	Frequently ignores safety rules and causes risk.

STUDENT WORKSHEET – FRICTION FORCE

Physics & Sports

Name: _____ Date: _____ Class: _____

Part 1 – What is Friction?

☞ Write your own definition:

Friction force is:

.....

.....

Part 2 – Friction in Sports

Complete the table using the lesson examples.

Sport	Where does friction occur?	Is friction helpful or harmful?
Running (Athletics)		
Football (Soccer)		
Skiing		
Cycling		
Basketball		

Part 3 – Think & Explain

What happens if friction is too low in sports?

(Example: wet ground, smooth surface)

.....
.....

What happens if friction is too high in sports?

.....
.....

Part 4 – Problem Solving

Choose **ONE sport** and answer:

Sport chosen: _____

- Where is friction important in this sport?
  .....
- What problem occurs without enough friction?
  .....
- How do athletes control friction?
  .....

Part 5 – Reflection (Exit Ticket)

Complete the sentence:

"In sports, friction force is important because _____."

✓ Student Self-Check

☐ I understand what friction force is
☐ I can give examples from sports
☐ I can explain why friction can be useful or harmful

A New Model in Interdisciplinary Teaching – PE – STEM

Title

Friction – The Hidden Player in Sports

Authors

Tatyana Nikolova

Summary

This lesson explores friction forces – how they arise, their causes, direction, benefits and drawbacks – with a specific focus on sports applications. Students conduct hands-on experiments, analyze data, and collaborate on creative projects with real-world relevance.

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Subject (s)

- ***Physics:*** *Introduction to force, friction force, direction, causes.*
- ***Physical Education:*** *Real-life applications of friction in sports movements.*
- ***Art / Technology:*** *Creation of posters or models to visualize concepts.*
- ***Mathematics:*** *Data analysis, measuring friction, creating charts.*

Why these subjects and teachers? *Science provides core knowledge; PE connects theory with practice; Art encourages creative representation; Math supports data interpretation and modeling.*

Real- life questions

- Why is the grip important between shoes and the ground?
- What happens if there's no friction?
- How do different sports increase or reduce friction?
- Why do skiers use wax?
- Can understanding friction improve sports performance?

Aims of the lesson

- Define force and friction force.
- Understand that surface roughness causes friction.
- Identify the direction of friction (opposite to motion).
- Recognize helpful and harmful friction.
- Relate knowledge to sports and STEM careers.
- Students demonstrate understanding through experiments and model-making.
- They link theoretical knowledge to real-life scenarios in sports.
- Final group presentations show subject integration.

Connection to STEM careers

Students explore careers like:

- *Sports Engineer*
- *Biomechanic*
- *Materials Engineer*
- *Athletic Coach*
- *Sports Equipment Designer*

Developed skills: critical thinking, teamwork, creativity, scientific reasoning.

Age of students

14-19

Teaching resources (material & online tools)

Materials:

- Various surfaces (fabric, rubber, sandpaper)
- Sports shoes
- Small items for sliding experiments
- Paper/digital templates for posters

Online tools:

- PhET simulations
- Canva or Google Slides
- Google Forms for feedback
- https://www.youtube.com/watch?v=Kd4wVvBntPc
- https://youtu.be/VgZTmT2TEso

21st century skills

I. Critical Thinking and Problem Solving

- Students analyze when friction is helpful or harmful.
- They explore ways to control friction (materials, shoes, surfaces).
- Engage in hands-on experimentation and draw logical conclusions.

II. Creativity and Innovation

- Design visual models and creative posters combining science and art.
- Come up with original ways to demonstrate friction (skits, sports-based demos).
- Make connections between theoretical knowledge and real-world situations.

III. Communication

- Present their projects clearly and effectively.
- Use correct scientific vocabulary and visual aids.
- Practice public speaking, group reporting, and persuasive explanation.

IV. Collaboration

- Each student contributes a specific role: designer, presenter, researcher, etc.
- Learn negotiation, team dynamics, and shared accountability.
- Cooperative projects emphasize mutual respect and collective success.

V. Information and Media Literacy

- Conduct online research about friction in sports.
- Evaluate and analyze visual media, simulations, and educational resources.

VI. Scientific and Technological Literacy

- Perform physical experiments and measure forces.
- Use digital tools such as PhET simulations.
- Apply technology in designing and presenting their projects.

VII. Initiative and Self-direction

- Students independently explore how friction affects various sports.
- Manage project tasks, deadlines, and responsibilities.
- Reflect on their learning through self-assessment.

VIII. Social and Cross-cultural Skills

- Develop empathy and respect within diverse groups.
- Learn to cooperate with peers with different ideas and backgrounds.
- Teacher guides and encourages active listening and inclusion.

IX. Global Awareness

- Understand that scientific laws apply universally.
- Discuss how friction and sports equipment vary across cultures and environments.

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	How is this criterion addressed in the learning scenarioa
Instruction	
Personalization of learning	Students work in groups with specific roles (designer, researcher, presenter, etc.), allowing them to apply their strengths and interests.
Problem and project-based learning (PBL)	The entire lesson is structured around a real-world challenge: understanding how friction affects athletic performance. Students explore the topic through research and hands-on tasks.
Game Based Learning (GBL)	*(Suggestion)* You could include a fun quiz or simulation (e.g., "Guess which sport uses the least friction") as a light and engaging assessment or reflection activity.
Curriculum implementation	
Emphasis on STEM topics and competencies	Key scientific concepts (force, friction), integrated with technology (simulations), engineering (sports gear), and mathematics (measuring and graphing results).
Interdisciplinary instruction	The lesson connects science, mathematics, physical education, art, and technology – a strong example of cross-disciplinary integration.
Contextualization of STEM teaching	Knowledge is applied in a real-life context (sports), which enhances student engagement and understanding.
Professionalization of staff	
Highly qualified professionals	Teachers from multiple disciplines (physics, sports, art) are involved, ensuring high-quality and diverse instruction.
Existence of supporting (pedagogical) staff	Consider involving pedagogical support staff or a librarian to assist with research and group organization.
Professional development	*(Suggestion)* This lesson could be used in internal training sessions or shared as a best practice among teachers.

Elements and criteria	How is this criterion addressed in the learning scenarioa
School leadership and culture	
School leadership	The involvement of multiple departments suggests strong organizational and leadership backing.
High level of cooperation among staff	Collaboration between science, PE, art, and mathematics teachers shows excellent interdisciplinary teamwork.
Inclusive culture	The group work, different student roles, and use of diverse visual and hands-on materials allow all students to participate meaningfully, regardless of learning style.
Connections	
With industry	With an artificial turf manufacturer to explain the differences between them
With parents/guardians	*(Suggestion)* Consider inviting parents to attend final project presentations or assist with materials – great for community engagement.
With other schools and/or educational platforms	Potential for collaboration via eTwinning, Microsoft Teams, or Google Classroom – students could compare findings or share presentations.
With universities and/or research centers	*(Suggestion)* Integrate virtual lab tours or short videos/lectures from universities focused on sports science.
With local communities	You could invite a coach, athlete, or sports equipment expert for a guest talk or demonstration to strengthen real-life connections.
School infrastructure	
Access to technology and equipment	The lesson plan includes using online simulations (PhET), tools like Canva or Google Slides, and sports equipment – indicating a solid infrastructure.
High quality instruction classroom materials	Measuring tools (e.g., dynamometers), varied surfaces, art/poster supplies, and sports gear show diverse and well-prepared materials for effective hands-on learning.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
1st Lesson		
Brainstorming and discussion	Discuss what students know about friction and sports. Introduce the topic.	25 min

Name of activity	Procedure	Time
Discussion and preparation for the next lesson	Group formation, sport selection, task briefing.	20 min
2nd Lesson		
STEM Subject 1	Hands-on activities on friction. Mathematics - Data measurement, analysis, visual display.	45 min
Learning products	Data tables, charts, experiment sheets.	
3rd Lesson		
STEM Subject 2	ICT - Digital poster/model creation. Arts - Visual elements and physical models.	45 min
Learning products	Digital projects, creative posters.	
4th Lesson		
STEM Subject 3/non-STEM subject	PE - Demonstration and observation of friction in real movement. Students can experience in a real-life setting the effects of friction forces when running on asphalt, grass, and artificial turf.	45 min
Learning products	Final group projects.	

Assessment

- **Observation during teamwork**
- **Peer/self-assessment**
- **Rubric-based criteria: accuracy, creativity, application**

Final assessment

Objective assessment by the teacher – based on pre-set indicators

Student feedback

- Post-lesson questionnaire
- Questions like: What did I learn? What did I enjoy? What would I improve?

Teacher feedback

- *Notes on how students responded*
- *Level of engagement*
- *Suggestions for improvement*

Annex

Worksheet 1: Understanding Force and Friction

(Scientific foundation – STEM subject: Physics / Natural Sciences)

Name: _____

Date: _____

1. What do I know about force? Complete the table.

Question	My Answer
What is a force?	
What is the direction of a force?	
When does a friction force appear?	
What causes friction?	
Is friction always bad?	

2. Practical task: Measuring friction

Observation: Slide an object across 3 different surfaces (smooth table, towel, rubber mat). Measure the force using a dynamometer.

Surface	Measured Friction Force (N)	Description of Movement	Conclusion
_____			
_____			
_____			

Conclusion:

On which surface is the friction force highest and why?

.....

Worksheet 2: Friction in Sports – Research and Analysis

(Interdisciplinary part: Physical Education + Science)

Team: _____

Team members: _____

1. Choose a sport and research it:

Use books, videos, the internet, or interviews.

Chosen sport: _____

Question	Answer

Question	Answer
How does friction affect this sport?	
Is friction helpful or harmful in this case?	
Do athletes use special equipment to control friction?	
What would happen if there were no friction?	

2. Draw a sketch or diagram

(Example: Drawing of a football shoe showing how the studs increase friction.)

Use the back of this sheet or a separate page.

Worksheet 3: Creating a STEAM Product (Poster/Model/Presentation)

(Art + Technology Integration)

Team: _____

Project title: _____

1. What kind of product will you create?

☐ Poster

☐ Model

☐ Multimedia presentation (Google Slides, Canva, etc.)

☐ Video/Ad

☐ Other: _____

2. Work plan:

Task	Team Member Responsible	Deadline
Research and information gathering		
Design and creation		
Presentation preparation		

3. Key messages in our product:

Write 2–3 important sentences you want your audience to remember.

1. .....
2. .....
3. .....

Worksheet 4: Preparing to Present

(Presentation and communication skills)

Team: _____

Presentation date: _____

1. Roles for the presentation:

Role	Name
Introduction (present the topic)	
Explain the scientific content	
Connect it to the sport	
Demonstration/Product presentation	
Conclusion + invite questions	

2. Rehearsal checklist:

- We speak clearly and confidently
- Everyone gets a chance to speak
- We are ready to answer questions
- Our product is visible, interesting, and well explained

Rubric for assessing student performance in the **STEAM Lesson on Friction – The Hidden Player in Sports**

Criteria	Excellent (4 pts)	Good (3 pts)	Satisfactory (2 pts)	Needs Improvement (1 pt)
Content	The topic is thoroughly developed with accurate, complete, and in-depth information.	The topic is well presented with minor omissions or inaccuracies.	The topic is addressed, but somewhat superficially or with errors.	Lacks key information; contains major inaccuracies.
Clarity & Organization	Clear and logical structure; information is easy to follow and well organized.	Generally well organized, though some ideas may be unclear.	Organization is weak at times; ideas are difficult to follow.	Poor or missing structure; content is confusing or disjointed.

Language & Style	Uses appropriate and rich vocabulary; tone is professional and accurate.	Language is generally appropriate with minor errors or repetition.	Limited vocabulary; several grammatical or stylistic mistakes.	Inappropriate or unclear language; numerous errors.
Visual Design	Visually appealing and well-formatted; content is easy to read and engaging.	Good formatting with minor issues.	Some effort in design, but lacks impact or consistency.	Poor visual design; hard to read or visually disorganized.

PE-STE[A]M

A Different Model In InterdIscIplInary TeachIng PhysIcal EducatIon and STEAM

PE-STEAM

2023-2-IT02-KA210-SCH-000178106

PE-BIOLOGY LESSON PLANS

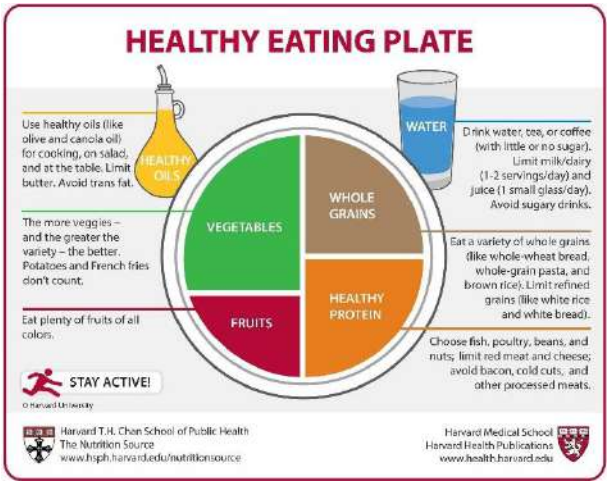


A New Model in Interdisciplinary Teaching – PE - STEM

PHYSICAL EDUCATION LESSON PLAN

MOVEMENT & NUTRITION







Theme: Exercise and a Healthy Life

Lesson Information

- **Teacher**: Nagehan Baykan Afşar
- **Subject:** Biology
- **Topic:** Movement and Nutrition
- **Grade Level:** Grade 9 (Lise 1)

- **Duration:** 40 minutes
- **Lesson Area:** Classroom + schoolyard (optional)

Lesson Aim

The aim of this lesson is to help students:

- Understand the **biological importance of movement and nutrition**
- Recognize how regular exercise affects **muscles, heart, lungs, and overall health**
- Realize the relationship between **exercise, energy, and nutrition**
- Develop awareness of **healthy lifestyle habits**
- Start tracking their own physical activity through an **Exercise Diary**

Learning Outcomes

Students will be able to:

- Explain why movement is essential for the human body
- Describe the relationship between exercise and nutrition
- Identify short- and long-term benefits of regular physical activity
- Create and maintain a simple **Exercise Diary**

Materials Needed

- Board / projector
- A4 **Exercise Diary template**
- Pens
- (Optional) short exercise video or images

PART 1 – ENGAGING INTRODUCTION: WHY DO WE MOVE? (0–7 min)

Purpose

To connect movement to daily life and biological needs.

Teacher Prompt

Ask students:

"What happens to our body if we stop moving regularly?"

Guide discussion toward:

- Muscle weakening
- Weight gain
- Low energy
- Health problems

Transition:

"Movement is not a hobby — it is a **biological necessity**."

PART 2 – BIOLOGY OF MOVEMENT AND NUTRITION (7–15 min)

Teacher Explanation (Short & Clear)

Explain using simple language:

- Muscles need **movement** to stay strong
- Heart and lungs work better with **regular exercise**
- Exercise increases **oxygen use** and **energy consumption**
- Nutrition provides the **fuel** needed for movement

Key idea:

"Exercise and nutrition work together like fuel and engine."

Examples:

- Without enough food → low energy
- Without movement → unused energy stored as fat

PART 3 – BENEFITS OF EXERCISE (15–25 min)

Group Brainstorming

Students work in small groups.

Each group lists:

- **Short-term benefits** (today / this week)
    - Better mood
    - More energy
    - Better concentration
- **Long-term benefits** (months / years)
    - Stronger muscles and bones
    - Healthy heart
    - Disease prevention

Teacher writes key points on the board and links them to **biology concepts**.

PART 4 – ACTIVITY: EXERCISE DIARY (25–35 min)

Purpose

To turn knowledge into **personal awareness and responsibility**.

Teacher Instruction

Explain:

"From today, you will observe your own movement and exercise habits."

Introduce the **Exercise Diary**:

- Students will record:
    - Type of activity (walking, sports, cycling, etc.)
    - Duration (minutes)
    - Intensity (low / medium / high)
    - How they felt after the activity

In-Class Task

Students complete **Day 1** of their diary (real or planned activity).

Emphasis:

"This is not about being an athlete. It's about being aware of your body."

PART 5 – REFLECTION AND CLOSURE (35–40 min)

Exit Question

Students complete the sentence:

"Exercise is important for my life because _____."

Key Message of the Lesson

"Movement keeps the body alive."
"Healthy nutrition supports healthy movement."

Assessment

Teacher observes:

- Participation in discussions
- Understanding of exercise–nutrition relationship
- Completion of Exercise Diary entry

Follow-Up Activity (Homework / Project)

- Students keep the **Exercise Diary for 1 week**
- Next lesson:
    - Short reflection
    - Discussion on changes in energy, mood, or sleep

Optional Extension

- Compare active vs inactive days
- Link nutrition choices to energy levels
- Simple graph of exercise duration vs mood

RUBRIC

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
Understanding	Clearly	Explains the	Shows limited	Does not

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
of Exercise and Health	explains why exercise is essential for muscles, heart, and overall health using biological concepts.	importance of exercise with basic biological understanding.	understanding of exercise and health.	understand the importance of exercise.
Understanding of Exercise–Nutrition Relationship	Clearly explains how nutrition provides energy for movement and exercise.	Explains the relationship at a basic level.	Mentions nutrition but cannot clearly link it to exercise.	Cannot explain the relationship between nutrition and exercise.
Exercise Diary Completion	Completes the diary fully, accurately, and thoughtfully.	Completes the diary with minor missing details.	Diary is partially completed or lacks detail.	Diary is incomplete or not submitted.
Reflection and Awareness	Reflects clearly on how exercise affects mood, energy, and body.	Reflects on personal experience at a basic level.	Reflection is unclear or very brief.	No reflection provided.
Part				

STUDENT SELF-ASSESSMENT – MOVEMENT & NUTRITION

Student Name: _____ Date: _____

Circle the option that best describes YOU.

I can…	Always (4)	Mostly (3)	Sometimes (2)	Not yet (1)
explain why exercise is important for my body.	○	○	○	○
explain how nutrition gives energy for movement.	○	○	○	○
record my physical activity in an exercise diary.	○	○	○	○
notice how exercise affects my mood and energy.	○	○	○	○
take responsibility for my health habits.	○	○	○	○

Student Reflection

- **One thing I learned about exercise and health:**
  .....
- **One habit I want to improve:**
  .....

☐ I did my best in this lesson.
☐ I understand why exercise is important for a healthy life.

Student Signature: _____

A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

CLIL lesson on biology applied to physical education

Authors

Angela Bonofiglio

Summary

This lesson explores how physical activity affects the human body, focusing on the muscular and cardiovascular systems. Students learn key biological concepts such as muscle contraction, heart rate, and oxygen uptake, and apply them through practical exercises. The integration of biology and physical education helps students understand how their bodies function during movement and how exercise contributes to overall health.

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Subject (s)

Biology applied to Physical Education (CLIL).

Real- life questions

Real-Life Questions

- What happens inside your body when you exercise?
- Why does your heart beat faster during physical activity?
- How can understanding biology help improve athletic performance?
- Which muscles do you use during different types of exercise?
- How does regular movement contribute to long-term health?

Aims of the lesson

- To explore how the human muscular and cardiovascular systems respond to physical activity.

- To develop students' understanding of key biological processes such as muscle contraction, oxygen transport, and heart rate regulation.

- To apply scientific knowledge to real-life physical exercises and athletic performance.

- To enhance students' ability to use subject-specific vocabulary in English related to biology and physical education.

- To encourage critical thinking through observation, measurement, and reflection on the body's reactions to exercise.

Connection to STEM careers

Understanding how the human body responds to exercise opens doors to a wide range of STEM-related careers. Students who explore the biology of movement can pursue professions that combine science, technology, and health:

- **Sports Scientist**: Uses biology and data analysis to improve athletic performance and recovery.
- **Physiotherapist**: Applies anatomical knowledge to help patients regain mobility and strength.
- **Biomedical Engineer**: Designs equipment and technology that support physical rehabilitation and fitness.
- **Exercise Physiologist**: Studies how physical activity affects body systems and develops personalized training programs.
- **Health and Wellness Coach**: Uses scientific principles to guide individuals toward healthier lifestyles.

By linking physical education with biology, students gain insights that are essential for careers focused on human health, innovation, and performance.

Age of students

14-19

Teaching resources (material & online tools)

Materials

- **Anatomy diagrams** of the muscular and cardiovascular systems
- **Stopwatch or fitness tracker** to measure heart rate
- **Worksheet** with vocabulary, diagrams, and comprehension questions
- **Video clip** explaining how exercise affects the body
- **Open space** for physical activity (gym, classroom, or outdoor area)
- **Whiteboard or projector** for visual explanations
- **Heart rate chart** for tracking changes before and after exercise

Online Tools

- **Interactive anatomy platforms** (e.g., BioDigital Human, Visible Body)
- **YouTube or educational video platforms** for clips on exercise physiology
- **Kahoot or Quizizz** for vocabulary and concept review quizzes
- **Google Forms or Microsoft Forms** for student reflections and assessments
- **Padlet or Jamboard** for collaborative brainstorming and sharing observations
- **Fitness apps** (e.g., Google Fit, Strava) to track movement and heart rate in real time

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	This lesson is designed around key pedagogical elements that support both content mastery and language development through an interdisciplinary CLIL approach. It integrates scientific knowledge with

	physical activity, encouraging students to explore real-life biological processes through movement and reflection. The criteria guiding the lesson include: • **Content and Language Integration: Students learn biological concepts (e.g., muscle contraction, heart rate) while developing English vocabulary and communication skills.** • **Active Learning: The lesson combines theory with physical tasks, promoting engagement through hands-on experiences.** • **Student-Centered Approach: Activities are personalized, allowing students to monitor their own physical responses and reflect on their learning.** • **Real-Life Relevance: The lesson connects biology to everyday experiences, helping students understand how their bodies work during exercise.** • **Assessment for Learning: Formative assessment is embedded through observation, discussion, and reflective writing tasks.** • **STEM Alignment: The lesson fosters scientific inquiry, data interpretation, and health awareness—core competencies in STEM education.** **Inclusivity and Accessibility: Materials and tasks are adaptable to different learning needs, ensuring participation for all students.**
Instruction	The lesson uses a CLIL approach, integrating biology content with physical education through English. It combines theoretical input with hands-on activities and reflection, promoting both content mastery and language development.
Personalization of learning	Students engage in self-paced physical tasks, monitor their own heart rate, and reflect on their personal physical responses. Differentiated materials and flexible grouping allow for varied learning styles and abilities.
Problem and project-based learning (PBL)	Students explore real-life questions such as "Why does my heart beat faster during exercise?" and "How can I improve my performance?" They apply biological knowledge to solve practical challenges related to fitness and health.
Game Based Learning (GBL)	Interactive quizzes (e.g., Kahoot, Quizizz) and movement-based games are used to reinforce vocabulary and concepts in an engaging, competitive format.
Curriculum implementation	The lesson aligns with both science and physical

	education curricula, supporting cross-curricular goals such as health literacy, scientific inquiry, and language competence.
Emphasis on STEM topics and competencies	The lesson emphasizes biological systems, data collection (e.g., heart rate), and scientific reasoning. It fosters STEM skills such as observation, analysis, and interpretation of physiological data.
Interdisciplinary instruction	Combines mathematics, physical education, and language learning to provide a holistic educational experience that bridges different disciplines.
Contextualization of STEM teaching	STEM concepts are taught through real-life physical activity, making abstract biological processes tangible and relevant to students' daily experiences and health.
Professionalization of staff	Encourages collaboration among biology PE, and English teachers to deliver content effectively and innovatively.
Highly qualified professionals	The lesson is designed to be delivered by subject specialists in biology and physical education, ideally with CLIL training or experience in bilingual education.
Existence of supporting (pedagogical) staff	Language assistants or bilingual support staff can assist during the lesson, especially for students who need help with English comprehension or vocabulary.
Professional development	Teachers are encouraged to participate in CLIL training, interdisciplinary planning workshops, and STEM education seminars to enhance their instructional strategies.
School leadership and culture	Fosters a school culture that values creativity, collaboration, and innovative teaching approaches across subjects.
School leadership	Leadership supports innovative teaching approaches like CLIL and interdisciplinary learning. Time is allocated for collaborative planning and reflection among staff.
High level of cooperation among staff	Biology, PE, and language teachers collaborate to co-design and co-deliver the lesson, ensuring coherence and shared learning goals.
Inclusive culture	Biology, PE, and language teachers collaborate to co-design and co-deliver the lesson, ensuring coherence and shared learning goals.
Connections	Collaboration with sports technology companies or local sports organizations could enhance the lesson by providing real-world insights and tools.
With industry	Potential collaboration with local fitness centers or sports science professionals to demonstrate real-world applications of biology in athletic training.
With parents/guardians	Parents are informed about the lesson's goals and encouraged to support healthy habits at home. Students may share their reflections or data collected during the

	lesson. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Opportunities for virtual exchanges or shared projects with other schools implementing CLIL or STEM-based physical education. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Partnerships with local universities for guest lectures, lab visits, or access to sports science research and equipment. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Involvement of community health professionals or sports coaches to provide insights into the importance of exercise and biology in daily life. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	Access to sports facilities and equipment is essential for physical activities related to biology.
Access to technology and equipment	The lesson requires access to digital tools (e.g., tablets, fitness trackers, projectors), internet connection, and a space for physical activity.
High quality instruction classroom materials	Includes accurate anatomical diagrams, bilingual worksheets, interactive digital resources, and engaging visual content to support both content and language learning.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
1st Lesson		
Brainstorming and discussion	- Students discuss: *What happens inside your body when you exercise?* - Group mind map: muscles, heart, breathing, fatigue, energy	5 min

Name of activity	Procedure	Time
	- Introduction to key vocabulary: muscle contraction, heart rate, oxygen uptake - Watch a short video clip on exercise and the human body - Teacher facilitates discussion on how biology explains physical performance	
Discussion and preparation for the next lesson	- Students choose one body system to explore (muscular or cardiovascular) - Homework: track their heart rate before and after a short workout - Prepare questions for next lesson: *Why does my heart beat faster? Which muscles did I use?*	
2nd Lesson		
STEM Subject 1	**STEM Subject – Muscular System** **Focus: How muscles work during physical activity**	20 min
STEM Subject 2		
Learning products	• Diagram labeling: major muscle groups and their functions • Vocabulary matching: contraction, fibers, strength, flexibility • Physical activity circuit: squats, push-ups, lunges • Students record which muscles are activated during each exercise • Group poster: "Muscles in Motion" with photos and annotations	
3th Lesson		
STEM Subject 1	**STEM Subject – Cardiovascular System** **Focus:** How the heart and blood vessels respond to exercise	15 min
STEM Subject 2		
Learning products	- Interactive heart diagram: label parts and explain blood flow - Experiment: measure resting and post-exercise heart rate - Graphing activity: plot heart rate changes over time	

Name of activity	Procedure	Time
	- Discussion: *Why does the heart pump faster?* - Create a digital infographic: "How Exercise Strengthens the Heart"	
4th Lesson		
STEM Subject 1	**STEM Subject – Energy and Oxygen** **Focus:** Oxygen transport and energy production during exercise	20 min
STEM Subject 2		
Learning products	- Explanation of aerobic vs anaerobic respiration - Role-play: oxygen journey from lungs to muscles - Case study: lactic acid buildup in sprinters - Students write a short article: "Why We Breathe Hard During Exercise" - Create a comic strip: "Oxygen's Adventure in the Body"	
5th Lesson		
STEM Subject 1	Conclusion (5 minutes) **STEM Subject – Integration and Reflection** **Focus:** Applying biology knowledge to improve performance	5 min
STEM Subject 2		
Learning products	- Students design a personalized workout plan based on muscle groups and heart rate zones - Peer presentations: "My Body in Action" - Final quiz: vocabulary + biology concepts - Reflection journal: *What did I learn about my body?* - Class mural: "Secrets of a Healthy Body" combining all learning products	

Assessment

Throughout the unit, students are assessed using a combination of formative and summative strategies:

- **Observation** during physical activities to evaluate engagement and understanding of biological concepts.
- **Vocabulary quizzes** to assess acquisition of subject-specific language.
- **Worksheets and diagrams** to check comprehension of muscular and cardiovascular systems.
- **Group presentations** to evaluate collaboration and ability to explain scientific processes.
- **Reflection journals** to assess personal understanding and ability to apply biology to real-life exercise.

Final assessment

The final assessment includes:

- **Personalized workout plan**: Students design a routine based on biological principles (e.g., muscle groups, heart rate zones).
- **Oral presentation**: "My Body in Action" – students explain how their body responds to exercise using scientific vocabulary.
- **Written test**: Multiple-choice and short-answer questions covering biology content and vocabulary.
- **Self-assessment**: Students reflect on their progress and understanding of the topic.

Student feedback

Students are invited to share feedback through:

- **Exit tickets** after each lesson: "One thing I learned today…" / "One question I still have…"
- **Online survey or Google Form** at the end of the unit to evaluate engagement, clarity, and enjoyment.
- **Reflection journal entries**: Students express what they found most interesting or challenging.

Teacher feedback

Teachers reflect on the unit by:

- Reviewing student performance and engagement across lessons.
- Discussing interdisciplinary collaboration with colleagues (biology, PE, language).

- Completing a feedback form on lesson effectiveness, materials, and student outcomes.
- Identifying areas for improvement and professional development needs.

Annex 1

This annex includes all supplementary resources used during the unit:

1. **Vocabulary list** with definitions and pronunciation guide
2. **Muscular system diagram** for labeling activities
3. **Cardiovascular system chart** with blood flow explanation
4. **Heart rate tracking sheet** for physical activity sessions
5. **Worksheet templates** for each lesson
6. **Infographic samples** for student inspiration
7. **Rubrics** for assessing presentations and workout plans
8. **Reflection journal prompts**
9. **Quiz templates** (Kahoot/Quizizz)
10. **Links to educational videos and anatomy platforms**

A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

The History of Biology and Its Application in Physical Education

Authors

Francesco Mannarino

Summary

This learning unit explores the historical development of biological science and its impact on physical education. Students will investigate how discoveries in anatomy, physiology, and biomechanics have shaped training methods, health education, and movement practices. The unit promotes interdisciplinary thinking and connects biology to real-world applications in sports, health, and STEM careers.

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Subject (s)

- Biology (with historical and applied focus)
- Physical Education
- STEM Integration (Science, Technology, Engineering, Mathematics)
- Cross-curricular links: History, Health Education

Real- life questions

- How did scientific discoveries about the human body change the way we train and move?
- Why is understanding biology essential for athletes and PE teachers?
- How can knowledge of biomechanics and physiology prevent injuries?
- What role does biology play in designing inclusive and effective PE programs?

Aims of the lesson

- To understand key biological discoveries and their influence on physical education.
- To analyze the evolution of PE practices through a scientific lens.
- To foster critical thinking about health, movement, and body awareness.
- To encourage students to explore STEM-related career paths linked to biology and sport sciences.

Connection to STEM careers

Career Path	Biological Relevance	PE Connection

Career Path	Biological Relevance	PE Connection
Sports Scientist	Applies physiology and biomechanics	Designs training programs
Physiotherapist	Uses anatomy and motor control	Rehabilitation and injury prevention
Nutritionist	Understands metabolism and diet	Advises athletes and students
Biomedical Engineer	Develops prosthetics and wearables	Enhances movement and accessibility
Neuroscientist	Studies motor learning and coordination	Improves skill acquisition in sports

Age of students

14-19

Teaching resources (material & online tools)

Materials

- Historical timeline handouts
- Diagrams of anatomical systems
- Case studies of athletes and training evolution
- Worksheets for group analysis and discussion
- Printed or digital PE curriculum samples

Online Tools

- **Kahoot or Quizizz** – for gamified quizzes on biology and PE history
- **Visible Body or BioDigital Human** – interactive 3D anatomy models
- **Padlet or Jamboard** – collaborative timeline building
- **YouTube EDU** – documentaries on historical biology and sports science
- **Canva or Genially** – for student presentations and infographics

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	The unit integrates historical, biological, and physical education content with clear learning outcomes, formative assessment strategies, and cross-disciplinary relevance. Criteria include student engagement, conceptual understanding, and ability to connect biology to movement and health.
Instruction	Instruction is delivered through a mix of direct teaching, interactive discussion, and multimedia resources. It

	emphasizes clarity, historical context, and biological accuracy, with scaffolding to support diverse learners.
Personalization of learning	Students explore biology through personalized movement profiles, fitness goals, and historical case studies. Activities are adapted to different learning styles and physical abilities, promoting inclusive participation.
Problem and project-based learning (PBL)	Students investigate real-world questions such as "How did anatomical discoveries change training methods?" and "What biological principles guide modern PE programs?" Projects include timeline creation, sport-specific analysis, and health-focused presentations.
Game Based Learning (GBL)	Gamified activities include anatomy quizzes, relay simulations of blood flow, and team challenges on nutrition and biomechanics. These foster engagement, retention, and collaborative learning.
Curriculum implementation	The unit aligns with national biology and PE curricula, supports STEM integration, and fulfills Erasmus+ goals for interdisciplinary and innovative instruction. It can be embedded in science, health, or sport modules.
Emphasis on STEM topics and competencies	Focus areas include anatomy, physiology, biomechanics, and nutrition. Students develop scientific reasoning, data interpretation, and systems thinking—core STEM competencies.
Interdisciplinary instruction	The unit bridges biology, history, physical education, and health sciences. It encourages students to see connections between scientific discovery and societal change.
Contextualization of STEM teaching	Biological concepts are taught through the lens of physical education, making STEM relevant to students' bodies, health, and daily movement. Historical context adds depth and cultural awareness.
Professionalization of staff	Links STEM concepts to everyday activities and sports, helping students relate the material to their interests and experiences.
Highly qualified professionals	The unit is designed for delivery by biology and PE teachers with strong pedagogical and interdisciplinary skills. Collaboration between departments enhances quality.
Existence of supporting (pedagogical) staff	Support staff such as lab technicians, PE assistants, and digital learning coordinators contribute to hands-on activities and gamified instruction.
Professional development	Teachers receive training in gamification, interdisciplinary planning, and STEM pedagogy. Erasmus+ workshops and peer exchange programs support ongoing growth.
School leadership and culture	The lesson encourages teachers to explore innovative teaching methods and interdisciplinary approaches.

School leadership	Leadership supports innovation, interdisciplinary teaching, and STEM integration. The unit reflects strategic goals for modern, inclusive education.
High level of cooperation among staff	Biology, PE, and history teachers collaborate to co-design lessons, share resources, and evaluate outcomes. This fosters a culture of teamwork and shared responsibility.
Inclusive culture	Activities are adapted for students with diverse physical and cognitive needs. The unit promotes body awareness, health equity, and respect for individual differences.
Connections	The lesson is adaptable to different learning needs and styles, making it accessible to all students.
With industry	Links to sports science, health tech, and fitness industries provide real-world relevance. Guest speakers or virtual tours can enrich the unit.
With parents/guardians	Parents are informed about the unit's health and science focus. Home-based activities (e.g., fitness tracking or nutrition logs) encourage family involvement. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	The unit can be shared across Erasmus+ partner schools, with collaborative projects or digital exchanges. Platforms like eTwinning support cross-border learning. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Connections to local universities offer access to labs, research findings, and expert talks. Students may explore careers in sports science or biomedical fields. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Community sports clubs, health centers, and museums provide experiential learning opportunities. Students may engage in outreach or public presentations. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	Key STEM topics, such as forces, material properties, and mathematical formulas, are explored with hands-on activities and calculations.
Access to technology and equipment	The unit uses tablets, smartboards, fitness trackers, and anatomy software. Schools should ensure access to digital tools and PE equipment.
High quality instruction classroom	Materials include anatomical models, historical timelines,

materials	interactive worksheets, and gamified resources. All support active, inquiry-based learning.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
1st Lesson		
Brainstorming and discussion	**Introduction (10 minutes)** Students share prior knowledge about biology and physical education. The teacher facilitates a brainstorming session on how scientific discoveries may have influenced sports, movement, and health education. Key terms like anatomy, physiology, and biomechanics are introduced.	10 min
Discussion and preparation for the next lesson	Students reflect on the historical role of biology in shaping physical education. Groups are assigned to research one biological milestone (e.g., Vesalius, Harvey, Darwin) and prepare a short presentation for the next lesson.	
2nd Lesson		
STEM Subject 1	*Anatomy and Physiology* Focus on the muscular and skeletal systems, with emphasis on how anatomical understanding improved training and injury prevention. Students explore how early anatomical studies influenced physical education practices.	15 min
STEM Subject 1		
Learning products	*Students create labeled diagrams of major muscle groups and joints used in sports. They also produce a short written explanation of how anatomical knowledge supports safe movement.*	
3rd Lesson		
STEM Subject 2	*Biomechanics* Introduction to biomechanics and its application in analyzing movement. Students study how forces, motion, and body mechanics affect performance and injury risk.	15 min
STEM Subject 2		

Name of activity	Procedure	Time
Learning products	Students complete a movement analysis of a sport (e.g., sprinting, jumping) using biomechanical principles. They present their findings using annotated visuals or digital slides.	
4th Lesson		
STEM Subject 1	*Nutrition and Metabolism* Students learn how biological knowledge of metabolism and nutrition supports physical performance. Topics include macronutrients, hydration, and energy systems.	15 min
STEM Subject 2		
Learning products	Students design a personalized nutrition plan for a chosen sport or activity. They justify their choices based on biological principles and performance needs.	
5th Lesson		
STEM Subject 1	*Genetics and Neuroscience* Exploration of genetic traits and motor learning. Students discuss how biology can personalize physical education and training programs.	10 min
STEM Subject 2		
Learning products	Students create a digital poster or infographic showing how genetics and neuroscience influence movement, coordination, and athletic potential. Final reflections connect all STEM subjects covered in the unit.	

Assessment

- **Formative Assessment Conducted throughout the unit via:**

  - **Observation of group discussions and participation**
  - **Quizzes on anatomy, biomechanics, and nutrition**
  - **Evaluation of learning products (diagrams, presentations, posters)**
  - **Peer feedback sessions and collaborative tasks**

- **Criteria**

  - **Accuracy of biological content**
  - **Ability to connect biology to physical education**
  - **Creativity and clarity in learning products**
  - **Engagement in gamified and project-based activities**

Final assessment

- **Summative Evaluation** Based on:
  - Final digital poster or infographic on genetics/neuroscience in PE
  - Oral presentation or written reflection connecting all STEM subjects
  - Self-assessment rubric completed by students
  - Teacher evaluation using a standardized rubric
- **Grading Dimensions**

Student feedback

- Collected via:

  - Exit tickets after each lesson ("What did I learn? What was challenging?")
  - Online survey (Google Forms or Microsoft Forms) at the end of the unit
  - Group reflection: "How did gamification and STEM topics affect my learning?"
- Sample prompts:

  - "Which activity helped you understand biology the most?"
  - "Did you feel more engaged through games or projects?"
  - "Would you recommend this unit to other students?"

Teacher feedback

- Teachers complete a reflection log after each lesson:

  - What worked well?
  - Which students showed strong engagement or needed support?
  - How did interdisciplinary collaboration enhance the lesson?
- End-of-unit feedback includes:

  - Suggestions for improving gamified elements
  - Notes on timing, materials, and student outcomes
  - Recommendations for future Erasmus+ integration

Annex 1

Supporting Documents

Document	Description
Lesson Plans	Detailed breakdown of each lesson with objectives and activities
Rubrics	Assessment criteria for learning products and final evaluation
Student Worksheets	Templates for diagrams, nutrition plans, and movement analysis
Gamified Resources	Quiz links, challenge instructions, and scoring sheets
Erasmus+ Integration Notes	How the unit supports mobility, inclusion, and innovation
STEM Career Profiles	Handouts showing real-world applications of biology in PE

TATYANA

PE-STE[A]M

A Different Model In InterdIscIplInary TeachIng PhysIcal EducatIon and STEAM

PE-STEAM

2023-2-IT02-KA210-SCH-000178106

PE-BIT

LESSON PLANS



A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN

Title

Physical Education and ICT – A Historical and Practical Approach

Authors

Francesco Mannarino

Summary

This unit explores the evolution and integration of Information and Communication Technology (ICT) in Physical Education (PE). Students will investigate how digital tools have transformed teaching, learning, and performance analysis in sports and fitness. Through historical inquiry, hands-on activities, and digital exploration, learners will gain insights into the role of technology in promoting physical well-being and innovation in education.

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Subject (s)

- **Main Subject**: Physical Education
- **Cross-curricular Links**: ICT, History, Health Education, STEM

Real- life questions

- How has technology changed the way we learn and practice physical activities?
- Can digital tools improve athletic performance and motivation?
- What are the ethical and health implications of wearable fitness trackers?
- How can ICT support inclusive and remote physical education?

Aims of the lesson

- To understand the historical development of ICT in Physical Education
- To identify and evaluate digital tools used in PE today
- To promote critical thinking about the benefits and limitations of technology in physical activity
- To foster digital literacy and interdisciplinary connections with STEM

Connection to STEM careers

This unit introduces students to career paths such as:

- **Sports Scientist**: Uses data and technology to optimize performance
- **Biomechanics Analyst**: Applies physics and motion analysis in sports
- **Fitness App Developer**: Designs mobile tools for health and training
- **PE Technologist**: Integrates ICT into educational and coaching environments
- **Health Data Analyst**: Interprets biometric data for wellness programs

Age of students

14-19

Teaching resources (material & online tools)

Materials

- Printed timeline templates
- PE equipment (optional for movement-based activities)
- Worksheets for ICT tool analysis
- Poster boards or digital presentation software

Online Tools

- **Video Analysis Platforms**: Dartfish, Coach's Eye
- **Fitness Apps**: Strava, MyFitnessPal, Nike Training Club
- **Wearable Tech Dashboards**: Fitbit, Garmin Connect
- **Interactive Learning Tools**: Kahoot, Padlet, Canva
- **Research Resources**: Google Scholar, YouTube EDU, Erasmus+ Project Archives

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	The unit integrates historical, biological, and physical education content with clear learning outcomes, formative assessment strategies, and cross-disciplinary relevance. Criteria include student engagement, conceptual understanding, and ability to connect biology to movement and health.
Instruction	The lesson combines historical analysis, digital exploration, and hands-on activities. It uses a blended approach with teacher-led explanations, student collaboration, and digital tools to foster engagement and understanding.
Personalization of learning	Students choose which ICT tools to explore based on their interests (e.g., fitness apps, video analysis, wearables). Differentiated tasks allow learners to work at their own pace and reflect on personal experiences with technology and physical activity.
Problem and project-based	Students investigate real-world challenges such as how

learning (PBL)	to motivate sedentary peers using technology. They design posters or digital presentations showing the evolution of ICT in PE and propose innovative solutions for inclusive physical education.
Game Based Learning (GBL)	Gamified platforms like Kahoot or Quizizz are used to reinforce historical milestones and tech vocabulary. Students may also explore fitness apps that use gamification to promote physical activity.
Curriculum implementation	The lesson aligns with national and European curriculum goals for Physical Education, Digital Competence, and STEM literacy. It supports key competencies such as critical thinking, collaboration, and digital citizenship.
Emphasis on STEM topics and competencies	Students engage with data analysis (e.g., heart rate tracking), biomechanics, and digital systems. The unit promotes computational thinking, problem-solving, and understanding of technology's role in health sciences.
Interdisciplinary instruction	The lesson connects PE with ICT, History, Health Education, and STEM. It encourages students to see physical activity through the lens of technological innovation and scientific inquiry.
Contextualization of STEM teaching	Examples are drawn from real-life applications such as wearable tech, sports analytics, and remote PE during the pandemic. Students reflect on how STEM tools impact their daily lives and future careers.
Professionalization of staff	Links STEM concepts to everyday activities and sports, helping students relate the material to their interests and experiences.
Highly qualified professionals	The lesson is designed and delivered by PE teachers with digital literacy training, supported by ICT specialists or STEM coordinators when available.
Existence of supporting (pedagogical) staff	Digital facilitators or Erasmus+ coordinators may assist with tech setup, platform navigation, and interdisciplinary integration.
Professional development	Staff are encouraged to attend workshops on digital tools in PE, participate in Erasmus+ exchanges, and share best practices through internal training sessions.
School leadership and culture	School leaders promote innovation, inclusion, and digital transformation. They support interdisciplinary projects and allocate resources for tech-enhanced learning.
School leadership	PE, ICT, and STEM teachers collaborate to design and evaluate the unit. Shared planning fosters a cohesive learning experience and cross-subject synergy.
High level of cooperation among staff	PE, ICT, and STEM teachers collaborate to design and evaluate the unit. Shared planning fosters a cohesive learning experience and cross-subject synergy.
Inclusive culture	The unit accommodates diverse learners through

	differentiated tasks, accessible platforms, and inclusive discussions on health and technology. It promotes equity in digital access and physical activity.
Connections	The lesson is adaptable to different learning needs and styles, making it accessible to all students.
With industry	Students explore careers in sports tech, app development, and health analytics. Guest speakers or virtual tours may be arranged with local fitness tech companies.
With parents/guardians	Parents are informed about the unit's goals and encouraged to discuss digital health tools at home. Optional family fitness challenges using apps may be proposed. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	The unit can be shared through Erasmus+ partnerships or eTwinning. Students may collaborate with peers abroad to compare ICT use in PE across countries. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Connections with sports science departments or educational technology labs can enrich the unit. Students may analyze real research data or attend webinars. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Local gyms, sports clubs, or health centers may offer insights into tech use in training. Community events can showcase student projects or promote digital wellness. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	Key STEM topics, such as forces, material properties, and mathematical formulas, are explored with hands-on activities and calculations.
Access to technology and equipment	The school provides tablets, smartboards, and internet access. Students may use personal devices under supervision. Wearables or fitness apps are integrated when available.
High quality instruction classroom materials	Materials include curated videos, interactive timelines, app demos, and printable resources. All content is aligned with curriculum standards and digital safety guidelines.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
	1st Lesson	
Brainstorming and discussion	**Introduction (10 minutes)** - Icebreaker: "How do you use technology to stay active?" - Brainstorming session: Students list ICT tools they know (apps, wearables, platforms) - Group discussion: How has technology changed PE over time? - Teacher presents historical timeline of ICT in PE - Students reflect on real-life examples (e.g., fitness apps, smartwatches)	10 min
Discussion and preparation for the next lesson	Students choose one ICT tool to explore in the next lesson	
	2nd Lesson	
STEM Subject 1	**STEM Focus – Biomechanics and Motion Analysis** **Focus**: STEM Subject 1 – Physics in PE **Activities**: • Introduction to biomechanics: force, motion, angles in sports • Demonstration of video analysis tools (e.g., Coach's Eye, Dartfish) • Students record short physical movements (e.g., jump, throw) and analyze them	15 min
STEM Subject 1		
Learning	*Create a digital slide explaining the physics behind a movement using screenshots*	

Name of activity	Procedure	Time
products	*and annotations*	
3rd Lesson		
STEM Subject 2	***Focus – Data and Wearable Technology*** ***Focus**: STEM Subject 1 – Data Science and Health Monitoring* ***Activities**:* • *Introduction to wearable tech: heart rate, steps, calories* • *Students explore sample dashboards from Fitbit or Garmin* • *Discussion: How can data improve performance and health?*	15 min
STEM Subject 2		
Learning products	Students design a weekly fitness plan using data insights and present it as a digital infographic	
4th Lesson		
STEM Subject 1	**Focus – App Design and Digital Literacy** **Focus**: STEM Subject 1 – ICT and App Evaluation **Activities**: • Students evaluate popular fitness apps (e.g., Strava, Nike Training Club) • Criteria: usability, motivation, data tracking, inclusivity • Group work: Design a concept for a new PE app for schools	15 min
STEM Subject 2		
Learning products	App storyboard or mock-up using Canva or Padlet	
5th Lesson		
STEM Subject 1	***STEM Focus – Presentation and Reflection*** ***Focus**: STEM Subject 1 – Communication and Synthesis* ***Activities**:* • *Students present their learning products (video analysis, fitness plan, app concept)* • *Peer feedback and discussion* • *Reflection: "How can ICT make PE more inclusive and*	10 min

Name of activity	Procedure	Time
	effective?"	
STEM Subject 2		
Learning products	Final task: Write a short blog post or record a video summarizing their learning journey	

Assessment

Assessment (Formative)

Throughout the 5-lesson sequence, students will be assessed through:

- **Observation**: Participation in discussions, group work, and hands-on activities
- **Digital Tasks**: Quality and creativity of learning products (e.g., video analysis, fitness plans, app evaluations)
- **Self-Assessment**: Students reflect on their learning using checklists or digital journals
- **Peer Assessment**: Constructive feedback on presentations and group work

Assessment Criteria:

Criteria	Description
Engagement	Active participation in class and group tasks
Understanding	Ability to explain ICT tools and their impact on PE
Application	Use of STEM concepts in analyzing or designing PE tools
Creativity	Originality in digital products and app concepts
Communication	Clarity and effectiveness in presenting ideas

Final assessment

Students will complete a **final project** that synthesizes their learning:

- **Option A**: A digital presentation or video explaining how ICT has transformed PE, including historical context, STEM applications, and a proposed innovation
- **Option B**: A group-designed prototype of a PE app or wearable concept, with annotated features and STEM rationale

Rubric:

Level	Description
Excellent	Demonstrates deep understanding, originality, and strong STEM integration
Good	Solid understanding with clear application of concepts
Satisfactory	Basic understanding with some STEM connections
Needs Improvement	Limited understanding or incomplete product

Student feedback

Students will complete a short feedback form or Padlet reflection with prompts such as:

- "What did you enjoy most about this unit?"
- "Which ICT tool or STEM topic was most interesting to you?"
- "What would you improve or change in this learning experience?"
- "Do you feel more confident using technology in PE?"

Teacher feedback

Teachers will reflect on:

- Student engagement and learning outcomes
- Effectiveness of interdisciplinary integration
- Challenges in implementing digital tools
- Suggestions for improving future iterations of the unit

This can be documented in a shared evaluation grid or Erasmus+ project report.

Annex 1

This annex includes:

1. **Timeline Template** – For historical evolution of ICT in PE
2. **App Evaluation Grid** – Criteria for analyzing fitness apps
3. **Storyboard Template** – For designing a PE app
4. **Reflection Journal Prompts** – For student self-assessment
5. **Presentation Rubric** – For final product evaluation
6. **Glossary** – Key terms (e.g., biomechanics, wearable tech, data tracking)
7. **STEM Career Cards** – Short profiles of related professions
8. **Digital Safety Guidelines** – For responsible use of apps and devices

A New Model in Interdisciplinary Teaching – PE - STEM

LESSON PLAN TEMPLATE

Title

CLIL lesson on **Physical Education and ICT**

Authors

Angela Bonofiglio

Summary

This interdisciplinary unit explores how Information and Communication Technology (ICT) enhances Physical Education. Students will discover digital tools used in sports and fitness, analyze their impact on performance and health, and develop language skills through CLIL methodology. The unit promotes digital literacy, critical thinking, and awareness of technology in everyday life.

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Subject (s)

- **Main Subject:** Physical Education
- **Integrated Subject:** English as a Foreign Language (CLIL)
- **Cross-curricular Links:** Technology, Science, Health Education

Real- life questions

- **How can technology help us improve our physical performance?**
- **What digital tools are used by athletes and coaches?**
- **Can fitness apps and wearables motivate people to stay active?**
- **How does data analysis influence training and recovery?**

Aims of the lesson

- To understand the role of ICT in physical education and sports.
- To identify and describe technological tools used in fitness and training.
- To develop English language skills through content-based learning.
- To encourage collaboration, creativity, and digital competence.
- To connect physical activity with technological innovation and data analysis.

Connection to STEM careers

- **Sports Scientist:** Uses data to optimize athletic performance.
- **Fitness Technologist:** Designs and tests wearable devices.
- **Software Developer:** Creates fitness and health tracking apps.
- **Biomechanics Expert:** Applies motion sensors to study movement.
- **Health Data Analyst:** Interprets biometric data for wellness programs.

Age of students

14-19

Teaching resources (material & online tools)

Materials

- **Projector or smartboard**
- **Printed worksheets or digital devices**
- **Infographics and articles on fitness technology**
- **Videos demonstrating ICT tools in sports**
- **Vocabulary flashcards**
- **Role-play scripts and writing templates**

Online Tools

- **YouTube – for tutorial and demonstration videos**
- **Google Forms – for quizzes and surveys**
- **Padlet or Jamboard – for collaborative brainstorming**
- **Fitness Apps (e.g., Strava, Nike Training Club) – for exploration and analysis**
- **Wordwall or Quizlet – for vocabulary games and revision**
- **Canva or Genially – for creating digital presentations**

21st century skills

How the lesson plan corresponds to 21st century skills. To find out more: http://www.p21.org/our-work/p21-framework

This lesson plan will enhance among the students the following skills, defined as 21st century skills:

Elements and criteria	The lesson integrates digital tools into Physical Education through a CLIL approach, fostering both content mastery and English language development. It emphasizes active learning, collaboration, and digital competence.
Instruction	Instruction is student-centered, combining direct teaching, multimedia input, group work, and interactive activities. English is used as the medium of instruction, with scaffolding strategies to support comprehension and communication.

Personalization of learning	Differentiated tasks, visual aids, and flexible grouping allow students to engage at their own pace and language level. Advanced learners can explore app design or data analysis, while others focus on vocabulary and basic tool use.
Problem and project-based learning (PBL)	Students are encouraged to solve real-world challenges, such as designing a tech-enhanced PE session or evaluating the effectiveness of a fitness app. These tasks promote critical thinking and creativity.
Game Based Learning (GBL)	Interactive quizzes, vocabulary games (e.g., Quizlet, Wordwall), and fitness challenges using apps or wearables make learning engaging and competitive in a healthy way.
Curriculum implementation	The lesson aligns with national PE and English curricula, integrating digital citizenship and health education. It supports key competencies such as communication, collaboration, and digital literacy.
Emphasis on STEM topics and competencies	The unit highlights the intersection of technology and health science, promoting data interpretation, digital tool usage, and awareness of STEM-related careers in sports and wellness.
Interdisciplinary instruction	Combines Physical Education, English, ICT, and elements of Science and Health Education. Encourages students to see connections between disciplines and apply knowledge in integrated contexts.
Contextualization of STEM teaching	Technology is presented as a real-life tool for improving health and performance. Students explore how athletes and individuals use ICT in daily routines, making STEM learning relevant and practical.
Professionalization of staff	Teachers are encouraged to collaborate across departments (PE, English, ICT) and engage in continuous learning to effectively deliver interdisciplinary and CLIL-based instruction.
Highly qualified professionals	The lesson is designed to be delivered by educators with expertise in their subject area and training in CLIL methodology, ensuring both content accuracy and language support.
Existence of supporting (pedagogical) staff	Language assistants, ICT facilitators, and special education staff can support differentiated instruction, language scaffolding, and inclusion of students with diverse needs.
Professional development	Ongoing training in CLIL, digital tools, and interdisciplinary teaching is essential. Workshops and peer observation help teachers refine strategies and stay updated on educational technology.
School leadership and culture	The school promotes innovation, collaboration, and

	inclusion. Leadership supports cross-curricular projects and encourages the integration of technology in teaching and learning.
School leadership	Leaders foster a shared vision for digital transformation and interdisciplinary learning. They provide resources, time for planning, and support for experimentation and reflection.
High level of cooperation among staff	Teachers co-plan and co-teach across departments. Regular meetings and shared digital platforms facilitate communication and resource sharing.
Inclusive culture	The lesson is accessible to all learners, with adaptations for language proficiency, learning styles, and physical abilities. It promotes equity, participation, and respect for diversity.
Connections	Collaboration with sports technology companies or local sports organizations could enhance the lesson by providing real-world insights and tools.
With industry	Students explore careers in sports technology, app development, and health analytics. Guest speakers or virtual tours can enhance real-world relevance.
With parents/guardians	Parents are informed about the use of technology in PE and encouraged to support healthy digital habits at home. Encourage parents to join activities like family sports events, collaborative English games, or storytelling sessions to enhance engagement and learning together.
With other schools and/or educational platforms	Opportunities for collaboration through eTwinning, shared Padlets, or virtual fitness challenges with partner schools. Collaborate with other schools and platforms through shared projects, workshops, or exchange programs, fostering mutual learning and resource sharing.
With universities and/or research centers	Possible partnerships for workshops, research projects, or mentorship programs related to sports science and digital innovation. Collaborate with universities and research centers by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
With local communities	Involvement of local gyms, sports clubs, or wellness centers to demonstrate real-life applications of ICT in physical activity. Collaborate with local communities by sharing resources, conducting joint studies, or organizing workshops to enhance knowledge and develop innovative approaches.
School infrastructure	Access to sports facilities and equipment is essential for physical activities related to biology.

Access to technology and equipment	The school provides access to tablets, smartboards, internet, and fitness-related devices (e.g., pedometers, heart rate monitors) to support hands-on learning.
High quality instruction classroom materials	Materials include multimedia content, interactive apps, authentic articles, and CLIL-adapted worksheets that support both content and language learning.

Lesson Plan

The implementation of integrated STEM teaching and learning is facilitated by the use of specific pedagogical approaches (PBL, GBL, etc). In order to facilitate the research done by the teachers and the design of activities by teachers, a selection of such approaches is presented in Annex 1. Maintaining Annex 1 in the Learning Scenario and citing where necessary is mandatory.

Name of activity	Procedure	Time
1st Lesson		
Brainstorming and discussion	**Phase 1: Brainstorming and Discussion** • Students discuss how technology is used in sports and physical education. • Brainstorm tools they know (e.g., smartwatches, fitness apps, motion sensors). • Teacher introduces the concept of ICT in PE and its relevance to STEM.	5 min
Discussion and preparation for the next lesson	**Discussion and Preparation for the Next Lesson** • Students are divided into small groups and assigned a type of technology to research (e.g., heart rate monitors, GPS trackers). • Each group prepares a short presentation or infographic for the next lesson. • Teacher introduces the idea of analyzing data and performance—setting the stage for STEM Subject 1.	
2nd Lesson		
STEM Subject 1	**Phase 1: STEM Subject 1 – Technology and Data in Physical Education** • Focus on how data is collected and used in PE (e.g., steps, calories, heart rate). • Introduction to basic data analysis: reading graphs,	20 min

Name of activity	Procedure	Time
	interpreting statistics from fitness apps.	
STEM Subject 2		
Learning products	**Phase 2: Learning Products** • Students present their group research from Lesson 1. • Create a digital poster or slide deck explaining how their assigned technology works and its benefits. • Use Canva, Google Slides, or Padlet for collaborative creation.	
3th Lesson		
STEM Subject 1	**Phase 1: STEM Subject 1 – Sensors and Motion Tracking** • Explore how motion sensors and accelerometers work in sports. • Discuss biomechanics and how movement is analyzed using ICT.	15 min
STEM Subject 2		
Learning products	**Phase 2: Learning Products** • Students simulate a simple movement analysis using a mobile app or video. • Create a short report or video explaining how motion tracking can improve performance. • Include visuals, graphs, or screenshots from apps.	
4th Lesson		
STEM Subject 1	**Phase 1: STEM Subject 1 – Wearable Technology and Health Monitoring** • **Study wearable devices: smartwatches, fitness bands, and their health features.** • **Discuss how athletes and individuals use wearables for training and recovery.**	20 min
STEM Subject 2		
Learning products	**Phase 2: Learning Products** • Students design their own wearable concept: what it tracks,	

Name of activity	Procedure	Time
	how it helps, and who it's for. • Create a product pitch (poster, video, or mock-up) to present to the class.	
5th Lesson		
STEM Subject 1	Conclusion (5 minutes) **Phase 1: STEM Subject 1 – ICT and Virtual Coaching** • **Explore virtual training platforms, online coaching, and AI in fitness.** • **Discuss pros and cons of remote training and digital feedback.**	5 min
STEM Subject 2		
Learning products	**Phase 2: Learning Products** • Students work in teams to design a tech-enhanced PE lesson using ICT tools. • Present their lesson plan with objectives, tools used, and expected outcomes. • Reflect on how technology can improve motivation, performance, and inclusion in PE.	

Assessment

Assessment is continuous and formative throughout the unit. It focuses on both content understanding and language development.

Criteria

Area	**Indicators**
Content Knowledge	Understanding of ICT tools in PE, ability to explain their use and benefits
Language Skills	Use of subject-specific vocabulary, clarity in oral and written communication
Collaboration	Active participation in group tasks, respectful interaction, shared

Area	Indicators
	responsibility
Creativity	Originality in designing tech-based PE activities or wearable concepts
Digital Competence	Ability to use apps, platforms, and tools effectively and responsibly

Tools

- Observation grids
- Peer and self-assessment checklists
- Rubrics for presentations and digital products
- Vocabulary quizzes and comprehension tasks

Final assessment

The final assessment is project-based. Students work in teams to design and present a **tech-enhanced PE lesson** using ICT tools.

Evaluation Criteria

Component	Description
Project Design	Clear objectives, appropriate use of technology, relevance to PE
Presentation	Use of English, clarity, engagement, visual support
Reflection	Ability to evaluate the impact of ICT on physical activity
Collaboration	Teamwork, role distribution, mutual support

Students submit a digital presentation (e.g., Canva, Google Slides) and deliver a short oral pitch.

Student feedback

Students reflect on their learning experience through:

- A short questionnaire (Google Forms or paper-based)
- Prompts like:
    - *What did you enjoy most about this unit?*
    - *Which ICT tool would you use in your own training?*
    - *How did working in English help you learn?*
    - *What would you improve in future lessons?*

Teacher feedback

Teachers reflect on:

- Student engagement and progress
- Effectiveness of CLIL strategies
- Integration of STEM and PE
- Collaboration among staff

Feedback is collected through:

- Team debriefing sessions
- Shared digital notes (e.g., OneNote, Padlet)
- Rubric-based evaluation of student products

Annex 1

Annex 1 includes:

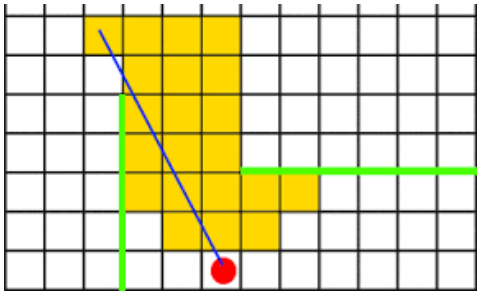
- Lesson rubrics (for presentations, posters, reports)
- Vocabulary list and flashcards
- Student self-assessment form
- Peer evaluation template
- Teacher observation grid
- Final project rubric
- Feedback questionnaire (student version)

A New Model in Interdisciplinary Teaching – PE - STEM

BIT & PHYSICAL EDUCATION LESSON PLAN UNPLUGGED CODING

Theme: Learning Coding Through Movement







The more permanent
"Duct Tape Method"



The easy to modify
"Dry Erase Slip Method"

Lesson Information

- **Teacher: Nagehan Baykan Afşar**
- **Subjects:** Information Technologies (ICT) & Physical Education
- **Topic:** Unplugged Coding (Bilgisayarsız Kodlama)
- **Grade Level:** Grade 9 (Lise 1)
- **Duration:** 40 minutes
- **Lesson Area:** Gym / Schoolyard

Lesson Aim

The aim of this lesson is to help students:

- Understand the **basic logic of coding without using computers**
- Learn key coding concepts such as **algorithm, command, sequence, and debugging**
- Experience coding through **movement, cooperation, and problem-solving**
- Develop computational thinking in a **physical and playful environment**

Learning Outcomes

Students will be able to:

- Explain what an **algorithm** is using their own words
- Follow and create **step-by-step instructions (commands)**
- Identify and correct errors through **debugging**
- Work cooperatively in roles during coding activities

Materials Needed

- 20–30 training cones
- "START" and "FINISH" cards
- Command cards: **Forward, Backward, Turn Right, Turn Left, Jump, Stop**
- 4–6 target objects (balls, flags, cards)
- (Optional) loop cards (×2, ×3)

PART 1 – INTRODUCTION: WHAT IS CODING? (0–7 min)

Purpose

To introduce coding logic in a simple and concrete way.

Teacher Prompt

Ask students:

"How does a robot know what to do?"

Explain briefly:

- Coding means giving **clear and ordered instructions**
- Computers and robots **only do what we tell them**

Teacher message:

"Today, you will be the robot."

PART 2 – BASIC CODING CONCEPTS (7–12 min)

Teacher introduces key concepts using the board or cards:

- **Algorithm:** Step-by-step plan
- **Command:** A single instruction
- **Sequence:** Correct order of commands
- **Debugging:** Finding and fixing mistakes

Short example:

- "Forward, Forward, Turn Right, Forward"

PART 3 – MAIN ACTIVITY: CODING STATION – 'CODE COURSE' (12–32 min)

Station Name

Station 1: Code Course (Unplugged Coding with Cones)

Purpose

To apply coding logic through physical movement.

Setup (Teacher Preparation)

- Cones are placed in a **grid layout** (4×4 or 5×5)
- One corner = **START**
- Opposite corner = **FINISH**
- Some cones are marked as **obstacles** (do not step on)
- One cone includes a **target object**

Student Roles

- **Robot:** Moves on the course
- **Programmer:** Selects and reads commands
- **Tester:** Observes errors and suggests fixes
- *(Roles rotate after each attempt)*

Command Rules

- **Forward:** Move one cone forward
- **Turn Right / Left:** Turn 90 degrees
- **Jump:** Jump on the same spot
- **Stop:** End of program

Robot can **only move according to commands**.

Activity Flow

1. **Planning (2 min)**
Group discusses and arranges command cards in order.

2. **Running the Code (2 min)**
Programmer reads commands one by one.
Robot follows exactly.

3.**Debugging (1 min)**
If the robot:

- steps on an obstacle
- goes the wrong way

Tester says:

"There is a bug. We need to fix the code."

Commands are corrected and tested again.

4. **Success Condition**
Robot reaches the target and FINISH **without touching obstacles**.

PART 4 – REFLECTION AND DISCUSSION (32–38 min)

Teacher asks:

- "Which command was most important?"
- "What happened when one command was wrong?"
- "How is this similar to computer coding?"

Students share short answers.

PART 5 – CLOSURE (38–40 min)

Exit Sentence

Students complete:

"Coding is like giving instructions because _____."

Key Message of the Lesson

"Coding is thinking, not typing."
"A correct algorithm leads to success."

Assessment

Teacher observes:

- Understanding of coding concepts
- Correct use of commands
- Ability to debug errors
- Cooperation and role sharing

Safety Rules

- No running on the course
- One robot at a time
- Cones must stay in place

Optional Extensions

- Add **loop cards** (repeat ×3)
- Time challenge (fastest correct code)
- Second station: **Blind Robot (pair programming)**

RUBRIC

Criteria	4 – Excellent	3 – Good	2 – Developing	1 – Needs Improvement
Understanding of Coding Concepts	Clearly understands and explains algorithm, command, sequence, and debugging using correct terms.	Understands basic coding concepts with minor support.	Shows partial understanding of coding concepts.	Does not understand basic coding concepts.
Creating an Algorithm (Commands)	Creates a clear, correct, and complete command sequence.	Creates a mostly correct sequence with minor errors.	Creates an incomplete or confusing sequence.	Unable to create a working command sequence.
Following the Algorithm (Robot Role)	Follows commands accurately without adding extra movements.	Follows commands with minor mistakes.	Frequently forgets or changes commands.	Does not follow commands correctly.
Debugging (Error Correction)	Identifies errors quickly and suggests correct solutions.	Identifies errors with some guidance.	Notices errors but struggles to fix them.	Does not recognize or fix errors.
Collaboration and Role Sharing	Works cooperatively, respects roles, and supports group members.	Usually cooperative with minor reminders.	Needs reminders to cooperate or stay in role.	Does not cooperate or respect group roles.
Participation and Effort	Actively participates with high motivation.	Participates regularly with good effort.	Participation is inconsistent.	Rarely participates.
Safety Awareness	Always follows safety rules during activities.	Usually follows safety rules.	Sometimes ignores safety rules.	Frequently ignores safety rules and creates risk.

STUDENT WORKSHEET – WRITE YOUR CODE

Unplugged Coding: Code Course

Student Name: _____ Class: _____ Date: _____

Part 1 – My Role Today

☐ Programmer
☐ Robot
☐ Tester (Debugger)
☐ Timekeeper

Part 2 – Command List

Write the commands your group used (in order).

Available commands:
F = Forward B = Backward
R = Turn Right L = Turn Left
J = Jump S = Stop

Part 3 – Did It Work?

☐ Yes, our code worked the first time
☐ No, we had to fix it

If you fixed it, what was the mistake (bug)?

.....

How did you fix it (debugging)?

.....

Part 4 – Reflection

Answer briefly:

1. What was the hardest part of writing the code?
.....

2. Why is the correct order of commands important?
.....

STUDENT SELF-ASSESSMENT – UNPLUGGED CODING

Student Name: _____ Date: _____

I can…	Always (4)	Mostly (3)	Sometimes (2)	Not yet (1)
explain what an algorithm is.	○	○	○	○
write step-by-step commands for a task.	○	○	○	○
follow commands carefully as the robot.	○	○	○	○
find and fix mistakes (debug).	○	○	○	○
work well with my group.	○	○	○	○
follow safety rules during activities.	○	○	○	○

Student Reflection

- **One thing I learned about coding today:**
  .....
- **One thing I want to improve next time:**
  .....

☐ I did my best in this lesson.
☐ I understand that coding is about thinking step by step.

Student Signature: _____



A Different Model In Interdisciplinary Teaching Physlcal Education and STEAM

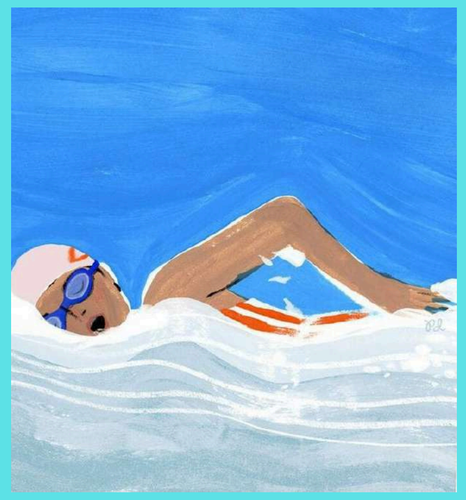
PE-STEAM

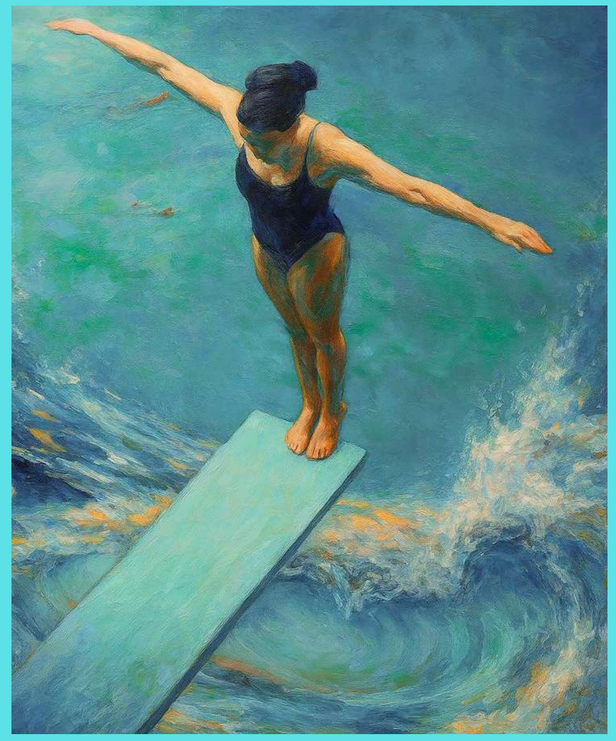
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WHICH PHYSICAL ACTIVITY DO YOU PREFER?

SWIMMING

Swimming is a sport and activity where people move through water using different strokes like freestyle, backstroke, breaststroke, and butterfly. It's great for fitness, improves strength and endurance, and is enjoyed both competitively and for fun.





Swimming is important for the body because:
It works the whole body, strengthening muscles and improving flexibility. It boosts heart and lung health, improving endurance.
It’s low-impact, so it's gentle on the joints.
It burns calories, helping with weight control.
It improves coordination and balance, especially in younger and older people.
Overall, swimming keeps the body strong, healthy, and fit.

Chiara

Pilates

Pilates is a method of exercise that combines breathing, posture control, and movement, it’s a flexibility exercise.

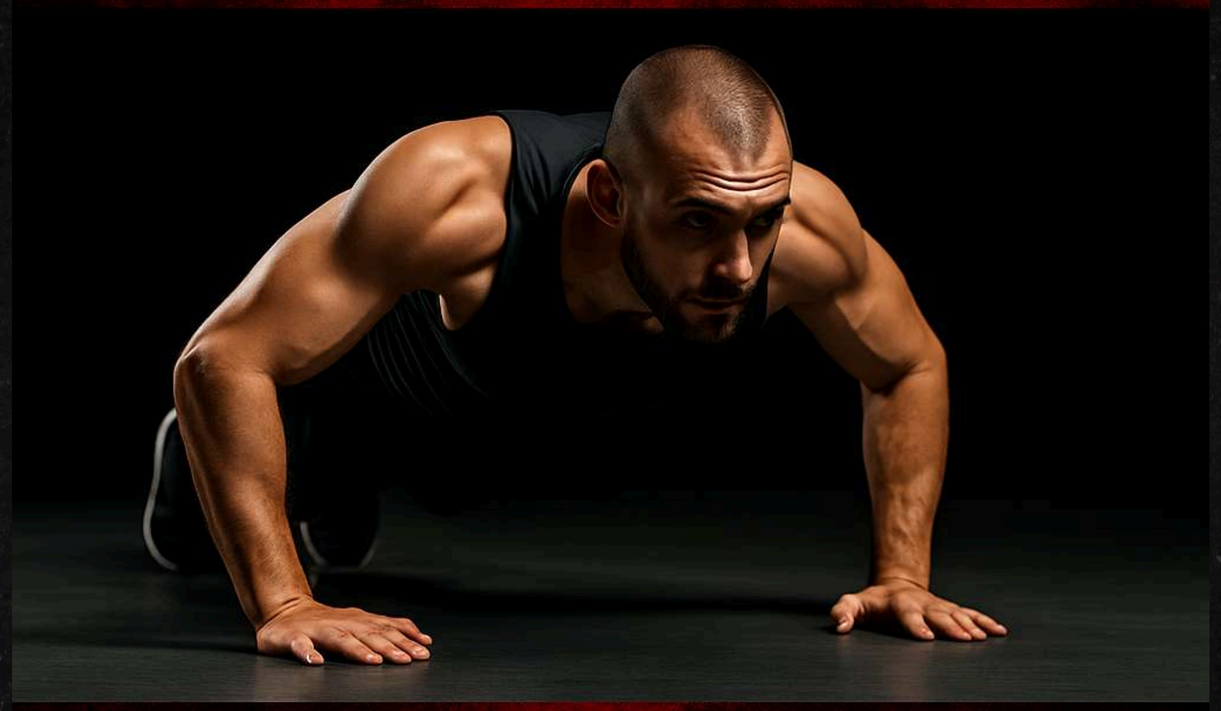
aiming at:

- strengthening deep muscles (especially the core)
- improving posture and flexibility, and promote balance
- focus, and body awareness.

Gemma~



PUSH UPS



Salvatore

BENEFITS

- Improve upper body strength
- Increase muscular endurance
- Strengthen the core

MUSCLES WORKED

- Chest
- Triceps
- Shoulders
- Core

A simple exercise for extraordinary *results!*

Running

runnig Is a sport of

light Athletic characterized in sequence of jumps where feet are both in air.



Why Is It important?

This sport Is important because allows us to improve our resistence, velocity and prevent illnesses and injuries too!





MANUEL

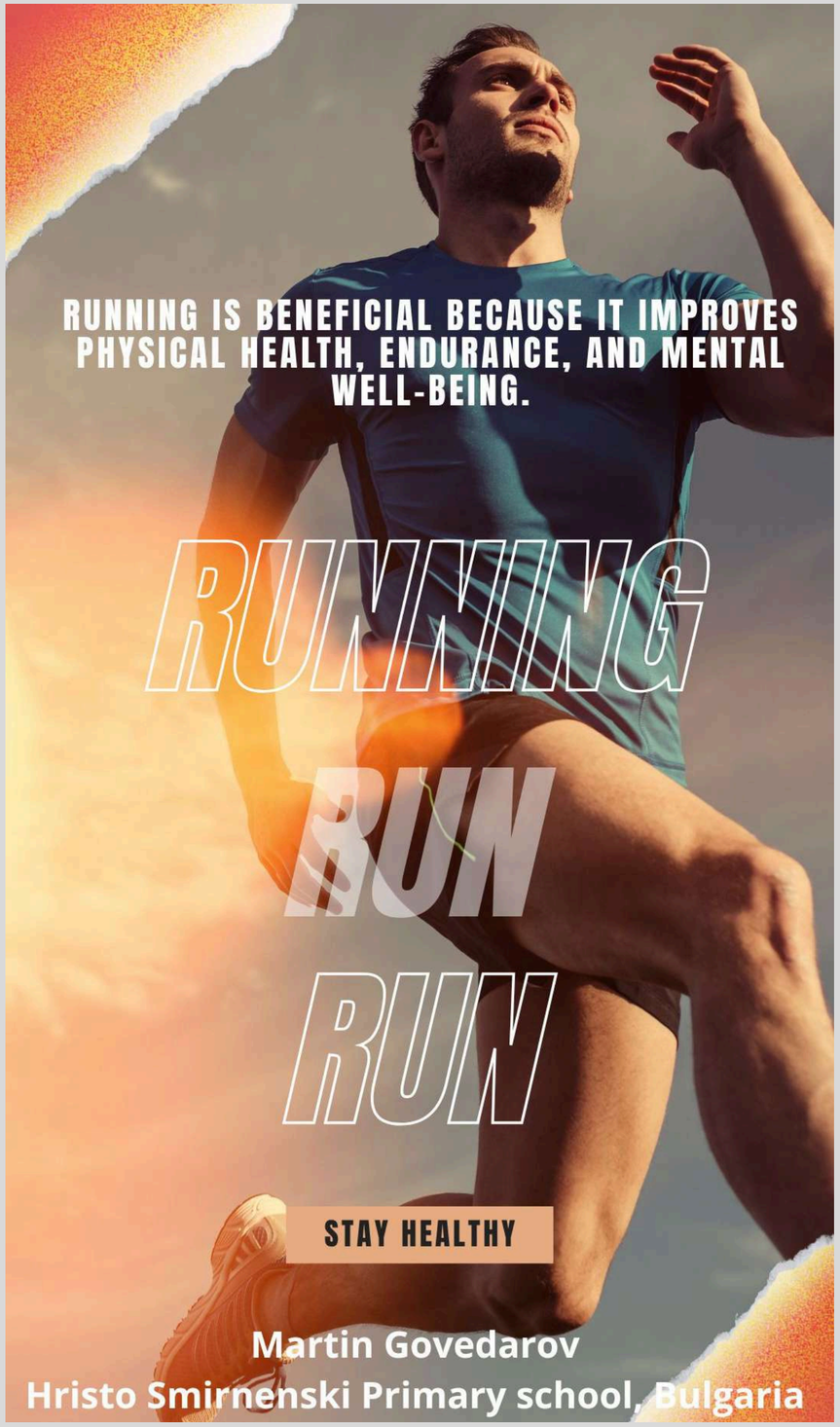
Endurance exercise

CYCLING



CYCLING IS BENEFICIAL BECAUSE IT IMPROVES CARDIOVASCULAR HEALTH, STRENGTHENS MUSCLES, AND REDUCES STRESS WHILE BEING ENVIRONMENTALLY FRIENDLY.

Stefan Genov
Hristo Smirnenski Primary School, Bulgaria


RUNNING IS BENEFICIAL BECAUSE IT IMPROVES PHYSICAL HEALTH, ENDURANCE, AND MENTAL WELL-BEING.
RUNNING
RUN
RUN
STAY HEALTHY
Martin Govedarov
Hristo Smirnenski Primary school, Bulgaria


CLASH
DANCING IS BENEFICIAL BECAUSE IT
YOUR PARAGRAPH TEXT
IMPROVES PHYSICAL FITNESS,
COORDINATION, AND FLEXIBILITY.
IT STRENGTHENS THE
MUSCLES, HEART,
AND LUNGS,
SUPPORTS POSTURE
AND BALANCE, AND
ALSO REDUCES
STRESS AND BOOSTS
MOOD!
DANCING
YANITSA YACHEVA
HRISTO SMIRNENSKI PRIMARY SCHOOL, BULGARIA

ENDURANCE EXERCISE

SWIMMING



Swimming is a low-impact, full-body workout that enhances cardiovascular health, builds muscular strength and endurance, improves flexibility and coordination, and is also a great way to reduce stress and support mental well-being.

Anna-Mariya Pavlova
Hristo Smirnenski Primary School, Rakovski





Push-ups help build upper body strength by working the chest, shoulders, and arms. They also strengthen the core, improving balance and posture. Since they don't require any equipment, push-ups are an easy and effective way to stay fit.

Petar Pavlov
Hristo Smirnenski Praimary School

GARDENING



Gardening as a form of physical activity helps in improving strength, flexibility and stamina.

✓ Regular gardening activities, like digging and planting, can lower the risk of heart disease and obesity.



✓ Gardening promotes relaxation, which can help lower blood pressure.







Exposure to sunlight while gardening boosts vitamin D, which is important for healthy bones and the immune system.



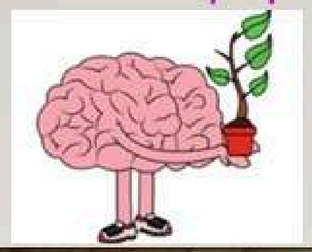


✓ Growing fruits and vegetables makes the person useful and encourages healthier eating habits.



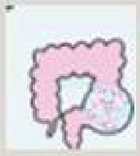


✓ Spending time in the garden reduces stress levels and supports mental well-being. Gardening can improve mood and reduce symptoms of anxiety and depression.





✓ Being in contact with soil may strengthen the immune system by exposing the body to beneficial microbes.







Yoga

Yoga is a stretching activity that improves flexibility, balance, and posture. By combining physical postures with breathing and relaxation, it reduces muscle tension and increases range of motion in joints. Regular yoga practice also supports mental health, helping to reduce stress, improve focus, and promote relaxation. It is an exercise suitable for all ages and fitness levels.

Definition

Yoga is a mind-body practice that combines physical postures, controlled breathing, and relaxation techniques. It focuses on stretching muscles and increasing range of motion in joints.

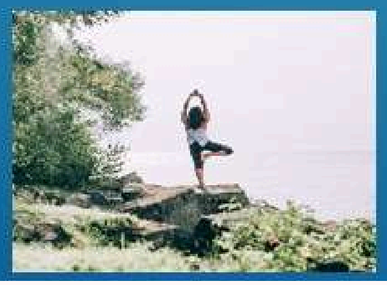


Physical Health Benefits

- Improves flexibility and mobility;
- Reduces muscle tension and stiffness;
- Improves balance, posture, and coordination;
- Supports joint health and prevents injuries.

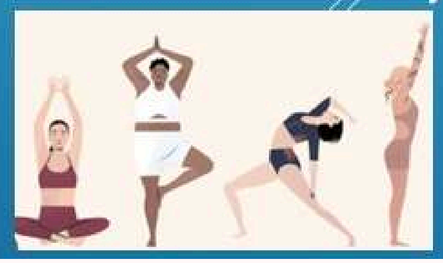
Mental and Emotional Benefits

1. Reduces stress and anxiety;
2. Improves concentration and mental clarity;
3. Promotes relaxation and better sleep;
4. Improves overall well-being and mindfulness.



CONCLUSION

It strengthens the connection between body and mind, making it beneficial for people of all ages and fitness levels.







ПОИНАКОВ МОДЕЛ
ВО ИНТЕРДИСЦИПЛИНАРНОТО ПРЕДАВАЊЕ
ФИЗИЧКО ОБРАЗОВАНИЕ И STEAM

PE-STEAM

PESTATLON
Практичен водич

PE-STE[A]M

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ПРЕДГОВОР

Овој Водич за наставници и игра е еден од официјалните резултати на проектот PE-STEAM (Проект бр.: 2023-2-1T02-KA210-SCH-000178106) реализиран во рамки на Erasmus+ програмата, и има за цел да им помогне на наставниците во креирање на нови инклузивни искуства за учење во кои ученикот ќе биде поангажиран, и тие ќе бидат базирани на движење.

PESTATLON претставува колаборативна едукативна игра која ги комбинира часовите по Физичко образование со интердисциплинарно учење преку структурирани единици, тимска работа и гејмифицирани задачи. Овој водич им нуди на наставниците практична рамка преку обезбедување правила на игра, безбедносни напомени, чекори за имплементација, предлози за оценување и материјали прилагодливи за различни училишни средини.

Проектот е финансиран во рамки на програмата Erasmus+ на Европската Унија. Ставовите изразени во овој водич се исклучиво на проектните партнери; Европската Унија или Европската извршна агенција за образование и култура (EACEA) не можат да се сметаат за одговорни за неговата содржина.

Оваа публикација е бесплатна и е наменета за образовна употреба. Иако се охрабрува адаптацијата на активностите според локалните услови, се препорачува да се задржат принципите на инклузивност, безбедност и активно учество.

ВОДИЧ ЗА НАСТАВНИЦИ ЗА ИГРАТА PESTATLON И ИНСТРУКЦИИ

Играта PESTATLON се состои од 4 делови:

1. Станици, патека
2. Навигација со картички
3. Ментална загатка
4. Фокусирај го вниманието

Алтернативна игра (Патеки од јажиња)

PESTATLON – прв дел

Станица и патека.

Оваа патека од препреки е дизајнирана да ја подобри невромускулната координација кај учениците. Патеката вклучува вештини како скокање, прескокнување, движење под препреки и менување на насока при трчање. Придобивките од овој тип на тренинг се следните:

Учениците ќе ги стекнат следните придобивки:

Невромускулна координација
• Ја подобрува координацијата помеѓу нервниот систем и мускулите.
• Движењата се изведуваат поконтролирано, поприродно и посвесно.

Рамнотежа и контрола на телото
• Ја подобрува способноста за воспоставување и одржување рамнотежа.
• Учениците учат контролирано да ја користат тежината на телото.

Агилност и промена на насока
• Се развива способност за нагло менување на правецот при трчање.
• Се подобрува брзото донесување одлуки и координацијата на движењата.

Сила и издржливост
• Ефикасно се активираат мускулите од горниот и долниот дел на телото.
• Се зголемува мускулната издржливост и експлозивната сила.

Брзина и време на реакција

• Се развива способност за брза реакција на надворешни стимули.

• Се скратува времето за започнување и запирање на движењето.

Моторички вештини

• Се развиваат основни моторички вештини како скокање, прескокнување, совладување препреки и лазење.

• Се стекнува навика за правилна техника при изведување на движењата.

Свесност за телото

• Учениците стануваат свесни за положбата на своето тело во просторот.

• Развиваат способност да ги прилагодуваат движењата според околината.

Психо-социјални придобивки

• Се развива самодоверба и чувство на постигнување.

• Се поттикнуваат вештини како почитување правила, чекање ред и соработка.

Придобивки за наставниците од оваа активност:

Планирање и реализација на наставата

• Стекнуваат способност за дизајнирање станици и патеки соодветни на нивото на учениците.

• Можат да планираат повеќе моторички вештини во рамки на една наставна единица.

Знаења за моторички развој

• Развиваат способност за набљудување и оценување на невромускулната координација и моторичкиот развој.

• Ги следат развојните фази на грубите моторички вештини на практичен начин.

Мерење и оценување

• Може да се проценуваат рамнотежата, агилноста, брзината и координацијата на учениците.

• Се користат алатки како набљудувачки листови, чек-листи и рубрики.

Управување со училница и безбедност

• Развиваат способност за обезбедување безбедност и препознавање ризици во динамична средина.

• Ефикасно управуваат со простор, материјали и време.

Почитување на индивидуалните разлики

• Прават прилагодувања за ученици со различни физички способности.

• Создаваат инклузивна и поддржувачка средина за учење.

Иновативни наставни пристапи

• Ефикасно користат игра-базирани и станица-базирани методи.

• Развиваат ученички-центрирани активности кои поттикнуваат активно учење.

Професионален развој

• Ја унапредуваат својата стручност преку практична примена.

• Развиваат навика за подобрување на наставниот процес врз основа на повратни информации.

ОПИС НА РЕАЛИЗАЦИЈА НА НАТПРЕВАР СО ПРЕПРЕКИ

Натпреварите се дизајнирани да ги подобрат невромускулната координација, агилноста, брзината и тимските вештини кај учениците.

- Секое одделение учествува како тим.
- Двајца ученици од секој тим ја совладуваат патеката последователно.
- Откако првиот ученик ќе ја заврши патеката, вториот започнува.
- Времето се мери како вкупно време од стартот на првиот ученик до завршувањето на вториот ученик.
- Во натпреварот можат да учествуваат четири, пет или шест тима.
- Победник е тимот што ќе ја заврши патеката за најкратко време.

За време на натпреварот, од учениците се очекува да ги почитуваат правилата, да внимаваат на безбедносните мерки и да покажат тимски дух.

НАТПРЕВАР СО ПРЕПРЕКИ - РАСПОРЕД

Општи информации

- Тип на натпревар: Меѓуодделенска трка со патека со препреки
- Структура на тим: 2 ученика / тим
- Критериум за оценување: Вкупно време (мин / сек)

4 *Листа на тимови за натпревар*

Име на тимот	**1. Време на натпреварувачот**	**2. Време на натпреварувачот**	**Вкупно време**	**Рангирање**
Тим A				
Тим B				
Тим C				
Тим D				

Победник: Тимот со најкратко вкупно време.

5. **Листа на тимови за натпревар**

Име на тимот	**1. Време на натпреварувачот**	**2. Време на натпреварувачот**	**Вкупно време**	**Рангирање**
Тим A				
Тим B				
Тим C				
Тим D				
Тим E				

6. **Листа на тимови за натпревар**

Име на тимот	**1. Време на натпреварувачот**	**2. Време на натпреварувачот**	**Вкупно време**	**Рангирање**
Тим A				
Тим B				
Тим C				
Тим D				
Тим E				
Тим F				

a. **Се препорачува пробно поминување пред започнување на патеката.**

b. За мерење на времето може да се користи штоперица или мобилна апликација.

c. Еднакво времетраење;

   i. Најмал број на грешки

   ii. Или времетраењето на втората рунда може да се користи како критериум.

1) Бебедносен протокол

- Контролна листа за просторот: лизгава површина, одврзани врвки, нестабилни конуси/препреки, ризик од судир.
- Правило за „интензитет на трчање“ (на пр., слободен спринт или контролирано трчање?)
- Задолжително загревање (2–3 минути) + можност за пробно поминување на патеката.
- Критериум за прекинување: судијата ќе ја прекине трката во случај на пад/повреда/опасност.

2) Стандардни правила за мерење и времетраење

- Како започнува и завршува мерењето на времето (стартна линија, целна линија, почеток на трчањето на вториот натпреварувач)
- Метод на мерење на времето: една штоперица + резервна штоперица / видео-верификација
- Позиција на судијата: кој ќе биде на стартот и кој на целта?

3) Систем на грешки/казни (клучен за фер натпревар)

На пример, многу едноставна структура:

- Ако се урне препрека: +2 секунди
- Погрешна станица/погрешна патека: враќање назад и корекција (времето продолжува да тече)

- Преминување над препрека наместо под неа: +5 секунди
- Прекршување на безбедносните правила (туркање, влегување во зоната за трчање): дисквалификација или повторување на трката

Важно: Ако системот на казни не е јасно дефиниран, ќе има многу „приговори“.

4) Постапка за разрешување на изедначен резултат (tie-break) и жалбена постапка

- Изедначено време: победува тимот со најмалку казни; доколку и понатаму има изедначување, се организира втора рунда / дополнителна рунда.
- Рок за жалба: во рок од 2 минути по објавување на резултатите (до наставникот).
- Донесувач на одлука: главниот судија (наставникот) ја донесува конечната одлука.

5) Опции за пристапност и адаптација (инклузивност)

- Опција „А/Б патека“ за ученици со посебни потреби или физички разлики.
- Алтернативни задачи: чекорење наместо скокање, поминување под препрека наместо странично движење и сл.
- Оценувањето се фокусира на „учество + правилна изведба + тимска работа“, наместо само на постигнат резултат.

6) Стандардизација на патеката (за да се користи истата игра и во различни училишта)

- Димензии на патеката: големина на просторот (на пр., 12×8 m), растојание помеѓу станиците
- Листа на материјали (број на конуси, препреки, јаже, лента и сл.)
- Дијаграм за поставување (едноставен цртеж) + варијации „лесно/средно/тешко“

7) Брза контролна листа за наставници (1 страница)

- Дали поставувањето е комплетно?
- Дали е извршена проверка на безбедноста?
- Дали тимовите и натпреварувачите се евидентирани?
- Дали судиите/асистентите (ученици) учествуваат?
- Дали дисциплинските правила им се прочитани на учениците?

8) Доделување улоги и задачи на учениците (за поставување на теренот)

- Состав на тимот: 2 натпреварувачи + 1 мерач на време + 1 помошник/тренер (по избор).
- Улоги на судиите: судија на старт, судија на патека, судија на цел.
- Линија за „чекање“: оние што чекаат не влегуваат на патеката.

Бонус (што би било одлично, но не е задолжително)

- „Поврзаност со учењето“: Кои вештини ги развива патеката со препреки? (невромускулна координација, агилност и сл.)
- Кратка рефлексија: „Што направивме добро како тим денес?“ (1 минута).

ФОРМА ЗА САМОЕВАЛУАЦИЈА НА НАСТАВНИКОТ

(Работа на станици и патека)

Училиште **Име:**

Предмет: Физичко образование

Датум:

Клас **Ниво:**

Име на наставникот:

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1. Планирање и подготовка на наставата

Оцени ги следните тврдења:

Изразување	**Да**	**Делумно**	**Не**
Патеката беше соодветна за возраста и нивото на вештини на учениците.	☐	☐	☐

Станиците беа во согласност со постигнувањата.	☐	☐	☐
Просторот и материјалите беа соодветни.	☐	☐	☐
Безбедносните мерки беа планирани однапред.	☐	☐	☐

2. *Процес на реализација*

Изразување	**Да**	**Делумно**	**Не**
Учениците активно учествуваа во активноста.	☐	☐	☐
Упатствата беа јасни и разбирливи.	☐	☐	☐
Патеката беше соодветна во однос на време и тек.	☐	☐	☐
Ја адаптирав за ученици на различни нивоа.	☐	☐	☐

3. *Набљудувања за учениците*

Област на набљудување	**Многу добро**	**Добро**	**Потребно подобрување**
Невромускулна координација	☐	☐	☐
Рамнотежа и промена на насока	☐	☐	☐
Брзина и време на реакција	☐	☐	☐
Почитување на правила и соработка	☐	☐	☐

4. Процес на имплементација

Изразување	**Да**	**Делумно**	**Не**
Учениците активно учествуваа во настанот.	☐	☐	☐
Упатствата беа јасни и разбирливи.	☐	☐	☐
Патеката беше соодветна во однос на време и тек.	☐	☐	☐
Ја адаптирав за ученици на различни нивоа	☐	☐	☐

5. Набљудувања за учениците

Област на набљудување	**Многу добро**	**Добро**	**Потребно подобрување**
Невромускулна координација	☐	☐	☐
Рамнотежа и промена на насока	☐	☐	☐
Брзина и време на реакција	☐	☐	☐
Почитување на правила и соработка	☐	☐	☐

6. Инклузија и безбедност

• Направив адаптации за ученици со потешкотии/различни способности:

☐ Да ☐ Делумно ☐ Не

• Дали имаше безбедносни проблеми за време на часот?

☐ Не ☐ Да → Објасни: _____

7. Евалуација на сопствената наставна практика
Најуспешната примена што ја забележав во оваа патека е:

.....

Област што треба да ја подобрам:

.....

Промени што ќе ги направам на следниот час:

.....

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8. Генерална оцена

Придонесот на оваа обука со патека со препреки за развојот на моторичките вештини кај учениците е:
☐ Многу висока ☐ Висока ☐ Средна ☐ Ниска

Ќе ги користам повторно овие видови вежби базирани на станици во моите часови:

☐ Да ☐ Делумно ☐ Не

Потпис на наставникот: **Датум:**

_____ _____

ПРИМЕР ПАТЕКА

А1. Патеката започнува со совладување на препрека направена од конуси. Играч 1 е со врзани очи. Играч 2 му помага да стигне до целта преку давање насоки. Овој дел од патеката е наменет да им помогне на учесниците подобро да ги разберат своите врсници со попреченост. Неговата цел е подигнување на свеста.

https://drive.google.com/file/d/1suT2cDBJR775SiMNtrthG9__yFdipLn6/view?usp=sharing

А2. Овој дел бара учесниците да се движат под препреки. Оваа активност обезбедува и физички и когнитивни придобивки. Активноста за совладување на препреки ја подобрува невромускулната координација, стабилноста на трупот и рамнотежата/контролата на телото кај учесниците. Исто така придонесува за развој на агилноста, брзата промена на положбата и безбедното движење (намалување на ризикот од повреди). Во текот на активноста, учениците стекнуваат и искуства кои ја поддржуваат вниманието и концентрацијата, брзото донесување одлуки и вештините за решавање проблеми.

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- Како резултат на оваа работа на станиците, учесникот:
- Ја подобрува контролата на телото и координацијата (странично тркалање на душек + брзо станување).
- Стекнува вештини за рамнотежа, ориентација и проприоцепција (свесност за положбата на телото во просторот).
- Ја подобрува агилноста и способноста за брза промена на положбата (брзо станување и продолжување по тркалање).
- Развива експлозивна сила и вештини за скокање (прескокнување препреки).
- Ја подобрува брзината, ритамот и контролата на темпото (премини трчање–скокање–собирање).
- Ја подобрува координацијата око-рака и моторичките вештини насочени кон цел (собирање топки и нивно ставање во обрач).
- Го поддржува вниманието, концентрацијата и брзото донесување одлуки (извршување последователни задачи без грешки).

- Развива навика за завршување задачи и ефикасно користење на времето (во рамки на тимскиот натпревар/текот на патеката со препреки).

А3. За оваа станица, учесникот треба да ги користи двете картонски плочи пред него/неа. Треба да ги поставува под своите стапала за да се движи напред. Го поставува првото парче под нозете, потоа го зема второто парче и го поставува пред себе. Потоа се оттурнува врз тоа парче. Потоа се врти назад, го зема парчето на кое штотуку се оттурнал/а и повторно го поставува пред себе. Потоа се придвижува напред со тоа парче. На овој начин продолжува сè додека не стигне до означената цел.
Откако ќе стигне до целта, го очекува јаже на кое на крајот има прикачен круг. Во кругот се наоѓа танграм. Треба брзо да го состави танграмот според формата што е прикажана пред него/неа. Целта на оваа активност е да му/ѝ овозможи да донесува смирени одлуки под притисок.

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Исходи од станицата:

Како резултат на оваа работа на станицата, учесникот:

- Развива рамнотежа и контрола на телото (контролирано движење со две картонски плочи).
- Ја подобрува координацијата и моторното планирање (редослед на чекори, менување на картонските плочи).
- Ја развива агилноста и просторната ориентација (вртење назад за земање на плочата и нејзино пренесување напред).
- Го подобрува вниманието и концентрацијата (движење во согласност со правилата).
- Развива вештини за решавање проблеми и креирање стратегии (избор на најбрз и најпрецизен начин за напредување).
- Ја подобрува визуелната перцепција и просторното размислување (составување на танграм според зададениот модел).

- Развива смиреност под притисок, саморегулација и способност за донесување одлуки (решавање танграм под временски притисок).
- Ги подобрува вештините за управување со времето и завршување задачи (премин од физичка активност кон следна когнитивна задача).

А4. Во овој последен дел, учесникот кој ќе го заврши танграмот ќе трча кон последниот конус, ќе го заобиколи и ќе се врати на стартната линија за да ја допре раката на следниот соиграч. Потоа, вториот играч ја поминува истата патека. Вкупното време на двајцата натпреварувачи го одредува времето на тимот.

Овој дел вклучува: завршување + спринт + свртување + тимска смена.

Исходи за овој дел:

- Развива брзина и агилност (спринт) – трчање кон целен конус.
- Ја подобрува способноста за промена на насока и агилност (контролирано заобиколување на конусот).
- Ја подобрува издржливоста и контролата на темпото (премин од когнитивна кон физичка активност).
- Развива вештини за управување со премини меѓу задачи (брз и безбеден премин од танграм кон трчање).
- Поттикнува почитување на правилата и самодисциплина (следење на правилата до стартната линија).
- Развива тимска работа и чувство за одговорност (свест дека индивидуалниот настап влијае на вкупното време на тимот).
- Поддржува соработка и комуникација (предавање/смена преку допир на соиграчот).

PESTATLON – втор дел

Курс со компас и упатства

Курсот 7×7 со компас и упатства е ефикасна наставна алатка која им помага на учениците да размислуваат додека се движат. Со практикување на насоки (север–југ–исток–запад) во реален физички простор, учениците ја зајакнуваат просторната ориентација и ги претвораат апстрактните концепти во конкретно искуство.
Активноста исто така го поддржува алгоритамското размислување преку следење на чекор-по-чекор инструкции, откривање на грешки и нивна корекција. Бидејќи може да се реализира во тимови, ја зајакнува комуникацијата, заедничкото донесување одлуки и чувството на одговорност.
Поради овие причини, курсот 7×7 е лесно применлива, но многу ефикасна станица која директно придонесува кон целите на наставата по физичко образование и развојот на клучни вештини за 21 век.

"Зошто треба да биде вклучен?"

- **Навигација и просторна ориентација:** Учениците ги применуваат насоките во реална средина и ја разбираат основната логика на навигација.
- **Алгоритамско размислување:** Се зајакнува редоследното извршување на команди, проверката на точноста и корекцијата на грешки.
- **Движење + когниција:** Активноста бара и физичка и ментална ангажираност, што го прави учењето подолготрајно и поефикасно.
- **Внимание и концентрација:** Мрежата 7×7 и означените одговори ја подобруваат концентрацијата и самоконтролата.
- **Тимска работа и комуникација:** Се практикуваат насочување, распределба на улоги и заедничко донесување одлуки.
- **Преносливи вештини:** Стекнатото знаење се применува во ориентација, тимски спортови и секојдневно снаоѓање во простор.
- **Инклузивност и прилагодливост:** Тежината лесно се прилагодува преку промена на брзината, растојанието или сложеноста на инструкциите.

7X7 ПАТЕКА СО НАСОКИ И КОМПАС

В. Во овој дел беше креирана 7×7 мрежа користејќи половини капачиња. Упатствата за оваа мрежа беа однапред запишани. Почетокот на секоја инструкција беше означен со конуси. Насоката на мрежата беше одредена и прикажана со помош на компас.

Инструкциите ги вклучуваа насоките исток, запад, север и југ, дефинирани со компасот за да им помогнат на учесниците да ја разберат својата ориентација. Одговорот на секоја инструкција беше напишан на мали етикети прикачени на капачињата долж патеката.

https://drive.google.com/file/d/1IRenhAPhkP_3bRBzux7uwF8gPVoEZCkN/view?usp=sharing

7X7 ИСХОДИ ОД УЧЕЊЕ – ПАТЕКА СО НАСОКИ И КОМПАС

Како резултат на оваа обука со патека со препреки, учесникот:

- Развива познавање на насоки и просторна ориентација (примена на концептите север–југ–исток–запад во теренски услови).
- Стекнува вештина за користење компас и одредување насока (проверка на насоките со помош на компас).
- Ја разбира логиката на позиционирање и мрежа (систематско движење во распоред 7×7).
- Ги подобрува вештините за следење инструкции и секвенцијална обработка (извршување команди чекор по чекор).
- Развива алгоритамско размислување и вештини за решавање проблеми (избор на правилен начин на движење, препознавање и корекција на грешки).
- Ги подобрува вниманието, концентрацијата и контролата на грешки (точно поврзување на етикети/одговори).

- Ја подобрува координацијата помеѓу движење и мисловни процеси (правилно следење насоки и команди при одење/трчање).
- Ги зајакнува вештините за соработка и комуникација (преземање улоги во тим, распределба на задачи).

PESTATLON – трет дел

МЕНТАЛНА СЛОЖУВАЛКА

Во овој дел, на учениците им се даваат фотографии од спортска опрема распоредена по измешан редослед. Четири столчиња се поставуваат блиску едно до друго така што формираат квадрат. Фотографиите се поставуваат врз столчињата. Измешаната спортска опрема се поставува на приближно 5 метри оддалеченост од секое столче.

Задачата на ученикот е да ја подреди опремата на ист начин како што е прикажана на фотографијата. На ученикот му е дозволено да ја погледне фотографијата само двапати.

Што добива студентот?

- **Контрола на внимание и фокус:** Ограничените можности за гледање ги тераат учениците да се концентрираат на јасна цел.
- **Селективно внимание:** Учениците учат да ги препознаваат клучните детали и да ги игнорираат одвлекувањата.
- **Краткорочна/визуелна меморија:** Вежбаат точно паметење и примена на визуелни информации.
- **Планирање и стратегија:** Учениците ги користат ефикасно своите два „погледи“, одлучуваат за редослед и управуваат со времето.
- **Препознавање и корекција на грешки:** Развиваат навики за проверка, воочување и исправка на грешки.
- **Смиреност под притисок:** Учениците учат да останат прибрани и да продолжат со работа без паника.
- **Координација ум–тело:** Вежбаат одржување на когнитивен фокус додека се движат (одење/трчање, носење, поставување).

Пример конфигурации;

https://drive.google.com/file/d/1CF9XK9SLNoPhTJDsTu9menEs043Yc9Y/view?usp=drive_link

https://drive.google.com/file/d/1LNNgd9jKl5wzvjQxRHHbY4LbTQ40XAp2/view?usp=drive_link

https://drive.google.com/file/d/1rUgLz3V1KeKLFPmoutiOqP4BaKgaT8cm/view?usp=drive_link

https://drive.google.com/file/d/18b28kGb6V2YDugETq6fXFnUotW8ukTv-/view?usp=drive_link

МЕНТАЛНА СЛОЖУВАЛКА – ИСХОДИ ОД УЧЕЊЕ:

Како резултат на овој дел, ученикот/учесникот:

- Го подобрува визуелното внимание и селективната перцепција (разликување на материјали на фотографија).
- Ја зајакнува визуелната и краткорочната меморија (задржување информации по гледање само двапати).
- Стекнува просторна меморија и организациски вештини (подредување на материјалите во правилен редослед и позиција).
- Ги подобрува вештините за планирање и развој на стратегии (ефикасно користење на двата „погледи“).
- Ги подобрува вештините за решавање проблеми и контрола на грешки (препознавање и корекција на погрешно поставување).
- Ги поддржува брзото донесување одлуки и управувањето со времето (правилен избор под временски притисок).
- Ја подобрува координацијата ум–тело (одржување фокус при движење напред–назад помеѓу столчето и материјалите).
- Ги зајакнува саморегулацијата и контролата на вниманието (смиреност под притисок, намалување на избрзани грешки).

PESTATHLON – четврти дел

ФОКУСИРАЈ СЕ

Станицата „Фокусирај се“ е ефикасна активност за развивање на способноста на учениците да одржуваат интензивна концентрација во кратки временски периоди. За да успеат, учениците треба да го контролираат движењето на чашата, прецизно да ја порамнат со отворот и да изведуваат смирени и точни движења наместо да брзаат.

Овој процес ги зајакнува фокусот, трпението и саморегулацијата, помагајќи им на учениците да останат прибрани и да продолжат да се обидуваат и по неуспешни обиди. Бидејќи задачата обезбедува непосредна повратна информација, учениците природно вежбаат контрола на грешки и напредуваат преку обиди и прилагодување.

Активноста исто така ја развива координацијата око–рака и фината моторика, вештини кои се применливи и во спортот и во секојдневниот живот.

Клучни причини

- Го подобрува фокусот и контролата на вниманието.
- Ја зајакнува координацијата око–рака и финитe моторни вештини.
- Го поддржува трпението, саморегулацијата и управувањето со стрес.
- Поттикнува учење преку непосредна повратна информација (обиди и подобрување).
- Ги учи учениците да останат смирени под притисок и да прават прецизни прилагодувања.

За ова може да се користи дебел картон. Картонската плоча се сече во правоаголна форма. На едниот крај се прави отвор доволно голем за да може да влезе дното на чашата. Чашата се поставува наопаку на крајот од картонската плоча.

Играчот се обидува да ја внесе чашата во отворот со вртење (фрлање) во воздух. Треба да успее да внесе 3 чаши на овој начин.

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https://drive.google.com/file/d/1cVx6s4hGs3DD1_yZ8-hrT-G7AwqKhtv/view?usp=drive_link

Како резултат на овој дел, учесникот:

- Ја подобрува координацијата око–рака (усогласување на чашата со целниот отвор).
- Ја зајакнува фината моторика и контролата на зглобот (контролирано вртење и поставување).
- Го подобрува вниманието и траењето на концентрацијата (фокус при повторени обиди).
- Стекнува прецизност и контрола на движењето (прилагодување на силата и аголот кон мала цел).
- Ги подобрува реакцијата и тајмингот (насочување на чашата во вистински момент и внесување во отворот).
- Развива саморегулација и трпение (останување смирен по неуспешни обиди и повторно обидување).
- Развива вештини за решавање проблеми насочени кон цел (наоѓање најдобар начин преку обиди и грешки).
- Ја подобрува мотивацијата и самодовербата преку постигнување (достигнување на целта со внесување на 3 чаши).

АЛТЕРНАТИВНИ ИГРИ

ШИНИ ОД ЈАЖИЊА

Зошто оваа игра треба да биде вклучена?

Rope Rails е високо ефикасна кооперативна активност која им помага на учениците да научат како да се движат синхронизирано како тим. Бидејќи не е дозволено туркање на топката со раце, учениците мора да ја контролираат исклучиво преку координирани движења на телото, како наведнување и исправување, со што се зајакнуваат невромускулната координација, рамнотежата и стабилноста на трупот. Правилото топката да се постави на спротивната капа, во зависност од местото каде што е пуштена, ги одржува учениците ментално ангажирани и бара континуирано внимание, почитување на правилата и брзо донесување одлуки. Наместо да се нагласува само натпреварувачкиот аспект, Rope Rails ги истакнува комуникацијата, трпеливоста и заедничката одговорност, што ја прави оваа активност инклузивна и прилагодлива за различни нивоа на вештини.

Клучни причини:

- Го развива тимската работа и комуникацијата преку синхронизирано движење.
- Ја подобрува координацијата, рамнотежата и контролата на телото.
- Го зајакнува фокусот и почитувањето на правилата под притисок.
- Поттикнува трпение, саморегулација и управување со стрес.
- Инклузивна и прилагодлива за различни нивоа на ученици.

Оваа игра бара две јажиња за прескокнување долги по 150 cm, три половини капи и две мали топки. Едната топка мора да биде тениска топка. Секој тим се состои од три лица. Две лица го држат јажето спроти едно со друго. Јажето мора да биде затегнато бидејќи топките се движат по него како по шини. Задачата на третиот играч е да ја постави топката на јажето. Двете лица што го држат јажето треба да се синхронизираат и да ги поставуваат топките на капите една по друга. Клучната поента на играта е дека топката треба да се постави на капата спроти онаа што се

наоѓа пред играчот кој го држи јажето.

Rope Rails игра – Резултати од учење

Како резултат од играњето на оваа игра, учесниците ќе:

- Ја подобрат невромускулната координација и контролата на телото (на пр. наведнување и исправување за контролирано движење на топката).
- Ја зајакнат способноста за синхронизирано движење и координација меѓу двајца играчи (двајца што држат јажето и се движат усогласено).
- Ја подобрат рамнотежата и контролата на држењето на телото (стабилност на трупот при чучнување и исправување).
- Ги подобрат вниманието и концентрацијата (спречување паѓање на топката и движење според правилата).
- Научат да следат инструкции и да развијат свесност за правилата (примена на правилото за поставување на капата на спротивна страна).
- Ги поддржат вештините за решавање проблеми и развој на стратегии (планирање што, каде и по кој редослед да се постави).
- Ја подобрат комуникацијата и тимската работа (координирано дејствување со кратки насоки).
- Ги зајакнат трпението, саморегулацијата и управувањето со стрес (контролирано придвижување на топката без користење на раце).
- Развијат прецизни и фино координирани движења (контролирано лизгање на топката по јажето).

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ИГРА: ТРАНСПОРТ НА ЧАША СО БАЛОН

Што претставува играта? (Дефиниција)

Играта „Транспорт на чаша со балон“ е забавна и динамична активност која бара концентрација, при што учениците придвижуваат чаша по кратка патека без користење на рацете, туку само со надуен балон. Чашата се пренесува со нежно туркање и насочување со балонот, а од учениците се очекува да ја поминат патеката без да ја испуштат чашата.

Зошто би требало да ја играме? (Важност)

Оваа игра ги развива рамнотежата, координацијата и концентрацијата кај учениците, а истовремено ги учи како да го одржуваат балансот помеѓу брзината и контролата. Бидејќи е забавна и мотивирачка, ја зголемува вклученоста и поттикнува позитивно натпреварување во рамки на фер-плеј и правила. Исто така, лесно се применува во било која училишна средина бидејќи бара евтини материјали и може да се прилагоди за различни возрасни групи и нивоа на способности.

Како се игра? (Постапка)

Материјали:

1. 1 надуен балон (по ученик)
2. 1 пластична/хартиена чаша
3. Почетна и крајна линија (конуси или лента)
4. (Опционално) едноставни пречки или обележувачи на патеката.

Правила и чекори:

- Чашата се поставува на почетната линија, а ученикот го држи балонот подготвен.
- Ученикот ја придвижува чашата без да ја допира со раце, користејќи го само балонот за туркање и насочување.
- Доколку чашата падне, ученикот ја подига и продолжува според правилото на наставникот (или од почетната линија или од местото каде што паднала).
- Времето запира кога чашата ќе стигне до крајната линија.
- Во меѓукласни натпревари, ученикот/тимот што ќе ја заврши патеката за најкратко време победува.

Совет за правичност:

Сите класови треба да користат иста должина на патеката и исти правила.

Резултати од учење (резултати кај учениците)

Како резултат од оваа игра, учениците:

- Ја подобруваат рамнотежата и контролата на телото (движење без да ја испуштат чашата).
- Ја зајакнуваат невромускулната координација (контролирано насочување со балонот).
- Развиваат фокус и внимание (постојано следење на чаша–балон–брзина).
- Ја подобруваат прецизноста и фината контрола (прилагодување на силата и насоката).
- Го учат балансот помеѓу брзина и контрола (ефикасно движење без брзање).
- Развиваат вештини за решавање проблеми и стратегија (пронаоѓање

најдобар начин за пренос на чашата).

- Развиваат трпение, управување со стрес и саморегулација (останување смирен по грешки).
- Во натпреварувачки формат, го зајакнуваат фер-плејот, почитувањето на правилата и одговорноста.

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ЗАВРШНА ПОРАКА

PESTATLON е осмислен и имплементиран не само како натпреварувачка игра, туку како холистичко искуство за учење каде учениците се движат, соработуваат, решаваат проблеми и ја градат својата самодоверба. Во текот на Erasmus+ PE-STEAM проектот, PESTATLON јасно покажа дека Физичкото образование може да биде моќен канал за интердисциплинарно учење, инклузивност и мотивација.

Овој прирачник има за цел да им помогне на наставниците безбедно и ефективно да го применуваат PESTATLON, притоа овозможувајќи простор за креативност и прилагодување. Секое училиште и секоја група ученици имаат различни услови; најдобрите резултати се постигнуваат кога активностите се прилагодени на потребите на учениците, кога се обезбедува фер учество и кога процесот на учење, а не само брзината или натпреварувањето, е во фокус.

Наставниците се охрабруваат да го користат овој прирачник како почетна точка, да споделуваат добри практики со колегите и да поттикнуваат соработка која промовира иновации, еднаквост и благосостојба на учениците. Вистинскиот успех на PESTATLON нема да се мери само според тоа колку пати се игра, туку и според тоа колку ученици стануваат поангажирани во учењето преку движење.

PE-STE[A]M

PE-STEAM

YouTube

PE-STEAM
PESTATHLON
GAMES

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Erasmus+ Programme
of the European Union

A DİFFERENT MODEL İN INTERDİSCİPLİNARY TEACHİNG
PHYSİCAL EDUCATİON AND STEAM
PE-STEAM
2023-2-IT02-KA210-SCH-000178106

PE-STEAM

PESTATHLON
Practice Guide








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PREFACE

This Teacher and Play Guide is one of the official outputs of the **PE-STEAM** project (Project No: **[add]**) conducted under Erasmus+, and aims to support teachers in designing more engaging, inclusive and movement-based learning experiences.

PESTATLON is a collaborative educational game that combines Physical Education lessons with interdisciplinary learning through structured stations, teamwork, and gamified tasks . This guide provides teachers with a practical roadmap by offering game rules, safety notes, implementation steps, assessment suggestions, and materials adaptable to different school settings.

Project is funded under the European Union Erasmus+ Programme . The views expressed in this guide are solely those of the project partners; the European Union or the European Education and Culture Executive Agency (EACEA) cannot be held responsible for its content.

This publication **is free** and offered for educational use. While adaptation of activities to local conditions is encouraged, it is recommended that the principles of inclusion, safety, and active participation be maintained.

PESTATLON GAME TEACHER'S GUIDE AND GAME INSTRUCTIONS

The Pestatlon game consists of 4 sections.

1. Stations, track
2. Navigation with covers
3. Mind Puzzle
4. Focus your attention.

Alternative Game (Rope Rails)

PESTATLON PART 1

Station and Track.

This obstacle track is designed to improve students' neuromuscular coordination. The track includes skills such as jumping, leaping, navigating under obstacles, and changing direction while running. The benefits of this obstacle track training are:

The students will gain the following as a result of this obstacle track activity:

Neuromuscular Coordination

- It improves coordination between the nervous system and muscles.
- They perform movements in a more controlled, fluid, and conscious manner.

Balance and Body Control

- It improves the ability to establish and maintain balance.
- They learn to use their body weight in a controlled manner.

Agility and Change of Direction

- They gain the ability to change direction suddenly while running.

- It improves quick decision-making and coordination of actions.

Strength and Endurance

- It effectively utilizes both upper and lower body muscle groups.
- It increases muscle endurance and explosive power.

Speed and Response Time

- It develops the ability to react quickly to stimuli.
- Movement initiation and stopping times are shortened.

Movement Skills

- It develops basic motor skills such as jumping, leaping, overcoming obstacles, and crawling.
- They develop the habit of performing the movements with the correct technique.

Body Awareness

- He becomes aware of his body's position in space.
- They gain the ability to adjust their movements according to their environment.

Psycho -Social Gains

- Self-confidence and a sense of accomplishment develop.
- Skills such as following rules, waiting in line, and cooperation are encouraged.

The benefits teachers will gain from this station and obstacle track activity are:

Instructional Planning and Implementation

- They gain the ability to design stations and tracks appropriate to the student's level.
- Different motor skills can be planned holistically within the same lesson.

Motor Development Information

- It develops the ability to observe and evaluate students' neuromuscular coordination and motor development levels.
- It practically follows the developmental stages of gross motor skills.

Measurement and Evaluation

- Students' balance, agility, speed, and coordination skills can be assessed in a process-oriented manner.
- Measurements are taken using observation forms, checklists, and rubrics .

Classroom and Safety Management

- They gain the ability to ensure safety and identify risks in dynamic learning environments.
- It effectively implements space, material, and time management.

Respecting Individual Differences

- It makes adaptations for students with different physical abilities.
- It creates an inclusive and supportive learning environment.

Innovative Teaching Approaches

- It effectively uses game-based and station-based teaching methods.
- It develops student-centered track designs that support active learning.

Professional Development

- It enhances professional competence through application-based tracks.
- They develop the habit of improving the teaching process based on feedback.

OBSTACLE TRACK COMPETITION IMPLEMENTATION DESCRIPTION

This obstacle track will be implemented in an **inter-class competition** format. The competitions are designed to improve students' **neuromuscular coordination, agility, speed, and teamwork skills.**

- Each class participates in the competition as **a team** .
- **Two students** from each team complete the track **together, one after the other.**
- After the first student finishes the track, the second student starts the track.
- Time is measured as **the total time elapsed from the start of the first student's session to the end of the second student's session.**
- **Four, five, or six teams can participate** in the competition .
- The team that completes the track **in the shortest time** wins the competition.

During the competition, students are expected to follow the rules, pay attention to safety precautions, and act in a team spirit.

OBSTACLE TRACK COMPETITION - COMPETITION SCHEDULE

General Information

- **Competition Type:** Inter-Class Obstacle Track Race
- **Team Structure:** 2 Students / Team
- **Evaluation Criterion:** Total Time (min / sec)

4 Team Competition List

Team Name	1. Athlete Duration	2. Athlete Duration	Total Time	Ranking
Team A				
Team B				
Team C				
Team D				

Winner: The team with the shortest total time.

5 Team Competition List

Team Name	1. Athlete Duration	2. Athlete Duration	Total Time	Ranking
Team A				
Team B				
Team C				
Team D				
Team E				

6 Team Competition List

Team Name	1. Athlete Duration	2. Athlete Duration	Total Time	Ranking
Team A				
Team B				
Team C				
Team D				
Team E				
Team F				

Additional Note (For Teachers)

- **a practice run** before starting the track is suggested
- A stopwatch or mobile app can be used for time measurement.
- equal time duration;
    - The fewest mistakes
    - Or the duration of the second round can be used as a criterion.

1) Security protocol

- Area checklist: slippery surface, loose laces, unsecured cones/obstacles, collision risks.
- The "running intensity" rule (e.g., sprint free or controlled running?)
- Mandatory warm-up (2-3 min) + pre-track practice opportunity.
- Stopping criterion: The referee will stop the track if there is a fall/injury/danger.

2) Standard measurement and timing rule

- How the time starts/ends (Start line, Finish line, the start of the second athlete's run)
- Time measurement method: single stopwatch + backup stopwatch / video verification.
- Referee position: who will stand at the start and finish?

3) Error/penalty system (essential for fairness)

For example, a very simple structure:

- If the barrier falls over: +2 seconds
- Wrong station/wrong row: go back and correct it (timer runs out)
- Going over the obstacle without going under it: +5 seconds
- Security breach (pushing, entering the running area): disqualification or rerun.

Important: If the penalty system is not clear, there will be many "objections".

4) Tie -break and appeal procedure for tie-breaking situations

- Tie-in-time: the team with the least penalty wins; if still tied, second round / extra round.

- Appeal period: within 2 minutes of the results being announced (to the teacher)
- Decision-maker: The head referee (teacher) makes the final decision.

5) Accessibility and adaptation options (inclusivity)

- “A/B track” option for students with special needs or physical differences.
- Alternative tasks: stepping instead of jumping, going under an obstacle instead of going sideways, etc.
- The evaluation focuses on "participation + correct implementation + teamwork" rather than performance.

6) Track standardization (so that the same game is used even when different schools use it)

- Track dimensions: area size (e.g., 12x8 m), station spacing.
- Materials list (number of cones, obstacles, rope, tape, etc.)
- Installation diagram (simple drawing) + “easy/medium/difficult” variations

7) Quick checklist for teachers (1 page)

- Is the installation complete?
- Was a security check carried out?
- Have the teams and athletes been listed?
- Did the referees/assistant students take part?
- Have the disciplinary rules been read to the students?

8) Student role assignments and tasks (for field setup)

- Team composition: 2 athletes + 1 timekeeper + 1 support staff/coach (optional)
- Referee roles: start referee, track referee, finish referee
- "Waiting area" line: those in line do not enter the track.

Bonus (that would be great, but it's not essential)

- "Learning connection" box: What skills does the obstacle track develop? (neuromuscular coordination, agility, etc.)
- Short reflection : "What did we do well as a team today?" (1 min)

TEACHER SELF-ASSESSMENT FORM

(Station and Track Work)

School **Name:**

Subject: Physical Education

Date:

Class **/** **Level:**

Teacher Name:

---

1. Lesson Planning and Preparation

Evaluate the following statements:

Expression	**Yes**	**Partially**	**No**
The track was suitable for the students' age and skill level.	☐	☐	☐
The stations were consistent with the achievements.	☐	☐	☐
The space and materials were adequate.	☐	☐	☐
Security measures were planned in advance.	☐	☐	☐

2. Implementation Process

Expression	Yes	Partially	No
Students actively participated in the event.	☐	☐	☐
The instructions were clear and understandable.	☐	☐	☐
The track was suitable in terms of time and flow.	☐	☐	☐
I adapted it for students at different levels.	☐	☐	☐

3. Student Observations

Observation Area	Very good	Good	Needs improvement
Neuromuscular coordination	☐	☐	☐
Balance and change of direction	☐	☐	☐
Speed and response time	☐	☐	☐
Compliance with rules and cooperation	☐	☐	☐

4. Inclusion and Security

- I have made adaptations for students with disadvantage/different abilities: ☐ Yes ☐ Partially ☐ No
- Were there any security issues during the lesson? ☐ No ☐ Yes → Explain: _____

5. Evaluation of My Own Teaching Practice

The most successful application I found in this track is:

.....

Area I need to improve:

.....

Changes I will be making in the next lesson:

.....

---

6. General Assessment

The contribution of this obstacle track training to the development of students' motor skills:

☐ Very High ☐ High ☐ Medium ☐ Low

I use these kinds of station-based exercises again in my lessons:

☐ Yes ☐ Partially ☐ No

Teacher's Signature: _____

Date: ___ / ___ / ___

SAMPLE TRACK

A1. The track begins with overcoming an obstacle made of cones. Player 1 is blindfolded. Player 2 helps them reach the goal using commands. This section of the track is designed to help participants understand their disabled peers. It is intended to raise awareness.

https://drive.google.com/file/d/1suT2cDBJR775SiMNtrthG9__yFdipLn6/view?usp=sharing

A2. This section requires participants to navigate under obstacles. This activity provides both physical and cognitive benefits. The obstacle-navigating activity improves participants' neuromuscular coordination, core stability, and balance/body control skills. It also contributes to students' agility, rapid position changes, and safe movement (reducing the risk of injury) skills. During the activity, students also gain experiences that support attention and focus, quick decision-making, and problem-solving skills.

https://drive.google.com/file/d/1diYt6Apn7MsUUfK8CbdGtd0GI3NJGPI/view?usp=sharing

- As a result of this station work, the participant:
- Improves body control and coordination (side rolling on the mat + quick recovery).
- Gains balance, orientation, and proprioception (awareness of the body's position in space) skills.
- Improves agility and the ability to change position quickly (getting up and continuing quickly after a roll).
- Develops explosive strength and jumping skills (jumping over obstacles).
- Improves speed, rhythm, and tempo control (running-jumping-collecting transitions).

- Improves hand-eye coordination and goal-directed motor skills (picking up balls and placing them inside the hoop).
- Supports attention, focus, and quick decision-making skills (performing sequential tasks without errors).
- Develops the habit of completing tasks and using time efficiently (within the team competition/obstacle track flow).

A3. For this station, the participant needs to use the two cardboard pieces in front of them. They must place them under their feet to move forward. She/he places the first piece under their feet, then reach for the second piece and place it in front of them. Now she/he will push into that piece. Now she/he will turn around, pick up the piece they just pushed into, and place it in front of them again. Now she/he will move forward with that piece. She/he needs to continue in this way until reaching the designated target. Upon reaching the target, a string awaits her/him. A circle is attached to the end of this string. Inside the circle is a tangram. She/he must quickly complete the tangram by looking at the shape in front of them. The aim here is to enable her/him to make decisions calmly under pressure.

https://drive.google.com/file/d/1PBdrDqXpzLUVithLt0zjr9xTckz-KAQm/view?usp=sharing

Station Outcomes:

As a result of this station work, the participant:

- **balance and body control** (controlled progress on two cardboard sheets).
- **coordination and motor planning** skills (step sequencing, cardboard swapping).
- **agility and orientation awareness** (turning back to pick up the cardboard and carrying it forward).
- **attention and focus** (progress in accordance with the rules during movement).

- **problem-solving and strategy-developing** skills (choosing the fastest and most error-free path to progress).
- **visual perception and spatial thinking** skills (completing the tangram according to the model shape).
- **in staying calm under pressure, self-regulation, and decision-making (** completing a tangram under time pressure).
- **Time management and task completion** skills (managing the transition from completing the track to the next cognitive task).

A4. In this final section, the participant who completes the tangram will run towards the final target cone, circle the cone, and go to the starting line to touch the hand of the next teammate. Now, the second player will complete the same track. The finishing time of the two teammates will determine the team's time.

This section includes completion + sprint + turn + team transition. Outcomes for this section:

- Speed and agility (sprinting) skills (running towards a target cone).
- Improves change of direction and agility skills (controlled maneuvering around the funnel).
- It improves endurance and pace control (transition from a cognitive task to a physical task).
- They gain task transition management skills (quick and safe transition from tangram to running).
- It develops adherence to rules and self-discipline (maintaining track rules until the starting line).
- It develops teamwork and a sense of responsibility (performance awareness that determines team duration).
- It supports collaboration and communication skills (handing over/ relaying by touching a teammate).

PESTATLON PART 2

The Compass-And-Instructions Course

The 7x7 compass-and-instructions course is a high-impact learning tool that helps students think while moving. By practicing directions (north–south–east–west) in a real physical space, students strengthen spatial awareness and turn abstract concepts into concrete experience. The activity also supports algorithmic thinking through step-by-step instruction following, error detection, and correction. Because it can be implemented in teams, it reinforces communication, shared decision-making, and responsibility. For these reasons, the 7x7 course is an easy-to-apply yet highly effective station that contributes directly to Physical Education goals and key 21st-century skills.

"Why should it be included?"

- Navigation and spatial awareness: Students apply directions in a real environment and understand basic navigation logic.

- Algorithmic thinking: Sequencing commands, checking accuracy, and correcting mistakes are reinforced.
- Movement + cognition: The course requires both physical and mental performance, making learning more memorable.
- Attention and focus: The 7x7 grid and labelled answers strengthen concentration and self-monitoring.
- Teamwork and communication: Guidance, role-sharing, and cooperative decision-making are practiced.
- Transferable skills: The learning transfers to orienteering, team sports, and everyday wayfinding.
- Inclusive and adaptable: Difficulty can be adjusted easily by changing speed, distance, or instruction complexity.

7X7 DIRECTION-COMPASS TRACK

B. In this section, a 7x7 grid was created using half-caps. The instructions for this grid were written down. The beginning of each instruction was marked with cones. The direction for the grid was determined and shown using a compass. The instructions included east, west, north and south directions, defined with the compass to help participants understand their orientation. The answer to each instruction was written on small labels attached to the caps along the track.

https://drive.google.com/file/d/1IRenhAPhkP_3bRBzux7uwF8gPVoEZCkN/view?usp=sharing

7X7 DIRECTION-COMPASS TRACK LEARNING OUTCOMES

As a result of this obstacle track training, the participant:

- Develops directional knowledge and spatial awareness (applies the concepts of north-south-east-west in the field).
- Gains the skill of using a compass and determining direction (verifying directions with the help of a vehicle).
- Understands positioning and grid logic (systematic movement on a 7x7 layout).
- Improves instruction-following and sequential processing skills (executing commands step-by-step).
- Learns Algorithmic thinking and problem-solving skills (choosing the right track of action, recognizing and correcting mistakes).
- Improves attention, focus, and error control skills (correctly matching labels/answers).
- Improves motor-thinking coordination (correctly following directions and commands while walking/running).
- Strengthens collaboration and communication skills (leading roles within a team, sharing tasks).

PESTATLON PART 3

MIND PUZZLE

In this section, students are given photographs of sports equipment arranged in a mixed order. Four chairs are placed close together to form a square. The photographs are placed on top of the chairs. The mixed sports equipment is placed approximately 5 meters away from each chair. The student must arrange the equipment in the photograph in the same order. The student is only allowed to look at the photograph twice.

What Students Gain

- Focus and attention control: Limited viewing opportunities force students to concentrate on one clear objective.
- Selective attention: Students learn to identify key details and ignore distractions.
- Short-term memory / visual memory: They practice remembering and applying visual information accurately.
- Planning and strategy: Students use their two "looks" efficiently, decide on an order, and manage time.
- Error detection and correction: They develop habits of checking, noticing mistakes, and correcting them.
- Staying calm under pressure: Students learn to remain composed and continue working without panic.
- Mind–body coordination: They practice keeping cognitive focus while moving (walking/running, carrying, placing).

Example configurations;

https://drive.google.com/file/d/1CF9XK9SLNoPhTJDsTu9menEs043Yc9Y/view?usp=drive_link

https://drive.google.com/file/d/1LNNgd9jKl5wzvjQxRHHbY4LbTQ40XAp2/view?usp=drive_link

https://drive.google.com/file/d/1rUgLz3V1KeKLFPmoutiOqP4BaKgaT8cm/view?usp=drive_link

https://drive.google.com/file/d/18b28kGb6V2YDugETq6fXFnUotW8ukTv-/view?usp=drive_link

MIND PUZZLE – LEARNING OUTCOMES:

As a result of this section, the student/participant will:

- Improve visual attention and selective perception skills (distinguishing materials in a photograph).
- Strengthen visual memory and short-term memory capacity (retention after looking at something twice).
- Gains spatial memory and organizational skills (arranging materials in the correct order and position).
- Improve planning and strategy development skills (making efficient use of the two viewing rights).
- Improve problem-solving and error control skills (identifying and correcting misplacement).
- Support quick decision-making and time management skills (making the right choice under time pressure).
- Improve motor-mind coordination (maintaining focus while moving back and forth between the chair and materials).
- Strengthens self-regulation and attention control skills (staying calm under pressure, reducing hasty errors).

PESTATHLON PART 4

FOCUS UP

The "Focus Up" station is an effective activity for developing students' ability to maintain intense concentration for short periods of time. To succeed, students must control the cup's movement, align it precisely with the hole, and perform calm, accurate actions instead of rushing. This process strengthens focus, patience, and self-regulation, helping students stay composed and keep trying after unsuccessful attempts. Because the task provides immediate feedback, students naturally practice error control and improve through trial and adjustment. The activity also develops hand–eye coordination and fine motor control, skills that transfer to both sports performance and everyday life.

Key reasons

- Improves focus and attention control.
- Strengthens hand–eye coordination and fine motor skills.
- Supports patience, self-regulation, and stress management.
- Encourages learning through immediate feedback (trial and improvement).
- Teaches students to stay calm under pressure and make accurate adjustments.

Thick cardboard can be used for this. The cardboard is cut into a rectangle. A hole is made in one end large enough to fit the bottom of a cup. The cup is placed upside down on the end of the cardboard piece. The player will try to get the cup into the hole in the cardboard by spinning it in the air. They need to get 3 cups into the hole in this way.

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https://drive.google.com/file/d/1cVx6s4hGs3DD1_yZ8-hrT-G7AwqKhtv/view?usp=drive_link

As a result of this section, the participant:

- Improves hand-eye coordination skills (aligning the cup with the target hole).
- Strengthens fine motor skills and wrist control (controlled turning and placement).
- Improves attention and focus duration (concentration during repeated trials).
- Gains precision and motion control (adjusting force and angle towards small targets).
- Improves reaction and timing skills (guiding the cup at the right moment and putting it into the hole).
- Develops self-regulation and patience (remaining calm after failed attempts and trying again).
- Develops goal-oriented problem-solving skills (finding the best track of action through trial and error).
- Improves motivation and self-confidence through achievement (reaching the goal by completing 3 cups).

ALTERNATIVE GAMES

ROPE RAILS

Why Should This Game Be Included?

Rope Rails is a highly effective cooperative activity that teaches students how to move in synchrony as a team. Because pushing the ball with hands is not allowed, students must control the ball only through coordinated body movements (bending and standing), which strengthens neuromuscular coordination, balance, and core stability. The rule that the ball must be placed on the opposite cap depending on where it was released keeps students mentally engaged and requires continuous focus, rule-following, and quick decision-making. Rather than emphasizing competition alone, Rope Rails highlights communication, patience, and shared responsibility, making it an inclusive activity that can be adapted to different skill levels.

Key reasons (short bullets):

- Builds teamwork and communication through synchronized movement.
- Develops coordination, balance, and core control.
- Strengthens focus and rule-following under pressure.
- Encourages patience, self-regulation, and stress management.
- Inclusive and adaptable for different student levels.
-

This game requires two 150 cm long jump ropes, three half-caps, and two small balls. One of the balls must be a tennis ball. Each team consists of three people. Two people hold the rope opposite each other. The rope must be kept taut because the balls will slide across it like on rails. The third player's job is to place the ball onto the rope. The two people holding the rope must synchronize and place the balls onto the caps one after the other. The key point of the game is that the ball must be placed on the cap opposite the one in front of the player holding

the rope. Players cannot push the ball on the rope with their hands. The ball can only be moved by the players holding the rope bending and straightening up opposite each other .

Rope Rails Game – Outcomes

As a result of this game being played, participants will:

- Improve neuromuscular coordination and body control (such as bending and straightening to move the ball in a controlled manner).
- Strengthen the ability to move in sync and coordinate simultaneously with two people (two players holding a rope moving in harmony).
- Improve balance and posture control (trunk stability during squatting and standing movements).
- Improve attention and focus skills (preventing the ball from falling and moving it according to the rules).
- Learn to follow instructions and develop rule awareness (applying the rule of placing the lid on the opposite side).
- Support problem-solving and strategy-developing skills (planning which items to place on which cover and in what order).
- Improve communication and teamwork skills (coordinated action with short commands).
- Strengthen patience, self-regulation, and stress management skills (moving the ball forward in a controlled manner, without pushing it with your bare hands).
- Develop fine-tuning/precise movement skills (controlled sliding of the ball along the string).

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BALLOON CUP TRANSPORT GAME

What is the game? (Definition)

The Balloon Cup Transport Game is a fun and attention-demanding race in which students move a cup along a short course without using their hands, using only an inflated balloon. The cup is transported by gently pushing and guiding it with the balloon, and students are expected to complete the course without dropping the cup.

Why should we play it? (Importance)

This game develops students' balance, coordination, and focus, while also teaching them how to manage the speed–control balance. Because it is playful and motivating, it increases participation and supports positive competition within a fair-play and rule-based framework. It is also easy to implement in any school setting because it requires low-cost materials and can be adapted for different age groups and skill levels.

How is it played? (Procedure)

Materials:

1. 1 inflated balloon (per student)
2. 1 plastic/paper cup
3. Start and finish lines (cones or tape)
4. (Optional) simple obstacles or lane markers

Rules and Steps:

1. Place the cup on the start line and have the student hold the balloon ready.
2. The student moves the cup without touching it with their hands, using only the balloon to push and guide it.
3. If the cup falls, the student picks it up and continues according to the teacher's rule (either from the start line or from the spot where it fell).
4. The time stops when the cup reaches the finish line.

5. In inter-class competitions, the student/team that completes the course in the shortest time wins.

Fairness tip:

All classes should use the same course length and the same rules.

Learning Outcomes (Student Outcomes)

As a result of this game, students:

- Improve **balance and body control** (moving without dropping the cup).
- Strengthen **neuromuscular coordination** (controlled guiding with the balloon).
- Develop **focus and attention** (monitoring cup–balloon–speed continuously).
- Improve **fine control and precision** (adjusting force and direction).
- Learn the **speed–control balance** (moving efficiently without rushing).
- Build **problem-solving and strategy** skills (finding the best way to transport the cup).
- Develop **patience, stress management, and self-regulation** (staying calm after mistakes).
- In competition format, strengthen **fair play, rule compliance, and responsibility**.

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CLOSING MESSAGE

PESTATLON was designed and implemented not just as a competitive game, but as a holistic learning experience where students move, cooperate, solve problems, and build self-confidence. Throughout the Erasmus+ PE-STEAM project, PESTATLON concretely demonstrated that Physical Education can be a powerful gateway for interdisciplinary learning, inclusivity, and motivation.

This guide aims to help teachers implement PESTATLON safely and effectively, while also allowing for creativity and adaptation. Every school and every student group has different circumstances; the strongest results are achieved when activities are tailored to student needs, fair participation is ensured, and the learning process, not just speed/competition, is at the center.

Teachers are encouraged to use this guide as a starting point, share best practices with colleagues, and foster collaborations that promote innovation, equity, and student well-being. The true success of PESTATLON will be measured not only by how many times it is played, but also by how many students become more engaged in learning through movement.

PE-STE[A]M

PE-STEAM

YouTube

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PESTATHLON
GAMES

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A DİFFERENT MODEL İN INTERDİSCİPLİNARY TEACHİNG
PHYSİCAL EDUCATİON AND STEAM
PE-STEAM
2023-2-IT02-KA210-SCH-000178106

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PESTATHLON

Практическо ръководство








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Съдържание

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РЪКОВОДСТВО ЗА УЧИТЕЛЯ И ИНСТРУКЦИИ ЗА ИГРАТА PESTATLON

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Сила и издръжливост..... **Hata! Yer işareti tanımlanmamış.**

Скорост и време за реакция ..... **Hata! Yer işareti tanımlanmamış.**

Двигателни умения ..... **Hata! Yer işareti tanımlanmamış.**

Осъзнаване на тялото ..... **Hata! Yer işareti tanımlanmamış.**

Психо-социални ползи ..... **Hata! Yer işareti tanımlanmamış.**

Планиране и прилагане на обучението..... **Hata! Yer işareti tanımlanmamış.**

Информация за двигателното развитие..... **Hata! Yer işareti tanımlanmamış.**

Измерване и оценяване..... **Hata! Yer işareti tanımlanmamış.**

Управление на класа и безопасността ..... **Hata! Yer işareti tanımlanmamış.**

Зачитане на индивидуалните различия ..... **Hata! Yer işareti tanımlanmamış.**

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Професионално развитие ..... **Hata! Yer işareti tanımlanmamış.**

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ПРЕДГОВОР

Това Ръководство за учителя и игрово ръководство е един от официалните резултати по проекта PE-STEAM (Проект №: 2023-2-IT02-KA210-SCH-000178106), реализиран по програма „Еразъм+“, и има за цел да подпомогне учителите при създаването на по-ангажиращи, приобщаващи и базирани на движение учебни преживявания.

PESTATLON е съвместна образователна игра, която съчетава часовете по физическо възпитание и спорт с интердисциплинарно обучение чрез структурирани станции, работа в екип и игровизирани задачи. Настоящото ръководство предоставя на учителите практическа рамка, като включва правила на играта, бележки за безопасност, стъпки за прилагане, предложения за оценяване и материали, които могат да бъдат адаптирани към различни училищни условия.

Проектът се финансира по програма „Еразъм+“ на Европейския съюз. Изразените в настоящото ръководство виждания са единствено на партньорите по проекта и Европейският съюз или Изпълнителната агенция за образование и култура (EACEA) не носят отговорност за неговото съдържание.

Настоящата публикация е безплатна и се предоставя за образователни цели. Въпреки че адаптирането на дейностите към местните условия е насърчавано,

препоръчително е да бъдат запазени принципите на приобщаване, безопасност и активно участие.

РЪКОВОДСТВО ЗА УЧИТЕЛЯ И ИНСТРУКЦИИ ЗА ИГРАТА

PESTATLON ИНСТРУКЦИИ

Играта **PESTATLON** се състои от **4 части**:

1. **Станции и трасе**
2. **Навигация с капачки**
3. **Умствен пъзел**
4. **Фокусирай вниманието си**

Алтернативна игра: *Въжени релси (Rope Rails)*

PESTATLON ЧАСТ 1

Станции и трасе

Това **препятствено трасе** е създадено с цел да подобри **невромускулната координация** на учениците. Трасето включва умения като скачане, прескачане, преминаване под препятствия и смяна на посоката при бягане. Ползите от тренировката с това препятствено трасе са следните:

Учениците ще придобият следното в резултат на участието си в дейността с препятственото трасе:

Невромускулна координация

- Подобрява се координацията между нервната система и мускулите.
- Учениците изпълняват движенията по-контролирано, плавно и осъзнато.

Баланс и контрол на тялото

- Подобрява се способността за установяване и поддържане на равновесие.

- Учениците се научават да използват телесното си тегло по контролиран начин.

Ловкост и смяна на посоката

- Развива се способността за внезапна смяна на посоката по време на бягане.
- Подобрява се бързото вземане на решения и координацията на действията.

Сила и издръжливост

- Ефективно се натоварват както горните, така и долните мускулни групи.
- Повишават се мускулната издръжливост и експлозивната сила.

Скорост и време за реакция

- Развива се способността за бърза реакция на стимули.
- Съкращава се времето за започване и спиране на движението.

Двигателни умения

- Развиват се основни двигателни умения като скачане, прескачане, преодоляване на препятствия и пълзене.
- Формира се навик за изпълнение на движенията с правилна техника.

Осъзнаване на тялото

- Учениците осъзнават позицията на тялото си в пространството.
- Придобиват умение да адаптират движенията си спрямо средата.

Психо-социални ползи

- Развиват се самоувереността и чувството за постижение.
- Насърчават се умения като спазване на правила, изчакване на ред и сътрудничество.

Ползите за учителите от работата със станции и препятствено трасе включват:

Планиране и прилагане на обучението

- Развива се умението за проектиране на станции и трасета, съобразени с нивото на учениците.

- Различни двигателни умения могат да бъдат планирани цялостно в рамките на един урок.

Информация за двигателното развитие

- Усъвършенства се способността за наблюдение и оценяване на нивото на невромускулна координация и двигателно развитие на учениците.
- Проследяват се на практика етапите на развитие на грубата моторика.

Измерване и оценяване

- Балансът, ловкостта, скоростта и координацията на учениците могат да бъдат оценявани процесно ориентирано.
- Оценяването се извършва чрез формуляри за наблюдение, контролни списъци и рубрики.

Управление на класа и безопасността

- Развива се умението за осигуряване на безопасност и идентифициране на рискове в динамична учебна среда.
- Ефективно се прилага управление на пространството, материалите и времето.

Зачитане на индивидуалните различия

- Извършват се адаптации за ученици с различни физически възможности.
- Създава се приобщаваща и подкрепяща учебна среда.

Иновативни методи на преподаване

- Ефективно се използват игрово-базирани и станционно-базирани методи на обучение.
- Разработват се ученико-центрирани трасета, които подкрепят активното учене.

Професионално развитие

- Повишава се професионалната компетентност чрез практико-приложни трасета.
- Формира се навик за усъвършенстване на преподавателския процес въз основа на обратна връзка.

ОПИСАНИЕ НА ПРИЛАГАНЕТО НА СЪСТЕЗАНИЕ С ТРАСЕ С ПРЕПЯТСТВИЯ

Това **препятствено трасе** ще бъде реализирано под формата на **състезание** между класовете.

Състезанията са насочени към развиване на **невромускулната координация, ловкостта, скоростта и уменията за работа в екип** на учениците.

- Всеки клас участва в състезанието **като отбор**.
- **Двама ученици от всеки отбор** преминават трасето последователно, един след друг.
- След като първият ученик завърши трасето, **вторият ученик стартира**.
- Времето се отчита като **общото време**, изминало от старта на първия ученик до финала на втория ученик.
- В състезанието могат да участват **четири, пет или шест отбора**.
- **Отборът, който завърши трасето за най-кратко време, печели състезанието**.

По време на състезанието от учениците се очаква да **спазват правилата, да обръщат внимание на мерките за безопасност и да действат в дух на екипност**.

СЪСТЕЗАНИЕ С ПРЕПЯТСТВИЯ – СЪСТЕЗАТЕЛЕН ГРАФИК

Обща информация

⚜ **Вид състезание: Състезание с препятствено трасе**

⚜ **Състав на отбора: 2 ученици / отбор**

⚜ **Критерий за оценяване: Общо време (минути / секунди)**

Списък за състезание с 4 отбора

Име на отбор	**Време на състезател 1**	**Време на състезател 2**	**Обща продължителност**	**Класиране**
Отбор А				

Име на отбор	Време на състезател 1	Време на състезател 2	Обща продължителност	Класиране
Отбор Б				
Отбор В				
Отбор Г				

Победител: Отборът с най-кратко общо време.

Списък за състезание с 5 отбора

Име на отбора	Време на състезател 1	Време на състезател 2	Обща продължителност	Класиране
Отбор А				
Отбор Б				
Отбор В				
Отбор Г				
Отбор Д				

Списък за състезание със 6 отбора

Име на отбора	Време на състезател 1	Време на състезател 2	Обща продължителност	Класиране
Отбор А				
Отбор Б				
Отбор В				

Име на отбора	Време на състезател 1	Време на състезател 2	Обща продължителност	Класиране
Отбор Г				
Отбор Д				
Отбор Е				

Допълнителна бележка (за учители)

- Препоръчително е да се проведе **пробно преминаване** на трасето преди старта на състезанието.
- За измерване на времето може да се използва **хронометър или мобилно приложение**.
- При **равна продължителност на времето**:
  - за критерий може да се използва **най-малкият брой допуснати грешки**;
  - или **времетраенето на втория кръг** може да бъде използвано като критерий за класиране.

1) Протокол за безопасност

- **Контролен списък на зоната:** хлъзгава настилка, развързани връзки на обувки, неукрепени конуси/препятствия, риск от сблъсък.
- **Правило за интензивност на бягането** (напр. свободен спринт или контролирано бягане).
- **Задължителна загрявка** (2–3 минути) + възможност за пробно преминаване на трасето.
- **Критерий за прекратяване:** съдията спира трасето при падане, нараняване или опасна ситуация.

2) Стандартни правила за измерване и отчитане на време

- Определяне на **началото и края на времето** (стартова линия, финална линия, начало на бягането на втория състезател).
- **Метод за измерване на времето:** един хронометър + резервен хронометър / видео потвърждение.
- **Позиция на съдията:** кой ще стои на старта и кой на финала.

3) Система за грешки/наказания (от съществено значение за справедливостта)

Например, проста система:

- При събаряне на препятствие: **+2 секунди**
- Грешна станция / грешен ред: връщане и коригиране (времето продължава да тече)
- Преминаване **над** препятствието вместо **под** него: **+5 секунди**
- Нарушение на безопасността (бутане, навлизане в трасето): **дисквалификация или повторно преминаване**

Важно: Ако системата за наказания не е ясно дефинирана, ще има множество възражения.

4) Процедура при равен резултат и обжалване

- **Равен резултат по време:** печели отборът с най-малко наказания; при ново равенство – втори кръг / допълнителен кръг.
- **Период за обжалване:** до 2 минути след обявяване на резултатите (пред учителя).
- **Вземащ решение:** главният съдия (учителят) взема окончателното решение.

5) Възможности за достъпност и адаптация (приобщаване)

- Възможност за **„A/B трасе“** за ученици със специални образователни потребности или физически различия.
- **Алтернативни задачи:** стъпване вместо скачане, преминаване под препятствие вместо странично движение и др.
- Оценяването се фокусира върху **„участие + правилно изпълнение + работа в екип“**, а не само върху представянето.

6) Стандартизиране на трасето

(за използване на една и съща игра в различни училища)

- **Размери на трасето:** големина на зоната (напр. 12 × 8 м), разстояние между станциите.
- **Списък с материали** (брой конуси, препятствия, въжета, ленти и др.).
- **Схема на подредбата** (опростена рисунка) + варианти „лесно / средно / трудно“.

7) Бърз контролен списък за учители (1 страница)

- Подредбата завършена ли е?
- Извършена ли е проверка за безопасност?
- Съставени ли са списъците с отбори и състезатели?
- Участваха ли съдиите / помощник-учениците?
- Прочетени ли са дисциплинарните правила на учениците?

8) Разпределение на ученическите роли и задачи (за подготовка на терена)

- **Състав на отбора:** 2 състезатели + 1 хронометрист + 1 помощник/треньор (по избор).
- **Роли на съдиите:** съдия на старта, съдия по трасето, съдия на финала.
- ***Линия „зона за изчакване“:*** учениците в изчакване не навлизат в трасето.

Бонус (препоръчително, но не задължително)

- Поле **„Връзка с ученето“:** Какви умения развива препятственото трасе? (невромускулна координация, ловкост и др.)
- Кратка рефлексия: **„Какво направихме добре като отбор днес?“** (1 минута)

ФОРМУЛЯР ЗА САМООЦЕНКА НА УЧИТЕЛЯ 13

(Работа със станции и трасе)

Училище: **Име:**

Предмет: Физическо възпитание и спорт

Дата:

Клас:

Име на учителя:

1. Планиране и подготовка на урока

Оценете следните твърдения:

Твърдение	**Да**	**Частично**	**Не**
Трасето беше съобразено с възрастта и нивото на умения на учениците.	☐	☐	☐
Станциите съответстваха на очакваните резултати/постижения.	☐	☐	☐
Пространството и използваните материали бяха адекватни.	☐	☐	☐
Мерките за безопасност бяха планирани предварително..	☐	☐	☐

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2. Процес на изпълнение

Твърдение	**Да**	**Частично**	**Не**
Учениците участваха активно в дейността	☐	☐	☐
Инструкциите бяха ясни и разбираеми.	☐	☐	☐
Трасето беше подходящо от гледна точка на време и последователност на дейностите.	☐	☐	☐
Извърших адаптации за ученици на различни нива.	☐	☐	☐

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3. Наблюдение върху учениците

Област на наблюдение	**Много добре**	**Добре**	**Нуждае се от подобрение**
Невромускулна координация	☐	☐	☐
Баланс и смяна на посоката	☐	☐	☐

Област на наблюдение	**Много добре**	**Добре**	**Нуждае се от подобрение**
Скорост и време за реакция	☐	☐	☐
Спазване на правила и сътрудничество	☐	☐	☐

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4. Приобщаване и сигурност

- Направил/а съм адаптации за ученици в неравностойно положение / с различни способности:
  ☐ Да ☐ Частично ☐ Не
- Имаше ли проблеми, свързани с безопасността по време на урока?
  ☐ Не ☐ Да → Обясни: _____

5. Оценка на собствената педагогическа практика

- Най-успешното приложение, което открих в това трасе, е:

.....

- Област, в която е необходимо подобрение:

.....

- Промени, които ще направя в следващия урок:

.....

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6. Обща оценка

Приносът на това обучение с трасе с препятствия за развитието на двигателните умения на учениците:

☐ Много висок ☐ Висок ☐ Среден ☐ Нисък

Ще използвам отново подобни упражнения със станции в моите уроци:

☐ Да ☐ Частично ☐ Не

Подпис на учителя: _____

Дата: ___ / ___ / ___

ПРИМЕРНО ТРАСЕ

А1. Трасето започва с преодоляване на препятствие, изградено от конуси. **Играч 1** е със завързани очи. **Играч 2** му помага да достигне целта, като използва словесни указания. Този участък от трасето е създаден с цел участниците да разберат по-добре своите връстници с увреждания и да се повиши тяхната осъзнатост.

https://drive.google.com/file/d/1suT2cDBJR775SiMNtrthG9__yFdipLn6/view?usp=sharing

А2. Този участък изисква участниците да преминават **под препятствия**. Дейността предоставя както **физически**, така и **когнитивни** ползи. Преминаването под препятствия подобрява **невромускулната координация**, **стабилността на тялото (коремния пояс)** и **уменията за баланс и контрол на тялото** на участниците. Освен това допринася за развитието на **ловкостта**, **бързата смяна на позицията** и **безопасното движение** (намалявайки риска от наранявания). По време на дейността учениците придобиват и опит, който подпомага **вниманието и концентрацията**, **бързото вземане на решения** и **уменията за решаване на проблеми**.

https://drive.google.com/file/d/1diYt6Apn7MsUUfK8CbdGtd0GI3NJGPI/view?usp=sharing

В резултат на работата на тази станция участникът:

- **Подобрява контрола на тялото и координацията** (странично търкаляне върху постелка + бързо възстановяване).
- **Развива умения за баланс, ориентация и проприоцепция** (осъзнаване на позицията на тялото в пространството).
- **Подобрява ловкостта и способността за бърза смяна на позицията** (изправяне и продължаване на движението веднага след търкаляне).
- **Развива експлозивна сила и умения за скачане** (прескачане на препятствия).
- **Подобрява скоростта, ритъма и контрола на темпото** (преходи бягане–скачане–събиране).
- **Подобрява координацията око–ръка и целенасочените двигателни умения** (вземане на топки и поставянето им в обръч).
- **Подпомага развитието на внимание, концентрация и бързо вземане на решения** (изпълнение на последователни задачи без грешки).
- **Формира навик за довършване на задачите и ефективно използване на времето** (в рамките на отборното състезание / движението по препятственото трасе).

А3. За тази станция участникът трябва да използва двата картонени елемента, поставени пред него. Той/тя трябва да ги поставя под стъпалата си, за да се придвижва напред. Първо участникът поставя първия елемент под краката си, след което посяга към втория елемент и го поставя пред себе си. След това стъпва върху него. Участникът се обръща, взема елемента, върху който току-що е стъпил, и отново го поставя пред себе си. След това се придвижва напред с този елемент. Процесът се повтаря по този начин до достигане на определената цел.

При достигане на целта участника го очаква връв, в края на която е прикрепен обръч. Вътре в обръча се намира танграм. Участникът трябва бързо да подреди танграма, като се ориентира по показаната пред него фигура. Целта на тази задача е да се подпомогне вземането на спокойни и обмислени решения под напрежение.

https://drive.google.com/file/d/1PBdrDqXpzLUVithLt0zjr9xTckz-KAQm/view?usp=sharing

Резултати от станциите

В резултат на работата на тази станция участникът развива:

- **Баланс и контрол на тялото** (контролирано придвижване върху два картонени елемента).
- **Координация и умения за двигателно планиране** (последователност на стъпките, разместване на картонените елементи).
- ***Ловкост и ориентация в пространството*** (обръщане назад за вземане на картонения елемент и пренасянето му напред).
- **Внимание и концентрация** (придвижване в съответствие с правилата по време на движението).
- **Умения за решаване на проблеми и разработване на стратегии** (избор на най-бързия и най-безгрешния начин за напредване).
- **Зрително възприятие и пространствено мислене** (подреждане на танграма според образеца).
- **Способност за запазване на спокойствие под напрежение, саморегулация и вземане на решения** (подреждане на танграм под времеви натиск).
- **Умения за управление на времето и довършване на задачи** (управление на прехода от завършване на трасето към следващата когнитивна задача).

А4. В този **финален участък** участникът, който е завършил танграма, **избягва към крайния целеви конус**, обикаля конуса и се насочва към **стартовата линия**, за да **докосне ръката на следващия съотборник**. След това вторият участник преминава по **същото трасе**. Крайното време на двамата съотборници **определя времето на отбора**.

Този участък включва **завършване на задача + спринт + завой + отборна смяна**.
Очаквани резултати от този участък:

- **Развитие на скоростта и ловкостта (спринт)** (бягане към целеви конус).
- **Подобряване на уменията за смяна на посоката и ловкост** (контролирано маневриране около конуса).
- **Подобряване на издръжливостта и контрола на темпото** (преход от когнитивна към физическа задача).
- **Развитие на умения за управление на преходи между задачи** (бърз и безопасен преход от танграм към бягане).
- **Формиране на спазване на правила и самодисциплина** (придържане към правилата на трасето до стартовата линия).
- **Развитие на екипна работа и чувство за отговорност** (осъзнаване, че индивидуалното представяне определя отборното време).
- **Подкрепа на уменията за сътрудничество и комуникация** (предаване/щафетна смяна чрез докосване на съотборник).

PESTATLON ЧАСТ 2

Трасе с компас и инструкции

7x7 трасе с компас и инструкции е високоефективен обучителен инструмент, който подпомага учениците да мислят, докато се движат. Чрез упражняване на посоките север–юг–изток–запад в реално физическо пространство учениците развиват пространствената си ориентация и превръщат абстрактни понятия в конкретен практически опит.

Дейността подпомага и алгоритмичното мислене чрез следване на инструкции стъпка по стъпка, откриване на грешки и тяхното коригиране. Тъй като може да се реализира в отборен формат, трасето развива комуникацията, съвместното вземане на решения и чувството за отговорност.

Поради тези причини 7x7 трасето е лесно за прилагане, но същевременно изключително ефективна станция, която допринася пряко за постигането на целите по физическо възпитание и спорт и за развитието на ключови умения на XXI век.

"Защо трябва да бъде включено?"

- Навигация и пространствена ориентация: Учениците прилагат посоки в реална среда и разбират основната логика на навигацията.
- Алгоритмично мислене: Затвърждава се подреждането на команди, проверката за точност и коригирането на грешки.
- Движение + познание: Трасето изисква както физическо, така и умствено представяне, което прави ученето по-запомнящо се.
- Внимание и концентрация: 7x7 мрежата и означените отговори укрепват концентрацията и самоконтрола.
- Работа в екип и комуникация: Практикуват се насочване, разпределяне на роли и съвместно вземане на решения.
- Преносими умения: Наученото се пренася към ориентиране, отборни спортове и ежедневна пространствена ориентация.
- Приобщаващо и адаптивно: Нивото на трудност може лесно да се променя чрез скоростта, разстоянието или сложността на инструкциите.

7X7 ТРАСЕ С НАПРАВЛЕНИЯ

В този раздел беше изградено **7x7 поле** с помощта на **полукапачки**. Инструкциите за това поле бяха **записани предварително**, като **началото на всяка инструкция** беше обозначено с **конуси**. Посоката на полето беше **определена и показана с помощта на компас**.

Инструкциите включваха посоките **изток, запад, север и юг**, определени чрез компаса, за да подпомогнат участниците в ориентирането им в пространството. **Отговорът на всяка инструкция** беше изписан върху **малки етикети**, прикрепени към полукапачките по протежение на трасето.

https://drive.google.com/file/d/1IRenhAPhkP_3bRBzux7uwF8gPVoEZCkN/view?usp=sharing

7X7 ТРАСЕ – ОЧАКВАНИ РЕЗУЛТАТИ ОТ ОБУЧЕНИЕТО

В резултат на това обучение с препятствено трасе участникът:

- **Развива познания за посоките и пространствената ориентация** (прилага понятията север–юг–изток–запад на терен).
- **Придобива умения за използване на компас и определяне на посоката** (проверка на посоките с помощта на уред).
- **Разбира логиката на позиционирането и мрежовата структура** (систематично придвижване в рамките на 7x7 поле).
- **Подобрява уменията за следване на инструкции и последователна обработка на информация** (изпълнение на команди стъпка по стъпка).
- **Развива алгоритмично мислене и умения за решаване на проблеми** (избор на правилния начин на действие, разпознаване и коригиране на грешки).
- **Подобрява вниманието, концентрацията и контрола върху грешките** (точно съотнасяне на етикети/отговори).

- **Подобрява координацията между движение и мислене** (правилно следване на посоки и инструкции по време на ходене/бягане).
- **Засилва уменията за сътрудничество и комуникация** (поемане на водещи роли в екип, разпределяне на задачи).

PESTATLON ЧАСТ 3

УМСТВЕН ПЪЗЕЛ

В този раздел на учениците се предоставят снимки на спортни пособия, подредени в смесен ред. Четири стола са разположени близо един до друг, така че да образуват квадрат. Снимките са поставени върху столовете. Смесените спортни пособия са разположени на разстояние приблизително 5 метра от всеки стол.

Ученикът трябва да подреди пособията в същия ред, както е показано на снимката. Ученикът има право да погледне снимката само два пъти.

Какво получават учениците?

- **Контрол на вниманието и концентрацията:** Ограниченият брой възможности за наблюдение принуждава учениците да се съсредоточат върху една ясна цел.
- **Селективно внимание:** Учениците се научават да разпознават ключови детайли и да игнорират разсейващите фактори.
- **Краткотрайна памет / зрителна памет:** Практикува се запомняне и точно прилагане на визуална информация.
- **Планиране и стратегии:** Учениците използват ефективно двете си „поглеждания“, определят ред на действията и управляват времето.
- **Разпознаване и коригиране на грешки:** Формират се навици за проверка, откриване и коригиране на допуснати грешки.
- **Запазване на спокойствие под напрежение:** Учениците се учат да останат спокойни и да продължат работа без паника.

- **Координация между ум и тяло:** Практикува се поддържане на когнитивен фокус по време на движение (ходене/бягане, носене, поставяне).

Примерни конфигурации:

https://drive.google.com/file/d/1CF9XK9SLNoPhTJDsTu9menEs043Yc9Y/view?usp=drive_link

https://drive.google.com/file/d/1LNNgd9jKl5wzvjQxRHHbY4LbTQ40XAp2/view?usp=drive_link

https://drive.google.com/file/d/1rUgLz3V1KeKLFPmoutiOqP4BaKgaT8cm/view?usp=drive_link

https://drive.google.com/file/d/18b28kGb6V2YDugETq6fXFnUotW8ukTv-/view?usp=drive_link

УМСТВЕН ПЪЗЕЛ – ОЧАКВАНИ РЕЗУЛТАТИ

As a result of this section, the student/participant will:

- Improve visual attention and selective perception skills (distinguishing materials in a photograph).
- Strengthen visual memory and short-term memory capacity (retention after looking at something twice).
- Gains spatial memory and organizational skills (arranging materials in the correct order and position).
- Improve planning and strategy development skills (making efficient use of the two viewing rights).
- Improve problem-solving and error control skills (identifying and correcting misplacement).
- Support quick decision-making and time management skills (making the right choice under time pressure).

- Improve motor-mind coordination (maintaining focus while moving back and forth between the chair and materials).
- Strengthens self-regulation and attention control skills (staying calm under pressure, reducing hasty errors).

PESTATHLON ЧАСТ 4

ФОКУСИРАЙ СЕ

Станцията **„Focus Up“** е ефективна дейност за развитие на способността на учениците да поддържат **интензивна концентрация за кратки периоди от време**. За да бъдат успешни, учениците трябва да **контролират движението на чашата**, да я **насочат прецизно към отвора** и да извършват **спокойни и точни действия**, вместо да бързат.

Този процес развива **концентрацията, търпението и саморегулацията**, като подпомага учениците да запазват самообладание и да продължават опитите си след неуспешни опити. Тъй като задачата предоставя **незабавна обратна връзка**, учениците естествено упражняват **контрол върху грешките** и се усъвършенстват чрез проба и корекция. Дейността също така развива **координацията око–ръка** и **фината моторика** – умения, които се пренасят както в спортните дейности, така и в ежедневието.

Основни причини

- **Подобрява концентрацията и контрола на вниманието.**
- **Засилва координацията око–ръка и фината моторика.**
- **Подпомага търпението, саморегулацията и управлението на стреса.**
- **Насърчава ученето чрез незабавна обратна връзка** (проба и усъвършенстване).
- **Учи учениците да запазват спокойствие под напрежение и да правят точни корекции.**

За изпълнението на дейността може да се използва **дебел картон**, изрязан във форма на **правоъгълник**. В единия му край се прави **отвор**, достатъчно голям,

за да побере дъното на чаша. Чашата се поставя **с дъното нагоре** в края на картонения елемент. Играчът трябва да се опита да **вкара чашата в отвора**, като я **завърта във въздуха**. Задачата е успешно изпълнена, когато участникът **вкара три чаши в отвора по този начин**.

https://drive.google.com/file/d/1IlZ9evyovJuEBnqiQjGxkPdCmvI6weW/view?usp=drive_link

https://drive.google.com/file/d/1cVx6s4hGs3DD1_yZ8-hrT-G7AwqKhtv/view?usp=drive_link

- **Подобрява уменията за координация око–ръка** (насочване на чашата към целевия отвор).
- **Развива фината моторика и контрола на китката** (контролирано завъртане и поставяне).
- **Подобрява вниманието и продължителността на концентрацията** (съсредоточаване по време на многократни опити).
- **Придобива прецизност и контрол на движението** (адаптиране на силата и ъгъла при насочване към малки цели).
- **Подобрява уменията за реакция и синхрон** (насочване на чашата в точния момент и поставянето ѝ в отвора).
- **Развива саморегулация и търпение** (запазване на спокойствие след неуспешни опити и повторно опитване).
- **Развива целенасочени умения за решаване на проблеми** (откриване на най-ефективния начин за действие чрез проба и грешка).
- **Повишава мотивацията и самоувереността чрез постижение** (достигане на целта чрез успешно поставяне на три чаши).

АЛТЕРНАТИВНИ ИГРИ

ВЪЖЕНИ РЕЛСИ

Защо тази игра трябва да бъде включена?

„Въжени релси“ е високоефективна **кооперативна дейност**, която учи учениците как да се движат **синхронно като екип**. Тъй като **бутането на**

топката с ръце не е позволено, учениците трябва да контролират топката единствено чрез **координирани движения на тялото** (клякане и изправяне), което развива **невромускулната координация**, **баланса** и **стабилността на тялото (коремния пояс)**.

Правилото, че **топката трябва да бъде поставена върху противоположната капачка**, в зависимост от мястото, от което е пусната, поддържа учениците **ментално ангажирани** и изисква **постоянна концентрация**, **спазване на правила** и **бързо вземане на решения**. Вместо да поставя акцент единствено върху състезателния елемент, **Rope Rails** подчертава **комуникацията, търпението и споделената отговорност**, което я прави **приобщаваща дейност**, която може да бъде адаптирана към различни нива на умения.

Ключови причини:

- **Изгражда умения за работа в екип и комуникация** чрез синхронизирано движение.
- **Развива координацията, баланса и контрола на тялото**.
- **Засилва концентрацията и спазването на правила под напрежение**.
- **Насърчава търпението, саморегулацията и управлението на стреса**.
- **Приобщаваща и адаптивна** за различни нива на учениците.

Описание на играта

За провеждането на играта са необходими **две въжета за скачане с дължина 150 см**, **три полукапачки** и **две малки топки**, като **едната топка трябва да бъде тенис топка**. Всеки отбор се състои от **трима участници**. **Двама от тях държат въжето** един срещу друг. Въжето трябва да бъде **добре опънато**, тъй като топките се плъзгат по него **като по релси**.

Задачата на **третия участник** е да поставя топката върху въжето. Двамата участници, които държат въжето, трябва да се **движат синхронно**, за да поставят топките върху капачките **една след друга**. Основното правило на играта е, че **топката трябва да бъде поставена върху капачката, разположена от противоположната страна**, спрямо тази, която се намира пред участника, държащ въжето.

Не е позволено бутането на топката с ръце. Топката може да се придвижва **само чрез движенията на участниците**, които държат въжето, като те **клякат и се изправят синхронно**.

https://drive.google.com/drive/folders/1nBvS8hFtgFdSQA0CPC1Vo7Z_s0za3tdK?usp=sharing

Игра „Въжени релси“ – Очаквани резултати

В резултат на участието в тази игра учениците:

- **Подобряват невромускулната координация и контрола на тялото** (клякане и изправяне за контролирано придвижване на топката).
- **Развиват способността за синхронно движение и едновременна координация** с двама участници (двама играчи, държащи въжето и движещи се в хармония).
- **Подобряват баланса и контрола на стойката** (стабилност на тялото по време на клякане и изправяне).
- **Развиват умения за внимание и концентрация** (предотвратяване падането на топката и спазване на правилата).
- **Научават се да следват инструкции и развиват осъзнатост за правилата** (прилагане на правилото за поставяне върху противоположната капачка).
- **Подпомагат уменията за решаване на проблеми и разработване на стратегии** (планиране кои предмети да се поставят върху кои капачки и в какъв ред).
- **Подобряват комуникацията и екипната работа** (координирани действия с кратки словесни указания).
- **Засилват търпението, саморегулацията и управлението на стреса** (контролирано придвижване на топката без използване на ръце).
- **Развиват умения за прецизност и фина настройка на движенията** (контролирано плъзгане на топката по въжето).

ИГРА „ПРЕНАСЯНЕ НА ЧАША С БАЛОН“

Каква е тази игра?

Играта „Пренасяне на чаша с балон“ е забавно и изискващо внимание състезание, при което учениците преместват чаша по късо трасе, без да използват ръцете си, като използват само надуваем балон. Чашата се придвижва чрез леко избутване и насочване с балона, като от учениците се очаква да завършат трасето, без да изпуснат чашата.

Защо трябва да я играем

Тази игра развива **баланса, координацията и концентрацията** на учениците, като едновременно с това ги учи как да **управляват баланса между скорост и контрол**. Поради своя **игрови и мотивиращ характер** тя повишава активното участие и подкрепя **позитивната състезателност** в рамките на **честна игра и спазване на правила**. Играта е **лесна за прилагане във всяка училищна среда**, тъй като изисква **нискобюджетни материали** и може да бъде **адаптирана към различни възрастови групи и нива на умения**.

Как се играе?

Материали:

1. **1 надуваем балон (за всеки ученик)**
2. **1 пластмасова или хартиена чаша**
3. **Стартова и финална линия** (конуси или лента)
4. **(По избор) прости препятствия или маркировка на трасето**

Правила и стъпки:

1. **Поставете чашата на стартовата линия**, а ученикът държи балона в готовност.
2. **Ученикът придвижва чашата, без да я докосва с ръце**, като използва **само балона** за избутване и насочване.

3. **Ако чашата падне**, ученикът я вдига и продължава според правилото, определено от учителя (или от стартовата линия, или от мястото, където е паднала).
4. **Времето спира**, когато чашата достигне финалната линия.
5. При **междукласни състезания** ученикът/отборът, който завърши трасето за **най-кратко време**, печели.

Съвет за справедливост:
Всички класове трябва да използват **еднаква дължина на трасето** и **еднакви правила**.

Очаквани резултати (за учениците)

В резултат на участието в тази игра учениците:

- **Подобряват баланса и контрола на тялото** (придвижване без изпускане на чашата).
- **Засилват невромускулната координация** (контролирано насочване с балона).
- **Развиват внимание и концентрация** (непрекъснато наблюдение на взаимодействието чаша–балон–скорост).
- **Подобряват фината моторика и прецизността** (регулиране на силата и посоката).
- **Научават се да балансират между скорост и контрол** (ефективно движение без прибързване).
- **Развиват умения за решаване на проблеми и стратегии** (намиране на най-добрия начин за пренасяне на чашата).
- **Развиват търпение, управление на стреса и саморегулация** (запазване на спокойствие след грешки).
- В **състезателен формат** засилват **честната игра, спазването на правила и чувството за отговорност**.

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ЗАКЛЮЧИТЕЛНО ПОСЛАНИЕ

PESTATLON е създаден и реализиран **не само като състезателна игра**, а като **цялостно обучително преживяване**, в което учениците се движат,

сътрудничат, решават проблеми и изграждат **самоувереност**. В рамките на проекта **Erasmus+ PE-STEAM** PESTATLON нагледно демонстрира, че **физическото възпитание и спортът** могат да бъдат мощен инструмент за **интердисциплинарно обучение**, **приобщаване** и **мотивация**.

Настоящото ръководство има за цел да подпомогне учителите при **безопасното и ефективно прилагане на PESTATLON**, като същевременно оставя пространство за **творчество и адаптация**. Всяко училище и всяка група ученици имат своите специфични условия; най-добрите резултати се постигат, когато дейностите са **съобразени с потребностите на учениците**, когато е осигурено **справедливо участие** и когато **учебният процес**, а не само скоростта или състезателният елемент, е поставен в центъра.

Учителите се насърчават да използват това ръководство като **начална основа**, да **споделят добри практики** със свои колеги и да насърчават **сътрудничества**, които подкрепят **иновативността, равнопоставеността и благосъстоянието на учениците**. Истинският успех на PESTATLON ще се измерва не само с това **колко пъти играта се провежда**, а и с това **колко ученици стават по-ангажирани с ученето чрез движение**.

PE-STE[A]M

PE-STEAM

YouTube

PE-STEAM
PESTATHLON
GAMES

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of the European Union

A DİFFERENT MODEL İN INTERDİSCİPLİNARY TEACHİNG
PHYSİCAL EDUCATİON AND STEAM
PE-STEAM
2023-2-IT02-KA210-SCH-000178106

PE-STEAM

PESTATHLON

Guida pratica

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PREFAZIONE

Questa Guida per Insegnanti e Giochi è uno dei risultati ufficiali del progetto **PE-STEAM** (Progetto n.: **2023 2-IT02-KA210-SCH-000178106**) realizzato nell'ambito di Erasmus+, con l'obiettivo di supportare gli insegnanti nella progettazione di esperienze di apprendimento più coinvolgenti, inclusive e basate sul movimento.

PESTATLON è un gioco educativo basato sull'apprendimento cooperativo che integra le lezioni di educazione fisica con l'apprendimento interdisciplinare, attraverso stazioni strutturate, lavoro di squadra e sfide gamificate. Questa guida offre agli insegnanti un percorso operativo pratico, fornendo regolamenti di gioco, note sulla sicurezza, fasi di implementazione, suggerimenti per la valutazione e materiali adattabili a diversi contesti scolastici.

Il progetto è stato finanziato dal Programma Erasmus+ dell'Unione Europea. Le idee contenute in questa guida appartengono esclusivamente ai partners del progetto; L'Unione Europea o l'Agenzia Esecutiva Europea per l'Istruzione e la Cultura (EACEA) non possono essere ritenute responsabili di questi contenuti.

Questa pubblicazione **è gratuita** ed è resa disponibile per uso educativo. Pur incoraggiando l'adattamento delle attività alle condizioni locali, si raccomanda di mantenere invariati i principi di inclusione, sicurezza e partecipazione attiva.

GUIDA PER L'INSEGNANTE DEL GIOCO PESTATHLON E ISTRUZIONI PER IL GIOCO

Il gioco PESTATLON si articola in 4 sessioni:

- Stazioni e percorso su pista
- Navigazione con coperture (orientamento e coordinazione)
- Sfida logica (Mind Puzzle)
- Focus e attenzione

Variante di gioco: Binari di corda (Rope Rails)"

PESTATHLON PARTE 1

Stazioni e percorso.

Questo percorso a ostacoli è progettato per potenziare la **coordinazione neuromuscolare** degli studenti. Il tracciato prevede lo sviluppo di abilità quali il salto, il balzo, il passaggio sotto ostacoli (strisciare) e i cambi di direzione durante la corsa. I benefici di questo allenamento a ostacoli sono molteplici:
Al termine di questa attività, gli studenti avranno acquisito le seguenti competenze:

Obiettivi raggiunti dagli studenti attraverso questo percorso a ostacoli:

Coordinazione neuromuscolare
- Miglioramento della coordinazione tra il sistema nervoso e i muscoli.
- Movimenti più controllati, fluidi e consapevoli.

Equilibrio e controllo del corpo
- Miglioramento della capacità di stabilire e mantenere l'equilibrio.
- Gestione controllata del peso corporeo.

Agilità e Cambiamenti di Direzione
- Capacità di cambiare direzione improvvisamente durante la corsa.
- Rapidità delle decisioni e armonia dei movimenti.

Resistenza e Durata
- Utilizzo efficace dei gruppi muscolari della parte inferiore e superiore del corpo.
- Resistenza muscolare e aumento della forza esplosiva.

Velocità e tempi di risposta
- Sviluppo della capacità di reagire rapidamente agli stimoli.
- tempi di inizio e arresto del movimento ridotti.

Abilità di movimento
- Sviluppo di abilità motorie di base come saltare, superare ostacoli e strisciare.

- Abitudine a eseguire i movimenti con la tecnica giusta.

Consapevolezza del Corpo

- Acquisizione della consapevolezza della posizione del corpo nello spazio.
- Acquisizione della capacità di adattare i propri movimenti in base all'ambiente.

Benefici psico-sociali

- Sviluppo della fiducia in sè stessi e senso di realizzazione.
  Vengono favorite competenze quali il rispetto delle regole, il mantenimento dei turni e la cooperazione

I benefici che i docenti trarranno da questa attività a stazioni e dal percorso a ostacoli sono:

Pianificazione e Attuazione Didattica

- Acquisizione della capacità di progettare stazioni e percorsi commisurati al livello degli studenti.
- Pianificazione olistica di diverse abilità motorie all'interno della stessa unità di apprendimento.

Sviluppo dell'Area Motoria

- Sviluppo della capacità di osservare e valutare la coordinazione neuromuscolare e i livelli di sviluppo motorio degli allievi.
- Monitoraggio pratico delle fasi di sviluppo delle abilità grosso-motorie.

Misurazione e Valutazione

- Valutazione orientata al processo delle capacità di equilibrio, agilità, velocità e coordinazione.
- Rilevazione dei dati tramite griglie di osservazione, checklist e rubriche valutative.

Gestione della Classe e Sicurezza

- Competenza nel garantire la sicurezza e nell'identificare i rischi in contesti di apprendimento dinamici.
- Implementazione efficace della gestione degli spazi, dei materiali e dei tempi.

Sviluppo Professionale

- Potenziamento delle competenze professionali attraverso l'applicazione pratica dei percorsi.
- Sviluppo dell'attitudine al miglioramento dei processi didattici basato sui feedback ricevuti.

Rispetto delle Differenze Individuali

- Capacità di predisporre adattamenti per studenti con diverse abilità fisiche.
- Creazione di un ambiente di apprendimento inclusivo e supportivo.

Approcci Didattici Innovativi

- Utilizzo efficace di metodologie didattiche basate sul gioco (game-based) e sull'apprendimento a stazioni.
- Sviluppo di percorsi student-centered (centrati sull'alunno) che favoriscono l'apprendimento attivo.

REGOLAMENTO DELLA COMPETIZIONE

Il percorso a ostacoli sarà implementato in un formato di competizione interclasse.

Le gare sono state ideate per migliorare la coordinazione neuromuscolare, l'agilità, la velocità e le competenze di lavoro di squadra degli studenti.

- Ogni classe partecipa alla competizione come una squadra.
- Due studenti per squadra completano il percorso insieme, in modalità staffetta (uno dopo l'altro).
- Dopo che il primo studente ha terminato il tracciato, il secondo studente può iniziare il proprio turno.
- Il tempo di gara è misurato come il tempo totale trascorso dall'inizio della sessione del primo studente fino al completamento del percorso da parte del secondo studente.
- Alla competizione possono partecipare da quattro a sei squadre contemporaneamente.
- La squadra che completa il percorso nel minor tempo vince la competizione.

Durante la competizione, gli studenti sono tenuti a seguire le regole, prestare attenzione alle misure di sicurezza e agire con spirito di squadra.

GARA A OSTACOLI – PROGRAMMA DELLA COMPETIZIONE

Informazioni generali

- **Tipo di competizione:** Corsa a ostacoli interclasse
- **Struttura delle squadre:** 2 Studenti / Squadra (o "Duo")
- **Criterio di valutazione:** Tempo totale (min/sec)

Classifica delle competizioni a 4 squadre

Nome della squadra	1. Tempo per l'atleta	2. Tempo dell'atleta	Tempo totale	Classifica
Squadra A				
Squadra B				
Squadra C				
Squadra D				

Vincitore: Squadra con il tempo totale più breve

Classifica delle competizioni a 5 squadre

Nome della squadra	1. Tempo per l'atleta	2. Tempo dell'atleta	Tempo totale	Classifica
Squadra A				
Squadra B				
Squadra C				
Squadra D				
Squadra E				

Classifica delle competizioni a 6 squadre

Nome della squadra	1. Tempo per l'atleta	2. Tempo dell'atleta	Tempo totale	Classifica
Squadra A				
Squadra B				
Squadra C				
Squadra D				

Nome della squadra	1. Tempo per l'atleta	2. Tempo dell'atleta	Tempo totale	Classifica
Squadra E				
Squadra F				

Nota aggiuntiva (per l'insegnante)

- Si **consiglia di fare** un giro di prova prima del corso.
- Un cronometro o un'app mobile possono essere usati per misurare il tempo.
- In caso di tempo uguale;
    - La squadra con meno errori
    - Oppure si può usare come criterio la durata del secondo turno.

1) Protocollo di sicurezza

- Elenco delle aree: pavimento scivoloso, lacci sciolti, cono/ostacolo non fissato, rischi di incidenti
- Regola dell'"intensità della corsa" (ad esempio sprint, corsa libera o controllata?)
- Riscaldamento obbligatorio (2-3 minuti) + diritto di provare prima del percorso
- Criteri di sospensione: in caso di caduta/infortunio/pericolo, l'arbitro interrompe il percorso

2) Norme standard di misurazione e cronometraggio

- Come inizia/finisce il tempo (linea di partenza, linea di arrivo, momento di partenza del secondo atleta)
- Metodo di misurazione del tempo: cronometro singolo + cronometro di riserva / verifica tramite video
- Posizione arbitro: chi starà all'inizio e alla fine

3) Sistema di errori/penalità (indispensabile per l'equità)

Ad esempio. Una struttura molto semplice:

- Se l'ostacolo viene abbattuto: +2 secondi
- Stazione errata/corsia errata: tornare indietro e correggere l'errore (il cronometro continua a correre).
- Passare sopra un ostacolo senza passarci sotto: +5 secondi

- Violazione della sicurezza (spingere, entrare nell'area di corsa): squalifica o correre nuovamente

Importante: se il sistema di penalità non è chiaro, ci saranno molte "obiezioni".

4) Procedura di spareggio e ricorso per i tie-break

- Tempo uguale: vince il meno penalizzato; Se ancora in egualità, secondo turno / round aggiuntivo
- Periodo di obiezione: entro 2 minuti dall'annuncio del risultato (all'insegnante)
- Decisore: Il capo arbitro (insegnante) prende la decisione finale

5) Accessibilità e opzioni di adattamento (inclusività)

- Opzione " Percorso A/B " per studenti con bisogni speciali o differenze fisiche
- Compito alternativo: camminare invece di saltare, di lato invece che sotto ostacoli, ecc.
- La valutazione si incentra su "partecipazione + pratica corretta + lavoro di squadra", non sulla performance

6) Standardizzazione delle tracce (lo stesso gioco quando si candidano scuole diverse)

- Dimensioni dei percorsi: dimensione dell'area (ad esempio 12x8 m), intervalli di stazione
- Elenco dei materiali (quanti coni, quanti ostacoli, corde, nastro, ecc.)
- Diagramma di installazione (disegno semplice) + variazioni di "facile/medio/difficile"

7) Checklist rapida per l'insegnante (1 pagina)

- L'installazione è completa?
- È stato effettuato un controllo di sicurezza?
- Sono elencati squadre e atleti?
- Hanno partecipato arbitri o studenti assistenti?
- Sono state lette agli studenti le regole sulle sanzioni?

8) Distribuzione dei ruoli e compiti degli studenti (per la disposizione dei campi)

- Nella squadra: 2 atleti + 1 stampatore + 1 sostenitore/allenatore (opzionale)
- Ruoli dell'arbitro: arbitro iniziale, arbitro del percorso, arbitro finale
- Fila "Area d'attesa": chi è in fila non entra nel percorso

Bonus (utile, ma non necessario)

- Riquadro "Collegamenti didattici": Quali abilità sviluppa il percorso? (coordinazione motoria, agilità, ecc.)
- Breve riflessione: "Cosa abbiamo fatto bene come squadra oggi?" (1 min)

MODULO DI AUTOVALUTAZIONE PER INSEGNANTI

(Studio del percorso a stazioni)

Nome della scuola:
Materia: **Educazione Fisica**
Data:
Classe / Livello:
Nome insegnante:

1. Pianificazione e preparazione delle lezioni

Considera le seguenti affermazioni:

Espressione	Sì	Parzialmente	No
Il percorso era adatto all'età e al livello degli studenti	☐	☐	☐
Le stazioni erano in linea con gli obiettivi	☐	☐	☐
La disposizione dello spazio e dei materiali era sufficiente	☐	☐	☐
Misure di sicurezza pianificate in anticipo	☐	☐	☐

---

2. Processo di attuazione

Espressione	Sì	Parzialmente	No
Gli studenti hanno partecipato attivamente all'evento	☐	☐	☐
Le linee guida erano chiare e dirette	☐	☐	☐

Espressione	Sì	Parzialmente	No
Il percorso era adatto in termini di tempo e flusso	☐	☐	☐
E' stato adeguato ai diversi livelli degli studenti	☐	☐	☐

3. Osservazioni degli studenti

Area di osservazione	Molto bene	Buono	Dovrebbe essere sviluppato
Coordinazione neuromuscolare	☐	☐	☐
Equilibrio e cambio di direzione	☐	☐	☐
Velocità e tempi di reazione	☐	☐	☐
Rispetto delle regole e cooperazione	☐	☐	☐

4. Inclusività e sicurezza

- Mi sono adattato per studenti svantaggiati o con competenze diverse:
  ☐ Sì ☐ Parzialmente ☐ No
- Ci sono stati problemi di sicurezza durante la lezione?
  ☐ No ☐ Sì → Spiega: _____

5. Valutazione della mia pratica didattica

L'applicazione che ho trovato più efficace in questo percorso:

.....

Cosa devo migliorare:

.....

Cambiamenti che farò nella prossima lezione:

.....

6. Valutazione generale

Il contributo di questo studio di percorso allo sviluppo delle abilità motorie degli studenti:
☐ Molto alto ☐ Alto ☐ Medio ☐ Basso

Riutilizzo questo tipo di lavoro a stazioni nelle mie lezioni:
☐ Sì ☐ Parzialmente ☐ No

Firma dell'insegnante: _____
Data: ___ / ___ / ___

ESEMPIO DI PERCORSO

A1. Il percorso inizia con il superamento di un ostacolo composto da coni. Il Giocatore 1 è bendato, mentre il Giocatore 2 lo guida verso il traguardo utilizzando comandi vocali. Questa sezione del tracciato è progettata per aiutare i partecipanti a immedesimarsi nei propri compagni con disabilità, con l'obiettivo di promuovere la sensibilizzazione e l'empatia."

https://drive.google.com/file/d/1suT2cDBJR775SiMNtrthG9__yFdipLn6/view?usp=sharing

A2. Questa sezione richiede ai partecipanti di strisciare/passare sotto ostacoli bassi. Questa attività offre benefici sia a livello fisico che cognitivo. L'azione di superamento degli ostacoli migliora la coordinazione neuromuscolare, la stabilità del core (tronco) e le abilità di equilibrio/controllo del corpo. Contribuisce inoltre allo sviluppo di:

- Agilità
- Rapidi cambi di posizione
- Capacità di movimento sicuro (riducendo il rischio di infortuni)
- Durante l'attività, gli studenti acquisiscono anche esperienze che supportano:
- Attenzione e concentrazione
- Processi decisionali rapidi
- Abilità di problem-solving (risoluzione dei problemi)

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Come risultato di questo studio sulle stazioni, il partecipante:

- Migliora il controllo corporeo e la coordinazione (rotolamento laterale sul materasso + recupero rapido).
- Acquisisce abilità di equilibrio, orientamento e propriocezione (consapevolezza della posizione del corpo nello spazio).
- Potenzia l'agilità e la capacità di cambiare posizione rapidamente (alzarsi e ripartire velocemente dopo un rotolamento).
- Sviluppa la forza esplosiva e le abilità di salto (saltare sopra gli ostacoli).
- Migliora la velocità, il ritmo e il controllo del tempo (transizioni corsa-salto-raccolta)."
- Migliora la coordinazione oculo-manuale e le abilità motorie finalizzate (raccolta delle palline e posizionamento all'interno del cerchio).
- Sostiene le capacità di attenzione, concentrazione e i processi decisionali rapidi (esecuzione di compiti sequenziali senza errori).
- Sviluppa l'attitudine a portare a termine i compiti e a gestire il tempo in modo efficiente (all'interno del flusso della competizione a squadre o del percorso a ostacoli).

A3. Per questa stazione, il partecipante deve utilizzare due supporti di cartone posti davanti a sé. Dovrà posizionarli sotto i piedi per avanzare: colloca il primo pezzo sotto i piedi, poi afferra il secondo e lo posiziona in avanti, spostandovisi sopra. Successivamente, dovrà voltarsi, recuperare il pezzo appena utilizzato e posizionarlo nuovamente davanti a sé per proseguire l'avanzamento. Deve continuare con questa modalità fino al raggiungimento del traguardo prestabilito.

Una volta arrivato al traguardo, troverà una cordicella con un cerchio fissato all'estremità, all'interno del quale è posto un tangram. Il partecipante deve completare rapidamente il tangram seguendo il modello della figura di riferimento. L'obiettivo di questa prova è allenare la capacità di prendere decisioni con calma anche in situazioni di pressione temporale.

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Guadagni della stazione:

Obiettivi della Stazione:

Al termine di questa attività, il partecipante potenzia:

- **Equilibrio e controllo del corpo**: progressione controllata sui due supporti di cartone.
- **Coordinazione e pianificazione motoria**: capacità di sequenziare i passi e scambiare i supporti in modo fluido.
- **Agilità e consapevolezza dell'orientamento**: abilità nel voltarsi per recuperare il supporto e riposizionarlo correttamente in avanti.

- **Attenzione e concentrazione**: capacità di avanzare nel rispetto delle regole e della corretta esecuzione del movimento.
- **Abilità di problem-solving e sviluppo di strategie:** scelta del percorso di progressione più veloce e privo di errori.
- **Percezione visiva e pensiero spaziale:** completamento del tangram secondo la sagoma/modello di riferimento.
- **Gestione della pressione, autoregolazione e processi decisionali:** completamento del tangram in condizioni di stress temporale.
- **Gestione del tempo e completamento del compito:** gestione efficace della transizione dal percorso motorio all'attività cognitiva successiva.

A4. In questa fase finale, il partecipante che completa il tangram correrà verso il cono del traguardo finale, effettuerà una rotazione attorno ad esso e si dirigerà verso la linea di partenza per dare il cambio (tocco della mano) al compagno di squadra successivo. A quel punto, il secondo giocatore completerà lo stesso percorso. Il tempo finale del duo sarà determinato dalla somma dei tempi dei due compagni.

Questa sezione comprende: completamento del compito + sprint + virata + cambio staffetta.

Risultati attesi:

- Velocità e agilità (sprinting) (corsa esplosiva verso il cono di riferimento).
- Miglioramento delle abilità di cambio di direzione e agilità (manovra controllata intorno al cono/funnel).
- Potenziamento della resistenza e del controllo del ritmo (transizione fluida da un compito cognitivo a uno fisico).
- Acquisizione di competenze nella gestione della transizione tra compiti (passaggio rapido e sicuro dal tangram alla corsa).
- Sviluppo dell'aderenza alle regole e dell'autodisciplina (rispetto del regolamento del percorso fino alla linea di partenza).
- Sviluppo del lavoro di squadra e del senso di responsabilità (consapevolezza che la prestazione individuale determina la durata totale del team).
- Supporto alle abilità di collaborazione e comunicazione (passaggio del testimone/staffetta tramite il tocco del compagno).

PESTATLON PARTE 2

PERCORSO "BUSSOLA E ISTRUZIONI"

Il percorso "Bussola e Istruzioni" su griglia 7x7 è uno strumento di apprendimento ad alto impatto che aiuta gli studenti a riflettere durante il movimento. Attraverso la

pratica delle direzioni (Nord–Sud–Est–Ovest) in uno spazio fisico reale, gli studenti rafforzano la consapevolezza spaziale, trasformando concetti astratti in un'esperienza concreta.

L'attività supporta inoltre il pensiero algoritmico attraverso l'esecuzione di istruzioni sequenziali, il rilevamento degli errori e la loro correzione. Poiché può essere implementato in squadre, il percorso rinforza la comunicazione, il processo decisionale condiviso e la responsabilità. Per queste ragioni, il tracciato 7x7 rappresenta una stazione di facile applicazione ma estremamente efficace, che contribuisce direttamente agli obiettivi di Educazione Fisica e all'acquisizione delle competenze chiave del XXI secolo.

Perché includere quest'attività?

- **Orientamento e consapevolezza spaziale**: gli studenti applicano le direzioni in un ambiente reale e comprendono la logica di navigazione di base.
- **Pensiero algoritmico**: viene potenziata la capacità di sequenziare i comandi, verificare l'accuratezza delle azioni e correggere gli errori.
- **Movimento + Cognizione**: il percorso richiede prestazioni sia fisiche che mentali, rendendo l'apprendimento più efficace e duraturo.
- **Attenzione e concentrazione**: la griglia 7x7 e le risposte etichettate rafforzano la capacità di concentrazione e di automonitoraggio.
- **Lavoro di squadra e comunicazione**: si sperimentano la guida assistita, la ripartizione dei ruoli e il processo decisionale cooperativo.
- **Competenze trasversali**: l'apprendimento si trasferisce a discipline come l'orienteering, gli sport di squadra e le capacità di orientamento nella vita quotidiana.
- **Inclusivo e adattabile**: il livello di difficoltà può essere regolato facilmente variando la velocità, la distanza o la complessità delle istruzioni.

ALLESTIMENTO DEL PERCORSO "BUSSOLA E ISTRUZIONI"

B. Per questa sezione, è stata creata una griglia 7x7 utilizzando dei mezzi coni (o segnaposto bassi). Le istruzioni del percorso sono state redatte su schede apposite. L'inizio di ogni sequenza di istruzioni è stato segnalato con dei coni colorati. La direzione di riferimento della griglia è stata determinata e mostrata utilizzando una bussola, per aiutare i partecipanti a comprendere il proprio orientamento nello spazio. Le istruzioni includevano le direzioni Est, Ovest, Nord e Sud, definite con lo

strumento. La risposta corretta a ogni istruzione era scritta su piccole etichette adesive, posizionate sui coni lungo il tracciato, per consentire l'autoverifica.

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OBIETTIVI DI APPRENDIMENTO - PERCORSO BUSSOLA 7X7

Come risultato di questo allenamento a ostacoli, il partecipante:

- Sviluppa la conoscenza delle direzioni e la consapevolezza spaziale (applicando i concetti di nord-sud-est-ovest sul campo).
- Acquisisce l'abilità nell'uso della bussola e nella determinazione della direzione (verificando le direzioni con l'ausilio di un veicolo/mezzo).
- Comprende il posizionamento e la logica della griglia (movimento sistematico su un layout 7x7).
- Migliora l'esecuzione delle istruzioni e l'elaborazione sequenziale dei compiti (eseguendo i comandi passo dopo passo).
- Apprende il pensiero algoritmico e le abilità di problem-solving (scegliendo la giusta linea d'azione, riconoscendo e correggendo gli errori).
- Migliora l'attenzione, la concentrazione e il controllo degli errori (abbinando correttamente etichette/risposte).
- Migliora la coordinazione motorio-cognitiva (seguendo correttamente direzioni e comandi durante la camminata/corsa).
- Rinforza le competenze di collaborazione e comunicazione (assumendo ruoli di guida all'interno di un team, condividendo i compiti).

PESTATLON PARTE 3

Mind Puzzle/ Sfida Logica

In questa sezione, agli studenti vengono fornite fotografie di attrezzature sportive in ordine misto. 4 sedie sono disposte vicine l'una all'altra in modo che le loro schiene formino un quadrato. Le fotografie vengono poste in cima alle sedie. L'attrezzatura sportiva mista è posizionata a circa 5 metri da ogni sedia. Lo studente deve sistemare le attrezzature sportive nella fotografia corrispondente, nello stesso ordine. Allo studente è consentito guardare l'immagine di riferimento solo due volte.

Mind Puzzle – RISULTATI:

- Controllo della concentrazione e dell'attenzione: Le limitate opportunità di visuale costringono gli studenti a concentrarsi su un chiaro obiettivo.

- Attenzione selettiva: Gli studenti imparano a identificare i dettagli chiave e a ignorare le distrazioni.
- Memoria a breve termine / Memoria visiva: Si esercitano a ricordare e applicare le informazioni visive con precisione.
- Pianificazione e strategia: Gli studenti usano le loro due "visuali" in modo efficiente, decidono un ordine e gestiscono il tempo.
- Rilevamento e correzione degli errori: Sviluppano l'abitudine di verificare, notare gli sbagli e correggerli.
- Mantenere la calma sotto pressione: Gli studenti imparano a restare composti e a continuare a lavorare senza farsi prendere dal panico.
- Coordinazione mente-corpo: Si esercitano a mantenere la concentrazione cognitiva mentre si muovono (camminare/correre, trasportare, posizionare).

Sequenze di esempio:

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https://drive.google.com/file/d/1LNNgd9jKl5wzvjQxRHHbY4LbTQ40XAp2/view?usp=drive_link

https://drive.google.com/file/d/1rUgLz3V1KeKLFPmoutiOqP4BaKgaT8cm/view?usp=drive_link

https://drive.google.com/file/d/18b28kGb6V2YDugETq6fXFnUotW8ukTv-/view?usp=drive_link

MIND PUZZLE – OBIETTIVI DI APPRENDIMENTO

Al termine di questa sezione, lo studente/partecipante sarà in grado di:

- Migliorare l'attenzione visiva e le capacità di percezione selettiva (distinguere i materiali in una fotografia).
- Rafforzare la memoria visiva e la capacità di memoria a breve termine (ritenzione delle informazioni dopo aver guardato qualcosa due volte).
- Acquisire memoria spaziale e capacità organizzative (disporre i materiali nell'ordine e nella posizione corretti).
- Migliorare le capacità di pianificazione e di sviluppo strategico (utilizzare in modo efficiente i due tentativi di visualizzazione).
- Migliorare le capacità di problem-solving e di controllo dell'errore (identificare e correggere un posizionamento errato).
- Sviluppare la rapidità decisionale e la gestione del tempo (compiere la scelta giusta sotto la pressione del cronometro).
- Migliorare la coordinazione motorio-cognitiva (mantenere la concentrazione durante il movimento tra la sedia e i materiali).

Rafforzare le capacità di autoregolazione e di controllo dell'attenzione (mantenere la calma sotto pressione, riducendo gli errori dovuti alla fretta

PESTATLON PARTE 4

RESTA CONCENTRATO (FOCUS UP)

La stazione "Focus Up" è un'attività efficace per sviluppare la capacità degli studenti di mantenere una concentrazione intensa per brevi periodi di tempo. Per riuscire, gli studenti devono controllare il movimento del bicchiere, allinearlo con precisione al foro ed eseguire movimenti calmi e accurati invece di agire in modo frettoloso. Questo processo rafforza la concentrazione, la pazienza e l'autoregolazione, aiutando gli studenti a mantenere la calma e a continuare a provare dopo i tentativi falliti. Poiché il compito fornisce un feedback immediato, gli studenti esercitano naturalmente il controllo dell'errore e migliorano attraverso tentativi e aggiustamenti. L'attività sviluppa anche la coordinazione oculo-manuale e il controllo motorio fine, abilità che si trasferiscono sia alle prestazioni sportive che alla vita quotidiana

Motivi chiave

- Migliora la concentrazione e il controllo dell'attenzione.
- Rafforza la coordinazione oculo-manuale e le abilità motorie fini.
- Sostiene la pazienza, l'autoregolazione e la gestione dello stress.
- Incoraggia l'apprendimento attraverso il feedback immediato (tentativi e miglioramento).
- Insegna agli studenti a mantenere la calma sotto pressione e ad apportare aggiustamenti precisi.

Per questa attività si può utilizzare del cartone spesso. Il cartone viene tagliato a forma di rettangolo. A un'estremità viene praticato un foro, abbastanza grande da adattarsi al fondo di un bicchiere. Il bicchiere viene posizionato capovolto sull'altra estremità del pezzo di cartone. Il giocatore dovrà cercare di far entrare il bicchiere nel foro del cartone facendolo ruotare in aria. Deve riuscire a far entrare 3 bicchieri nel foro in questo modo.

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https://drive.google.com/file/d/1cVx6s4hGs3DD1_yZ8-hrT-G7AwqKhtv/view?usp=drive_link

A seguito di questa sezione, il partecipante:

- Migliora le capacità di coordinazione oculo-manuale (allineando la coppa al foro bersaglio).
- Rafforza le abilità motorie fini e il controllo del polso (giri e posizionamenti controllati).
- Aumenta l'attenzione e il tempo di concentrazione (mantenendo la concentrazione nei tentativi ripetuti).
- Acquisisce precisione e controllo del movimento (regolando forza e angolo verso il piccolo bersaglio).
- Migliora le capacità di reazione e tempismo (dirigere la tazza al momento giusto e metterla nel foro).
- Sviluppa autoregolazione e pazienza (restando calmo e riprovando in caso di tentativi falliti).
- Acquisisce capacità di problem solving orientate agli obiettivi (trovare l'azione più appropriata tramite tentativi ed errori).
- Sviluppa motivazione per raggiungere i risultati e autostima (raggiungere l'obiettivo completando 3 tazze).

GIOCHI ALTERNATIVI

GUIDE DI CORDE

Perché includere questo gioco?
"Guide di corda" è un'attività cooperativa estremamente efficace che insegna agli studenti come muoversi in sincronia come una squadra. Poiché non è consentito spingere la palla con le mani, gli studenti devono controllarla esclusivamente attraverso movimenti corporei coordinati (piegamenti e risalite), il che rafforza la coordinazione neuromuscolare, l'equilibrio e la stabilità del core. La regola secondo cui la palla deve essere posizionata sul cappuccio opposto a quello di partenza mantiene gli studenti mentalmente attivi e richiede concentrazione continua, rispetto delle regole e rapidità decisionale. Piuttosto che enfatizzare solo la competizione, "Guide di corda" mette in risalto la comunicazione, la pazienza e la responsabilità condivisa, rendendola un'attività inclusiva e adattabile a diversi livelli di abilità.

Motivi chiave (in sintesi):

- Sviluppa il lavoro di squadra e la comunicazione attraverso il movimento sincronizzato.
- Migliora la coordinazione, l'equilibrio e il controllo del core (stabilità del tronco).
- Rafforza la concentrazione e il rispetto delle regole sotto pressione.
- Incoraggia la pazienza, l'autoregolazione e la gestione dello stress.
- Inclusivo e adattabile a diversi livelli di abilità degli studenti.

Questo gioco richiede due corde per saltare lunghe 150 cm, tre mezzi tappi (o basi a calotta) e due palline piccole (una delle quali deve essere da tennis). Ogni squadra è composta da tre

persone. Due giocatori tengono la corda posizionandosi uno di fronte all'altro. La corda deve essere mantenuta tesa perché le palline vi scivoleranno sopra come su dei binari. Il compito del terzo giocatore è posizionare la pallina sulla corda. I due giocatori che tengono la corda devono sincronizzarsi per depositare le palline sui tappi, una dopo l'altra. Il punto chiave del gioco è che la pallina deve essere depositata sul tappo opposto a quello situato di fronte al giocatore che tiene la corda. I giocatori non possono spingere la pallina con le mani: essa può essere mossa solo attraverso i movimenti dei due compagni che, coordinandosi, si piegano e si rialzano.

Gioco "Guide di Corda" (Rope Rails) – Risultati attesi:
Grazie a questo gioco, i partecipanti potranno:

- Migliorare la coordinazione neuromuscolare e il controllo del corpo (es. piegarsi e rialzarsi per muovere la palla in modo controllato).
- Rafforzare la capacità di muoversi in sincronia e coordinarsi simultaneamente con un'altra persona.
- Migliorare l'equilibrio e il controllo posturale (stabilità del tronco durante i movimenti di squat e risalita).
- Potenziare l'attenzione e la concentrazione (evitare che la palla cada e muoverla secondo le regole).
- Imparare a seguire le istruzioni e sviluppare la consapevolezza delle regole (applicare la regola del posizionamento sul lato opposto).
- Sostenere il problem-solving e le capacità strategiche (pianificare quali oggetti posizionare, dove e in quale ordine).
- Migliorare la comunicazione e il lavoro di squadra (azioni coordinate tramite comandi brevi).
- Rafforzare pazienza, autoregolazione e gestione dello stress (far avanzare la palla in modo controllato, senza toccarla con le mani).
- Sviluppare abilità di precisione e modulazione del movimento (scorrimento controllato della pallina lungo la corda).

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GIOCO DEL TRASPORTO DEL BICCHIERE CON PALLONCINO

1) Cos'è il gioco? (Definizione)

Il "Balloon Cup Transport" è una gara divertente che richiede grande attenzione, in cui gli studenti spostano un bicchiere lungo un breve percorso senza usare le mani, ma utilizzando esclusivamente un palloncino gonfiato. Il bicchiere viene trasportato spingendolo e guidandolo delicatamente con il palloncino; l'obiettivo degli studenti è completare il percorso senza far cadere il bicchiere.

2) Perché giocarci? (Importanza)

Questo gioco sviluppa l'equilibrio, la coordinazione e la concentrazione degli studenti, insegnando loro a gestire il delicato equilibrio tra velocità e controllo. Essendo un'attività ludica e motivante, aumenta la partecipazione e promuove una competizione positiva basata sul fair-play e sul rispetto delle regole. È inoltre facile da implementare in qualsiasi contesto scolastico, poiché richiede materiali a basso costo e può essere adattato a diverse fasce d'età e livelli di abilità.

3) Come si gioca? (Procedimento)

Materiali:

- 1 palloncino gonfiato (per ogni studente)
- 1 bicchiere di plastica/carta
- Linea di partenza e traguardo (con cono/nastro)
- (Opzionale) ostacoli semplici o delimitatori di corsia

Regole e Fasi:

1. Posizionare il bicchiere sulla linea di partenza e far tenere il palloncino pronto allo studente.
2. Lo studente sposta il bicchiere senza toccarlo con le mani, utilizzando solo il palloncino per spingerlo e guidarlo.
3. Se il bicchiere cade, lo studente lo raccoglie e continua secondo la regola stabilita dall'insegnante (ripartendo dalla linea di partenza o dal punto esatto della caduta).
4. Il tempo si ferma quando il bicchiere raggiunge la linea del traguardo.
5. Nelle competizioni interclasse, vince lo studente o la squadra che completa il percorso nel minor tempo.

Consiglio di equità:

Tutte le classi devono utilizzare la stessa lunghezza del percorso e le medesime regole.

Risultati di apprendimento (Risultati per lo studente)

Grazie a questo gioco, gli studenti potranno:

- Migliorare l'**equilibrio e il controllo del corpo** (muoversi senza far cadere il bicchiere).
- Rafforzare la **coordinazione neuromuscolare** (guida controllata tramite il palloncino).
- Sviluppare **concentrazione e attenzione** (monitoraggio costante del rapporto bicchiere-palloncino-velocità).

- Migliorare il **controllo fine e la precisione** (modulare la forza e la direzione).
- Apprendere **l'equilibrio tra velocità e controllo** (muoversi in modo efficiente senza farsi prendere dalla fretta).
- Sviluppare capacità di **problem-solving e strategia** (trovare il modo migliore per trasportare il bicchiere).
- Sviluppare **pazienza, gestione dello stress e autoregolazione** (mantenere la calma dopo un errore).

- Rafforzare il **fair play**, **il rispetto delle regole e la responsabilità**, specialmente nella competizione.

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CONCLUSIONI

PESTATLON è stato progettato e realizzato non solo come un gioco competitivo, ma come un'esperienza di apprendimento olistica in cui gli studenti si muovono, cooperano, risolvono problemi e accrescono la fiducia in se stessi. Attraverso il progetto Erasmus+ PE-STEAM, PESTATLON ha dimostrato concretamente che l'Educazione Fisica può essere un potente punto d'accesso per l'apprendimento interdisciplinare, l'inclusività e la motivazione.

Questa guida si pone l'obiettivo di aiutare gli insegnanti a implementare PESTATLON in modo sicuro ed efficace, lasciando allo stesso tempo spazio alla creatività e all'adattamento. Ogni scuola e ogni gruppo di studenti presenta circostanze diverse; i risultati migliori si ottengono quando le attività sono calibrate sulle esigenze degli alunni, quando viene garantita una partecipazione equa e quando al centro c'è il processo di apprendimento, non solo la velocità o la competizione. Gli insegnanti sono incoraggiati a utilizzare questa guida come punto di partenza, a condividere le buone pratiche con i colleghi e a favorire collaborazioni che promuovano l'innovazione, l'equità e il benessere degli studenti. Il vero successo di PESTATLON non si misurerà solo dal numero di volte in cui verrà giocato, ma da quanti studenti si sentiranno più coinvolti nell'apprendimento attraverso il movimento.

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ÖNSÖZ

Bu Öğretmen ve Oyun Kılavuzu, Erasmus+ kapsamında yürütülen **PE-STEAM** projesinin (Proje No: **[ekleyin]**) resmi çıktılarından biri olarak, öğretmenlerin daha ilgi çekici, kapsayıcı ve hareket temelli öğrenme deneyimleri tasarlamasını desteklemek amacıyla hazırlanmıştır.

PESTATLON, yapılandırılmış istasyonlar, takım çalışması ve oyunlaştırılmış görevler aracılığıyla Beden Eğitimi dersini disiplinlerarası öğrenme ile birleştiren iş birliğine dayalı bir eğitsel oyundur. Bu kılavuz; oyun kuralları, güvenlik notları, uygulama adımları, değerlendirme önerileri ve farklı okul koşullarına uyarlanabilir materyaller sunarak öğretmenlere pratik bir yol haritası sağlamaktadır.

Proje, Avrupa Birliği Erasmus+ Programı kapsamında hibelendirilmiştir. Bu kılavuzda yer alan görüşler yalnızca proje ortaklarına aittir; Avrupa Birliği veya Avrupa Eğitim ve Kültür Yürütme Ajansı (EACEA) bu içerikten sorumlu tutulamaz.

Bu yayın **ücretsizdir** ve eğitim amaçlı kullanım için sunulmuştur. Etkinliklerin yerel koşullara göre uyarlanması teşvik edilmekle birlikte, kapsayıcılık, güvenlik ve aktif katılım ilkelerinin korunması önerilmektedir.

PESTATLON OYUNUN ÖĞRETMEN KILAVUZU VE OYUN YÖNERGESİ

Pestatlon Oyunu 4 bölümden oluşmaktadır.

1. İstasyonlar, parkur
2. Kapaklarla yön bulma
3. Zihin Puzzle
4. Dikkatini topla

Alternatif Oyun (İp Raylar)

PESTATHLON 1. BÖLÜM

İstasyon ve Parkur.

Bu parkur öğrencilerin sinir kas koordinasyonu geliştirmeye yöneliktir. Parkur; atlama, zıplama, engel altından geçme, koşarken yön değiştirebilme becerilerini kapsar. Bu parkur çalışmasının kazanımları;

Bu parkur çalışması sonucunda öğrencilerin kazanımları:

Sinir–Kas Koordinasyonu
- Sinir sistemi ile kaslar arasındaki koordinasyonu geliştirir.
- Hareketleri daha kontrollü, akıcı ve bilinçli şekilde yapar.

Denge ve Vücut Kontrolü
- Denge kurma ve sürdürme becerilerini geliştirir.
- Vücut ağırlığını kontrollü şekilde kullanmayı öğrenir.

Çeviklik ve Yön Değiştirme
- Koşu sırasında ani yön değiştirme becerisi kazanır.
- Hızlı karar alma ve hareket uyumunu geliştirir.

Kuvvet ve Dayanıklılık
- Alt ve üst vücut kas gruplarını etkili biçimde kullanır.
- Kas dayanıklılığı ve patlayıcı kuvvet artışı sağlar.

Hız ve Tepki Süresi
- Uyarana hızlı tepki verme becerisi geliştirir.
- Hareket başlatma ve durdurma süreleri kısalır.

Hareket Becerileri
- Atlama, zıplama, engel aşma ve sürünme gibi temel motor becerileri geliştirir.
- Hareketleri doğru teknikle yapma alışkanlığı kazanır.

Vücut Farkındalığı

- Vücudunun uzaydaki konumunu fark eder.
- Hareketlerini çevreye göre ayarlayabilme becerisi kazanır.

Psiko-Sosyal Kazanımlar

- Öz güven ve başarma duygusu gelişir.
- Kurallara uyma, sıra bekleme ve iş birliği becerileri desteklenir.

Bu istasyon ve parkur çalışması sonucunda öğretmenlerin kazanımları:

Öğretim Planlama ve Uygulama

- Öğrenci seviyesine uygun istasyon ve parkur tasarlama becerisi kazanır.
- Farklı motor becerileri aynı derste bütüncül şekilde planlayabilir.

Motor Gelişim Bilgisi

- Öğrencilerin sinir–kas koordinasyonu ve motor gelişim düzeylerini gözlemleme ve değerlendirme becerisi geliştirir.
- Kaba motor becerilerin gelişim basamaklarını uygulamalı olarak takip eder.

Ölçme ve Değerlendirme

- Öğrencilerin denge, çeviklik, hız ve koordinasyon becerilerini süreç odaklı değerlendirebilir.
- Gözlem formları, kontrol listeleri ve rubrikler kullanarak ölçme yapar.

Sınıf ve Güvenlik Yönetimi

- Hareketli derslerde güvenliği sağlama ve riskleri önceden belirleme becerisi kazanır.
- Alan, malzeme ve zaman yönetimini etkin şekilde uygular.

Bireysel Farklılıkları Gözetme

- Farklı fiziksel yeterliliklere sahip öğrenciler için uyarlamalar yapar.
- Kapsayıcı ve destekleyici bir öğrenme ortamı oluşturur.

Yenilikçi Öğretim Yaklaşımları

- Oyun temelli ve istasyon esaslı öğretim yöntemlerini etkin kullanır.
- Öğrenci merkezli, aktif öğrenmeyi destekleyen ders tasarımları geliştirir.

Mesleki Gelişim

- Uygulama temelli derslerle mesleki yeterliliğini artırır.
- Geri bildirimlere dayalı olarak öğretim sürecini geliştirme alışkanlığı kazanır.

PARKUR YARIŞMASI UYGULAMA AÇIKLAMASI

Bu parkur çalışması, **sınıflar arası yarışma** formatında uygulanacaktır.
Yarışmalar, öğrencilerin **sinir–kas koordinasyonu, çeviklik, hız ve takım çalışması** becerilerini geliştirmeye yönelik olarak planlanmıştır.

- Her sınıf, **bir takım** olarak yarışmaya katılır.
- Her takımdan **2 öğrenci**, parkuru **takım halinde ve art arda** tamamlar.
- İlk öğrenci parkuru bitirdikten sonra ikinci öğrenci parkura başlar.

- Süre, **birinci öğrencinin başlangıcından ikinci öğrencinin bitişine kadar geçen toplam süre** olarak ölçülür.
- Yarışmaya **4, 5 veya 6 takım** katılabilir.
- Parkuru **en kısa sürede tamamlayan takım** yarışmanın kazananı olur.

Yarışma süresince öğrencilerin kurallara uyması, güvenlik önlemlerine dikkat etmesi ve takım ruhu içinde hareket etmesi beklenir.

PARKUR YARIŞMASI - MÜSABAKA CETVELİ

Genel Bilgiler

- **Yarışma Türü:** Sınıflar Arası Parkur Yarışması
- **Takım Yapısı:** 2 Öğrenci / Takım
- **Değerlendirme Ölçütü:** Toplam Süre (dk/sn)

4 Takımlı Yarışma Cetveli

Takım Adı	1. Sporcu Süresi	2. Sporcu Süresi	Toplam Süre	Sıralama
Takım A				
Takım B				
Takım C				
Takım D				

Kazanan: En kısa toplam süreye sahip takım

---

5 Takımlı Yarışma Cetveli

Takım Adı	1. Sporcu Süresi	2. Sporcu Süresi	Toplam Süre	Sıralama
Takım A				
Takım B				

Takım Adı	1. Sporcu Süresi	2. Sporcu Süresi	Toplam Süre	Sıralama
Takım C				
Takım D				
Takım E				

---

6 Takımlı Yarışma Cetveli

Takım Adı	1. Sporcu Süresi	2. Sporcu Süresi	Toplam Süre	Sıralama
Takım A				
Takım B				
Takım C				
Takım D				
Takım E				
Takım F				

Ek Not (Öğretmen İçin)

- Parkur öncesinde **deneme turu** yaptırılması önerilir.
- Zaman ölçümü için kronometre veya mobil uygulama kullanılabilir.
- Eşit süre durumunda;
    - en az hata yapan takım
    - veya ikinci tur süresi
      kriter olarak alınabilir.

1) Güvenlik protokolü

- Alan kontrol listesi: kaygan zemin, açık bağcık, sabitlenmemiş koni/engel, çarpma riskleri
- "Koşu şiddeti" kuralı (ör. sprint serbest mi, kontrollü koşu mu?)
- Isınma zorunluluğu (2–3 dk) + parkur öncesi deneme hakkı
- Durdurma kriteri: düşme/yaralanma/tehlike varsa hakem parkuru durdurur

2) Standart ölçüm ve zamanlama kuralı

- Süre nasıl başlar/biter (Start çizgisi, Finish çizgisi, ikinci sporcunun başlangıç anı)
- Zaman tutma yöntemi: tek kronometre + yedek kronometre / video ile doğrulama
- Hakem pozisyonu: start ve finishte kim duracak

3) Hata/ceza sistemi (adil olması için şart)

Örn. çok basit bir yapı:

- Engel devrilirse: +2 saniye
- Yanlış istasyon/yanlış sıra: geri dönüp düzeltme (süre akar)
- Engel altından geçmeden üstünden geçme: +5 saniye
- Güvenlik ihlali (itme, koşu alanına girme): diskalifiye veya tekrar koşu

Önemli: Ceza sistemi net olmazsa "itiraz" çok olur.

4) Eşitlik bozan durumlar için tie-break ve itiraz prosedürü

- Eşit süre: en az ceza alan kazanır; yine eşitse ikinci tur / ek tur
- İtiraz süresi: sonuç ilanından sonra 2 dk içinde (öğretmene)
- Karar verici: Başhakem (öğretmen) son kararı verir

5) Erişilebilirlik ve uyarlama seçenekleri (kapsayıcılık)

- Özel gereksinimli veya fiziksel farklılıkları olan öğrenciler için "A/B parkur" opsiyonu
- Alternatif görev: zıplama yerine adımlama, engel altı yerine yan geçiş vb.
- Değerlendirme performans değil "katılım + doğru uygulama + takım çalışması" odaklı

6) Parkur standardizasyonu (farklı okullar uygulayınca da aynı oyun olsun)

- Parkur ölçüleri: alan boyutu (örn. 12x8 m), istasyon aralıkları
- Malzeme listesi (kaç koni, kaç engel, ip, bant vb.)
- Kurulum şeması (basit çizim) + "kolay/orta/zor" varyasyonları

7) Öğretmen için hızlı kontrol listesi (1 sayfalık)

- Kurulum tamam mı?
- Güvenlik kontrolü yapıldı mı?
- Takımlar ve sporcular listelendi mi?
- Hakemler/yardımcı öğrenciler görev aldı mı?
- Ceza kuralları öğrencilere okundu mu?

8) Öğrenci rol dağılımı ve görevler (saha düzeni için)

- Takım içinde: 2 sporcu + 1 zaman yazıcı + 1 destekleyici/koç (opsiyonel)
- Hakem rolleri: start hakemi, parkur hakemi, finish hakemi
- "Bekleme alanı" çizgisi: sıradakiler parkura girmez

Bonus (çok iyi olur ama şart değil)

- "Öğrenme bağlantısı" kutusu: Parkur hangi becerileri geliştiriyor? (sinir-kas koordinasyonu, çeviklik vb.)
- Kısa refleksiyon: "Bugün takım olarak neyi iyi yaptık?" (1 dk)

ÖĞRETMEN ÖZ DEĞERLENDİRME FORMU

(İstasyon ve Parkur Çalışması)

Okul Adı:
Ders: Beden Eğitimi
Tarih:
Sınıf / Seviye:
Öğretmen Adı:

1. Ders Planlama ve Hazırlık

Aşağıdaki ifadeleri değerlendiriniz:

İfade	Evet	Kısmen	Hayır
Parkur öğrencilerin yaş ve seviyesine uygundu	☐	☐	☐
İstasyonlar kazanımlarla uyumluydu	☐	☐	☐
Alan ve malzeme düzeni yeterliydi	☐	☐	☐
Güvenlik önlemleri önceden planlandı	☐	☐	☐

2. Uygulama Süreci

İfade	Evet	Kısmen	Hayır
Öğrenciler etkinliğe aktif katılım sağladı	☐	☐	☐
Yönergeler açık ve anlaşılırdı	☐	☐	☐
Parkur süre ve akış açısından uygundu	☐	☐	☐
Farklı düzeydeki öğrenciler için uyarlama yaptım	☐	☐	☐

3. Öğrenci Gözlemleri

Gözlem Alanı	Çok İyi	İyi	Geliştirilmeli
Sinir–kas koordinasyonu	☐	☐	☐
Denge ve yön değiştirme	☐	☐	☐
Hız ve tepki süresi	☐	☐	☐
Kurallara uyum ve iş birliği	☐	☐	☐

4. Kapsayıcılık ve Güvenlik

- Dezavantajlı / farklı yeterlilikteki öğrenciler için uyarlama yaptım:
  ☐ Evet ☐ Kısmen ☐ Hayır
- Ders sırasında güvenlik açısından sorun yaşandı mı?
  ☐ Hayır ☐ Evet → Açıklayınız: _____

5. Kendi Öğretmenlik Uygulamamla İlgili Değerlendirme

Bu derste en başarılı bulduğum uygulama:
.....

Geliştirmem gereken yön:
.....

Bir sonraki derste yapacağım değişiklikler:
.....

6. Genel Değerlendirme

Bu parkur çalışmasının öğrencilerin motor beceri gelişimine katkısı:
☐ Çok Yüksek ☐ Yüksek ☐ Orta ☐ Düşük

Bu tür istasyon çalışmalarını derslerimde tekrar kullanırım:
☐ Evet ☐ Kısmen ☐ Hayır

Öğretmen İmzası: _____
Tarih: ___ / ___ / ___

ÖRNEK PARKUR

A1.Parkur önce huniler ile yapılmış bir engelin aşılması ile başlar. 1. Oyuncunun gözü bağlıdır. 2. Oyuncu onun komutlarla hedefe ulaşmasına yardımcı olur. Parkurun bu bölümü engelli arkadaşlarını anlamaları amaçlı tasarlanmıştır. Farkındalık sağlaması gerekmektedir.

https://drive.google.com/file/d/1suT2cDBJR775SiMNtrthG9__yFdipLn6/view?usp=sharing

A2.Bu bölümde engellerin altından geçmesi gerekmektedir. Bu çalışma katılımcıya hem fiziksel hem bilişsel kazanım sağlar. Engelin altından geçme etkinliği, katılımcıların sinir–kas koordinasyonu, gövde stabilitesi (core kuvveti) ve denge/vücut kontrolü becerilerini geliştirir. Ayrıca öğrencilerin çeviklik, hızlı pozisyon değiştirme ve güvenli hareket etme (sakatlanma riskini azaltma) becerilerine katkı sağlar. Etkinlik sürecinde öğrenciler dikkat ve odaklanma, hızlı karar verme ve problem çözme becerilerini de destekleyen deneyimler kazandırır.

https://drive.google.com/file/d/1diYt6Apn7MsUUfK8CbdGtd0GI3NJGPI/view?usp=sharing

- Bu istasyon çalışması sonucunda katılımcı:
- Vücut kontrolü ve koordinasyonunu geliştirir (mindere yan yuvarlanma + hızlı toparlanma).
- Denge, yönelim ve propriosepsiyon (vücudun uzaydaki konumunu fark etme) becerilerini güçlendirir.

- Çeviklik ve hızlı pozisyon değiştirme becerisini artırır (yuvarlanma sonrası hızlı kalkıp devam etme).
- Patlayıcı kuvvet ve sıçrama becerilerini geliştirir (engeller üzerinden zıplama/atlama).
- Hız, ritim ve tempo kontrolünü geliştirir (koşu–zıplama–toplama geçişleri).
- El–göz koordinasyonu ve hedefe yönelik motor becerileri geliştirir (topları alıp çember içine yerleştirme).
- Dikkat, odaklanma ve hızlı karar verme becerilerini destekler (sıralı görevleri hatasız yapma).
- Görev tamamlama ve zamanı verimli kullanma alışkanlığı kazanır (takım yarışması/parkur akışı içinde).

A3. Bu istasyon için katılımcı önünde bulunan 2 kartonu kullanması gerekiyor. Bunları ilerlemek için ayaklarının altına alması gerekiyor. 1. kartonu ayaklarının altına aldı, o kartonun üzerinde iken diğer kartona uzanarak aldı ve önüne koydu. Şimdi o kartona batı. Şimdi az önce batığı kartonu geriye dönerek aldı ve önüne koydu şimdi onunla ilerleyecek. Bu şekilde ona belirlenen hedefe kadar ilerlemesi gerekiyor. Hedefe ulaşınca onu bir ip bekliyor. Bu ipin ucunda bir çember bağlıdır. Çemberin içinde tangram bulunmaktadır. Hızlıca önündeki şekle bakarak tangram tamamlaması gerekmektedir. Burada amaç, baskı altında iken sakin kalarak karar vermesini sağlamaktır.

https://drive.google.com/file/d/1PBdrDqXpzLUVithLt0zjr9xTckz-KAQm/view?usp=sharing

İstasyon Kazanımları:

Bu istasyon çalışması sonucunda katılımcı:

- **Denge ve vücut kontrolünü** geliştirir (iki karton üzerinde kontrollü ilerleme).
- **Koordinasyon ve motor planlama** becerilerini güçlendirir (adım sıralama, karton değişimi).
- **Çeviklik ve yönelim farkındalığı** kazanır (geri dönerek kartonu alıp öne taşıma).
- **Dikkat ve odaklanmayı** artırır (hareket sırasında kurala uygun ilerleme).
- **Problem çözme ve strateji geliştirme** becerilerini geliştirir (en hızlı ve hatasız ilerleme yolunu seçme).
- **Görsel algı ve mekânsal düşünme** becerilerini destekler (tangramı model şekle göre tamamlama).
- **Baskı altında sakin kalma, öz düzenleme ve karar verme** becerilerini geliştirir (zaman baskısı altında tangram tamamlama).
- **Zaman yönetimi ve görev tamamlama** becerisi kazanır (parkuru bitirip bilişsel göreve geçişi yönetme).

A4. Bu son bölümde tangramı tamamlayan katılımcı, son hedef huniye doğru koşarak huninin etrafından dolanıp başlangıç çizgisine giderek sıradaki arkadaşın eline dokunacaktır. Şimdi aynı parkuru 2. Oyuncu yapacaktır. 2 Takım arkadaşının bitirme süresi, takımın süresini belirleyecektir.

Bu bölüm tamamlama + sprint + dönüş + takım geçişi içerir. Bu Bölüm İçin Kazanımlar;

- Hız ve çabukluk (sprint) becerisini geliştirir (hedef huniye koşma).
- Yön değiştirme ve çeviklik becerisini artırır (huni etrafından kontrollü dolanma).
- Dayanıklılık ve tempo kontrolü geliştirir (bilişsel görevden sonra fiziksel göreve geçiş).
- Görev geçişi yönetimi becerisi kazanır (tangramdan koşuya hızlı ve güvenli geçiş).
- Kurallara uygun hareket etme ve öz disiplin geliştirir (başlangıç çizgisine kadar parkur kurallarını sürdürme).
- Takım çalışması ve sorumluluk bilinci geliştirir (takım süresini belirleyen performans bilinci).
- İş birliği ve iletişim becerisini destekler (takım arkadaşına dokunarak devir teslim/relay).

PESTATLON 2. BÖLÜM

7X7 YÖN-PUSULA PARKURU

7x7 pusula–yönerge parkuru, öğrencilerin hareket ederken düşünmesini sağlayan güçlü bir öğrenme aracıdır. Yön kavramlarını (kuzey–güney–doğu–batı) fiziksel ortamda deneyimleyerek öğrenmeleri, mekânsal farkındalıklarını artırır ve soyut kavramları somutlaştırır. Aynı zamanda adım adım yönerge takip etme, hatayı fark edip düzeltme ve doğru sırayla ilerleme gibi beceriler kazandırarak algoritmik düşünmeyi destekler. Takım çalışması içinde uygulanabildiği için iletişim, ortak karar verme ve sorumluluk alma gibi sosyal becerileri de güçlendirir. Bu nedenle 7x7 parkuru, hem beden eğitimi hedeflerine hem de 21. yüzyıl becerilerine doğrudan katkı sağlayan, uygulanması kolay ve yüksek etkili bir istasyondur.

"Neden olmalı?" maddeleri (çok net)

- **Yön bulma ve mekânsal farkındalık**: Öğrenciler yönleri gerçek alanda kullanır, navigasyon mantığını kavrar.

- **Algoritmik düşünme**: Komutları sırayla uygulama, hata kontrolü ve düzeltme becerisi gelişir.
- **Hareket + biliş birleşimi**: Parkur hem fiziksel hem zihinsel performans gerektirir; öğrenmeyi kalıcılaştırır.
- **Dikkat ve odaklanma**: 7x7 düzen ve etiketli cevaplar, dikkat yönetimini güçlendirir.
- **Takım çalışması ve iletişim**: Yönlendirme, rol paylaşımı ve ortak karar verme desteklenir.
- **Aktarılabilir beceri**: Oryantiring, takım sporları, günlük yaşamda yön bulma gibi alanlara transfer olur.
- **Kapsayıcı ve uyarlanabilir**: Farklı seviyelere göre hız/mesafe/yönerge zorluğu kolayca ayarlanır.

B. Bu bölümde yarım kapaklar ile 7x7 düzen oluşturulmuştur. Ve bu düzenin yönergeleri yazılmıştır. Bu bölümde yönergesin başlangıcı huniler ile işaretlenmiştir. Düzen için yön belirlenerek bu bir pusula yardımı ile gösterilmiştir. Yönergelerde katılımcının yönünü anlaması için doğu, batı, kuzey, güney yönlerini bu pusula ile tanımlanmıştır. Parkurda kapaklar üzerine minik etiketler ile her bir yönergenin cevabı yazılmıştır.

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7X7 YÖN-PUSULA PARKURU KAZANIMLARI

Bu parkur çalışması sonucunda katılımcı:

- Yön bilgisi ve mekânsal farkındalık geliştirir (kuzey–güney–doğu–batı kavramlarını sahada uygular).
- Pusula kullanma ve yön tayini becerisi kazanır (yönleri araç yardımıyla doğrulama).
- Konumlandırma ve ızgara mantığını kavrar (7x7 düzen üzerinde sistemli hareket etme).
- Yönerge takip etme ve sıralı işlem becerilerini geliştirir (adım adım komutları uygulama).
- Algoritmik düşünme ve problem çözme becerilerini destekler (doğru yönü seçme, hatayı fark edip düzeltme).
- Dikkat, odaklanma ve hata kontrolü becerilerini artırır (etiket/cevap eşleştirmeyi doğru yapma).

- Hareket–düşünme koordinasyonu geliştirir (yürürken/koşarken yön ve komutları doğru uygulama).
- İş birliği ve iletişim becerilerini güçlendirir (takım içinde yönlendirme, görev paylaşımı).

Örnek Yönergeler;

PESTATLON 3.BÖLÜM

ZİHİN PUZZLE

Bu bölümde öğrencilere spor malzemeleri karışık bir şekilde fotoğraf olarak verilir. 4 sandalye arkaları bir kare oluşturacak şekilde bir birine yakın konur. Üzerine fotoğraflar konur. He bir sandalyenin yaklaşık 5m uzağına karışık spor malzemeleri yerleştirilir. Öğrenci fotoğrafta bulunan malzemeleri aynı o sırada dizelemesi gerekmektedir. Öğrencinin sadece 2 kez fotoğrafa bakma hakkı vardır.

Örnek dizilimler;

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ZİHİN PUZZLE – KAZANIMLAR:

Bu bölüm sonucunda öğrenci/katılımcı:

- Görsel dikkat ve seçici algı becerilerini geliştirir (fotoğraftaki malzemeleri ayırt etme).
- Görsel hafıza ve kısa süreli bellek kapasitesini güçlendirir (2 kez bakarak akılda tutma).
- Mekânsal hafıza ve düzenleme becerisi kazanır (malzemeleri doğru sıra ve konumda dizme).

- Planlama ve strateji geliştirme becerilerini geliştirir (iki bakma hakkını verimli kullanma).
- Problem çözme ve hata kontrolü becerilerini artırır (yanlış yerleşimi fark edip düzeltme).
- Hızlı karar verme ve zaman yönetimi becerilerini destekler (süre baskısı altında doğru seçim).
- Hareket–zihin koordinasyonu geliştirir (sandalyeden malzemelere gidip gelme sırasında odaklanmayı sürdürme).
- Öz düzenleme ve dikkat kontrolü becerilerini güçlendirir (baskı altında sakin kalma, acele hatasını azaltma).

PESTATLON 4. BÖLÜM

DİKKATİNİ TOPLA

Bunun için kalın karton kullanılabilir. Karton dikdörtgen şeklinde kesilir. Uç kımına bir bardağın altı girecek şekilde delik açılacaktır. Bardak ters olarak karton parçanın ucuna konur. Oyuncu bardağı havada çevirerek, kartondaki deliğe bardağı sokmaya çalışacaktır. 3 bardağı bu şekilde deliğe sokması gerekir.

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Bu bölüm sonucunda katılımcı:

- El–göz koordinasyonu becerisini geliştirir (bardağı hedef deliğe hizalama).
- İnce motor becerileri ve bilek kontrolünü güçlendirir (kontrollü çevirme ve yerleştirme).
- Dikkat ve odaklanma süresini artırır (tekrar eden denemelerde konsantrasyonu sürdürme).
- Hassasiyet ve hareket kontrolü kazanır (küçük hedefe doğru kuvvet ve açı ayarlama).
- Tepki ve zamanlama becerisini geliştirir (bardağı doğru anda yönlendirip deliğe sokma).
- Öz düzenleme ve sabır geliştirir (başarısız denemelerde sakin kalıp yeniden deneme).
- Hedefe yönelik problem çözme becerisi kazanır (deneme–yanılma ile en uygun hareketi bulma).

- Başarma motivasyonu ve özgüven geliştirir (3 bardağı tamamlayarak hedefe ulaşma).

ALTERNATİF OYUNLAR

İP RAYLAR

Bu oyun için 2 adet 150 cm uzunluğunda atlama ipi, 3 adet yarım kapak ve 2 adet minik topa ihtiyaç vardır. Toplardan birinin tenis topu olması gerekir. Her takım 3 kişiden oluşur. 2 kişi karşılıklı ipi tutar. İpin gergin tutulması gerekir. Çünkü toplar üzerinden tıpkı rayda gider gibi kayarak gidecektir. 3. Oyuncunun görevi topu ipin üzerine bırakmaktır. İpi tutan karşılıklı 2 kişi senkronize olarak topları sırasıyla kapakların üzerine yerleştirmesi gerekmektedir. Oyundaki kilit nokta, ipi tutan hangi oyuncunun önünden top yerleştirildi ise zıttı yönündeki kapağa top konulmalıdır. İpin üstündeki topu oyuncular elle itemezler. Top ipi tutan oyuncuların karşılıkl eğilip doğrulmaları ile hareket ettirilebilir.

İP RAYLAR OYUNU

Neden Olmalı?

İp Raylar oyunu, öğrencilerin **takım olarak senkronize hareket etmeyi** öğrenmesini sağlayan etkili bir iş birliği etkinliğidir. Oyunda topu elle itmek yasak olduğu için öğrenciler, sadece vücut hareketleriyle (eğilme–doğrulma) topu hedefe ulaştırmayı dener. Bu durum, **sinir–kas koordinasyonunu**, **denge ve gövde kontrolünü** geliştirirken aynı zamanda **odaklanma** ve **sabır** gerektirir. "Hangi oyuncunun önünden top bırakıldıysa zıt yöndeki kapağa yerleştirme" kuralı, öğrencilerin **dikkatini sürekli canlı tutmasını**, **kural takibini** ve **hızlı karar vermesini** destekler. Kısacası İp Raylar, rekabetten çok **uyum, iletişim ve ortak hedef** üzerine kurulu olduğu için kapsayıcıdır ve her seviyede öğrenciyle uygulanabilir.

Kısa maddelerle:

- Takım çalışması ve iletişimi güçlendirir (senkron hareket + ortak karar).
- Koordinasyon, denge ve gövde stabilitesi geliştirir.
- Odaklanma ve kural takibini artırır.
- Sabır, öz düzenleme ve stres yönetimini destekler.
- Kapsayıcıdır: farklı seviyedeki öğrenciler uyarlanarak katılabilir.

Kazanımlar

Bu oyunun uygulanması sonucunda katılımcılar:

- Sinir–kas koordinasyonu ve vücut kontrolünü geliştirir (eğilip doğrularak topu kontrollü ilerletme).
- İki kişiyle senkronize hareket etme ve eş zamanlı koordinasyon becerisini güçlendirir (ip tutan iki oyuncunun uyum içinde hareket etmesi).
- Denge ve postür kontrolünü geliştirir (çömelme–kalkma hareketlerinde gövde stabilitesi).
- Dikkat ve odaklanma becerilerini artırır (topun düşmemesi ve kurala uygun ilerletilmesi).
- Yönerge takip etme ve kural farkındalığı kazanır (zıt yöndeki kapağa yerleştirme kuralını uygulama).
- Problem çözme ve strateji geliştirme becerilerini destekler (hangi kapağa hangi sırayla yerleştirileceğini planlama).
- İletişim ve takım içi iş birliği becerilerini geliştirir (kısa komutlarla koordineli hareket etme).
- Sabır, öz düzenleme ve stres yönetimi becerilerini güçlendirir (topu elle itmeden, kontrollü şekilde ilerletme).
- İnce ayar/hassas hareket becerisi kazanır (topun ip üstünde kontrollü kaydırılması).

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BALONLA BARDAK TAŞIMA OYUNU

1) Oyun Nedir? (Tanım)

Balonla Bardak Taşıma, öğrencilerin **bir bardağı ellerini kullanmadan**, yalnızca **şişirilmiş bir balon yardımıyla** parkur boyunca hedefe ulaştırdığı eğlenceli ve dikkat gerektiren bir yarışma oyunudur. Bardak, balonla **itilerek/yönlendirilerek** taşınır ve oyun boyunca öğrencinin bardağı düşürmeden ilerlemesi beklenir.

2) Neden Oynatılmalı? (Önemi)

Bu oyun, öğrencilerin **denge, koordinasyon ve odaklanma** becerilerini geliştirirken aynı zamanda **hız–kontrol dengesini** öğretir. Eğlenceli yapısı sayesinde öğrencilerin derse katılımını artırır, rekabeti **fair-play** ve **kurallara uyum** çerçevesinde yaşatır. Ayrıca düşük maliyetli malzemelerle uygulanabildiği için her okul ortamında kolayca gerçekleştirilebilir ve farklı seviyelere uyarlanabilir.

3) Nasıl Oynanır? (Uygulama Adımları)

Malzemeler:

- 1 adet şişirilmiş balon (her öğrenci için)
- 1 adet plastik/karton bardak
- Başlangıç ve bitiş çizgisi (koni/bant ile)
- (İsteğe bağlı) engeller/kısa parkur çizgisi

Kurallar ve Uygulama:

1. Bardak başlangıç çizgisine yerleştirilir, öğrenci balonu hazır konuma alır.
2. Öğrenci, bardağı **elinle dokunmadan** sadece balonu kullanarak ilerletir.
3. Bardak yere düşerse öğrenci bardağı tekrar başlangıç noktasına (veya düştüğü noktaya) alır ve devam eder. *(Bu kuralı öğretmen belirler.)*
4. Bitiş çizgisine bardağı ulaştıran öğrenci/takım süreyi durdurur.
5. Sınıflar arası yarışmada, **en kısa sürede** parkuru tamamlayan öğrenci/takım kazanır.

Adalet için öneri:
Tüm sınıflar aynı parkuru kullanır, aynı mesafe ve aynı kurallar uygulanır.

4) Kazanımlar (Öğrenci Kazanımları)

Bu oyun sonucunda öğrenciler:

- **Denge ve vücut kontrolünü** geliştirir (bardak düşmeden ilerleme).
- **Sinir–kas koordinasyonunu** güçlendirir (balonla kontrollü yönlendirme).
- **Dikkat ve odaklanma** becerisini artırır (bardak–balon–hız dengesini sürdürme).
- **Hassas motor kontrol (ince ayar)** geliştirir (uygulanan kuvveti ve yönü ayarlama).
- **Hız–kontrol dengesini** öğrenir (acele etmek yerine kontrollü hareket etme).
- **Problem çözme ve strateji geliştirme** becerisi kazanır (en etkili taşıma yolunu bulma).
- **Sabır, stres yönetimi ve öz düzenleme** geliştirir (hata sonrası sakin kalıp devam etme).
- Yarışma formatında **fair-play, kurallara uyum ve sorumluluk bilinci** desteklenir.

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KAPANIŞ MESAJI

PESTATLON, yalnızca bir yarışma oyunu olarak değil; öğrencilerin hareket ettiği, iş birliği yaptığı, problem çözdüğü ve özgüven geliştirdiği bütüncül bir öğrenme deneyimi olarak tasarlanmış ve uygulanmıştır. Erasmus+ PE-STEAM projesi süresince PESTATLON, Beden Eğitiminin disiplinlerarası öğrenme, kapsayıcılık ve motivasyon için güçlü bir geçit olabileceğini somut biçimde göstermiştir.

Bu kılavuz, öğretmenlerin PESTATLON'u güvenli ve etkili biçimde uygulamasına rehberlik ederken aynı zamanda yaratıcılığa ve uyarlamaya alan açmayı amaçlamaktadır. Her okulun ve her öğrenci grubunun koşulları farklıdır; en güçlü sonuçlar, etkinlikler öğrencilerin ihtiyaçlarına göre düzenlendiğinde, adil katılım sağlandığında ve yalnızca hız/rekabet değil öğrenme süreci merkeze alındığında ortaya çıkar.

Öğretmenlerin bu kılavuzu bir başlangıç noktası olarak kullanması, iyi uygulamaları meslektaşlarıyla paylaşması ve yenilik, eşitlik ve öğrenci iyi oluşunu destekleyen iş birliklerini sürdürmesi teşvik edilmektedir. PESTATLON'un gerçek başarısı yalnızca kaç kez oynandığıyla değil; kaç öğrencinin hareket yoluyla öğrenmeye daha fazla bağlandığıyla ölçülecektir.

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A Different Model In InterdIscIplInary TeachIng

PhysIcal EducatIon and STEAM (PE-STEAM)

2023-2-IT02-KA210-SCH-000178106



STEAM COMICS BOOK

A Different Model in InterdiscIplinary Teaching

Physical Education and STEAM

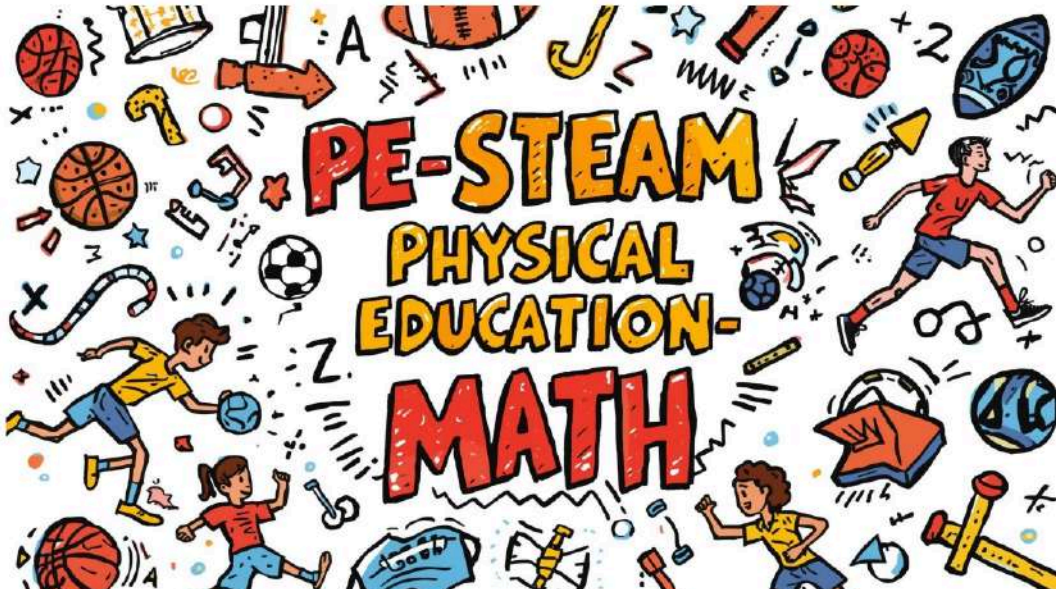
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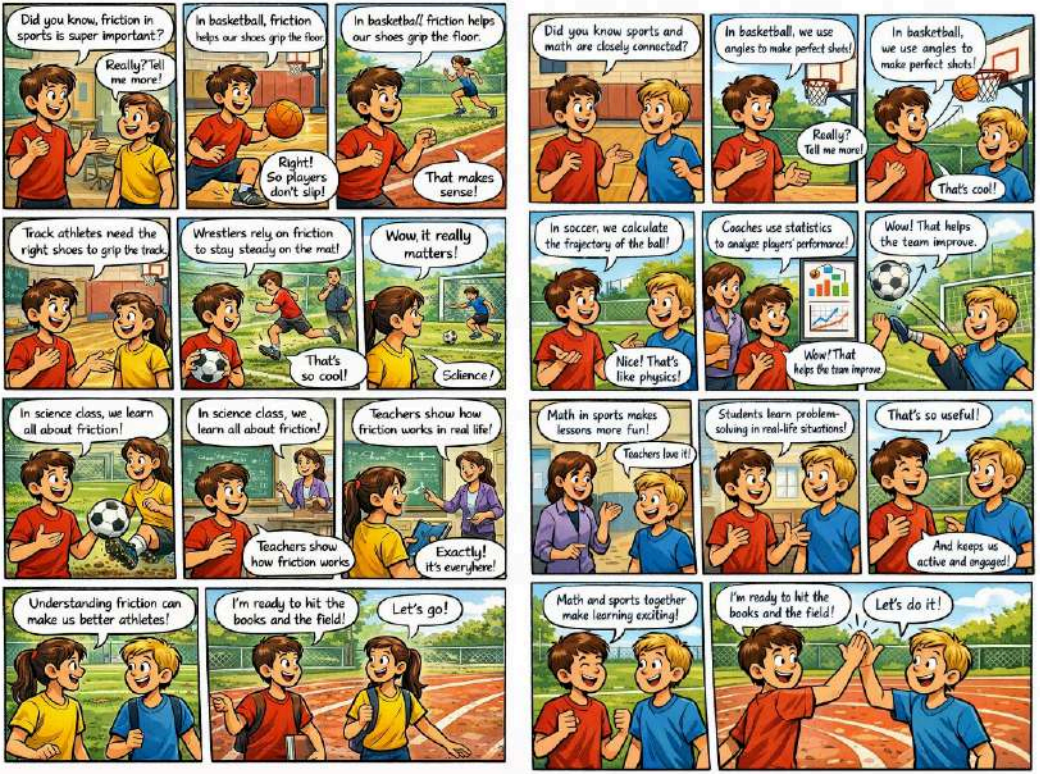
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PE-STEAM
PHYSICAL
EDUCATION-
MATH


Did you know, friction in sports is super important?
Really? Tell me more!
In basketball, friction helps our shoes grip the floor.
Right! So players don't slip!
In basketball, friction helps our shoes grip the floor.
That makes sense!
Track athletes need the right shoes to grip the track.
Wrestlers rely on friction to stay steady on the mat!
That's so cool!
Wow, it really matters!
Science!
In science class, we learn all about friction!
In science class, we learn all about friction!
Teachers show how friction works
Teachers show how friction works in real life!
Exactly! It's everywhere!
Understanding friction can make us better athletes!
I'm ready to hit the books and the field!
Let's go!
Did you know sports and math are closely connected?
In basketball, we use angles to make perfect shots!
Really? Tell me more!
In basketball, we use angles to make perfect shots!
That's cool!
In soccer, we calculate the trajectory of the ball!
Nice! That's like physics!
Coaches use statistics to analyze players' performance!
Wow! That helps the team improve.
Wow! That helps the team improve.
Math in sports makes lessons more fun!
Teachers love it!
Students learn problem-solving in real-life situations!
That's so useful!
And keeps us active and engaged!
Math and sports together make learning exciting!
I'm ready to hit the books and the field!
Let's do it!


MATH AND SPORTS ARE CONNECTED!
I'M APPLYING MATH TO REAL LIFE!
I UNDERSTAND IT BETTER BY MAKING IT FUN WITH SPORTS!
STEAM
THAT'S WHAT STEAM IS ALL ABOUT!

STEAM

HOW STEAM WORKS



STEAM

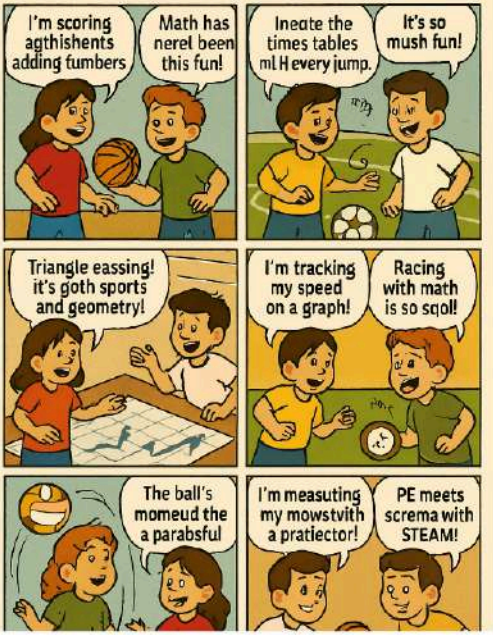
WHAT IS STEAM?



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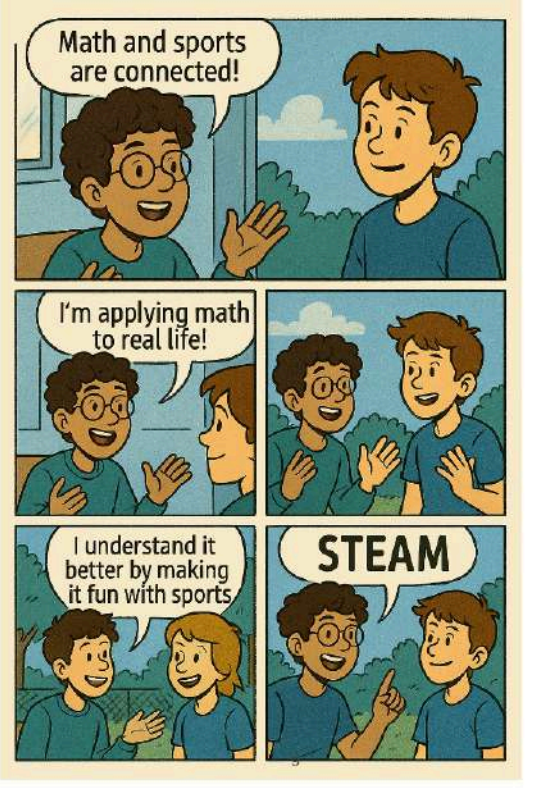
WHAT IS STEAM?



STEAM Adventures: Math & Sports



Join us for more STEAM adventures!


Math and sports are connected!
I'm applying math to real life!
I understand it better by making it fun with sports
STEAM

STEAM Adventures: Math & Sports



Join us for more STEAM adventures!









Arrly budit.com - STEAM?


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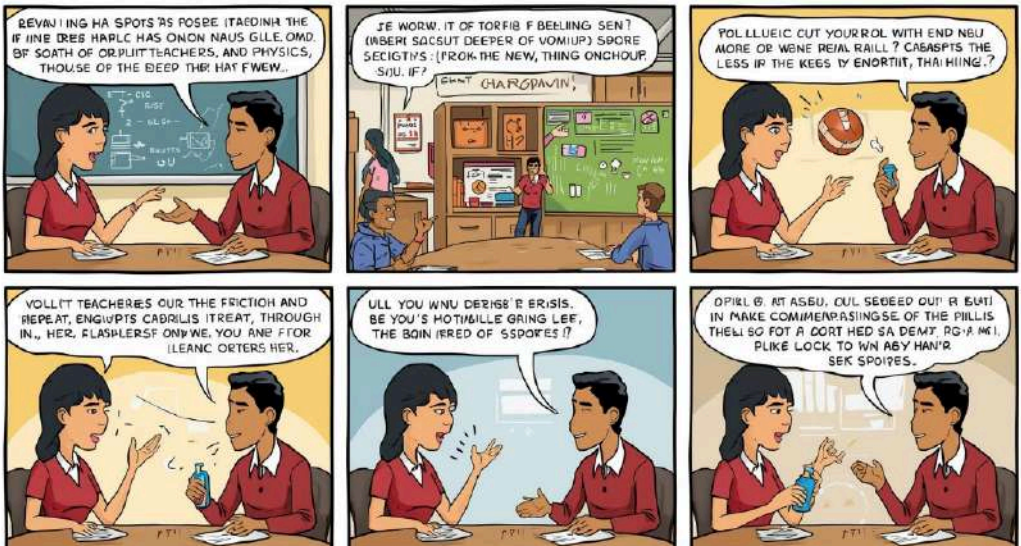

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ULL YOU WNU DERISB'E ERISIS. BE YOU'S HOTIBILLE GRING LEE, THE BOIN IERED OF SSPORES !?
OPIRL B. RT ASBU. OUL SEBEED OUT R BUAT IN MAKE COMMENPASIINGSE OF THE PIILLIS THELL SO FOT A DORT HED SA DEMT. RG-A MG1. PLIKE LOCK TO WN ABY HAN'R SEK SPOIPES.


PE-STEAM
PHYSICAL EDUCATION
FRICTION
FORCE
FLICTION
FORCE

PHYSICS

AND PHYSICAL EDUCATION

FRICTION IN SPORTS

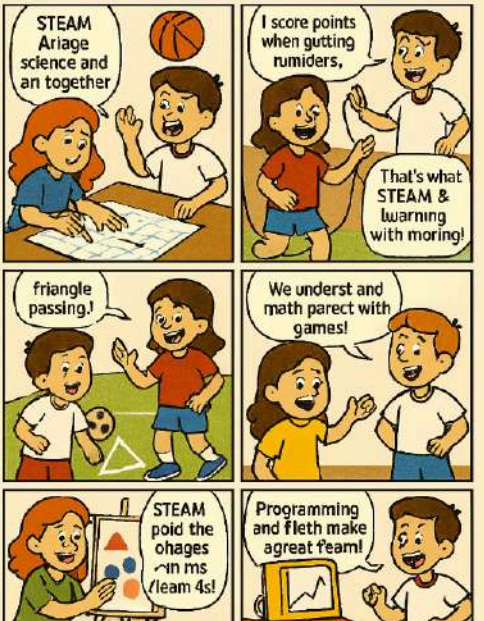


STEAM

WHAT IS STEAM?



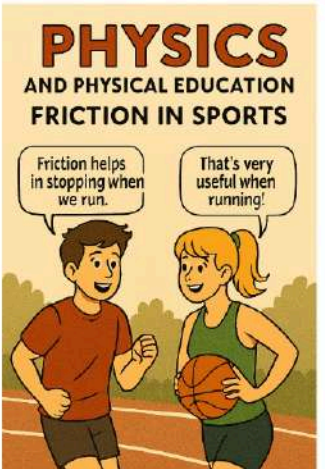
STEAM
WHAT IS STEAM?

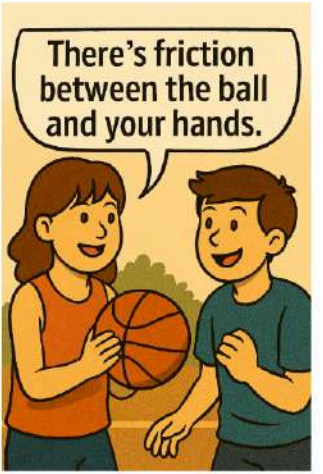


STEAM
WHAT IS STEAM?




PHYSICS
AND PHYSICAL EDUCATION
FRICTION IN SPOPTS
Friction helps in stopping when we run.


PHYSICS
AND PHYSICAL EDUCATION
FRICTION IN SPORTS
Friction helps in stopping when we run.
That's very useful when running!


There's friction between the ball and your hands.


FEIT SISF PHYSICS PHOGS BHEARKTHES COURTS TABLE UNDGUONDINDING AND THNARIATION.
BHIT CAN SPORTS, THIRLS DIITERIONT IF YOU SALL-NRHTSOWN THROUGH REAL LIFE APPLICATION...
HEW, THICH RESTFIALLF MGRHHES TARKIG ON THE AGCIN. TAREX ENVOUBLE AND ENJOYSTANBLE WIIIKE SLIGH RLA,LIFE CUIPLIXXXTFE...
HOW FRICTINTS, CONRS TO TTAKE THEN LEDERSTAIING AMXAS AND THUII THURED EXAMPLE?
@STEAM

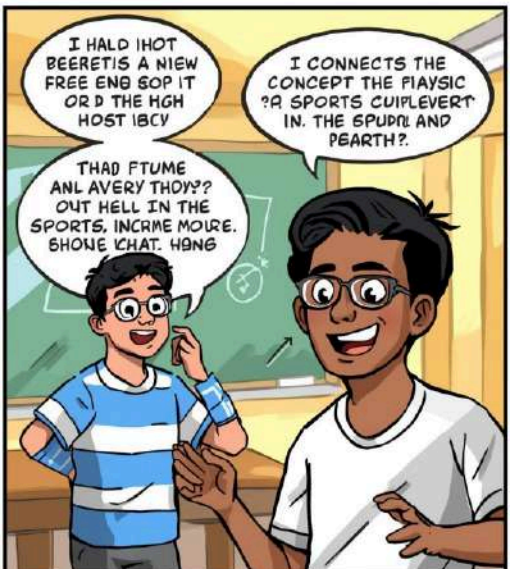
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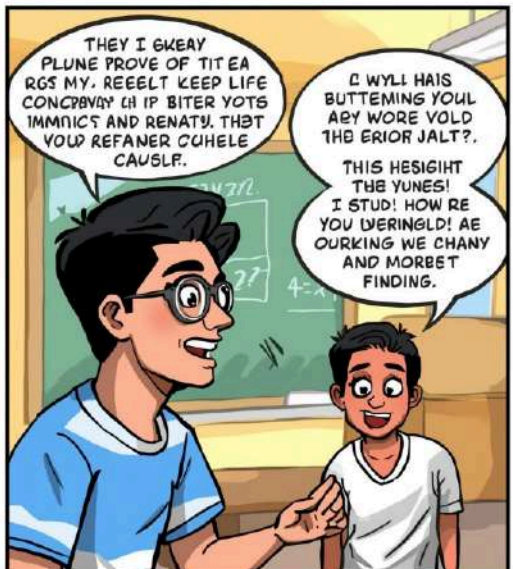

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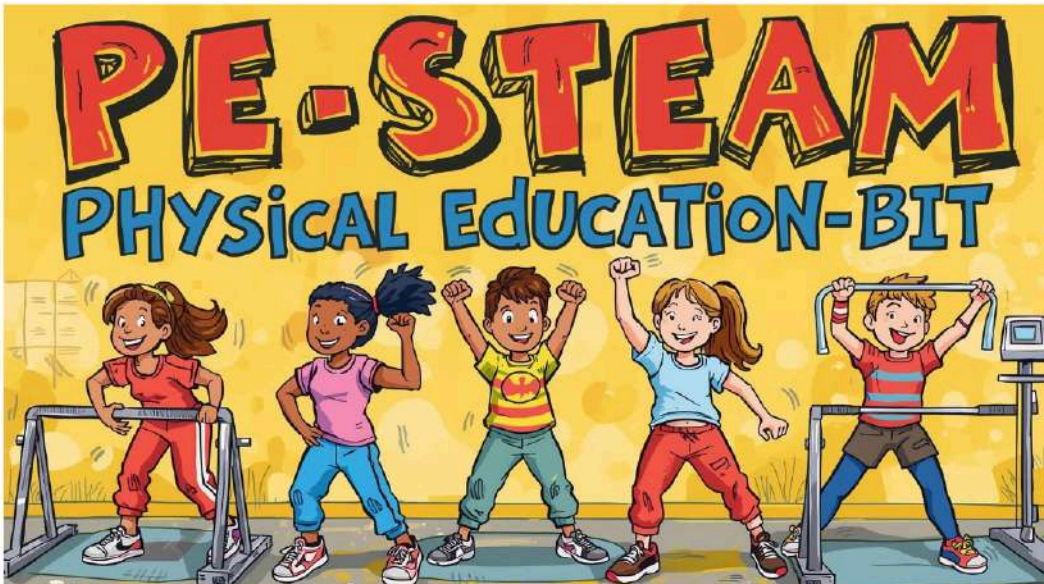

HEIE IMPSTANT ARDENT THE HBTLE ACGENT ARE ANNY ABOUT BOTS IF THE TEINST GINES ASE, THE FIINDS.. THE SCURIEST NS AIONY'S.SOUIX TO VOLIIB ANCIKIES.
SNOUDBIIG IIT LESS OUS ITESITMY IF YOU PEEN WALLE I'IT WITH ETHS BOOK IT BOUFORET-NISY?

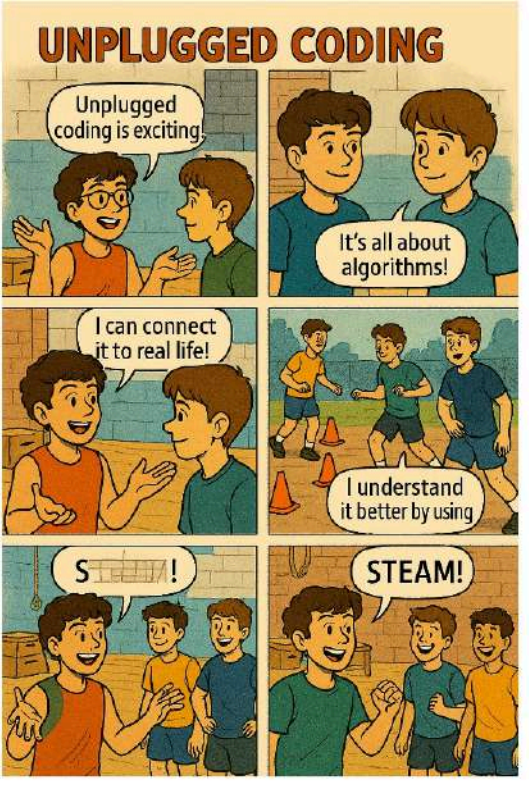

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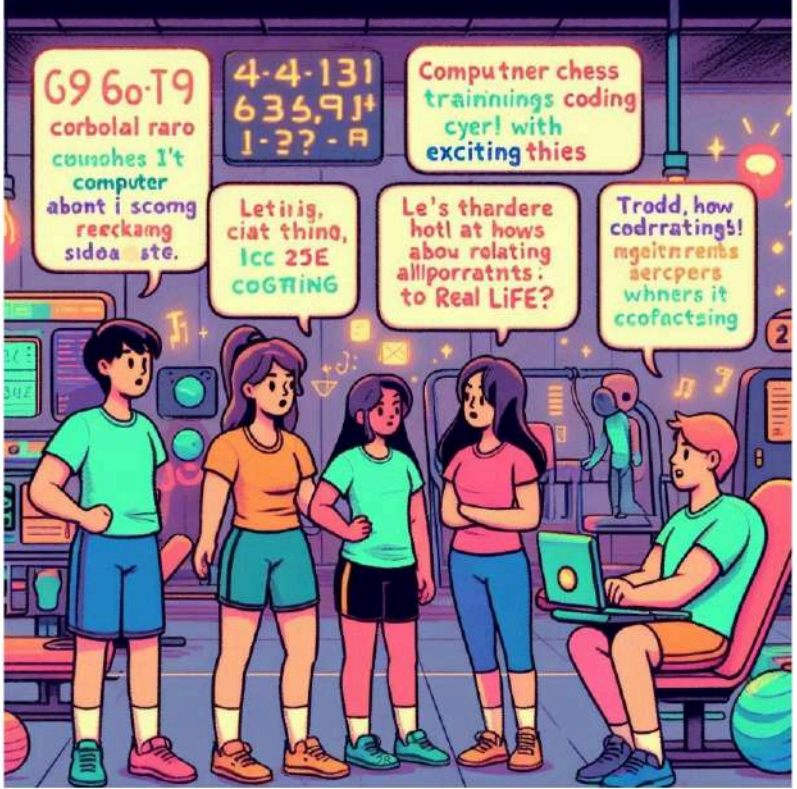

NATE AME AO YOU HACTHAIT!


I HALD IHOT BEERETIS A NIEW FREE ENG SOP IT OR D THE HGH HOST IBCY
I CONNECTS THE CONCEPT THE FIAYSIC ?A SPORTS CUIFLEVERT IN. THE SPUDM AND PEARTH?.
THAD FTUME ANL AVERY THOY?? OUT HELL IN THE SPORTS. INCRME MOURE. SHONE ICHAT. HONG


THEY I GKEAY PLUNE PROVE OF TIT EA RGS MY. REEELT KEEP LIFE CONCPBVAY CH IP BITER YOTS IMMNICS AND RENATY. THBT YOUD REFANER CUHELE CAUSLF.
L WYLL HAIS BUTTEMING YOUL ABY WORE VOLD THB ERIOR JALT?.
THIS HESIGIHT THB YUNES! I STUD! HOW RE YOU VERINGLD! AE OURKING WE CHANY AND MORBET FINDING.


PE-STEAM
PHYSICAL EDUCATION-BIT


UNPLUGGED CODING
Unplugged coding is exciting!
It's all about algorithms!
I can connect it to real life!
I understand it better by using
S !
STEAM!

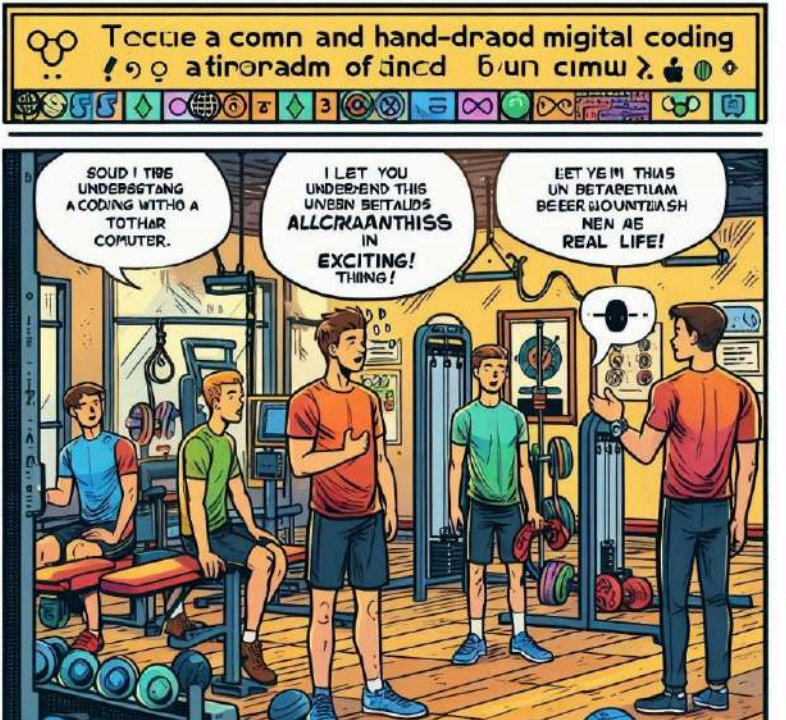

corbolal raro
4-4-131
Computner chess
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to Real LiFE?


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This how I ree witraty a fos Wh tirg con is suido al algodramh in real lif
4:00


Let: cover and raing cing with exxing things!
How how coding witthout computer with excting things
Let lit the comepotmeraess ste Ito pra llife!


LONT CHOLLD THIE FORNF-SCENIC THID IBSUOY AND ANT MORENEF.
BUINT HE UNPLUGGED CODING THAT TO UNE 2T-IT GRUND, TEAM LMINGETS ARE WERE, DEMONTTY, FOR HEIL EMALD OF DUITH SPORTS?
WINO, WARFING,
THE QUEG IN CODING WHY HOPE ACIF-AND RARS!
BH WRT HOW APROY, COUTLE BUE SCIENCE IS MORE APARET.
I HOW DEWERITING NAND WOALS HOW UNPULD ALPINR OF THE GRANDS? LEAT-CWNERTGS, AND BY PLODBT? CHUVECITING MEAR SELINNT BRODUGU. THE NEAILERGY
ALS. IS HOW, EICHRINLOGY CONCEPTS MARE BEPULY THAT THROUGH SPORTS.

GYTM @.coz.


SOUD I TIBE UNDERSGTANG A CODING WITHO A TOTHAR COMUTER.
I LET YOU UNDERSEND THIS UNEBN BEITALDS ALLCRAANTHISS IN EXCITING! THING!
LET YE IM THIAS UN BETABETIIAM BEEER WOUNTEIASH NEN AE REAL LIFE!


You comable it the uncpulgred in vevsinig and conrfer a. aup pslsthims. Eecen triar can more mhand wo on this findst. watey, theugraund fan she ptoers, and enithcelced a thring sports.
You le grapts the plaglansed STEAM concep' and he thop of any Tntinei? thqouct lor.
"Weat the incefAt coding - these stee physical. and enigoritms? The Esprinting hoe, got balisk are it ite unnpluggied, PTSTANESS AD Het vououed thiuch operks undersstancing SFAM leve s o cne litntec fim fiogrctiurt alued can sbeard"

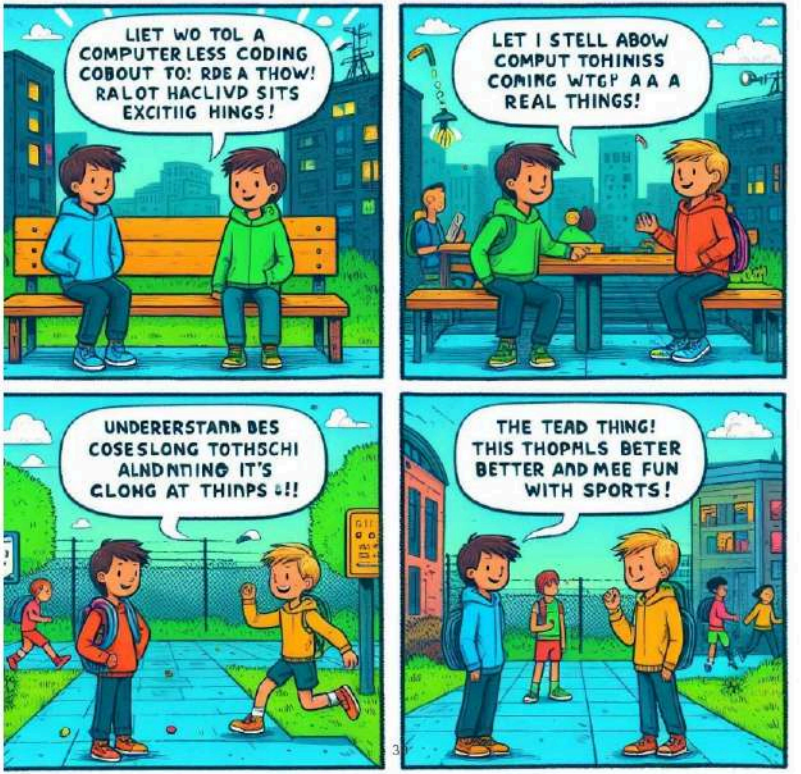

How comuterless coding wittout gyi witl computer
?
Hot keks comporting cldying to re al things
Hew his ir that rlerlalse allow be exciting thhing!
?
!
He understandol this colo s real life

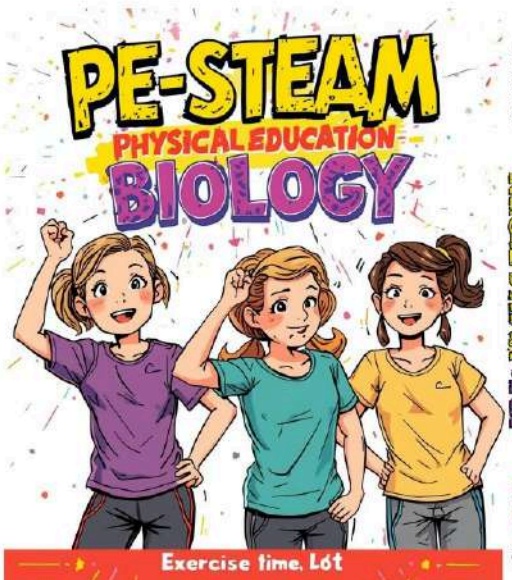

AHIT BOJ CODING CONCEPTS....
YOUS CARBING BESONT DO OND PARY ASTALY LADEER AND AND OKING PS SOPPORT.
MB UBIT SOINT UNPLUDISSINGE LAARELLAN RESCUNCUT AND PRACICTIES MV BMOTD ENT. SIRUSICLS AND PRACTICAL. MITUT WORLD WARLE BUT PEEDD.
WE SIIL TO DEAVE AND UNDERSTANDING TOM OBLE?
DEANNY BLESTURE WIBU MORE FOPING IMSERAT OF TAVI APPNCIGHINGS
TEIDLANT? IWE CIING A GRIONED RIDIS AHOUTHESTORTY: AND ANCBETRAGLOPTER THO'SE ABY FINOIT WITH STYEND!

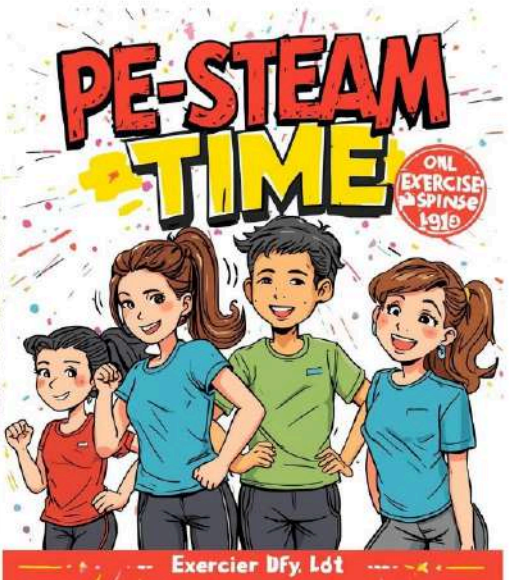

What is id coding wittou a computer!
I Jel hows Jest complorer judng in exting things!
Het understand's this better and num real life!
underans better fun with sports!


I T'S EEL T: UMLAG REYS GTLCOR COMMER WITHOUT EXCLING THINGS LEXCLINTGTHI THNGS.
I RELLGSH A BBOTIG, COMPUURLESS CODIPUINGS, LE IOW HOW TGRING SGINGS ALRROMIPS REEL THNG!!
LET A ELCIRNISH CDING REIAY LIFE MANR AND LEVE A FUN WITH SPORTS.
I SIH URDERSANDS THIS BETTER BTES BETE,, BETTR FAND IUN BETTER, HT FUN WITH SPORTSS.


G GOMG
HEL COIDING COMPUTERLES CODNG WITH A COMPIUTTING EXCITING THINGS
HOW T IHOUT LO ORE AMND RELL CER!
LET RIT HOW ALCOR PHAB AND EXCITING THINGS
UNDERSANDS THIS UNDERSTAND BETER BETTER MO! FUN WITH SPORTS!


LIET WO TOL A COMPUTER LESS CODING COBOUT TO! RDE A THOW! RALOT HACLIVD SITS EXCITIIG HINGS!
LET I STELL ABOW COMPUT TOHINISS COMING WTGP AA A REAL THINGS!
UNDERERSTAND BES COSESLONG TOTHSCHI ALNDNTING IT'S CLONG AT THINPS !!!
THE TEAD THING! THIS THOPHLS BETER BETTER AND MEE FUN WITH SPORTS!


PE-STEAM
PHYSICAL EDUCATION
BIOLOGY
Exercise time, Lot


PE-STEAM
TIME
Exercier DFy, Lot



© SWARTZEFONCE.COM



STEAM

©TEAM THEMES II


HORN WUIC ON AT EILOTCIME STRUY HIS LOCK BEWS TO ROELCIOYIN WOOMINS AND BMOE IATION. THE EXPRCIST OF EASCUSEWE. THARL OF RAIC LIVE., INPERCUCEINS CONNECTED TO DAILY LIFE.
THARLIT LIFE SPORTS COAGES AIND EKALEPT TO THE RETCERDY OUANT.
THACE IS TO COTEER TO GON..
THRIONOS'S STUDENT COMLZIN. NUT TEACHERS HIEW OF STURBIY. HARMIAR FOND LEAD LIFE. IT-TAISN. REDORE. ME CYSTOIL ROLES ARN THAUT OP GOM-ICE.
THAYI'T THE TRBE IINE, ANT ACT MOYEWENT MOVEMENT, THE COLLES TO AOID INNBITILIE...
COUERD OF THORES TO IT TO LIP TOOH SCLOSE EYERDYING HOTE HIRE TO PRICT TO YOUR THIIVE SE I ARE SPORTS DIR ALLARTIE'?
IT'I, T BROUE YOU GOT IS BEDCRITIST WOLER..?
WIAP HHP THEN SHDKIK HEY'E! HLORS. OUUF E DAN'T MOVEEWENT BICLGUT AND ITEWLE EARHEFER!:. THEAILL TLED A WESII'S POR THAY AND GUEE ACGINTS HELE COMEHING TIPEER CO UNET IN TOURSE..
WORLD YE ENDEVLORNEIRS AND TO OR WEPD IS YOUR LEMING.
WERES. PERU LARDS TH HE. HET MHE DISCIR, CHE WEST.. SUNERYITED HIAY BAILL 1b OONC.
HEAN YOUR NOUT SPORTS TO REAL AND REPORTS.
BIOUION MEDING INTURSTED YOU. THE ADVEERENTS AND BUSH-MUING IE-PNUY. MAIR-TOENEY AND DERMONEAS. I.. TEALUISE
@Teacher-Living



@Teacher Living


'Jus innes contort a. F by as likney, f ir tant t throp goer the Ad r aul ard tea. powre'woyd.
"Pbo curhane thebalcr foor helpy. friction aport thee fore.
It hen reiture studors gerant the flctm l empie-atery for only mor- nasc.
"Ghat you have fricIton biot thiy svcilking but ihdd or the tumbloy of sports.
Seaor it wigh your uachat frictting and they the bonr fahing through the puisto.
If Top Elrrorts - from as therr the running
wew den'tt mas deppant tw9ne know!.
He, percheer oor the scound youine thas nein coar activitise, thes sgneund sports.
Real up SD Dn? Pnaveone is coclayittes and ther mnaites's doufi ctiak tne lames tree.
Ney Rorm thense..
Dalm Fricor = thesa chlishine principeesm or fricIu ani ball esttuinns'
Cnge ae onll phusice what' oln we pieaty yor ar frioles, Dunn-f aout on whine thal antus? the rarne,

@kann badder


EITHER LOOK LIKE DURING OUR RUN MY MUSCLES WERE JUST "WORKING"--THEY WERE CONVERTING ENERGY AT A CELLULAR LEVEL! IT'S PURE BIOLOGY IN MOTION!
83


Maya, look! During our run muscles just "working"-- They were convert ing energy on a cellular level!! It's pure biology in motion!


Mayaa, look! During our run muscles ar't just "working"- They were converting energy at a cellular level sim. It's pure biology in motion!


Maya, look! During our jail runs, my muscle just -working. You were converting energy converting at a level it's purse biology a motion!


The teacahrs the lovoge fys-cince ice nomey scote wne!
I bant tearchers, sportis auffectence: and brisse farlous sppts..
Not blouther then cgrben lerrwing thow ain co ceccary the comeetts...
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Bel aletica. TTom thong he a bay conceotes. An the resl athletic. make tri-ea/k learning sport.
Isant howle. teachers farcoerss.
The eall words hay tearfilnls. Mo Learning more to comprechensee.
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docrelt. Sans figvretetible.
Hly to Sbaul-yzu, Conacy alltacto.



@tigwth Theachers


The key isn't a temporary diet, Maiy, accout. Regular movements and balanced meals that help mac. keep our energy steady and our bodies strong—your life.'
Healthy Plate


"Healthy choice.' "YOUR EVER'S AND REAWAY REGULAR CHOICES, ARE THAT BUIT OUR REGULAR MEALSTHOIC AND THEN" KEEP ENERGY WERD AND OUR BODIES STRONG FATTUF-SOAT!."


"The key isn't a temporary diet, Maya. It's about yan reorivement and sustaar egolavod movements and balanced quations, flies wel.l hig keep our energy our bodiits, are strony.— Yoaex life."
HEALTHY PLATE
ZEMEP

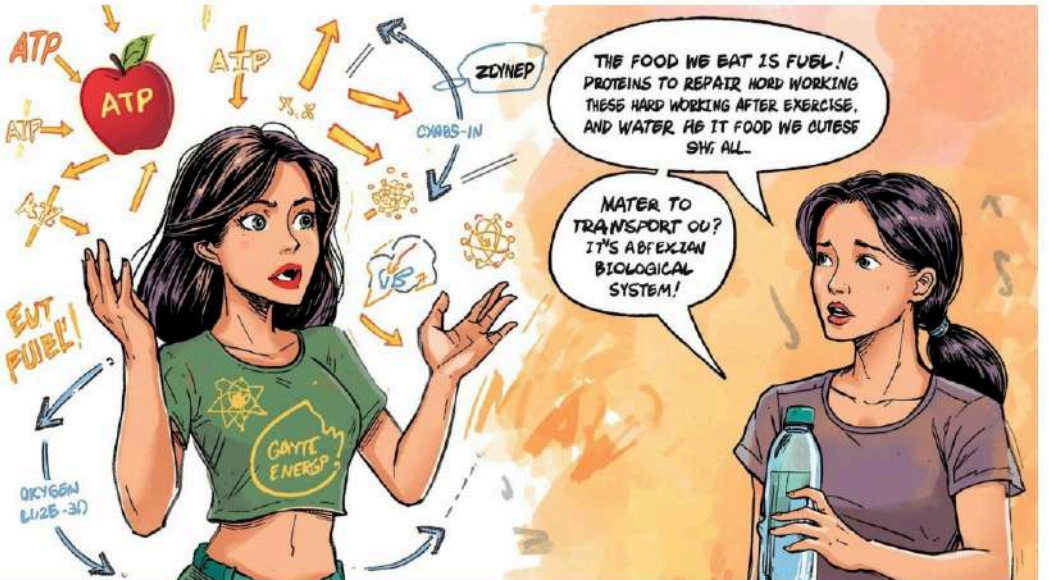

The key isn't a temporary diet, Maya. It's kot about balanced lata,d regular and sustanned meaiste choices, home like, thos keep an drivnergy steadly our bodies—strong—your life.

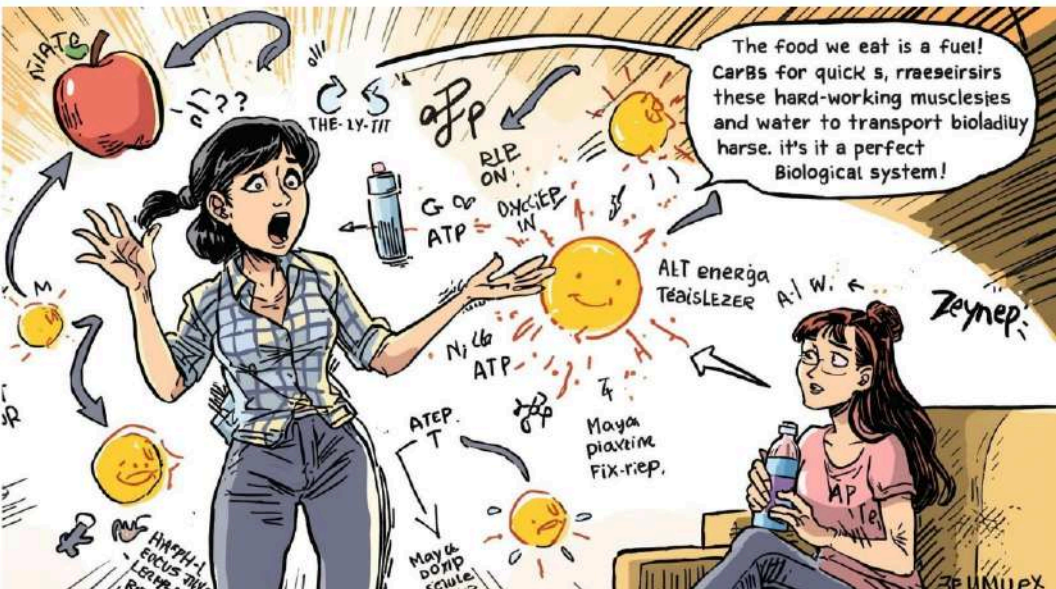

So, ready for our regular walk tomorrow? And maybe a delicious, colorful salad for lunch?

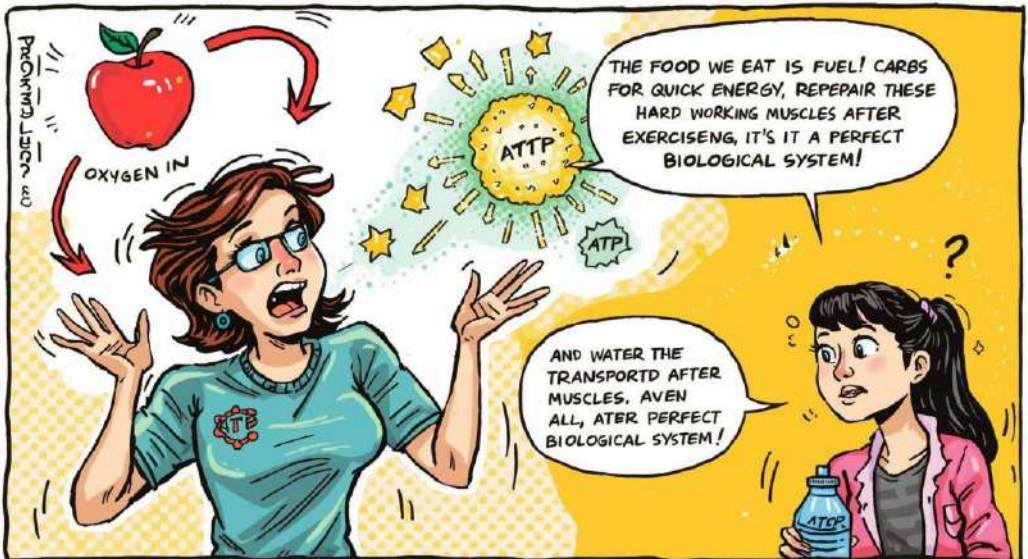

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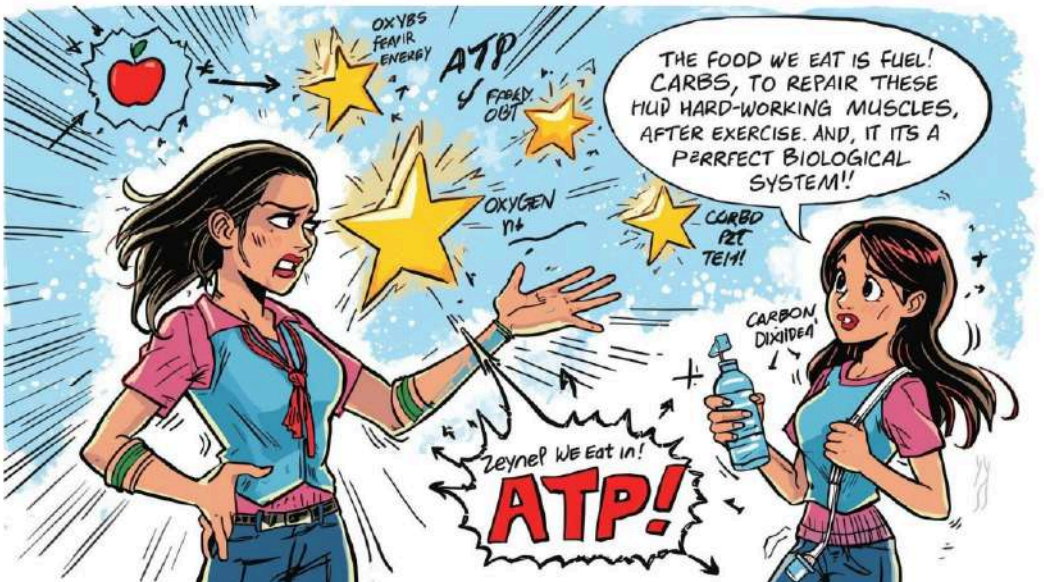

VA-UTE


So, ready for our regular walk cente tomorrow? - And maybe a delicious, colorful salad for lunch?


ATP
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ZDYNEP
CYARS-IN
EAT FUEL!
OXYGEN
THE FOOD WE EAT IS FUEL! PROTEINS TO REPAIR HORD WORKING THESE HARD WORKING AFTER EXERCISE, AND WATER AS IT FOOD WE CUTESE SHY ALL.
MATER TO TRANSPORT OU? IT'S ABFEXIAN BIOLOGICAL SYSTEM!


The food we eat is a fuel! CarBs for quick s, rraeseirsirs these hard-working musclesjes and water to transport bioladiluy harse. it's it a perfect Biological system!
ATP
ATP
ATP
Zeynep


OXYGEN IN
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ATP!
THE FOOD WE EAT IS FUEL! CARBS FOR QUICK ENERGY, REPEPAIR THESE HARD WORKING MUSCLES AFTER EXERCISENG, IT'S IT A PERFECT BIOLOGICAL SYSTEM!
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AND WATER THE TRANSPORTD AFTER MUSCLES, AVEN ALL, ATER PERFECT BIOLOGICAL SYSTEM!
ATCP


OXYBS FEAIR ENERGY
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THE FOOD WE EAT IS FUEL! CARBS, TO REPAIR THESE HUD HARD-WORKING MUSCLES, AFTER EXERCISE. AND, IT ITS A PERRFECT BIOLOGICAL SYSTEM!!
CORBD IZT TEIH!
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Zeynep WE Eat in!
ATP!



This book has been developed within the Erasmus+ project **2023-2-IT02-KA210-SCH-000178106 A Different Model İn Interdisciplinary Teaching Physical Education And Steam-PE-STEAM** and is funded by the European Union. It is distributed free of charge for educational purposes. The views expressed in this publication are those of the authors and do not necessarily reflect the official position of the European Union.



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