STEM SPORTS EDUCATION

THE SCIENCE OF ORIENTEERING

Core Unit - 2
Technology and Orienteering

VUB Vrije Universiteit Brussel
UAB Universitat Autònoma de Barcelona
inquirium
institut Bitàcola
www.insbitacola.cat
ASD Sport Compass
ΓΥΜΝΑΣΙΟ ΛΑΤΡΙΩΝ 1991
KAE campus GO! Atheneum Etterbeek

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Epos vzw. Neither the European Union nor the granting authority can be held responsible for them [project number: 2024-1-BE02-KA220-SCH-000244223]

STEM SPORTS EDUCATION

Environment and Physical Education: Integrating STEM through Sports

Core Unit Two: Technology & Orienteering

Introduction

The Technology & Orienteering core unit invites you to see movement through nature in a new way: not just as “going for a walk or run,” but as a smart navigation challenge where science, maps, and digital tools help you make good decisions. In this unit, you become a kind of real-world navigator, learning how to combine your sense of direction, your observation skills, and basic technology to find your way safely through outdoor spaces. You will discover that tools like maps, compasses, and GPS apps are not just for hikers or explorers in movies; they are everyday STEM tools that can support physical activity, safety, and environmental care in your own school grounds or local park.

The first main learning goal of this unit is to help you understand how geolocation works and how to use simple mapping tools to plan and follow a route. You will learn to read a map legend, recognise common map symbols, and use cardinal directions (north, south, east, west) to orient a paper map. You will also explore how a smartphone or tablet can turn those same maps into dynamic, “live” tools that show you where you are in real time, how far you need to go, and which path to take. By applying these ideas in short orienteering tasks, you will experience how technology improves accuracy, builds confidence, and reduces the risk of getting lost, especially when working together in a team.

The second main learning goal is to use technology to better understand and protect the environment while you move through it. Using simple observation checklists and route traces from your mapping app, you will think about questions such as: Which areas show signs of erosion or damage? Where is litter collecting? How could we redesign our route to be kinder to the environment while still being fun and challenging? By the end of the unit, you will see that technology is not just about speed or convenience; it is also a powerful ally for planning safer, more sustainable ways to enjoy physical activity in nature.

VRIJE UNIVERSITEIT BRUSSEL
UAB Universitat Autònoma de Barcelona
INQUIRIUM
institut BITÀCOLA www.insbitacola.cat
ASD SPORT COMPASS
GO! ATHENEUM Etterbeek

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Epos vzw. Neither the European Union nor the granting authority can be held responsible for them [project number: 2024-1-BE02-KA220-SCH-000244223]

Learning goals

Orientation learning goals	**In this Unit I will learn how to**
Learning goal 1	Students will understand basic geolocation principles and use simple digital mapping tools to plan and follow routes, recognizing how technology enhances navigation accuracy and safety.
Learning goal 2	Students will apply technology to assess environmental impact during orienteering, analyze route data, and propose sustainable navigation strategies that minimize ecological footprint.

Lesson 1: Digital Mapping and geolocation principles

Introduction

Imagine getting lost in a forest or park during a game – scary, right? Today in our first Technology & Orienteering lesson, you'll discover how simple technology like maps and GPS apps turns confusion into confidence. Orienteering isn't just a sport; it's a real-world test of navigation skills powered by technology. You'll learn what "geolocation" really means, how digital maps work differently from paper ones, and how to use free smartphone tools to find your way. By the end of this lesson, you'll plan and test a short route, seeing firsthand how technology makes outdoor exploration safer, faster, and more precise. Get ready to become tech-savvy explorers!.

IMPORTANT VIDEOS TO WATCH BEFORE PROCEEDING

1. **How Devices work | GPS** *VIDEO LINK*
2. **Neighborhood Map With Compass Rose –** *VIDEO LINK*
3. **Using a Map Key on a Park Map** *VIDEO LINK*
4. **Landform with Map Keys** *VIDEO LINK*
5. **Learn how to use Grid Maps** *VIDEO LINK*
6. **Latitudes and Longitudes** *VIDEO LINK*

VRIJE UNIVERSITEIT BRUSSEL · UAB Universitat Autònoma de Barcelona · INQUIRIUM · institut BITÀCOLA www.insbitacola.cat · ASD SPORT COMPASS · GO! ATHENEUM Etterbeek

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Epos vzw. Neither the European Union nor the granting authority can be held responsible for them [project number: 2024-1-BE02-KA220-SCH-000244223]

Geolocation & GPS Basics (Detailed):
Geolocation uses satellites (GPS = Global Positioning System) to pinpoint your exact location on Earth within 5-10 meters. 24 GPS satellites orbit Earth, constantly sending signals to your phone/app. Triangulation (measuring distance from 3+ satellites) calculates latitude/longitude coordinates.

- Latitude/Longitude: Invisible "grid lines" – latitude (horizontal, equator=0°), longitude (vertical, Greenwich=0°). Example: Rome ~41.9°N, 12.5°E.
- Digital Maps vs Paper: Apps like Google Maps or OsmAnd show real-time position (blue dot), distance to target (e.g., "150m"), and turn-by-turn directions. They auto-rotate and update for traffic/terrain.
- Scale & Symbols: Map scale (1:10,000 = 1cm=100m real). Universal symbols: green=tree/park, blue=water, black=line=path/road, brown=terrain contours (hills).
- Compass Integration: Digital compass uses phone magnetometer + accelerometer for accurate N/S/E/W even when moving.

Why for Orienteering: Technology reduces "dead reckoning" errors (guessing direction/time), prevents wandering into hazards, and tracks exact paths for analysis.

Lesson One - Activity

Teams of 3-4 will use free mapping apps to plan and walk a 200-300m schoolyard route with 3 checkpoint (Also referred as CP). Compare paper map vs digital app accuracy. Who navigates fastest/safest?

Tool Requirements (per team):

- 1 smartphone/tablet with free app (Google Maps, OsmAnd, or Maps.me – offline capable).
- Simple paper map of school grounds (printed A4 with 3 checkpoints marked).
- 3 checkpoint markers (cones/flags with numbers).
- Stopwatch/timer.
- Worksheet: route plan sheet + accuracy checklist.
- Compass (physical or phone app).

VUB VRIJE UNIVERSITEIT BRUSSEL
UAB Universitat Autònoma de Barcelona
inq uiri um
institut BITÀCOLA
ASD SPORT COMPASS
KAE campus GO! ATHENEUM Etterbeek

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Epos vzw. Neither the European Union nor the granting authority can be held responsible for them [project number: 2024-1-BE02-KA220-SCH-000244223]

Detailed Steps:

Step 1: App Setup & Planning (15 min)
a) Install/open mapping app, enable GPS/location.
b) Zoom to school area, drop 3 pins: Start (classroom door), CP1 (eg. gym), CP2 (eg. tree cluster), CP3 (back to start).
c) Record distances: example "CP1 = 120m NE."
d) On worksheet, sketch planned route + estimated time (pace ~5min/100m).

Step 2: Paper vs Digital Test (10 min)

- Team A uses only paper map + compass.
- Team B uses only app (screen on, voice directions).
- Walk to CP1, note time + any wrong turns.

Step 3: Full Circuit Navigation (15 min)
Switch roles: Paper team uses app, app team uses paper. Complete full loop (Start-CP1-CP2-CP3-Start). Record:

- Total time.
- Wrong turns (#).
- Confidence level (1-5).

Step 4: Debrief & Compare (15 min)
Teams report: "Paper took 8min with 2 wrong turns. App took 5min, 0 errors."
Class discussion: "Why did tech win? (Real-time position, auto-correction)."

VRIJE UNIVERSITEIT BRUSSEL
UAB Universitat Autònoma de Barcelona
inqUIRIum
institut BITÀCOLA www.insbitacola.cat
ASD SPORT COMPASS
KAE campus
GO! ATHENEUM Etterbeek

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Epos vzw. Neither the European Union nor the granting authority can be held responsible for them [project number: 2024-1-BE02-KA220-SCH-000244223]

Lesson 2: Technology to Assess Environmental Impact

Introduction

In previous lesson you navigated like pros! Now we add purpose: orienteering isn't just getting there – it's observing and protecting the environment along the way. Today you'll use technology to collect "eco-data" on your route (litter, erosion, plants), analyze how paths impact nature, and redesign for sustainability. Apps track your exact path, speed, and stops – turning fun navigation into environmental science. You'll see how poor route choices cause soil damage or litter buildup, then create "green routes" that balance adventure with eco-respect. This lesson shows technology as a tool for both exploration and conservation.

Key STEM Knowledge That Will Be Taught

Environmental Impact Assessment (Detailed):
Orienteering paths create "trails" – repeated footsteps compact soil (reduces water absorption → erosion), damage plants (trampling), increase litter (if crowded). Tech quantifies impact: GPS traces show path width/wear patterns.

- Erosion: Soil loss from foot traffic on slopes (gravity + water runoff). Slopes >15° risk high erosion.
- Biodiversity: Narrow paths through vegetation = plant damage. Wide/circled paths = habitat corridors preserved.
- Sustainable Routing: Shortest path ≠ greenest. Optimal = minimal slope, avoid wetlands/plants, use existing trails.
- Data Layers: Apps overlay GPS track with topo (elevation), vegetation maps, or satellite imagery to spot issues.

Route Optimization: Tech calculates "green score" – distance + slope + vegetation impact. Example: 300m direct path vs 450m eco-path (longer but less damage).

VRIJE UNIVERSITEIT BRUSSEL
UAB Universitat Autònoma de Barcelona
institut BITÀCOLA
ASD SPORT COMPASS
GO! ATHENEUM Etterbeek
Co-funded by the European Union
Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Epos vzw. Neither the European Union nor the granting authority can be held responsible for them [project number: 2024-1-BE02-KA220-SCH-000244223]

STEM SPORTS EDUCATION

Lesson two - Activity

Using previous lesson’s route + new eco-data collection, analyze environmental impact and redesign for sustainability. Track with app, score paths, present "best green route."

Tool Requirements (per team):

- Same mapping app (with track recording).
- Eco-observation checklist (litter, erosion, plants).
- Slope measurer (clinometer app or string/plumb bob).
- Poster paper/markers for redesign.
- Class projector for sharing tracks.

Detailed Steps:
Step 1: Eco-Data Walk (20 min)
a) Walk same route, stop at 5 points/team member.
b) Record on checklist: Litter (yes/no, type), Erosion (bare soil? ruts?), Plants (trampled? thriving?).
c) Use app to record GPS track + photos. Note slope at turns.

Step 2: Impact Analysis (15 min)
On worksheet:

- Score original route (0-10): +2 no litter, +2 minimal erosion, +2 healthy plants, +2 gentle slopes, +2 existing path. Draw "hot spots" (high damage areas).

Step 3: Green Redesign (20 min) On poster:
a) Trace GPS track, mark problems (red X).
b) Draw new route avoiding issues (green line): wider turns, existing paths, gentler slopes.
c) Calculate new distance/time vs original.
d) "Green Score" comparison.

Step 4: Route Gallery & Vote (10 min)
Teams present: "Our new route fixes erosion by..." Class votes "Most Sustainable."

VUB Vrije Universiteit Brussel
UAB Universitat Autònoma de Barcelona
inquirium
institut Bitàcola www.insbitacola.cat
ASD Sport Compass
GO! Atheneum Etterbeek

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Epos vzw. Neither the European Union nor the granting authority can be held responsible for them [project number: 2024-1-BE02-KA220-SCH-000244223]

Important take aways

By the end of the Technology & Orienteering core unit, students should clearly understand that navigation is not just about “finding the way,” but about combining STEM thinking, physical movement, and environmental responsibility. They will take away a practical ability to read and interpret simple maps, use cardinal directions confidently, and translate lines and symbols on paper into real movements on the ground. They will also have experienced how digital tools—like GPS-based apps and digital maps—can make navigation more accurate and safer, showing in real time where they are, how far they have travelled, and how to reach planned checkpoints efficiently. At the same time, students will recognise that technology is only one part of the story: they need sharp observation skills to notice roots, mud, slopes, and other hazards that an app cannot “feel” for them. A key conceptual takeaway is that every route choice has an environmental impact—repeated footsteps can compact soil, damage plants, and create erosion zones—so students learn to use both their route data and their eco-observations to redesign paths that are more sustainable. Finally, they will have practiced working in teams with clear roles (leader, pacer, scribe, safety scout), learning that good communication and shared decision making are just as important as any device. Together, these experiences show them that technology, when used thoughtfully, can support safe, enjoyable, and environmentally respectful physical activity in natural settings..

VUB Vrije Universiteit Brussel
UAB Universitat Autònoma de Barcelona
inqUIRIum
institut Bitàcola
ASD Sport Compass
GO! Atheneum Etterbeek

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Epos vzw. Neither the European Union nor the granting authority can be held responsible for them [project number: 2024-1-BE02-KA220-SCH-000244223]