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Sustainability Education: entrepreneurship, problem-solving and critical thinking in nature-inspired activities

CONNECT Handbook 4

Erasmus+ projekt:
Cultivating Outdoor Nature-based Education for Competence and Teaching

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About the project

This handbook has been developed within the framework of the Erasmus+ project CONNECT: Cultivating Outdoor Nature-based Education for Competence and Teaching. Its primary target group is teachers working in secondary education, while remaining adaptable to primary education settings and teacher training contexts. The chapter responds directly to the project's core concerns: increasing stress among teenagers, growing social isolation, declining social skills, and the urgent need to support students' mental wellbeing while fostering inclusion and key competences through innovative teaching approaches.

Nature-Based Learning as a Response to Current Educational Challenges

Research and practice across Europe indicate that today's teenagers face unprecedented pressures. Excessive screen time, reduced contact with nature, academic demands, social comparison and uncertainty about the future have contributed to rising levels of stress, emotional overload and disengagement from learning. Schools are increasingly challenged to respond to these trends using methods that go beyond traditional classroom instruction.

Nature-based outdoor learning offers a concrete and experiential response to these challenges. By moving learning outside the classroom, teachers can create more dynamic, engaging and human-centred educational experiences. Outdoor environments provide rich stimuli for learning while simultaneously supporting physical, emotional and mental wellbeing. As highlighted in the project application, contact with nature can reduce stress, improve resilience and increase motivation to learn, particularly when combined with hands-on, participatory activities .

Making Outdoor Learning Inclusive

Inclusion is a central priority of the Erasmus+ programme and a guiding principle of this project. Inclusive outdoor learning does not mean treating all students the same way; rather, it means creating conditions where every student can participate meaningfully, regardless of ability, background or emotional state.

Nature-based activities naturally lend themselves to inclusion because they allow for multiple forms of engagement. Observation, movement, creative expression, cooperation and reflection can coexist within the same activity. This flexibility is particularly valuable in secondary education settings where classes often include students with diverse learning profiles, cultural backgrounds and levels of confidence.

Outdoor learning environments tend to reduce performance pressure and rigid hierarchies. Students who may struggle in academically demanding classroom settings often find new ways to contribute and succeed outdoors. This supports the project's aim of reducing isolation and social exclusion among teenagers by fostering shared experiences and a sense of belonging.

Supporting Social-Emotional Competences Through Experience

A key objective of the CONNECT project is the development of transversal and social-emotional competences such as communication, collaboration, self-awareness and resilience. These competences are not acquired through instruction alone but through experience, reflection and interaction with others.

Outdoor learning creates natural opportunities for cooperation, problem-solving and shared responsibility. Group tasks such as exploring local ecosystems, participating in sustainability actions or reflecting together during outdoor activities encourage students to listen to one another, negotiate roles and manage emotions. These experiences strengthen social skills that are essential for both personal wellbeing and active citizenship.

Importantly, nature-based learning also supports emotional regulation. Time spent outdoors can help students slow down, reconnect with their senses and shift attention away from constant digital stimulation. Simple activities such as short wellbeing walks, sensory exploration or outdoor reflection circles can support self-management and emotional balance, directly addressing the project's concern about declining mental wellbeing among teenagers .

Working with Mixed-Ability Groups

Secondary school teachers increasingly work with mixed-ability groups where differentiation is essential. Outdoor learning supports differentiation in a non-stigmatising way. Activities can be open-ended, allowing students to engage at different depths and paces. One student may focus on factual observation, another on creative expression, and another on emotional reflection, all within the same learning framework.

Teachers are encouraged to focus on process rather than outcomes and to value effort, cooperation and reflection. Pair and small-group work further supports inclusion and social learning, helping students build confidence and interpersonal skills while learning from one another.

Low-Cost, Low-Risk and Sustainable Implementation

A common barrier to outdoor learning is the perception that it requires significant resources, time or specialised training. In reality, many effective nature-based activities are low-cost and easy to implement. Schoolyards, nearby parks or local green spaces can become meaningful learning environments when used intentionally.

Short, regular outdoor activities are often more impactful than occasional large projects. Even ten minutes spent outside can contribute to wellbeing and engagement. Risk management should focus on awareness and responsibility rather than avoidance, with clear boundaries and shared rules supporting both safety and autonomy.

Aligning Practice with Erasmus+ Priorities

The approaches presented in this handbook directly contribute to Erasmus+ priorities on wellbeing, inclusion and the development of key competences. By integrating nature-based outdoor learning into everyday teaching practice, educators support students' personal growth, social cohesion and environmental awareness. At the same time, teachers strengthen their own professional competences by adopting innovative, experiential methods that respond to contemporary educational needs.

Ultimately, outdoor learning is not an additional burden but a powerful pedagogical resource. When used thoughtfully, it helps teachers create inclusive, supportive and engaging learning environments that empower young people to become resilient, socially connected and environmentally responsible future citizens.

PART I – THEORETICAL FOUNDATIONS

This handbook presents sustainability education as a space where care for the environment, economic activity and social value can coexist. It challenges the idea that sustainability is only about restriction or sacrifice, and instead introduces young people to the possibility that environmental challenges can become sources of meaningful work, innovation and income.

Nature is positioned as a teacher, a testing ground and a source of inspiration for entrepreneurial thinking. Through observation of natural systems and engagement with local environmental challenges, students learn how to identify needs, design solutions, evaluate impacts and act responsibly in real-world contexts.

Chapter 1: From Environmental Responsibility to Opportunity

For many young people, sustainability is often introduced as a responsibility: something they should care about, worry about or feel accountable for. Environmental education frequently emphasises what must be reduced, avoided or protected, focusing on limits, risks and future threats. While these messages are important, they can sometimes leave students feeling overwhelmed or disconnected, especially when environmental responsibility is presented as a burden rather than a possibility. This chapter offers a different perspective. It explores sustainability not only as an ethical duty, but also as a field of opportunity, creativity and future livelihoods.

Box 1: What Is Sustainability?

Sustainability means living, working and creating in ways that do not damage the world we depend on. It is about using resources carefully, respecting nature and other people, and making choices that still allow future generations to live well.
For young people, sustainability means thinking about the long-term effects of everyday actions: how we produce, consume, move, eat and use energy. It is not only about protecting nature, but also about finding smart, fair and creative solutions to real problems.
Sustainability is about balance: meeting our needs today while making sure that people and the planet can thrive tomorrow.

Across Europe and beyond, societies are undergoing major ecological and economic transitions. Climate change, resource scarcity and environmental degradation are creating urgent challenges, but they are also generating new needs. These needs require solutions related to renewable energy, sustainable food systems, waste reduction, circular economy, green mobility and responsible consumption. Increasingly, these solutions are developed through entrepreneurial thinking that combines environmental care with innovation and value creation. For young people, this means that sustainability is not only about changing behaviour, but also about imagining new ways of working, producing and living.
Understanding sustainability as opportunity helps shift the narrative from sacrifice to agency. Instead of asking young people only what they must give up, education can invite them to ask different questions:

- What problems exist in my environment?
- What needs are not being met?
- How could these challenges be addressed in ways that benefit both people and nature?

When students are encouraged to see environmental challenges as starting points for ideas, they begin to recognise their own potential as problem-solvers and innovators.

Entrepreneurship plays a key role in this shift. In this handbook, entrepreneurship is not understood solely as starting a business or pursuing profit. It is defined more broadly as the ability to turn ideas into action in a responsible way. Entrepreneurial thinking involves initiative, creativity, planning, collaboration and decision-making. When applied to sustainability, it encourages young people to design solutions that create environmental and social value, while also considering economic viability. This approach helps students understand that caring for the environment and earning a living do not have to be opposing goals.

Nature provides a particularly powerful context for this kind of learning. Natural systems demonstrate efficiency, resilience and adaptability. Ecosystems operate within limits, reuse resources and respond creatively to change. By observing natural processes, students can learn principles that are highly relevant for sustainable innovation. For example, nature rarely produces waste; materials circulate in cycles. Energy is used efficiently, cooperation is common, and systems adapt continuously to changing conditions. These observations can inspire young people to think differently about how products, services or initiatives might be designed.

Box 2: Different types of companies supporting sustainability and entrepreneurship

Entrepreneurship does not always mean creating a traditional company focused only on profit. There are many business models that combine economic activity with social and environmental goals. These models show young people that it is possible to earn a living while contributing positively to society and the environment.

Social entrepreneurship focuses on solving social or environmental problems through entrepreneurial activities. At European Union level, social enterprises are defined as organisations that carry out economic activities while prioritising social or environmental objectives over profit distribution. Any profit generated is mainly reinvested to achieve these goals rather than paid to owners or shareholders. Social enterprises may work in areas

such as environmental protection, inclusion, education, community services or sustainable production.
The social economy is a broader concept that includes organisations whose main aim is collective or social benefit rather than maximising profit. It includes cooperatives, associations, foundations, mutual organisations and social enterprises. These organisations are often based on democratic decision-making, shared ownership and strong links to local communities. In the context of sustainability, social economy organisations play an important role in areas such as renewable energy, recycling, sustainable food systems and local development.
Associations and non-profit organisations can also act entrepreneurially. While they may not aim to generate profit, they often develop innovative services, projects or solutions to respond to environmental and social needs. Many associations combine funding, partnerships and income-generating activities to sustain their work over time.
Traditional businesses can also adopt sustainable or responsible models. These enterprises operate on the market but integrate environmental and social responsibility into how they produce, sell and operate. This may include using sustainable materials, reducing environmental impact, supporting local communities or offering fair working conditions.
Together, these business models show that entrepreneurship is flexible and diverse. Young people can choose paths that match their values, skills and ambitions, whether through social enterprises, community initiatives, sustainable businesses or innovative non-profit projects.

Local environmental challenges offer concrete entry points for entrepreneurial thinking. Issues such as food waste in schools, lack of green spaces, inefficient energy use or excessive packaging are familiar to students and directly affect their daily lives. When young people explore these problems through a sustainability lens, they can begin to identify opportunities for improvement. Designing solutions might involve proposing new systems, creating awareness campaigns, developing services or rethinking existing practices. The emphasis is not on creating perfect solutions, but on learning how to identify needs, test ideas and evaluate impact.
Importantly, this approach also addresses young people's concerns about their future. Many students are aware that traditional career paths are changing and that environmental transitions will shape labour markets in the coming decades. Sustainability-related fields are expanding, offering opportunities in green technologies, environmental services, social enterprises and community-based initiatives. By linking sustainability education with entrepreneurship and problem-solving, schools can help students see how their values and skills might align with future work and income opportunities.
Ethics remain central to this vision. Sustainable entrepreneurship is not about exploiting environmental concerns for profit, but about creating value responsibly. Students are encouraged to consider the environmental, social and economic consequences of their ideas. This includes reflecting on fairness, long-term impact and unintended effects. Learning to balance opportunity with responsibility prepares young people to engage thoughtfully with sustainability challenges, avoiding simplistic or purely profit-driven solutions.
By reframing sustainability as a field of opportunity, education can support motivation, relevance and engagement. Young people are more likely to invest energy in learning when they see how it connects to their aspirations and sense of purpose. This chapter has introduced sustainability as a space where responsibility, creativity and future pathways intersect. In the next chapter, attention will turn to nature itself, exploring how natural systems can inspire innovative thinking and problem-solving that supports both environmental care and sustainable development.

Chapter 2: Nature as a Model for Innovation and Problem-Solving

When young people think about nature in school, it is often presented as something to study, protect or preserve. While this perspective is important, it is only part of the picture. Nature is not only something that needs care; it is also a complex system that has been solving problems for millions of years.

For example, forests manage water naturally by slowing rainfall, absorbing moisture through soil and roots, and releasing it gradually into rivers and groundwater. This reduces flooding and drought without any engineered infrastructure. Wetlands act as natural water filters, cleaning polluted water through plants and microorganisms long before humans invented treatment plants.

In ecosystems, waste does not exist in the way it does in human systems. What is discarded by one organism becomes a resource for another. Fallen leaves decompose and return nutrients to the soil. Animal waste enriches ecosystems. This natural circularity has inspired ideas such as composting, circular economy models and waste-free production systems.

Nature also demonstrates efficient energy use. Plants convert sunlight into energy through photosynthesis, producing food and oxygen without burning fuel or creating pollution. This process has inspired renewable energy technologies such as solar panels and the search for cleaner energy systems that work with natural cycles rather than against them.

Adaptation is another powerful example. Animals change their behaviour, migration patterns or physical characteristics in response to environmental changes. Trees grow deeper roots during dry periods. Species adjust to seasonal rhythms. These strategies show that resilience comes from flexibility and responsiveness, not from rigid systems. This principle is highly relevant for young people learning to respond to environmental, economic and social change.

Collaboration is also central to natural problem-solving. Bees and other pollinators support plant reproduction, while plants provide food in return. Fungi connect trees underground, helping them share nutrients and information. These relationships demonstrate that cooperation often leads to greater stability and success than competition alone.

Table 1. Examples on how we can use nature natural processes in human sustainability actions

Natural system or process	Problem nature solves	How nature does it	What humans can learn for sustainability
Forests and soil systems	Flooding and water scarcity	Forest soil and roots absorb rainwater, slow its flow and release it gradually into rivers and groundwater	Managing water naturally, reducing floods and droughts without heavy infrastructure
Wetlands and marshes	Water pollution	Plants and microorganisms filter and clean water as it passes through wetlands	Natural water purification, inspiration for low-impact water treatment
Nutrient cycles (decomposition)	Waste accumulation	Fallen leaves and organic matter decompose and return nutrients to the soil	Circular economy, composting, waste-free systems
Plants and photosynthesis	Energy production	Plants convert sunlight into energy without pollution or fuel	Renewable energy, clean energy systems

Animal and plant adaptation	Environmental change	Species adapt behaviour, structure or timing to survive changing conditions	Resilience, flexibility, learning from change rather than resisting it
Pollination and symbiosis	Food production and survival	Bees pollinate plants while plants provide food and shelter	Cooperation, mutual benefit, interdependence
Underground fungal networks	Resource sharing	Fungi connect plants and trees, allowing them to share nutrients and information	Collaboration, shared systems, collective resilience

By observing how natural systems function, young people can learn valuable lessons about innovation, efficiency and adaptability that are highly relevant for sustainable entrepreneurship and problem-solving.

Natural systems operate under constant constraints. Resources such as energy, water and space are limited, yet ecosystems manage to function, adapt and regenerate. Nothing is wasted unnecessarily, and everything has a role within a larger system. Leaves fall, decompose and become nutrients for new growth. Animals adapt their behaviour to seasons and availability of food. These processes demonstrate principles that are central to sustainable thinking: circularity, balance and long-term resilience.

For young people, learning from nature begins with observation. Spending time outdoors, noticing patterns and asking questions encourages curiosity and critical thinking. Why does a certain plant grow better in one place than another? How do insects cooperate? How does water move through a landscape after rain? These observations help students understand that solutions do not always require complex technology; often they emerge from understanding relationships and systems.

Box 3: How Does Water Move Through a Landscape After Rain?

When rain falls on the ground, water does not behave the same everywhere. How it moves depends on the type of soil, vegetation and surface it encounters.

On hard surfaces such as concrete, asphalt or compacted ground, water cannot soak in easily. It flows quickly across the surface, often running into drains or rivers. This fast movement can contribute to flooding and carries pollution with it.

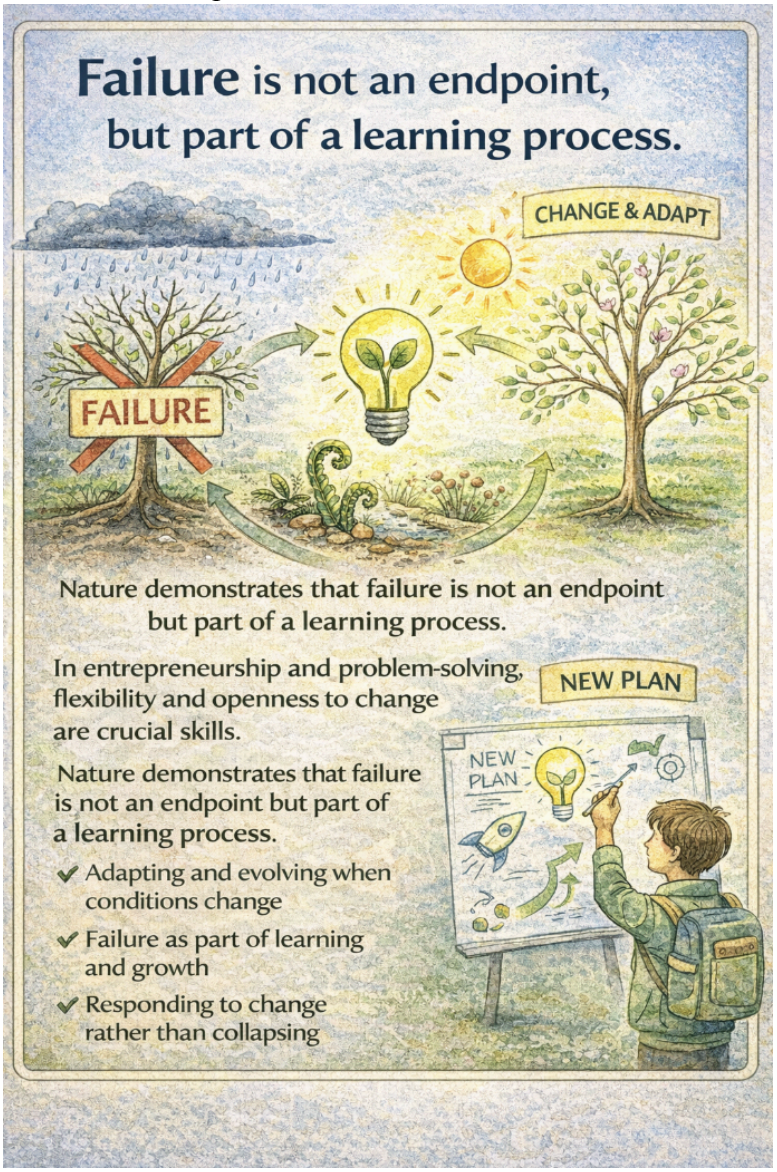
On sandy soil, water moves quickly downward. Sand has large spaces between particles, allowing rainwater to infiltrate easily and reach deeper layers of the ground. This helps recharge groundwater but may not hold water for long periods.

Clay soil behaves differently. Its particles are very small and tightly packed, which slows water movement. Rainwater may stay near the surface longer, forming puddles or slowly seeping through the soil. While this can reduce groundwater recharge, it helps retain moisture for plants.

In forested or vegetated areas, water movement is slower and more balanced. Leaves and plants intercept rainfall, roots create channels in the soil, and organic matter acts like a sponge. Water is absorbed, filtered and gradually released into the ground and nearby streams. This natural process reduces flooding, improves water quality and supports ecosystems.

These natural water pathways show how landscapes manage rainfall through infiltration, storage and gradual release. Understanding how water moves through different soils helps young people see why protecting green spaces, soil health and vegetation is essential for sustainable water management.

Nature also shows that adaptation is essential. Environmental conditions are constantly changing, and living systems respond by adjusting, evolving or reorganising. This principle is highly relevant for young people preparing for uncertain futures. In entrepreneurship and problem-solving, flexibility and openness to change are crucial skills. Nature demonstrates that failure is not an endpoint but part of a learning process. When conditions change, systems respond rather than collapse. In nature we call it evolution.



Efficiency is another key lesson. Natural systems achieve results with minimal waste and energy use. This challenges young people to rethink human systems that rely on overproduction, excess consumption and short-term gains. By learning from nature, students can begin to imagine solutions that use fewer resources, rely on local materials or work in harmony with existing environments. These ideas can inspire sustainable products, services or community initiatives.

Box 4: How Nature Responds to Change – An Evolutionary Perspective

Nature responds to change not by collapsing, but by adapting over time. This process is known as evolution. When environmental conditions change, living organisms gradually adjust their characteristics in ways that help them survive and thrive in new situations.

Human evolution provides a clear example of this process. As early humans migrated from Africa to different parts of the world, they encountered new climates, sunlight levels and environments. Over many generations, human bodies adapted to these conditions. In regions with strong sunlight, darker skin developed as protection against ultraviolet radiation. In areas with less sunlight, lighter skin evolved to support vitamin D production. Hair type also adapted to climate, with different textures helping regulate body temperature in hot or cold environments.

Other changes included body shape and size. In colder regions, humans tended to develop shorter limbs and more compact bodies to conserve heat, while in warmer climates longer limbs helped release excess heat. These adaptations did not happen suddenly, nor were they planned. They emerged gradually as responses to environmental challenges.

This evolutionary process shows that change is not a failure, but a driver of learning and development. Species that were able to adapt survived and continued to evolve. Those that could not respond to change disappeared. Nature demonstrates that resilience comes from flexibility, experimentation and adjustment over time.

Collaboration is deeply embedded in natural systems. Plants, animals and microorganisms often depend on one another to survive. This interdependence highlights the importance of cooperation over competition. For young people, this reinforces the idea that sustainable solutions are rarely developed alone. Teamwork, shared knowledge and collective responsibility are essential for addressing complex environmental challenges.

Nature-inspired problem-solving does not mean copying nature directly, but translating its principles into human contexts. Young people may use natural processes as inspiration when designing solutions to everyday challenges, such as reducing waste at school, improving energy use or creating more inclusive public spaces. These activities help students understand that innovation does not need to start from scratch; it can grow from attentive observation and thoughtful adaptation.

By positioning nature as a model rather than only a subject, education helps young people develop a different mindset. They learn to approach problems with curiosity, patience and openness, recognising that sustainable solutions often require time, experimentation and revision. This perspective supports both critical thinking and entrepreneurial initiative, showing students that nature can guide not only environmental care, but also creative and responsible action.

In the next chapter, attention will shift to how these insights from nature can be transformed into entrepreneurial thinking. Students will explore how ideas inspired by natural systems can be turned into actions that create environmental and social value, while remaining realistic and responsible in economic terms.

Chapter 3: Entrepreneurial Thinking for Sustainable Futures

Entrepreneurial thinking is often associated with business plans, competition and financial success. In sustainability education, however, entrepreneurship takes on a broader and more meaningful role. It becomes a way of thinking and acting that helps young people respond creatively and responsibly to real challenges in their environment. This chapter explores how entrepreneurial thinking can support sustainable futures by enabling students to turn ideas into action while considering environmental, social and economic impacts.

At its core, entrepreneurship is about initiative. It begins when young people notice a problem, an unmet need or an opportunity for improvement and decide to respond rather than ignore it. In sustainability contexts, these starting points are often visible in everyday life: excessive waste at school, lack of green spaces, inefficient energy use, food waste, or limited

access to sustainable options. Entrepreneurial thinking encourages students to ask not only why these problems exist, but also what could be done differently.

Box 5: Everyday Problems That Can Become Entrepreneurial Ideas

Entrepreneurial thinking often starts with noticing small but recurring problems in everyday life. These issues may seem normal or unavoidable at first, but they can become starting points for creative and sustainable solutions.

Examples of everyday situations that can inspire ideas include:

- large amounts of clothing being thrown away or rarely worn, fast fashion trends and lack of repair or second-hand options
- polluted air in towns and cities, especially near schools or busy roads
- lack of safe cycling paths or pedestrian-friendly routes, making sustainable transport difficult
- absence of municipal bicycle systems or affordable local transport options
- excessive packaging in shops and school cafeterias
- food waste in school canteens, shops or households
- unused public spaces that could become green, social or cultural areas
- limited access to refill stations for water, leading to high use of plastic bottles
- energy waste in public buildings, schools or housing (lights, heating, cooling)
- lack of local services that support sustainable lifestyles, such as repair cafés or sharing systems

Entrepreneurial thinking encourages students to ask deeper questions about these situations: Why does this problem exist? Who is affected by it? What needs are not being met? What small changes or new solutions could improve the situation?

By starting from everyday experiences, sustainability becomes concrete and relevant. Young people learn that innovation does not begin with big ideas or advanced technology, but with attention, curiosity and the willingness to respond to real needs in their own environment.

Turning ideas into action requires creativity, but also structure. Young people learn to move from observation to idea generation, and then from ideas to practical steps. This process involves planning, testing and revising. Nature-inspired learning supports this approach by showing that solutions rarely emerge fully formed. Just as ecosystems develop through gradual adaptation, entrepreneurial solutions evolve through experimentation and learning from mistakes. Failure is not treated as an endpoint, but as feedback that informs the next step.

Responsibility is a key element that distinguishes sustainable entrepreneurship from purely profit-driven approaches. Students are encouraged to consider who benefits from their ideas and who might be affected negatively. They learn to evaluate environmental impact, social fairness and long-term consequences alongside economic feasibility. This helps young people understand that not every innovative idea is automatically sustainable, and that responsible decision-making requires critical reflection.

Box 6: How Do We Evaluate a Sustainability Idea?

When young people hear the word “evaluation”, it can sound abstract or complicated. In practice, evaluation simply means stopping for a moment and asking a few clear questions before deciding whether an idea is really a good one.

A simple way to evaluate a sustainability idea is to look at it from four angles:

Environmental impact

Students ask: Does this idea help nature or harm it? Does it reduce waste, pollution or

energy use? For example, if we introduce reusable lunch boxes at school, will it reduce plastic waste?

Social fairness

Students ask: Who benefits from this idea and who might be left out? Is it accessible and fair? For example, if we create a paid bike-sharing system, can all students afford it, or only some?

Long-term consequences

Students ask: What happens in the future if this idea is used for a long time? Will it still work in five or ten years? For example, if we plant trees, who will take care of them over time?

Economic feasibility

Students ask: Is this idea realistic? Can it be paid for, maintained or supported? For example, does the school or community have the money, materials or skills needed to make it work?

Evaluation does not mean finding a perfect idea. It means thinking carefully before acting. Young people learn that a good sustainability solution balances care for the environment, people and resources, while remaining realistic. This process helps students make smarter decisions and understand that responsible entrepreneurship is about thoughtful choices, not quick answers.

Collaboration plays an essential role in this process. Sustainability challenges are complex and interconnected, making them difficult to address alone. Entrepreneurial learning therefore emphasises teamwork, communication and shared responsibility. Working in groups allows students to combine different perspectives, skills and experiences, mirroring how real-world sustainability initiatives operate. Through collaboration, young people learn that collective effort often leads to stronger and more resilient solutions.

Entrepreneurial thinking also helps young people connect sustainability with their future lives and careers. Many students are concerned about employment, financial stability and relevance of education. By exploring sustainability-oriented entrepreneurship, they begin to see how environmental and social challenges can become areas of meaningful work and innovation. This perspective supports motivation and engagement, showing that caring for the environment and earning a living do not have to be opposing goals.

Box 7: Examples of work and innovation driven from sustainability

Environmental and social challenges are not only problems to solve; they can also become areas of meaningful work and innovation. Many jobs, initiatives and small businesses start by responding to real needs linked to sustainability.

Examples include:

- repairing and upcycling clothing to reduce textile waste, creating local repair services or second-hand platforms
- designing reusable packaging or refill systems for shops, schools or local markets
- developing bicycle repair services, bike-sharing initiatives or apps supporting sustainable mobility
- creating community gardens, urban farming projects or local food networks
- working in renewable energy, such as solar panel installation, maintenance or energy consulting
- organising waste reduction services, composting systems or recycling initiatives
- developing eco-tourism activities that support local nature and communities
- creating digital tools or campaigns that promote sustainable habits and responsible consumption

- working in green construction, sustainable architecture or nature-based solutions for cities
- supporting social enterprises that combine environmental care with inclusion and community support

These examples show that sustainability-related work can take many forms. Some initiatives become businesses, others social enterprises, cooperatives or community projects. What they have in common is that they respond to real challenges while creating value for both people and the environment.
By exploring these possibilities, young people begin to see that caring for the planet and building a future career do not have to be separate goals. Sustainability can be a space where values, creativity and livelihoods meet.

Importantly, entrepreneurial education in this context does not aim to turn all students into business owners. Instead, it equips them with transferable skills: initiative, problem-solving, adaptability, critical thinking and the ability to work with uncertainty. These competencies are valuable across many professions and life paths, especially in a world shaped by rapid change and environmental transition.
By framing entrepreneurship as responsible action, education supports young people in developing confidence and agency. Students learn that they can contribute to solutions, even on a small scale, and that their ideas have value when grounded in care, reflection and collaboration. This chapter has shown how entrepreneurial thinking can support sustainable futures by transforming environmental challenges into opportunities for learning, innovation and positive impact.
In the next chapter, attention will turn more explicitly to critical thinking and decision-making, exploring how young people can evaluate sustainability solutions, recognise trade-offs and make informed choices in complex and uncertain situations.

Chapter 4: Critical Thinking and Decision-Making in Sustainability

Sustainability challenges are rarely simple. Environmental and social problems are often interconnected, shaped by economic realities, cultural habits and competing needs. For young people, this complexity can be confusing or discouraging, especially when sustainability is presented as a set of fixed rules or "right answers." Critical thinking plays a key role in helping students navigate this complexity and make thoughtful, responsible decisions.
Critical thinking in sustainability education means learning to question, analyse and reflect rather than accepting solutions at face value. Not every idea labelled as "green" is automatically sustainable, and not every solution works equally well in every context. Students need opportunities to explore different perspectives, identify assumptions and understand that sustainability often involves balancing multiple factors rather than choosing between clear opposites.

Box 8: Definition of Critical Thinking in Sustainability Education

Critical thinking in sustainability education means learning to question, analyse and reflect instead of accepting ideas or solutions at face value. It encourages young people to ask why a solution is proposed, how it works and what consequences it may have.
In practice, critical thinking helps students look beyond labels such as "green" or "eco-friendly" and consider whether an idea is truly sustainable. It involves examining environmental impact, social fairness, long-term effects and possible trade-offs. Students

learn that sustainability rarely has one simple answer and that different perspectives and contexts matter.
Critical thinking also means being open to uncertainty and change. Young people learn that it is acceptable to revise ideas, learn from mistakes and adapt solutions over time. In this way, critical thinking supports responsible decision-making and prepares students to engage thoughtfully with complex environmental and social challenges.

Decision-making in sustainability requires recognising trade-offs. For example, a product made from recycled materials may be more environmentally friendly, but also more expensive. A renewable energy project may reduce emissions, but affect local landscapes or communities. By examining these situations, young people learn that sustainable solutions often involve compromises and careful judgement. This helps them move beyond simplistic thinking and develop more realistic expectations.
Nature-inspired learning supports this process by showing that systems are dynamic and adaptive. Natural systems constantly adjust to changing conditions, and there is rarely a single perfect solution. Similarly, sustainability-oriented entrepreneurship involves testing ideas, learning from feedback and revising plans. Critical thinking helps students understand that changing direction is not a sign of failure, but part of responsible decision-making.

Box 9: When “Green” Ideas Are Not Always Sustainable

Not every idea labelled as “green” automatically leads to sustainability. Some solutions solve one problem while creating others, especially when context, scale or long-term impact are not considered.
For example, electric cars are often promoted as environmentally friendly because they do not produce exhaust emissions. However, if electricity comes from coal or gas, or if batteries are produced using environmentally damaging mining practices, the overall environmental benefit can be limited. In cities without good public transport policies, electric cars may also encourage continued car dependency rather than reducing traffic and emissions.
Reusable cotton bags are another example. While they are often seen as a sustainable alternative to plastic bags, producing cotton requires large amounts of water, land and energy. If a cotton bag is used only a few times and then discarded, its environmental footprint can be higher than that of a single-use plastic bag.
Biofuels are sometimes promoted as a renewable energy source, yet growing crops for fuel can compete with food production, increase deforestation and reduce biodiversity. In some cases, land used for biofuel crops could have been used for food or natural ecosystems.
Fast fashion brands may launch “eco collections” made from recycled materials, but still encourage frequent buying and short product lifespans. When clothing is designed to be worn only a few times before being discarded, sustainability claims lose credibility, even if materials appear environmentally friendly.
Replacing plastic straws with paper straws is often presented as a major environmental action, yet plastic straws make up only a small percentage of plastic pollution. Focusing on highly visible but low-impact changes can distract from more effective solutions such as reducing overall plastic production or improving waste systems.
These examples show why critical thinking is essential in sustainability education. Students learn that sustainability is not about quick fixes or labels, but about understanding full life cycles, long-term consequences and real impact in specific contexts.

Another important aspect of critical thinking is considering long-term consequences. Young people are encouraged to look beyond immediate results and ask what impact a solution may

have over time. Will it still be useful in a few years? Who will maintain it? What happens if conditions change? These questions help students develop foresight and responsibility, skills that are essential for sustainable innovation and leadership.

Social fairness is also a key element of critical decision-making. Students learn to consider who benefits from a solution and who might be excluded. A sustainability initiative that works well for one group may not be accessible to others. By reflecting on inclusion and equity, young people begin to understand sustainability as a shared responsibility rather than an individual achievement.

Critical thinking also involves recognising uncertainty. Many sustainability challenges do not have clear data or predictable outcomes. Students learn to make decisions based on available information, while remaining open to learning and adjustment. This builds confidence in dealing with uncertainty and prepares young people for real-world situations where perfect knowledge is rarely available.

Through critical thinking and reflective decision-making, sustainability education moves beyond slogans and quick fixes. Young people develop the ability to evaluate ideas carefully, weigh consequences and act responsibly in complex situations. These skills are essential not only for sustainability-oriented entrepreneurship, but also for active participation in society and informed citizenship.

This chapter completes the theoretical foundation of the handbook by highlighting the importance of thoughtful judgement and reflection. In the next part, attention will shift from theory to practice, exploring real examples and activities that show how entrepreneurship, problem-solving and critical thinking can be developed through nature-inspired learning.

PART II – PRACTICAL EXAMPLES FROM AROUND THE WORLD

While theory helps explain how sustainability, entrepreneurship and critical thinking are connected, it is through real experiences that these connections become meaningful for young people. Across different countries and educational contexts, teachers, schools and community organisations have developed practical ways to use nature-inspired learning to support problem-solving, creativity and responsible action. These initiatives show how sustainability education can move beyond abstract discussions and become a space for experimentation, innovation and real-world engagement.

The examples presented in this section illustrate how natural environments and local sustainability challenges can serve as starting points for entrepreneurial thinking. By observing ecosystems, exploring everyday environmental problems and working with real constraints, students learn to identify needs, generate ideas and test solutions. These activities help young people develop initiative, collaboration and critical judgement, while understanding that sustainable solutions must balance environmental care, social fairness and economic feasibility.

Rather than offering ready-made models to copy, the case studies and activities included here are intended as sources of inspiration and reflection. Each example shows how educators have adapted nature-inspired entrepreneurship to their specific context, using available spaces, local issues and community resources. Together, they demonstrate that entrepreneurship in sustainability education does not require advanced technology or large investments, but begins with curiosity, observation and the willingness to respond to real needs. By exploring these practices, teachers are invited to reflect on their own context and consider how similar approaches might be used to empower students as problem-solvers, innovators and responsible contributors to sustainable futures.

Real world-inspiried examples from around Europe

Example 1: From School Waste to Circular Solutions

In several European secondary schools, students have been invited to analyse waste produced during a typical school day. Instead of starting with lectures, teachers encouraged learners to observe bins, food leftovers, packaging and disposal routines. Students identified patterns, such as high levels of food waste from lunches or excessive single-use packaging.

Working in small groups, students developed different solution ideas: composting organic waste for school gardens, introducing reusable containers in collaboration with local suppliers, or designing awareness campaigns aimed at younger pupils. Some groups explored economic aspects by calculating costs, savings and possible partnerships with local municipalities or social enterprises.

Nature-inspired learning played a role through composting activities and soil observation, helping students understand natural cycles and decomposition. Critical thinking emerged as students compared solutions, questioned feasibility and considered long-term maintenance. The project showed how a common environmental problem could become a learning opportunity combining ecological understanding, entrepreneurial initiative and responsible decision-making.

Example 2: Rethinking Urban Spaces through Observation and Design

In urban schools with limited green areas, students worked outdoors to map how public spaces were used in their neighbourhoods. They observed heat, noise, lack of vegetation and limited places for social interaction. Teachers encouraged learners to spend time in parks, streets and courtyards, noticing how nature (or its absence) affected wellbeing and behaviour.
Students then developed proposals to improve these spaces, such as small green installations, shaded seating areas, rainwater collection systems or biodiversity corners. Some groups explored how these ideas could be implemented through cooperation with local authorities, community groups or small businesses.
The entrepreneurial element focused on transforming observations into realistic proposals, while critical thinking helped students assess environmental impact, social inclusion and cost. Nature was not only the subject of protection, but a design partner inspiring solutions based on cooling, water flow and plant resilience.

Example 3: Sustainable Mobility as a Local Challenge

In several European municipalities, schools have collaborated with local governments to address mobility issues affecting students. Young people investigated how they travelled to school, identifying barriers to walking or cycling such as unsafe routes, lack of bike storage or poor public transport connections.
Outdoor learning included route mapping, observation of traffic patterns and discussions held in the actual spaces used for commuting. Students then developed proposals such as school-led bike repair workshops, shared bicycle initiatives, awareness campaigns or improved storage solutions.
Critical thinking was central as students compared different mobility options, analysed environmental benefits and considered economic feasibility. Some groups explored entrepreneurial models, such as social bike services or partnerships with local shops. The project demonstrated how everyday experiences can lead to innovation grounded in real needs.

Example 4: Nature-Inspired Product Design in Schools

In some vocational and general secondary schools, students have been encouraged to design simple products inspired by natural systems. By observing how plants store water, how shells protect organisms or how insects build structures, learners explored how natural principles could inform human design.
Students developed ideas for reusable containers, modular furniture or low-impact packaging, often using recycled or local materials. Prototypes were tested, discussed and improved. Evaluation focused not only on creativity, but also durability, usefulness and environmental impact.
This process helped students understand that innovation involves iteration, learning from failure and adapting ideas. Nature served as a source of inspiration, while entrepreneurship skills helped turn concepts into tangible outcomes.

Example 5: Community-Based Sustainability Initiatives

In some regions, schools have partnered with local NGOs or community groups to address shared environmental challenges such as biodiversity loss, water management or waste reduction. Students worked outdoors alongside professionals, learning by doing rather than observing from a distance.
Young people contributed to planning, communication and implementation of small projects, such as local clean-ups combined with data collection, biodiversity monitoring or awareness events. Entrepreneurial skills were developed through project organisation, stakeholder communication and resource management.
Critical thinking was supported through reflection sessions, where students evaluated what worked, what did not and why. These experiences reinforced the idea that sustainability solutions require cooperation, flexibility and continuous learning.

EcoSystem Europe

In the *Green Entrepreneurship in Schools* programme developed by EcoSystem Europe, students engage in hands-on activities that connect environmental sustainability with entrepreneurial thinking. The programme includes design challenges where students rethink products and processes through a "green entrepreneur" lens, exploring how linear models (take–make–dispose) can be transformed into closed-loop, sustainable systems. Through practical exercises like biomimicry exploration, value and behaviour change workshops, and design thinking challenges, learners practise initiative, creativity, collaboration and problem-solving with a sustainability focus. The activities are grounded in nature-inspired principles, helping students see how sustainable business ideas can emerge from understanding natural systems and how they might be applied to real goods and services.
What students do:

- Explore sustainability concepts like closed-loop systems and biomimicry through outdoor observations and games
- Work in teams to redesign everyday products using sustainable principles
- Present and prototype creative ideas that have both *environmental and economic value*
  These exercises help students build entrepreneurial confidence while learning about *ecological constraints and opportunities*.

Germany[1]

Training courses such as *Circular Economy and Entrepreneurship for Greener Europe* often offered under Erasmus+ and youth worker networks support educators and youth leaders to design workshops that introduce sustainable entrepreneurship and circular economy thinking. These programmes focus on practical, activity-based methods youth workers can use to engage young people in sustainable entrepreneurial thinking, such as identifying community needs, co-creating local solutions and developing simple prototypes that reflect circular economy principles. Although these are not school courses per se, youth organisations frequently bring them into after-school clubs, outdoor workshops and community events, supporting problem-solving, sustainability innovation and entrepreneurial skills among teenagers.

What youth activities include:

- Workshops on circular design and idea generation
- Group projects that respond to *local sustainability challenges*, like reuse systems or community sharing platforms
- Simulations and game-based learning that encourage reflective decision-making about resources and impact.

[1] https://www.salto-youth.net/tools/european-training-calendar/training/circular-economy-and-entrepreneurship-for-greener-europe.11697/m

PART III – LESSON PLANS & USEFUL ACTIVITIES

1. Lesson Plan

Clothing Recycling and Fast Fashion Pollution

(English Language – CLIL Approach)

Introduction

In this lesson, students explore the environmental impact of fast fashion and clothing waste through the English language. They reflect on their own consumption habits, examine how textile pollution affects the environment, and develop critical thinking and argumentation skills in English.

Students are informed about the environmental consequences of low-cost (fast fashion) clothing and are encouraged to propose sustainable solutions, while practicing reading, speaking, listening, writing, and mediation skills.

This lesson combines **English Language learning** with **Environmental Education and Economics**, following a CLIL-oriented approach.

Thematic Areas

Sustainability – Recycling – Fast Fashion – Consumer Awareness – Entrepreneurship

Learning Objectives

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

- Understand and use key vocabulary related to fast fashion and textile recycling
- Explain in English the environmental consequences of clothing overproduction
- Develop critical thinking through discussion and structured debate
- Analyze cause–effect relationships between consumer behavior and pollution
- Collaborate in groups using English as the language of communication
- Propose realistic and creative solutions to reduce textile waste
- Express personal opinions and justify them with arguments

Age Group

Upper Secondary Education (15–18 years old)

Duration

110–140 minutes

Materials

- Projector or interactive whiteboard
- Short video on fast fashion and pollution
- Worksheets with reading texts
- Internet access
- Old clothes (optional, for demonstration)
- Flipchart or poster paper
- Questionnaire handouts

Activities

Introduction (10–15 minutes)

The teacher shows students a bag of old clothes and asks in English:

- What happens to clothes we don't wear anymore?
- Why do people buy so many cheap clothes?
- Is fast fashion a problem? Why or why not?

Students brainstorm ideas. Key vocabulary (e.g., textile waste, sustainability, pollution, recycling, carbon footprint, second-hand clothes) is introduced on the board.

A short video (3–4 minutes) about fast fashion pollution is shown.

Students briefly discuss their first impressions in pairs and report back to the class.

Language focus: expressing opinion (I believe…, In my opinion…, One consequence is…, It leads to…).

Activity 1 – Reading and Critical Discussion (20–25 minutes)

Students are divided into small groups.

Each group receives a short English text related to:

- Water pollution caused by textile production
- Textile waste in landfills
- Overconsumption and fast fashion
- Environmental impact of synthetic fabrics

Students complete comprehension questions and identify:

- Main idea
- Key environmental problems
- Cause–effect relationships

Groups summarize their text orally in English.

Language focus: summarizing and reporting information.

Activity 2 – Critical Thinking Quiz (10–15 minutes)

Students complete a short quiz (digital or printed) about:

- Environmental consequences of fast fashion
- Recycling practices
- Sustainable alternatives

The quiz reinforces vocabulary and comprehension.

Understanding the Problem (10–15 minutes)

Through guided discussion, the teacher presents key facts:

- The fashion industry is one of the largest polluters globally
- Textile production requires large amounts of water
- Synthetic fabrics release microplastics
- Millions of tons of clothing end up in landfills every year
- Consumer behavior drives overproduction

Students are asked:

- To what extent are consumers responsible?
- How does advertising influence our choices?

Students respond using structured argumentation.

Language focus: expressing agreement/disagreement and giving justification.

Ways to Address the Problem (10–15 minutes)

Students discuss the difference between **reuse** and **recycling**.

Examples discussed:

- Donating clothes
- Buying second-hand
- Organizing clothing swap events
- Supporting sustainable brands
- Reducing consumption

The teacher introduces the idea that sustainability can also have economic benefits (second-hand businesses, upcycling entrepreneurship, eco-brands).

Students brainstorm practical actions that could be applied in their school.

Language focus: modal verbs for suggestion (should, could, must).

Main Activity – Structured Role Play & Mini Project (30–40 minutes)

Students are divided into four groups. Each group represents a different role:

- Fast fashion company executive
- Environmental NGO representative
- Government policymaker
- Conscious consumer

Each group prepares arguments in English defending their perspective.

Students participate in a structured classroom debate discussing:

- Should fast fashion be regulated?
- Who is responsible for pollution?
- What realistic solutions can be applied?

After the debate, each group proposes one concrete action plan for the school community (e.g., clothing swap day, awareness campaign, recycling collection point).

Language focus: persuasive language, argumentation, negotiation.

Presentation of Assignments – Discussion (20–30 minutes)

Groups present their solutions.

Class discussion follows:

- Which proposal is most realistic?
- Which one would have the greatest environmental impact?
- Would you personally change your habits?

Students write a short reflection paragraph in English (5–8 sentences).

Questionnaire (5–10 minutes)

- How frequently do you purchase new clothing items?
  Very often / Often / Occasionally / Rarely
- Are you aware of the environmental impact of fast fashion?
  Yes / Partly / No
- What is one environmental consequence of textile waste?
  a. Increased biodiversity
  b. Water and soil pollution
  c. Cleaner oceans
  d. Reduced consumption

- After this lesson, which action are you most likely to take?
  a. Buy less clothing
  b. Recycle or donate clothes
  c. Support sustainable brands
  d. No change
- What argument against fast fashion did you find most convincing?
  (Open-ended response)

2. Lesson Plan

Reducing Food Waste

(Economics – Social Sciences – Environmental Education)

Introduction

Food waste is one of the most pressing sustainability challenges worldwide. Approximately one-third of the food produced globally for human consumption—around 1.3 billion tons per year—is lost or wasted. This waste represents not only uneaten food, but also wasted natural resources such as land, water, and energy, as well as wasted labor and transportation costs.

Food waste is not solely an issue of individual irresponsibility. It is a systemic problem influenced by consumer behavior, market structures, supply chain inefficiencies, cultural norms, and economic incentives.

This lesson encourages students to examine food waste from three complementary perspectives:

- **Environmental** (resource depletion, pollution, climate impact)
- **Economic** (financial losses, inefficiency, market failures)
- **Social** (inequality, food insecurity, ethical responsibility)

Thematic Areas

Sustainability – Responsible Consumption – Market Efficiency – Social Inequality – Resource Management

Learning Objectives

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

- Understand the magnitude of food waste at local and global levels
- Analyze environmental impacts such as greenhouse gas emissions and resource loss
- Examine the economic consequences of food waste for households, businesses, and society
- Identify social implications, including food insecurity and inequality
- Recognize structural causes within supply chains and markets
- Propose practical and policy-based solutions

- Develop critical thinking and collaborative problem-solving skills

Age Group

Lower and Upper Secondary Education (13–18 years old)

Duration

110–140 minutes

Materials

- Projector / interactive board
- Statistical data on food waste
- Graphs and charts for analysis
- Case studies
- Paper and markers for group work
- Access to research material
- Educational resources from Μπορούμε

Activities

Introduction & Awareness (15–20 minutes)

The lesson begins with a discussion:

- How much food do households waste weekly?
- Why does food waste occur despite widespread hunger?

Students analyze global statistics (1/3 of food wasted annually).

The teacher explains that food waste reflects inefficiency in production, distribution, and consumption systems.

Students briefly reflect on their own household habits.

Activity 1 – Investigating Causes (20–30 minutes)

Students are divided into groups and examine food waste causes from three perspectives:

Environmental Perspective

- Overproduction of food
- Resource depletion (water, land, energy)
- Emissions from production and transportation

Economic Perspective

- Poor demand forecasting
- Over-purchasing by consumers
- Retail standards rejecting “imperfect” products
- Financial losses for businesses and households

Social Perspective

- Unequal food distribution
- Food insecurity
- Cultural norms encouraging overconsumption

Each group prepares a short analytical presentation explaining how these factors interact.

Understanding the Problem (10–15 minutes)

The teacher introduces the concept of **market inefficiency** and explains how food waste represents:

- Misallocation of resources
- Externalities (environmental damage not reflected in price)
- Systemic failures in supply chains

Students connect the topic to United Nations Sustainable Development Goal 12: Responsible Consumption and Production.

Discussion questions:

- Is food waste a market failure?
- Who bears the real cost of wasted food?
- Should governments intervene?

Students justify their answers using economic and social reasoning.

Ways to Address the Problem (15–20 minutes)

Students propose solutions at three levels:

Individual Level

- Planning purchases
- Proper storage
- Using leftovers creatively

Business Level

- Improved logistics
- Donation of surplus food
- Flexible aesthetic standards

Policy Level

- Awareness campaigns
- Incentives for donation
- Regulations encouraging redistribution

The class evaluates which solutions are most realistic and cost-effective.

Main Activity – Applied Socioeconomic Analysis (30–40 minutes)

Students are divided into four groups. Each group works on a different applied task:

Group 1 – Household Economics

Calculate the annual financial loss of food waste for an average family.

Group 2 – Environmental Cost Analysis

Estimate the environmental footprint (water, energy, emissions) of wasted food.

Group 3 – Social Impact Study

Analyze how reducing food waste could improve food security at community level.

Group 4 – Policy & Entrepreneurship Proposal

Design a small-scale initiative (e.g., school redistribution program or awareness campaign) with basic cost–benefit analysis.

Groups prepare structured presentations.

Presentation of Assignments – Discussion (20–30 minutes)

Each group presents findings.

Class discussion focuses on:

- Which dimension (economic, social, environmental) is most critical?
- How are the three dimensions interconnected?
- What actions can be realistically implemented at school or community level?

Students write a short reflection explaining which solution they consider most effective and why.

Questionnaire (5–10 minutes)

- Approximately what proportion of global food production is wasted?
  a. 10%

b. 20%
c. About one-third
d. 50%

- Food waste represents which type of economic issue?
  a. Perfect efficiency
  b. Market failure
  c. Increased productivity
  d. Resource optimization
- One environmental consequence of food waste is:
  a. Reduced emissions
  b. Greenhouse gas production
  c. Lower resource use
  d. Improved biodiversity
- Which solution operates at the policy level?
  a. Planning shopping
  b. Composting at home
  c. Government incentives for food donation
  d. Ignoring expiration dates
- Why is food waste also a social issue?
  (Open-ended response)

3. Lesson Plan (110–140 minutes)

Recycling Used Cooking Oils

Introduction

In this lesson, students reflect on the management of used cooking oils. They are informed about the environmental impacts caused by the improper disposal of these oils in nature and are encouraged to propose solutions for their environmentally sound management, as well as explore the possibility of their economic utilization.
This lesson combines the scientific fields of **Natural Sciences** and **Economics**.

Thematic Areas

Recycling – Reuse / Entrepreneurship

Learning Objectives

- To help students understand the extent of environmental pollution that can result from used cooking oils
- To emphasize the importance of reuse
- To enhance cooperation through group participation
- To foster creativity and critical thinking
- To connect waste management with entrepreneurship

Age Group

14–16 years old

Duration

110–140 minutes

Materials

- Bottles containing used cooking oil
- Two plants
- Transparent containers with water
- Interactive whiteboard or projector
- Computers or tablets (for groups of up to 4 students)

Introduction (10–15 minutes)

Students go out into the schoolyard or a nearby park.
The teacher shows them a bottle containing used cooking oil.
The teacher asks the students why this oil was collected and why it should not be poured into the nearby sink, onto the flowers around them, or into a stream near their home or school.

Students are expected to respond that there are environmental pollution issues, such as water contamination or damage to plants. Some may also mention that fats can clog sinks. If this answer is not given, the teacher may ask whether students believe that sink clogging is related to pouring used oils into it. Students are expected to answer positively.

Students are then asked to hypothesize more specifically why oils cause pollution, why plants may be damaged by them, and why sinks may become clogged.

Activities in the Schoolyard (15–20 minutes)

Activity 1

Students are divided into groups of 5–6. Each group is given an opaque cup filled with water, with a small coin placed at the bottom. Students are asked to observe the coin.
Then they are asked to pour a small amount of oil so that the surface of the liquid is covered. They are asked to observe the coin again and discuss whether it is equally visible and why. Students are expected to respond that there is a reduction in the amount of light passing through.

Students are asked to recall the importance of sunlight in plant growth (photosynthesis).

Activity 2

Students may conduct an experiment by watering two identical plants planted earlier in soil of the same quality and under the same environmental conditions. One plant is watered with clean water, while the other is watered with water mixed with used cooking oil. Over time, on a weekly basis, students can observe and compare the growth of the plants.

Understanding the Problem (10–15 minutes)

A video, photographs, or a PowerPoint presentation is shown illustrating the environmental impacts caused by the disposal of used cooking oils into nature. Specifically, brief information is provided on the following issues:

- One liter of oil can pollute up to 1,000,000 liters of clean water
- The formation of oil layers on the surface of water creates several problems, such as:
    - Reduction of sunlight penetration in lakes and seas, resulting in limited growth of plants and microorganisms
    - Reduction of oxygen levels necessary for microorganisms in wastewater treatment facilities

Ways to Address the Problem (10–15 minutes)

Students are asked whether they know materials that can be recycled or reused and how recyclable or reusable materials can result from these processes. Before answering, they are asked to explain the difference between recycling and reuse.

Students are expected to mention recycling paper or plastics and reusing glass bottles—processes familiar to everyone—and possibly the recycling of electrical devices.

The teacher asks whether there are economic benefits for individuals or businesses from these processes. Students' ideas are shared and discussed.

The teacher may collect these ideas to demonstrate that recycling can benefit both individuals (e.g., receiving money when returning a glass bottle to a supermarket) and businesses involved in recycling paper or plastics, for example.

Activity (30–40 minutes)

In the computer lab or classroom, students are divided into four groups of 4–6 members.

The teacher asks whether students know how used cooking oils can be recycled or reused. It is certain that few or none will have an answer.

Students are asked to search online for two basic methods of recycling used cooking oils (5–10 minutes).

They are expected to find that used cooking oils can be used as raw material for the production of biofuels and the manufacture of soaps.

The teacher assigns one task to each group:

- **First task:** Students search for a recipe to produce biodiesel. They look up the prices of the required materials online and calculate the cost of producing one liter of biodiesel using used cooking oil as the main ingredient. They then compare this cost with the price of one liter of diesel fuel at a gas station.
- **Second task:** Students search for a recipe to produce scented soap. They research the prices of the materials and essential oils used. They are given the information that approximately 1,400 grams of soap can be produced from 1 liter of oil. They compare this cost with the price of an equivalent quantity of commercially available soap.
- **Third task:** Students think of ways to effectively inform the local community about the benefits of recycling used cooking oils, aiming to establish a collection point at the school with corresponding economic benefits.
- **Fourth task:** Students think of ways to economically utilize and promote soaps that could be produced using used cooking oils as raw material.

Presentation of Assignments – Discussion (30 minutes)

Each group briefly presents the results of its work.

Questionnaire (5 minutes)

1. Which of the following is an advantage of biodiesel made from used cooking oils?
a. It causes more pollution than conventional diesel
b. It is more expensive than diesel fuel
c. It utilizes a waste material
d. It cannot be produced on a small scale

2. From 1 liter of used cooking oil, approximately how much soap can be produced?
a. 500 g of soap
b. 1 kg of soap
c. 1,400 g of soap
d. 2 kg of soap

3. Which of the following actions is considered most effective for informing the community?
a. Creating a website
b. Posters and leaflets
c. Informing other schools
d. All of the above

4. What is the main purpose of promoting soaps produced from used cooking oils?
a. Increasing waste
b. Environmental and economic utilization
c. Replacing all commercial products
d. Reducing recycling.