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Regenerative Agriculture. An innovative approach towards mitigation of climate change through multi-tier learning

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Forestry and Wood Technology School in Postojna (Slovenia)

SECAD Partnership CLG (Ireland)

Veres Péter Secondary School (Hungary)

University of Florence (Italy)

GYMSM Farmers' Association (Hungary)

REGINA Learning Methodology & Tools

Produced by:

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Introduction

Willett et al. (2019) argue that global agricultural production systems pose a significant threat to ecosystem resilience and climate stability. These systems contribute to environmental degradation and the breach of planetary boundaries, such as species biodiversity loss and the decline of essential ecosystem services like pollination (Gossner et al. 2016; IPBES 2018). They also lead to soil erosion, reduced soil fertility, damage to water resources, and the degradation of coastal ecosystems (Fader et al. 2013; Rist et al. 2014). Agriculture and related food systems account for over a third of global greenhouse gas emissions, significantly driving climate change. Specifically, food systems are responsible for 34% of GHG emissions, with animal-based foods alone contributing 20% (Xu et al. 2021; Crippa et al. 2021). Additionally, agriculture is highly vulnerable to climate change, with shifting temperature and rainfall patterns predicted to become more erratic. This sector's environmental impact has steadily increased, contributing to 26% of global greenhouse gas emissions, 50% of the world's habitable land use, and 70% of global freshwater withdrawals (Ritchie et al. 2022). Recurring extreme weather events have further strained the sector, impacting farmers, particularly smallholders, who face harvest and livestock losses. Consequently, countries are aiming to reduce input use while maximizing efficiency.

Over the past thirty years, it has become clear that significant changes in farming and food systems are necessary to achieve sustainability (European Commission, 2020; European Commission Directorate-General for Research and Innovation, 2020; UNFSS, 2021). The European Commission's Green Deal, especially the Biodiversity and Farm to Fork Strategies, aims to address climate change and biodiversity loss while ensuring a steady supply of nutritious food. To move the EU food system towards sustainability, the Farm to Fork and Biodiversity Strategies have set ambitious targets for 2030:

- Reduce the use and risk of chemical pesticides by 50%, including a 50% reduction in the use of more dangerous pesticides.
- Decrease nutrient losses by at least 50%, ensuring stable soil fertility, leading to a 20% reduction in fertilizer use.
- Cut the sales of antimicrobials for farmed animals and aquaculture by 50%.
- Ensure that 25% of agricultural land is under organic farming.
- Ensure that at least 10% of agricultural areas have high-diversity landscape features.

The ultimate goal is to make European food production a global sustainability standard by addressing climate change, protecting the environment, and preserving biodiversity. The Green New Deal prioritizes the efficient use of resources, biodiversity restoration, and pollution reduction. Innovative farming systems are identified as crucial for ensuring resource availability for future generations.

Queiroz et al. (2021) suggest that achieving sustainability and resilience in agriculture requires a systemic approach that mitigates current crises' impacts on agriculture and identifies necessary transformations to reduce agriculture's contributions to these crises while enhancing food system resilience. Various approaches, such as agroecology, conservation farming, organic farming, ecological intensification, and carbon farming, have been studied for agricultural sustainability. Regenerative Agriculture (RA) also addresses similar goals by

enhancing ecosystem services, including carbon capture and storage, maintaining agricultural productivity, and increasing biodiversity (Oberč and Arroyo Schnell 2020). RA employs a holistic and systemic approach to farming, integrating ecological principles to enhance soil health, biodiversity, and ecosystem services. It focuses on regenerating natural resources, improving farmer livelihoods, and fostering community and economic resilience. RA emphasizes working with nature, using diversified farming systems like cover crops, crop rotations, and reduced tillage to enhance soil health and promote biodiversity. This approach addresses environmental and social challenges associated with conventional agriculture, including climate change, soil degradation, and biodiversity loss. RA also aims to restore soils and integrate various crops and animals into the production chain. While RA shares principles with agroecology and organic agriculture, it is considered broader and more flexible, allowing for a targeted use of modern agricultural tools.

The REGINA project (Regenerative Agriculture: An Innovative Approach Towards Mitigation of Climate Change through Multi-tier Learning) under the ERASMUS+ program aims to redirect farming practices to be more environmentally friendly and climate-mitigating while maintaining economic profitability. It involves partnerships with educators, students, farmers, farmers' associations, development agencies, advisors, policymakers, and public authorities. The project's focus is on improving agricultural knowledge and skills through a holistic approach. It aims to design a learning methodology and innovative tools to introduce an interdisciplinary course on RA for university students, adaptable for secondary schools and adult learning. The course will address major issues like climate change, soil health, and food and water security. An online platform will provide learning materials, tools, and real-time interaction, featuring an open library and a repository of good practices in RA. The project aims to promote RA principles and practices across Europe, create a RA library for farmers, and develop a flexible methodology and educational content for agricultural students and related disciplines. It also targets secondary education students and adult learners, especially farmers, through pilot-testing and adaptation of the methodology and tools. The project will create a digital learning environment, interact with stakeholders and communities, publish a guidebook on RA learning, and disseminate results widely through the REGINA platform and partner communication efforts.

PART 1: REGINA Themes & Modules

General information

The course on Regenerative Agriculture (RA) focuses on sustainable farming practices that enhance soil health, increase biodiversity, and promote ecosystem resilience. Topics covered over the course include soil health, crop rotation, cover cropping, agroforestry, and the use of natural fertilizers and pest control methods.

The course begins with an introduction to the concept of RA, its history and evolution, and the holistic approach to agriculture. Students will learn the principles of Regenerative Agriculture, such as minimizing soil disturbance, keeping the soil covered, and maximizing biodiversity. The benefits of Regenerative Agriculture, including improved soil health, increased nutrient density in crops and reduced greenhouse gas emissions, will also be discussed.

Specific practices in Regenerative Agriculture will be explored in detail. Students will learn about crop rotation, which helps prevent pest and disease buildup and enhances soil health by adding different nutrients and organic matter. Cover cropping, the practice of planting crops that cover the soil between cash crops to prevent erosion and improve soil organic matter, will also be covered.

Agroforestry, which integrates trees and shrubs into agricultural landscapes, will be another key topic. Students will learn about its benefits, such as increased biodiversity, improved soil health, and higher crop yields. The course will also cover animal management in RA, emphasizing the benefits of properly managed grazing, such as increased soil organic matter, improved soil health and enhanced biodiversity. Ethical considerations and animal welfare in livestock management will be highlighted.

Throughout the course, students will have opportunities to learn from practitioners, including farmers, researchers, and experts in the field. They will also apply their knowledge by designing and implementing their own Regenerative Agriculture systems.

For whom is the course recommended?

In general, a study course in Regenerative Agriculture is essential for anyone interested in sustainable agriculture.

It provides a strong foundation for understanding the principles and practices of Regenerative Agriculture and highlights the critical role that agriculture can play in creating a more sustainable and resilient future and land management. This course is an educational program designed to teach university students, secondary grade students, farmers and agriculture professionals about the principles and practices of regenerative soil management. This course can teach farmers how to manage their soil in a way that not only improve soils profitability, but also supports healthy ecosystems, long-term sustainable food production and contributes to mitigate the climate change.

Course structure

The course will be structured as follow (a graphical representation is also reported below):

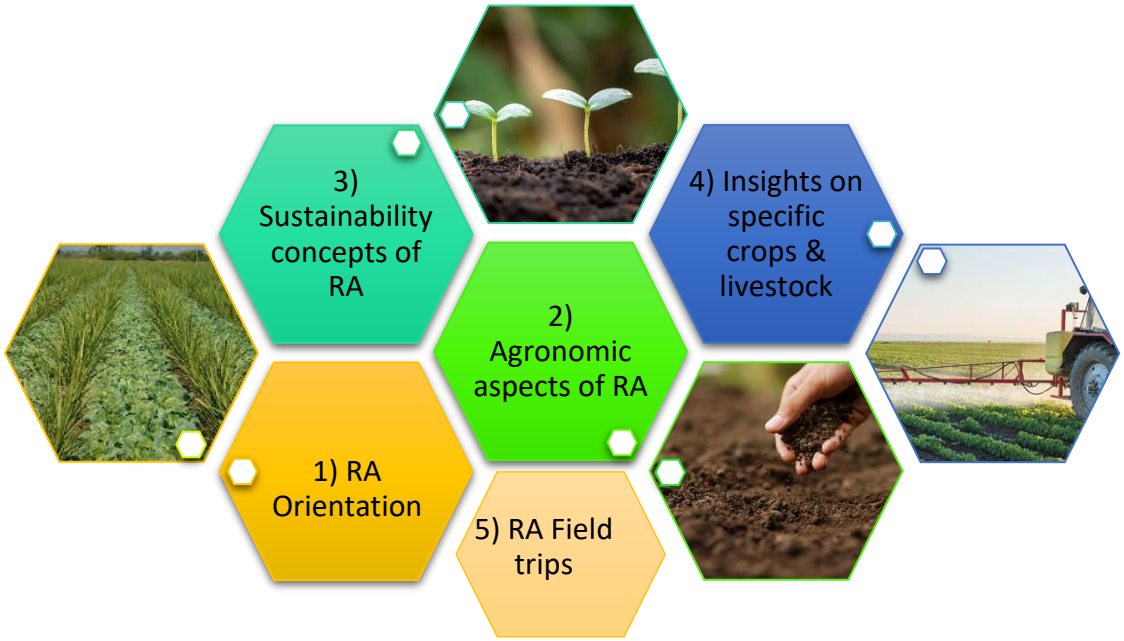
Module 1: Regenerative Agriculture Orientation - Definition of RA (Definition created in the project), Holism, Introductory module (based on National Reports and PR1 Synthesis Report) are described.

Module 2: Agronomic aspects of Regenerative Agriculture - Rethinking the soil management through RA; Regenerative nutrition for plants; Regenerative cropping systems: crop rotations, cover crops, intercropping; Integrated technologies in RA: biosystems engineering including soil metagenomics and bioinformatics, precision agriculture, IoT. Weeding following the RA principles.

Module 3: Sustainability concepts of Regenerative Agriculture (& mitigation of climate change) - Sustainable Water use under RA; Assessing Biodiversity enhancement after the adoption of RA practices; Reduction of GHG emissions through RA (economic, social, environmental advantages); Rural development aspects of RA.

Module 4: Insights on specific crops & livestock (Practical implications) - Cereal cultivation; Industrial crops; Horticultural crops; Grassland management; Livestock management; Agroforestry.

Module 5 - Horizontal Module: Field trips taken over the course of the programme. Visiting farms that demonstrate best practices showcased in the REGINA programme case studies. Implementing the +experiences and knowledge gained from these visits into the course material offered by the RA program.



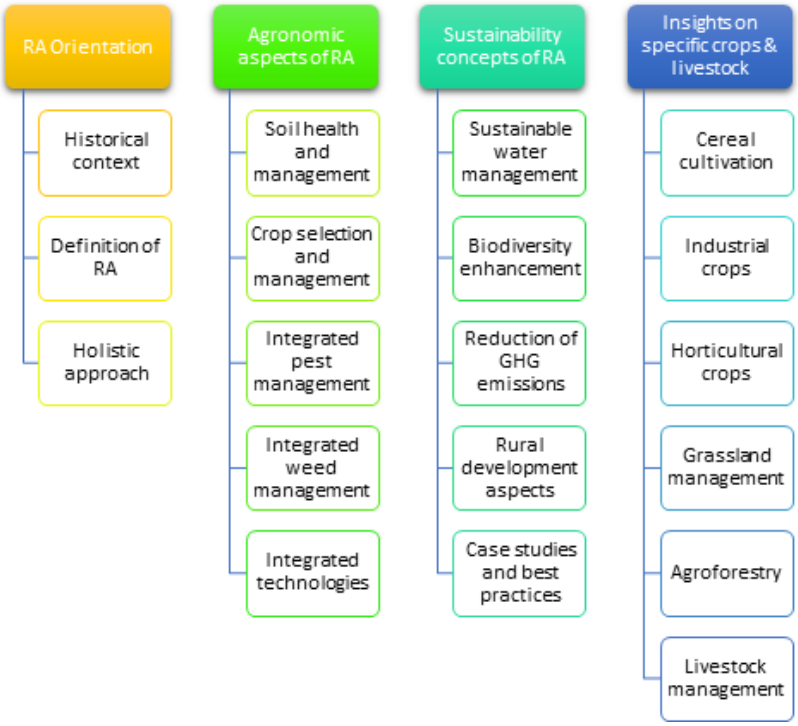


Figure 1: Course structure

Module 1: Regenerative Agriculture orientation

Background

Although the term "Regenerative Agriculture" (RA) is relatively new, its foundational idea was conceived in the early 1980s by Robert Rodale, who aimed to advance agriculture through the conservation of natural resources such as soil fertility and biodiversity. RA is a holistic approach to farming and ranching that emphasizes improving soil health, increasing biodiversity, and promoting sustainable farming practices. The core principle of RA is that soil health is crucial for the well-being of plants, animals, and people. By nurturing healthy soil, regenerative farmers can enhance the fertility, resilience, and productivity of their land, while also minimizing the need for chemical inputs and other detrimental practices.

RA seeks to rejuvenate the land rather than merely deplete its resources. The ultimate goal of regenerative agriculture is to establish a robust and resilient ecosystem capable of sustaining long-term food production and contributing to the health and well-being of the surrounding community. This farming approach is grounded in principles such as agroforestry, crop rotation, cover cropping, no-till farming, and holistic grazing, all of which aim to emulate natural systems and promote biodiversity.

As the challenges of climate change, soil degradation, and food security intensify, regenerative agriculture has emerged as a promising solution for sustainable and resilient food production. By adopting regenerative practices, farmers can improve their livelihoods and contribute to a healthier and more sustainable food system for everyone.

Main idea

The course aims to provide students with a thorough understanding of the principles and practices of Regenerative Agriculture (RA), along with the benefits and challenges associated with implementing these practices on farms and ranches. The curriculum may begin with an exploration of the historical and ecological foundations of regenerative agriculture, emphasizing the role of traditional and indigenous agricultural practices in sustaining healthy ecosystems.

Students will delve into specific techniques used in RA, such as cover cropping, crop rotation, agroforestry, and the integration of livestock in rotational grazing systems. The course will likely address organic farming methods and underscore the critical importance of soil health and biodiversity for long-term sustainability.

Hands-on learning opportunities, such as visits to local farms and ranches, will be a key component, allowing students to apply theoretical knowledge in real-world settings. Additionally, the course will cover the economic, social, and environmental advantages of regenerative agriculture, including enhanced soil fertility, reduced water usage, improved biodiversity, and increased resilience to climate change.

Ultimately, this course represents an exciting opportunity for students to learn about sustainable farming practices that promote healthy ecosystems and support local communities. By offering a solid foundation in the principles and techniques of regenerative agriculture, the course aims

to inspire and empower future generations of farmers and ranchers to strive for a more sustainable and equitable food system.

Course Goals:

- Understanding the principles and practices of regenerative agriculture, including how it differs from conventional farming techniques.
- Learning about the benefits of regenerative agriculture, such as improved soil health, increased biodiversity, and reduced environmental impact.
- Gaining knowledge of the economic and social benefits of regenerative agriculture, including how it can benefit farmers and local communities.
- Examining case studies of successful regenerative agriculture projects, and understanding how to implement similar projects in your own community.
- Understanding the science behind regenerative agriculture, including soil biology, carbon sequestration, and nutrient cycling.
- Understanding the importance of regenerative agriculture in the context of broader environmental and social issues, such as climate change and food security.
- Engaging with experts in the field and connecting with other individuals and organizations working on regenerative agriculture projects.
- Developing a comprehensive understanding of how regenerative agriculture can contribute to a more sustainable and equitable food system.

Topics covered:

- Historical context - The course provides an in-depth exploration of the origins and evolution of regenerative agriculture practices. The course covers the historical, cultural, and social contexts that have shaped the development of regenerative agriculture, and how it has evolved over time. Students in the course will learn about the traditional farming practices that have been used by indigenous peoples and small-scale farmers for centuries, and how these practices have influenced contemporary regenerative agriculture practices. The course will also cover the emergence of modern regenerative agriculture movements, such as organic farming, permaculture, and agroecology, and how they have contributed to the development of regenerative agriculture.
- Definition of RA - the course is designed to provide a comprehensive understanding of what RA is and what it entails. The course covers the principles, practices, and benefits RA, as well as its historical and cultural contexts. Students in the course will learn about the key features of RA, such as soil health, biodiversity, and ecosystem function. In addition, the course will examine the various definitions of RA that have emerged in different contexts and regions. Students will gain an understanding of the diversity of approaches to RA and the potential trade-offs and synergies between them.
- The holistic approach – the course explores the principles and practices of regenerative agriculture. The course emphasizes a whole systems approach to farming that prioritizes

soil health, biodiversity, and ecological resilience. Students in the course will learn about the importance of soil microbiology, plant diversity, and animal integration in regenerative agriculture. In addition, the course will cover the social and economic dimensions of regenerative agriculture, including the role of community building, market development, and policy advocacy in promoting sustainable food systems.

Main definitions

- **Regenerative Agriculture**: a holistic approach to farming that focuses on improving the health and vitality of soil, increasing biodiversity, and reducing the environmental impact of agriculture.
- **Holism:** philosophical and theoretical approach that views systems and phenomena as interconnected wholes, rather than as a collection of individual parts. It emphasizes the importance of understanding the whole system, rather than just the individual components, and recognizes that the whole is greater than the sum of its parts.
- **Soil Health**: the capacity of soil to function as a living system that sustains plants, animals, and humans. Healthy soil has good structure, nutrients, water-holding capacity, and microbial activity.
- **Carbon Sequestration**: the process of capturing and storing carbon from the atmosphere into soil, plants, or other organic matter, reducing the concentration of carbon dioxide in the atmosphere.
- **Biodiversity:** the variety of living organisms, including plants, animals, and microorganisms, in an ecosystem.
- **Sustainable Agriculture**: a system of farming that aims to meet the needs of the present without compromising the ability of future generations to meet their own needs.
- **Agroforestry**: a land-use management system that integrates trees or shrubs with crops and/or livestock, creating a more diverse and productive ecosystem.
- **Permaculture**: a design system that mimics the patterns and relationships found in natural ecosystems, creating sustainable and self-sufficient human habitats.
- **Cover Crops**: crops that are grown primarily to improve soil health, prevent erosion, and suppress weeds, rather than for harvest.
- **No-till Farming**: a farming technique that minimizes soil disturbance and erosion by eliminating ploughing and other tillage operations.
- **Crop Rotation**: a farming practice that involves planting different crops in a particular order to improve soil health, prevent pests and diseases, and increase yields.
- **Livestock Integration**: incorporating livestock into the farming system to improve soil health, reduce weed growth, and provide additional income streams.
- **Natural Pest Management**: using natural methods to control pests and diseases, such as crop rotation, companion planting, and biological control.
- **Composting**: the process of decomposing organic waste into a nutrient-rich soil amendment that can be used to improve soil health and fertility.
- **Water Management**: the practice of conserving and managing water resources to ensure sustainable agriculture and protect the environment.

- **Food Justice**: the principle that all people should have access to healthy, affordable, and culturally appropriate food, regardless of their income or location.

Module 2: Agronomic aspects of Regenerative Agriculture

Background

Soil is the foundation of agriculture, and the productivity of crops is directly impacted by the health of soil. Therefore, Regenerative agriculture practices aim to enhance soil health by boosting soil organic matter, enhancing soil structure, and promoting soil biodiversity. The application of correct agronomic practices is crucial because agriculture contributes significantly to greenhouse gas emissions, and the way we manage our soils can have a significant impact on the carbon cycle. Implementing regenerative agriculture practices can assist in carbon sequestration, reducing the amount of carbon dioxide in the atmosphere. Moreover, regenerative agriculture practices aim to establish sustainable farming systems that can provide food for future generations while reducing the impact on the environment. In addition, regenerative practices can have economic benefits for farmers by lowering the requirement for expensive inputs such as fertilizers and pesticides.

Main idea

The module is designed to provide a detailed understanding of the agronomic practices and techniques involved in implementing regenerative agriculture on farms. Regenerative agriculture is a holistic approach to farming that focuses on enhancing soil health, biodiversity, and ecosystem services, while also improving productivity and profitability. Overall, the "Agronomic Aspects of Regenerative Agriculture" module aims to provide participants with a comprehensive understanding of the agronomic practices and techniques involved in implementing regenerative agriculture on farms, and how these practices contribute to improving soil health, enhancing biodiversity, and increasing productivity and profitability.

Course Goals:

- Develop a strong foundation in soil health and its importance in Regenerative Agriculture.
- Learn about crop selection and management techniques for Regenerative Agriculture systems.
- Understand natural pest control methods and how they can be implemented in Regenerative Agriculture.
- Understand sustainable weed control methods.
- Identify and evaluate different types of integrated technology (i.e. precision agriculture, data analytics) that can be used to improve crop management and reduce environmental impact.

Topics covered:

The module covers a range of topics related to soil management, including soil health assessment, soil biology, soil fertility, nutrient management, cover cropping, crop rotation, conservation tillage, and integrated pest management. It also emphasizes the importance of reducing soil erosion, increasing water retention, and improving the quality of soil organic matter. The module covers the importance of soil health in regenerative agriculture and the role of organic matter, soil biology, and nutrient cycling. Participants may learn about soil testing, nutrient management, and the use of cover crops and green manures. The module covers also the benefits of reduced tillage practices and the use of no-till or conservation tillage techniques to improve soil structure, retain soil moisture, and reduce soil erosion. Another important topic of the course it is the use of natural fertilizers and pest management techniques in regenerative agriculture, such as composting, intercropping, and the use of natural predators and beneficial insects. The student will also learn about the benefits of crop rotation and the importance of diversifying crop species to maintain soil health and manage pests and diseases. The module may cover also the integration of livestock into regenerative agriculture systems, such as the use of rotational grazing to improve soil health, reduce inputs, and increase productivity.

- **Soil health and management**: This will cover the fundamental principles of soil health, including soil structure, nutrient cycling, and microbial activity. Students will learn how to assess soil health and implement practices such as cover cropping, reduced tillage, and crop rotation to improve soil health.
- **Crop selection and management**: This component covers the selection and management of crops for Regenerative Agriculture systems, including the use of cover crops, intercropping, and the integration of livestock into cropping systems.
- **Integrated pest management:** Students will learn about the use of natural pest control methods in Regenerative Agriculture, including the use of beneficial insects, crop rotation, and other techniques for reducing pest pressure without the use of synthetic pesticides.
- **Integrated weed management**: Students will learn about the principles of IWM and how it can be used to control weeds while promoting soil health and biodiversity. The course will cover a range of topics, including cultural, mechanical, and chemical control methods, as well as the importance of taking a holistic approach to weed management.
- **Integrated technology**: Students will learn how technological advancements can be used to enhance soil health, biodiversity, and crop productivity, while minimizing environmental impact. The course will cover a range of topics, including precision agriculture, data analytics, drones, and robotics, as well as the potential benefits and limitations of using technology in regenerative agriculture.

Main definitions

- **Soil Health**: The physical, chemical, and biological properties of soil that enable it to function as a dynamic living system capable of sustaining plant and animal life, storing carbon, and filtering and cycling nutrients and water.
- **Cover Crops**: Plants grown between cash crop seasons to protect and enhance soil health by reducing erosion, adding organic matter, and suppressing weeds.
- **Crop Rotation**: The practice of growing different crops in succession on the same field to maintain soil fertility, control pests and diseases, and reduce erosion.
- **Conservation Tillage**: A farming practice that minimizes soil disturbance by leaving crop residues on the soil surface and reducing the use of tillage equipment, thereby reducing erosion and preserving soil structure.
- **Integrated Pest Management**: A holistic approach to pest control that uses a combination of biological, cultural, and chemical methods to manage pests and diseases while minimizing environmental impact.
- **Nutrient Management**: The practice of balancing nutrient inputs and outputs to maintain soil fertility and promote healthy plant growth, while minimizing environmental pollution.
- **Agroforestry**: The integration of trees and shrubs with crops and/or livestock to enhance soil health, increase biodiversity, and provide ecosystem services such as shade, wind protection, and carbon sequestration.
- **Precision Agriculture**: The use of advanced technologies such as GPS, sensors, and data analytics to optimize crop management, reduce input costs, and minimize environmental impact.
- **Organic Agriculture**: A production system that relies on natural inputs and processes to promote soil health, biodiversity, and environmental sustainability, while also producing nutritious food and fiber.

Module 3: Sustainability concepts of Regenerative Agriculture

Background

Agriculture can have a significant impact on the environment and is a well-known contributor to greenhouse gas emissions. Sustainable agricultural practices help protect soil, water, and biodiversity by reducing pollution, conserving resources, and minimizing the use of harmful chemicals. Further, sustainable agriculture practices such as crop rotation, agroforestry, and conservation tillage can reduce greenhouse gas emissions and help mitigate climate change. Sustainable agriculture ensures that food production can continue for generations to come. By using methods that maintain soil fertility and reduce the use of non-renewable resources, sustainable agriculture helps to ensure that food production is not only environmentally responsible but also economically and socially viable. Sustainable agriculture can provide economic benefits to farmers and rural communities. By using practices that reduce input costs, such as using natural fertilizers and pest control methods, farmers can increase profits. Additionally, sustainable agriculture can create jobs and provide opportunities for small-scale farmers to participate in local and regional food systems. Achieving sustainable agriculture requires a comprehensive and integrated approach that addresses environmental, social, and economic factors. Some strategies can be jointly used to move towards a more sustainable agriculture: Adopt agriculture practices, such as cover cropping, crop rotations, agroforestry, and integrated pest management; Promote approach to farming promoting biodiversity, reduce the use of synthetic inputs, and enhance ecosystem services; Reduce food waste, using water-efficient irrigation systems, and improving energy efficiency in farming operations; Support local food systems; Invest in research and education as these can help to identify and promote sustainable agriculture practices, as well as to educate farmers, policymakers, and the public about the importance of sustainable agriculture.
Overall, achieving sustainable agriculture requires a multifaceted approach that addresses the environmental, social, and economic dimensions of food systems. By adopting regenerative agriculture practices, promoting agroecology, reducing waste and increasing efficiency, supporting local food systems, promoting food sovereignty, and investing in research and education, we can move towards a more sustainable and resilient food system.

Main idea

This course explores the principles and practices of regenerative agriculture from a sustainability perspective. The course typically covers the principles and practices of regenerative agriculture, which is a holistic approach to farming that seeks to improve soil health, increase biodiversity, and enhance ecosystem resilience. The course may include topics such as biodiversity, carbon sequestration, and water conservation, as well as the social and economic dimensions of sustainable agriculture. Students will learn about the importance of soil health, biodiversity, water conservation, energy efficiency, social sustainability, and policy and economics in supporting healthy and productive agricultural systems. They may also explore practical strategies for implementing regenerative practices on farms, such as cover

cropping, crop rotations, intercropping, and agroforestry. The course is designed to provide students with a comprehensive understanding of the principles and practices of regenerative agriculture, and to equip them with the knowledge and skills needed to pursue careers in sustainable agriculture, conservation, and related fields.

Course goals:

- To understand the principles and practices of regenerative agriculture and its relationship to sustainability.
- To identify the key factors that contribute to the sustainability of regenerative agriculture systems.
- Challenges and opportunities in promoting sustainable agriculture from a policy and economics perspective.
- Effectiveness of different sustainability practices in regenerative agriculture.
- To develop practical skills for implementing sustainable agriculture practices in personal and professional contexts.
- To analyze case studies of successful regenerative agriculture systems and apply principles to real-world scenarios.
- To understand the role of community development in promoting sustainable agriculture.
- Discussion and critique of sustainability concepts and practices in regenerative agriculture.

Topics covered

An examination on the principles and practices of Regenerative Agriculture, including building healthy soil, enhancing biodiversity, improving ecosystem services, mitigating and adapting to climate change, conserving water, and integrating livestock management will be carried out. In addition to learning about the technical aspects of regenerative agriculture, students in the course may also examine the social and cultural factors that shape sustainable food systems, including issues related to land tenure, farm labour, food access, and food justice. They may explore case studies of successful regenerative agriculture projects and initiatives and consider the policy and advocacy implications of sustainable agriculture. The course will include case studies and on-site visits to regenerative agriculture systems, as well as opportunities for students to design and implement sustainable agriculture projects. Through a combination of lectures, discussions, case studies, and hands-on activities, the holistic approach of RA and its potential to create sustainable food production systems that are socially and economically viable in addition to being environmentally sustainable. By the end of this module, the student will have the knowledge and skills to design and implement RA practices in a way that promotes sustainability and resilience in agricultural systems.

- **Sustainable water management**: This module will cover the importance of water management in regenerative agriculture, including the use of techniques such as rainwater harvesting, contour farming, and irrigation management.

- **Biodiversity enhancement**: This module will explore the role of biodiversity in regenerative agriculture, including the benefits of diverse ecosystems, and the strategies used to enhance biodiversity, such as intercropping and agroforestry.
- **Reduction of GHG emissions**: This module will examine the potential of regenerative agriculture to mitigate climate change by reducing the emission of GHG as well as sequestering carbon in soils This module also includes the role of practices such as no-till farming, cover cropping, and agroforestry in mitigating the climate change.
- **Rural development aspects**: This module will explore the economic viability of regenerative agriculture, including the potential for increased profitability, market demand, and certification and labelling programs.
- **Case Studies and Best Practices**: This module will showcase successful examples of regenerative agriculture in practice, including case studies from the REGINA partners, and highlight best practices for implementation.

Main definitions

- **Sustainability**: Meeting the needs of the present without compromising the ability of future generations to meet their own needs. In agriculture, sustainability encompasses environmental, social, and economic considerations.
- **Biodiversity**: The variety of life in a particular ecosystem or region, including the number and variety of species, genetic diversity, and ecosystem diversity.
- **Ecosystem Services**: The benefits that people derive from ecosystems, including provisioning services (e.g., food, water), regulating services (e.g., climate regulation, flood control), cultural services (e.g., recreation, aesthetic values), and supporting services (e.g., nutrient cycling, soil formation).
- **Carbon Sequestration:** The process of capturing and storing carbon from the atmosphere in vegetation, soils, and other organic matter, in order to mitigate climate change.
- **Holistic Management**: A decision-making framework that aims to optimize the health of the ecosystem, the productivity of the land, and the well-being of people, through a focus on whole system thinking, goal setting, and monitoring.
- **Social Justice**: The fair and equitable distribution of resources and opportunities, including access to land, water, and other natural resources, as well as fair wages and working conditions for farmers and farm workers.

Module 4: Insights on specific crops and livestock

Background

Crops and livestock cultivation under RA is an approach that focuses on promoting the health and productivity of the ecosystem while producing high-quality food for human consumption. The goal of regenerative crop cultivation is to enhance soil health and fertility, promote biodiversity, reduce soil erosion, and minimize the use of synthetic fertilizers and pesticides. In this framework, livestock represents the essential part of the farming system as animals produce manure that can be used instead of the mineral fertilizer, achieving the circularity of the farms. RA can enhance the nutrient content of the crops produced and improve their resilience to pests and diseases. Regenerative cultivation practices can also have positive impacts on climate change mitigation, as the sequestration of carbon in the soil can offset greenhouse gas emissions from crop and livestock production. Additionally, RA practices can contribute to the development of more sustainable and resilient rural communities, by enhancing food security and creating job opportunities.

Main concept

As the demand for sustainable and organic food is constantly growing, there is an increasing need for farmers and professionals in the agriculture industry to have a deep understanding of regenerative agriculture and its various practices. This includes a specific knowledge of how to apply regenerative agriculture principles to specific crops and livestock. The course "Insights on Specific Crops & Livestock in Regenerative Agriculture" provides students with an in-depth understanding of specific crops and livestock in regenerative agriculture. By focusing on specific crops and livestock, the course will delve into the unique characteristics and needs of different plants and animals and how they can be integrated into a Regenerative Agriculture system. The course will also provide students with an understanding of the benefits of Regenerative Agriculture and how it can be used to promote sustainable and environmentally friendly agriculture practices. The course will cover different types of crops and livestock, their characteristics, and how they can be integrated into a Regenerative Agriculture system. The example of some farmers could enhance student knowledge as practical tip will be enormously useful for them. Some tips from other farmers will be also considered to clarify the right position of specific crop into the crop rotation or intercropping.

Course goals:

- To provide students with a comprehensive understanding of Regenerative Agriculture and its principles, as well as the unique benefits it can offer to specific crops and livestock.
- To educate students on the different types of crops and livestock, their characteristics, and how to integrate them into a regenerative farming system.
- To teach students the various regenerative practices used in crop production (e.g. cover cropping, crop rotations, reduced tillage, and organic fertilization) and how they can be applied to specific crops.
- To educate students on the importance of soil health and its role in regenerative agriculture, including the use of soil testing, soil amendments, and crop selection to improve soil health.
- To provide students with the knowledge and skills necessary to design and implement a regenerative agriculture system, including the use of livestock as an integral component of a sustainable farming system.
- To promote critical thinking and problem-solving skills in students, enabling them to identify and solve issues related to specific crops and livestock in regenerative agriculture.
- To instil in students an appreciation for the importance of sustainable agriculture practices and their potential to benefit the environment, local communities, and the economy.

Topics covered

- **Cereal cultivation** – example of approach to cereal production that focuses on promoting the health and productivity of the soil ecosystem while producing high-quality cereals for human consumption. Principles and practices of RA, including reducing tillage, promoting crop rotation, and integrating other new practices will be addressed during the course with specific examples aimed at the cultivation of cereals.
- **Industrial crops** - Technical aspects of industrial crop cultivation under RA will be deeply analysed through the combination of the knowledge of different professional figures. The importance of specific crop will be pointed out along with its role in the rural development of a definite Country. The module will also deepen both the biology and botany of used crops, in order to match crop phenology with the correct time of intervention; it improves the efficiency of intervention while reducing the amount of input required, in line with the guidelines of RA.
- **Horticultural crops** - The benefits of improving soil health, nutrient availability for vegetables, and resilience of the ecosystems could be strongly useful for horticultural farmers. Again, specific horticultural crops will be deeply studied both through conventional systems along with RA system. This module can be integrated with the water footprint of vegetable obtained under RA with respect to the conventional system, as vegetable require more water than common herbaceous crops.

- **Grassland management -** In line with the as-much-biodiverse-as possible policy, the management of grasslands is included in the possible systems that can shift towards RA. Another important aspect will be the grassland management. A full map with the grassland area will be showed in order to scale the possible change toward RA. Furthermore, an indicative grassland management under RA will be studied and assessed: RA tillage management, the sowing of the right plant during the right period of the year, and the correct pest and disease management.
- **Agroforestry** - The course will cover: tree-crop interactions and their benefits; agroforestry systems and their design; plant and tree propagation techniques; soil health and management; livestock integration and management; pest and disease management in agroforestry systems; market analysis and value chain development. Students will learn about the benefits of agroforestry for both farmers and the environment, gain practical skills in designing and implementing agroforestry systems.
- **Livestock management** – In this module the correct management of livestock will be assessed in order to reduce the input requirement of an ideal farm. This module will cover the principles and practices of regenerative livestock management, including rotational grazing, integrating livestock into cropping systems, and using livestock to improve soil health. The best RA practices will be studied and some case studies will be reported in order to achieve the perfect match between theoretical and practical principles.

Main definitions

- **Crop/livestock selection**: The process of choosing a specific crop or livestock species based on various factors such as climate, soil type, market demand, and resource availability.
- **Agroforestry**: It is a field that focuses on the integration of trees, crops, and livestock on the same piece of land.
- **Genetics:** The study of inherited traits in plants and animals, which can be used to improve crop and livestock productivity, disease resistance, and other desirable characteristics.
- **Nutrition:** The study of how nutrients are obtained, processed, and used by living organisms, including plants and animals, and how they can be optimized for maximum health and productivity.
- **Marketing**: The process of promoting and selling crops and livestock, which includes market analysis, branding, packaging, pricing, and distribution.
- **Sustainability:** The practice of managing resources in a way that meets the needs of the present without compromising the ability of future generations to meet their own needs, including soil health, biodiversity, and resource conservation.
- **Value-added products**: The creation of new or enhanced products from crops or livestock, which can increase their market value and profitability, such as processed foods, biofuels, or specialized products like wool or honey.

- **Animal welfare**: The ethical and humane treatment of animals, which includes proper housing, feeding, and healthcare, as well as minimizing stress and pain during handling and processing.
- **Environmental impact**: The assessment of the impact of crop and livestock production on the environment, including soil erosion, water quality, greenhouse gas emissions, and habitat destruction, and strategies to minimize negative impacts.

PART 2: REGINA Methodology in Higher Education

The Importance of Regenerative Agriculture Education in Universities

Regenerative Agriculture is gaining prominence as a sustainable approach to farming that emphasizes the restoration of ecosystems, soil health, and biodiversity. Unlike conventional agriculture - which often depletes natural resources - Regenerative Agriculture seeks to rebuild and enhance them leading to more resilient and productive farming systems. The integration of regenerative agriculture into university curricula is crucial for equipping future generations with the knowledge and skills needed to address the pressing challenges of food security, environmental degradation, and climate change. This essay explores the importance of regenerative agriculture education in universities and its potential impact on society and the environment.

Further Understanding Regenerative Agriculture

As it has been described previously in the section of Sustainability Concepts of RA, Regenerative Agriculture encompasses a variety of practices designed to improve the health of farming ecosystems. Key practices include cover cropping, crop rotation, reduced tillage, agroforestry, integrated livestock management, and the use of compost and organic fertilizers. These practices work synergistically to enhance soil fertility, increase biodiversity, sequester carbon, and improve water retention and quality.

1. Soil Health: Healthy soil is the foundation of productive agriculture. Regenerative practices increase organic matter in the soil, enhancing its structure and fertility. This not only boosts crop yields but also improves the soil's capacity to retain water and nutrients, reducing the need for synthetic fertilizers and irrigation.

2. Biodiversity: By promoting diverse plant and animal species, regenerative agriculture fosters a balanced ecosystem. This biodiversity helps control pests and diseases naturally, reducing the reliance on chemical pesticides and promoting healthier, more resilient crops.

3. Carbon Sequestration: Regenerative practices such as cover cropping and agroforestry can sequester significant amounts of carbon in the soil and vegetation, helping to mitigate climate change. This is a critical benefit, as agriculture is both a significant contributor to and a potential mitigator of global greenhouse gas emissions.

4. Water Management: Improved soil structure and organic matter content enhance the soil's ability to absorb and retain water, reducing runoff and erosion. This leads to improved water management, especially in areas prone to drought or heavy rainfall.

The Need for Regenerative Agriculture Education

Given the significant benefits of regenerative agriculture, it is imperative that universities integrate this paradigm into their agricultural education programs. Educating the next

generation of farmers, researchers, and policymakers in regenerative principles is crucial for several reasons:

1. Addressing Environmental Challenges: Agriculture is a major driver of environmental degradation, including deforestation, soil erosion, and water pollution. Educating students in regenerative practices can equip them to develop and implement farming systems that are environmentally sustainable and resilient.

2. Ensuring Food Security: With the global population expected to reach nearly 10 billion by 2050, there is an urgent need to produce more food sustainably. Regenerative Agriculture can play a key role in enhancing food security by increasing crop yields and resilience to climate change.

3. Promoting Economic Viability: Regenerative Agriculture can also be economically beneficial for farmers. By reducing dependency on expensive inputs like synthetic fertilizers and pesticides, and by improving soil health and productivity, farmers can achieve higher and more stable yields, leading to better economic outcomes.

4. Shaping Future Leaders: Universities play a pivotal role in shaping the minds of future leaders. By incorporating Regenerative Agriculture into their curricula, they can inspire and equip students to become advocates and practitioners of sustainable farming, driving positive changes in agricultural policies and practices worldwide.

Integrating Regenerative Agriculture into University Curricula

To effectively teach Regenerative Agriculture, universities should adopt a multidisciplinary approach, combining theoretical knowledge with practical applications. Here are several key components that could form part of a comprehensive Regenerative Agriculture education program:

1. Core Courses: These should cover the principles and practices of Regenerative Agriculture, soil science, agroecology, and sustainable farming systems. These courses should include topics such as cover cropping, crop rotation, agroforestry, organic farming, and holistic grazing management.

2. Fieldwork and Practical Training: Hands-on experience is vital for understanding and applying regenerative practices. Universities should provide students with opportunities to work on farms, conduct soil and plant health assessments, and engage in activities such as composting, cover cropping, and integrated pest management.

3. Interdisciplinary Studies: Regenerative Agriculture intersects with various disciplines, including biology, ecology, economics, and social sciences. Integrating these perspectives can help students understand the broader implications of agricultural practices and develop holistic solutions.

4. Research and Innovation: Universities should encourage and support research in Regenerative Agriculture, which includes studying the impacts of regenerative practices on soil

health, crop yields, biodiversity, and carbon sequestration, as well as developing new techniques and technologies to enhance regenerative farming.

5. Community Engagement and Outreach: Universities can play a key role in promoting Regenerative Agriculture by partnering with local farmers, agricultural organizations, and policymakers. Through outreach programs, workshops, and extension services, they can help disseminate knowledge and best practices to the broader farming community.

Case Studies and Success Stories

Highlighting successful examples of Regenerative Agriculture can inspire and motivate students. Case studies of farms that have transitioned to regenerative practices and achieved significant improvements in productivity, soil health, and ecosystem services can provide valuable learning experiences. These real-world examples can demonstrate the feasibility and benefits of regenerative agriculture, helping to build confidence and support for its adoption.

For instance, the Rodale Institute in the United States has been a leader in Regenerative Agriculture research and education for decades. Their Farming Systems Trial, the longest-running comparison of organic and conventional cropping systems in North America, has shown that regenerative organic practices can match or exceed the productivity of conventional methods while significantly improving soil health and reducing environmental impacts.

Another example is the Savory Institute, which promotes holistic management and regenerative grazing practices worldwide. Their work has demonstrated the potential of regenerative livestock management to restore degraded grasslands, increase biodiversity, and sequester carbon, all while supporting profitable farming operations.

The Broader Impact of Regenerative Agriculture Education

Educating students in regenerative agriculture has the potential to drive significant positive change at multiple levels:

1. Local Communities: Graduates equipped with regenerative agriculture knowledge can directly impact their local communities by implementing sustainable practices on their farms, leading to healthier soils, increased biodiversity, and more resilient agricultural systems.

2. National and Global Food Systems: As more farmers adopt regenerative practices, the cumulative impact can lead to more sustainable national and global food systems. This can enhance food security, reduce greenhouse gas emissions, and promote biodiversity conservation on a larger scale.

3. Policy and Advocacy: Educated individuals can influence agricultural policy and advocacy efforts, pushing for policies that support sustainable farming practices, provide incentives for regenerative agriculture, and address the barriers to its adoption.

4. Research and Development: A well-educated workforce can contribute to ongoing research and development in regenerative agriculture, leading to innovations that further enhance the sustainability and productivity of farming systems.

Conclusion

Regenerative agriculture represents a transformative approach to farming that prioritizes environmental health, economic viability, and social well-being. Integrating regenerative agriculture education into university curricula is crucial for equipping future generations with the knowledge and skills needed to address the complex challenges facing global agriculture. By fostering a deep understanding of regenerative principles and practices, universities can empower students to become leaders and innovators in sustainable farming, driving positive change for the environment and society. The impact of such education extends far beyond the classroom, influencing local communities, national and global food systems, and agricultural policies for a more sustainable and resilient future.

Involving Stakeholders in Teaching a Regenerative Agriculture (REGINA) Course

Involving stakeholders in the teaching of a Regenerative Agriculture (REGINA) course is essential to ensure the curriculum is relevant, practical, and impactful. Stakeholders, including farmers, agribusiness professionals, environmental organizations, policymakers, and students themselves, bring valuable perspectives, expertise, and resources that can enhance the educational experience. This essay explores various strategies to effectively engage stakeholders in the development and delivery of a REGINA course, ensuring that the program not only educates but also inspires and equips students to implement regenerative practices.

Identifying Key Stakeholders

Before engaging stakeholders, it is important to identify who they are and what roles they can play in the REGINA course. Key stakeholders typically include:

1. Farmers and Ranchers: Practitioners who can provide real-world insights and case studies.

2. Agribusiness Professionals: Representatives from companies that supply inputs or services to the agricultural sector.

3. Environmental Organizations: NGOs and advocacy groups focused on sustainability and conservation.

4. Policymakers and Government Agencies: Officials who influence agricultural policies and regulations.

5. Academic Institutions and Researchers: Experts who contribute to the programme with theoretical knowledge and research findings.

6. Students: The primary beneficiaries of the course, whose feedback and involvement are crucial.

Strategies for Stakeholder Engagement

1. Advisory Committees

Establishing an advisory committee comprising representatives from each stakeholder group can provide valuable guidance throughout the course development process. This committee can help define course objectives, identify key topics, and suggest practical applications of theoretical concepts. Regular meetings with the advisory committee ensure that the curriculum remains aligned with industry needs and emerging trends in regenerative agriculture.

2. Collaborative Course Design

Engaging stakeholders in the course design process fosters a sense of ownership and relevance. This can be achieved through workshops, focus groups, and surveys to gather input on course content and structure. Collaborative design not only enriches the curriculum with diverse perspectives but also ensures that it addresses real-world challenges faced by practitioners.

3. Guest Lectures and Expert Panels

Inviting stakeholders to deliver guest lectures or participate in expert panels can provide students with firsthand knowledge and experience. Farmers and agribusiness professionals can share practical insights and case studies, while environmentalists and policymakers can discuss the broader implications of regenerative practices. These sessions can be integrated into the curriculum as standalone lectures, Q&A sessions, or panel discussions, providing students with a well-rounded understanding of the subject.

4. Field Trips and On-Site Learning

Organizing field trips to regenerative farms, research institutions, and agribusinesses allows students to observe and engage with real-world applications of course concepts. These experiential learning opportunities can be supplemented with on-site workshops where students participate in hands-on activities such as soil testing, cover cropping, and livestock management. Collaboration with local farmers and organizations can facilitate these visits and enhance the learning experience.

5. Internships and Practicums

Offering internships and practicums with stakeholder organizations provides students with practical experience and helps bridge the gap between theory and practice. Partnering with farms, agribusinesses, and environmental organizations to offer structured internship programs can give students the opportunity to apply their knowledge in real-world settings. These experiences not only reinforce learning but also help students build professional networks and gain insights into potential career paths.

6. Research Collaboration

Encouraging collaborative research projects between students and stakeholders can enhance the learning experience and contribute to the advancement of regenerative agriculture. Research topics can be identified through discussions with stakeholders to ensure they address relevant issues and challenges. Collaborative research can lead to practical solutions and innovations that benefit both students and the wider agricultural community. It may also lead to a valuable topic for a future thesis or the Local Conference of Scientific Students Associations.

7. Community-Based Projects

Incorporating community-based projects into the curriculum can provide students with opportunities to work on real-world challenges faced by local farmers and communities. These projects can involve designing and implementing regenerative practices, conducting impact assessments, and developing educational materials for community outreach. Engaging with community stakeholders helps students understand the social and cultural dimensions of regenerative agriculture and fosters a sense of social responsibility.

8. Feedback Mechanisms

Establishing robust feedback mechanisms ensures continuous improvement of the course. Regular surveys, focus groups, and feedback sessions with students and other stakeholders can provide valuable insights into the effectiveness of the curriculum and teaching methods. This feedback can be used to make adjustments and enhancements, ensuring that the course remains relevant and impactful.

9. Co-Creation of Learning Materials

Collaborating with stakeholders in the creation of learning materials can enrich the educational content and ensure its practical relevance. Farmers and agribusiness professionals can contribute to case studies, best practices and technical guides, while environmental organizations can provide resources on sustainability and conservation. Co-creation of materials not only diversifies the curriculum but also strengthens partnerships with stakeholders.

10. Capstone Projects

Capstone projects provide students with the opportunity to apply their knowledge and skills to real-world challenges. These projects can be designed in collaboration with stakeholders, addressing specific issues or opportunities in regenerative agriculture. Capstone projects encourage critical thinking, problem-solving, and innovation, and can result in practical solutions that benefit stakeholders and the broader community.

Benefits of Stakeholder Engagement

Engaging stakeholders in the teaching of a REGINA course offers numerous benefits:

1. Enhanced Relevance and Practicality: Stakeholders bring real-world perspectives that ensure the curriculum is relevant and practical, preparing students for careers in regenerative agriculture.

2. Diverse Perspectives: Involving a range of stakeholders enriches the learning experience by exposing students to diverse viewpoints and expertise.

3. Stronger Networks: Collaboration with stakeholders helps students build professional networks and gain insights into potential career paths.

4. Improved Outcomes: Stakeholder engagement can lead to more effective and impactful educational outcomes, as the curriculum is continuously refined based on feedback and evolving industry needs.

5. Innovation and Research: Collaborative research and projects with stakeholders can lead to innovative solutions and advancements in regenerative agriculture.

6. Community Impact: Engaging with local communities and stakeholders helps address real-world challenges and fosters a sense of social responsibility among students.

Challenges and Solutions

While engaging stakeholders offers many benefits, it also presents challenges that need to be addressed:

1. Coordination and Communication: Coordinating with multiple stakeholders can be complex and time-consuming. Establishing clear communication channels and roles can help manage this complexity.

2. Resource Constraints: Engaging stakeholders often requires additional resources, such as time, funding and logistical support. Seeking grants, partnerships, and in-kind contributions may help address these constraints.

3. Aligning Objectives: Different stakeholders may have varying objectives and priorities. Facilitating open dialogue and finding common ground help align objectives and foster collaboration.

4. Maintaining Engagement: Sustaining stakeholder engagement over time requires ongoing effort and commitment. Regular communication, recognition of contributions, and demonstrating the impact of their involvement can help maintain engagement.

Conclusion

Involving stakeholders in the teaching of a Regenerative Agriculture (REGINA) course is essential for creating a relevant, practical, and impactful educational experience. By leveraging the expertise and perspectives of farmers, agribusiness professionals, environmental organizations, policymakers, and students, universities can develop a robust curriculum that prepares future leaders and experts in regenerative agriculture. Through strategies such as advisory committees, collaborative course design, guest lectures, field trips, internships, research collaboration, community-based projects, feedback mechanisms, co-creation of learning materials, and capstone projects, stakeholders can play a vital role in shaping and enhancing the learning experience. Overcoming challenges through effective coordination, resource management, alignment of objectives, and sustained engagement ensures that stakeholder involvement leads to meaningful and lasting benefits for students, the agricultural community, and the society as a whole.

Learning Objectives & Outcomes

General Characteristics of the Learners at Secondary, Tertiary and Adult Education

University students enrolled in the course, having already mastered fundamental subjects, are prepared to delve into the content offered by the REGINA course, encompassing topics such as botany, soil science, and agrometeorology.

Regarding secondary school students, the course content, either in its entirety or in part, can be seamlessly integrated into the curriculum alongside the acquisition of vocational skills.

Expected trainees in adult education seminars are farmers, members of the general public interested in sustainable farming and agronomists who would wish to upgrade their knowledge of farming methods responding to the climate crisis, expected to exhibit professional curiosity.

General Characteristics of the Teachers

The instructors of the course are equipped with appropriate professional qualifications and extensive experience, holding the requisite academic degrees for university education. They employ modern technologies and methodologies, adopting a learner-centred approach that incorporates practical examples, collaborative teaching and learning techniques, elements of project-based learning, and interactive lectures.

Their teaching process involves integrating external experts, decision-makers, and practitioners into both classroom instruction and fieldwork training, thereby enriching the learning experience. They maintain continuous, live contact with teachers, practitioners, and policymakers to exchange experiences and ensure ongoing improvement. Furthermore, they promptly incorporate up-to-date guidelines, objectives, and regulations into educational materials.

To foster interdisciplinary learning, teachers across various disciplines collaborate closely to jointly develop teaching materials. They extensively utilize project-based and practice-oriented teaching methods to provide students with deep insights into agricultural sciences, utilizing case studies for analysis and collaborative processing. Additionally, they incorporate perspectives and insights from decision-makers and farmers to enrich students' understanding.

Their overarching goals include facilitating international experience exchange, updating knowledge bases, presenting best practices, and evaluating their effectiveness.

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Description of Learning Objectives, Targets of the Course

based on the different target groups/specific aims (secondary school, other tiers of education, adults)

I. Upon successful completion of the course, Students in Higher Education (HE) will achieve the following competencies:

1. **Understanding and Application of Regenerative Agriculture (RA):**
   - Students can comprehend and proficiently apply fundamental concepts related to regenerative agriculture, including the ability to define RA.
2. **Critical Evaluation of Soil Management Practices:**
   - They can critically evaluate various soil management practices and methods, selecting those aligned with RA principles. They are capable of planning soil preparation tailored to different crops, considering climatic and soil conditions.
3. **Principles of Plant Nutrition and Nutrient Management:**
   - Students understand plant nutrition principles and adopt a critical approach to nutrient management issues. They can develop nutrient management plans consistent with RA principles, analyse soil test results, and recommend appropriate fertilizers.
4. **Crop Structure Planning and Crop Rotation:**
   - They are proficient in planning farm crop structures based on RA guidelines, including setting up crop rotations. Students can select cover crops, green manure crops, and catch crops, integrating them into the crop structure. They critically evaluate crop rotation elements and propose improvements as needed.
5. **Integration of Advanced Agricultural Technologies:**
   - Students can synthesize their knowledge to effectively implement results from disciplines like metagenomics, bioinformatics, and precision farming into practice.
6. **Sustainable Water Management and Moisture Conservation:**
   - They identify steps for sustainable water management and apply soil cultivation guidelines and crop structures to conserve moisture. Students critically assess agrotechnical elements related to moisture conservation and propose solutions for identified challenges.
7. **Role of Biodiversity and its Management in RA:**
   - Students understand the role of biodiversity in RA and can plan and implement changes in crop production to enhance biodiversity growth.
8. **Reducing GHG Emissions and Sustainable Farming Practices:**
   - They grasp RA's role in reducing greenhouse gas emissions and recognize its economic, environmental, and social benefits. Students can plan farming processes with these elements in mind.
9. **RA's Contribution to Rural Development:**
   - They comprehend RA's significance in rural development contexts.
10. **Evaluation and Optimization of Production Practices:**

- Students analyse and evaluate the roles of various crops, grasslands, and livestock in RA. They apply RA principles to plan crop, horticultural, grassland, and livestock production, evaluating production indicators and optimizing decisions accordingly.

11. **Case Study Analysis and Continuous Improvement:**
    - They will have the ability to conduct case studies, analyse results, and compare them with conventional farming outcomes. Students can draw appropriate conclusions and refine RA methods based on study findings.

These learning objectives equip students with comprehensive skills and knowledge essential for implementing and advancing regenerative agriculture practices effectively so that they will reach the following learning outcomes:

Knowledge:

- Students will understand and utilize fundamental concepts of science, engineering, technology, food chain safety, and management that support regenerative agriculture. They will be knowledgeable about modern RA technologies and their practical applications, as well as the environmental and economic impacts of agricultural production. They will also comprehend the challenges posed by climate change and the importance of adaptation.

Skills:

- Students will be adept at working in cooperative environments, clearly interpreting and communicating professional instructions to employees. They will be capable of identifying pests, pathogens, weeds, and their natural enemies, and planning and implementing integrated pest management with minimal chemical inputs. Additionally, they will interpret, comply with, and enforce regulations and legislation relevant to RA. Strong communication skills will enable them to express and defend their professional opinions and positions in the event of disputes.

Attitude:

- Students will adopt a constructive approach to professional issues, be sensitive to new production trends in RA, and strive to introduce them. They will be attuned to environmental, animal welfare, and food safety aspects of agricultural production, reflecting this sensitivity in both their professional stance and daily work.

Autonomy:

- Students will be capable of independent, regenerative farming and counselling, taking responsibility for their decisions and performance. They will understand and credibly represent the importance of RA at both national and international levels. Committed to maintaining and enhancing the positive image of RA in society, their communication

will responsibly articulate their professional convictions. They will express their opinions independently, professionally, and responsibly.

II. Secondary School Students

Secondary school students will understand and create content interpreted at their level of knowledge through which they will be able to recognise the basis and the benefits of RA, strive to use it and deepen their knowledge.

III. Stakeholders (farmers)

It is important for policy makers and agricultural businesses to have creative engineers with up-to-date knowledge and good collaboration skills in the labour market. Students who are able to work in teams, apply critical thinking skills and work independently are in demand. Those professionals who are interested in a course compiled based on the principles of REGINA project will be provided with the necessary tools to achieve these objectives.

Upon completion of the REGINA course, **practitioners and farmers** will gain new information that will enable them to carry out their activities more effectively and confidently. They will receive guidance on how to make the transition to RA. They will learn about its benefits and risks in order to make responsible and well-grounded decisions on the future of their business. Learning about international findings in the field will provide the opportunity to gain knowledge on RA and an access to professionally sound knowledge at an academic level.

Effective Learning in Higher Education

Effective learning in higher education is a complex and dynamic process that involves not only the absorption of information but also the development of critical thinking, problem-solving, and independent learning skills. As the educational landscape evolves, so do the methods and platforms used to facilitate learning. To achieve these objectives we explore the components of effective learning in higher education, focusing on the roles of different learning platforms, lectures, practical exercises, and e-learning and refer to their adaptation at the other levels of education.

The Role of Learning Platforms in Modern Education

Learning platforms are essential in modern education, providing tools and resources that support both teaching and learning. These platforms can be categorized into traditional classroom environments, online learning management systems and hybrid models.

Learning Management Systems (LMS) such as Blackboard, **Moodle**, and Canvas are widely used in higher education. These platforms offer a centralized location for course materials, assignments, assessments, and communication. They facilitate organization and accessibility, allowing students to manage their coursework efficiently. LMSs also support various types of content, including videos, readings, quizzes, and interactive simulations, catering to diverse learning preferences.

One of the key benefits of LMSs is their ability to provide timely feedback. Instructors can quickly grade assignments and provide comments, helping students understand their strengths and areas for improvement. LMSs also enable peer interaction through discussion forums and group projects, fostering a collaborative learning environment.

Hybrid Learning Platforms blend online and in-person instruction, combining the flexibility of online learning with the benefits of face-to-face interaction. This approach allows for a more personalized learning experience, as students can engage with digital content at their own pace while still receiving direct support from instructors and peers during in-person sessions. Hybrid models are particularly effective in promoting active learning and engagement, as they encourage students to prepare for and participate actively in classroom activities.

The Role of Lectures

Lectures have been a cornerstone of higher education for centuries, and they continue to play a crucial role in effective learning. While the traditional lecture format has been criticized for its passive nature, modern approaches to lecturing can improve the level of student engagement and learning outcomes.

Traditional Lectures involve the instructor delivering content to a large group of students, often with the aid of visual aids such as slides. This method is efficient for covering a significant

amount of material in a short period and is particularly useful for introducing new concepts and providing a comprehensive overview of a subject.

However, traditional lectures can be improved through various techniques that promote active learning. **Interactive Lectures** incorporate elements such as questioning, discussions, and in-class activities to engage students actively. For example, the **Socratic method** involves the instructor posing thought-provoking questions and encouraging students to discuss and debate their responses. This approach helps students develop critical thinking skills and deepens their understanding of the material.

Flipped Classrooms are another innovative approach to lecturing. In a flipped classroom, students review lecture materials (such as video lectures or readings) before class, freeing up classroom time for interactive activities such as discussions, problem-solving, and group work. This model encourages active participation and allows instructors to provide more personalized support.

Guest Lectures and Expert Talks can also enrich the learning experience. Inviting professionals and experts from various fields to share their insights and experiences exposes students to real-world applications of theoretical knowledge and provides inspiration and motivation.

The Role of Practical Exercises/Practicums

Practical exercises are essential for effective learning in higher education, as they allow students to apply theoretical knowledge in real-world contexts. These exercises can take various forms, including laboratory work, case studies, simulations, and hands-on projects.

Case Studies are widely used in fields such as business, law, and social sciences. They involve analysing real or hypothetical scenarios to identify problems, evaluate options, and propose solutions. Case studies encourage students to think critically and apply their knowledge to complex, real-world issues. They also promote the development of problem-solving and decision-making skills.

Project-Based Learning (PBL) involves students working on extended projects that require research, planning, and execution. Projects can be individual or group-based and often culminate in a final presentation or report. PBL promotes deep learning by encouraging students to explore topics in depth and apply their knowledge creatively. It also helps develop important skills such as time management, collaboration, and communication.

The Role of E-Learning

E-learning, or electronic learning, refers to the use of digital technologies to deliver and support education. E-learning encompasses a wide range of activities, from fully online courses to supplementary online resources used in traditional classroom settings. The role of e-learning in

higher education has grown significantly in recent years, driven by advancements in technology and the increasing demand for flexible and accessible learning options.

Fully Online Courses provide flexibility and convenience, allowing students to study from anywhere and at any time. Online courses often include a variety of multimedia resources, such as video lectures, interactive simulations, and online discussions, catering to different learning styles. They can also be more accessible to non-traditional students, such as working professionals or those with family commitments.

Blended Learning combines online and face-to-face instruction, offering a balanced approach that leverages the strengths of both methods. In a blended learning environment, students can benefit from the flexibility of online learning while still having opportunities for in-person interaction and support. This model can enhance engagement and provide a more comprehensive learning experience.

Massive Open Online Courses (MOOCs) are a form of e-learning that offers free or low-cost courses to a large number of participants. MOOCs provide access to high-quality educational content from top universities and institutions worldwide. While MOOCs are often self-paced and require a high degree of self-motivation, they offer opportunities for lifelong learning and professional development.

Although the following methods are not included in the REGINA project, for the sake of completeness we find them important to mention:

Laboratory Work is particularly important in science and engineering disciplines. Labs provide students with the opportunity to conduct experiments, collect data, and analyse results, reinforcing their understanding of scientific principles and techniques. Hands-on experience in the lab also helps students develop important skills such as precision, attention to detail, and critical analysis. – not applied in REGINA project, but we find it important to mention.

Simulations and Role-Playing activities are effective for teaching skills that require practice and experience, such as negotiation skills in business. Simulations provide a safe environment for students to experiment and learn from their mistakes without real-world consequences. Role-playing can also enhance empathy and understanding by allowing students to experience different perspectives.

Virtual Learning Environments (VLEs) are platforms that support e-learning by providing tools for content delivery, communication, and assessment. VLEs enable instructors to create and manage online courses, facilitate discussions, and track student progress. They also provide students with access to a wealth of resources and support tools, enhancing the learning experience.

Strategies for Effective Learning

To maximize the benefits of various learning platforms, lectures, practical exercises, and e-learning, students can adopt several strategies for effective learning in higher education.

Active Engagement involves participating actively in the learning process rather than passively absorbing information. This includes asking questions, joining discussions and engaging with course materials critically. Active engagement helps deepen understanding and improve retention.

Time Management is crucial for balancing the demands of coursework, practical exercises, and other responsibilities. Effective time management involves setting priorities, creating a study schedule, and breaking tasks into manageable chunks. Tools such as calendars and to-do lists can help students stay organized and focused.

Collaborative Learning encourages students to work together to achieve common goals. Group study sessions, peer teaching, and collaborative projects can enhance understanding and provide diverse perspectives on the material. Collaboration also helps develop important interpersonal skills.

Self-Directed Learning involves taking responsibility for one's own learning. This includes setting learning goals, seeking out additional resources, and reflecting on progress. Self-directed learners are proactive and motivated, often going beyond the requirements of the course to deepen their knowledge and skills.

Utilizing Resources effectively means making the most of the available learning platforms, tools, and support services. This can include attending office hours, seeking help from tutors, using online resources, and participating in study groups. Leveraging these resources can provide additional support and enhance learning outcomes.

Challenges and Solutions

While there are numerous strategies and methods to support effective learning in higher education, students may also face various challenges. Understanding these challenges and implementing solutions help students overcome obstacles and achieve success.

Procrastination is a common challenge that can hinder effective learning. Students can overcome procrastination by breaking tasks into smaller, manageable steps, setting deadlines, and using tools such as timers to stay focused.

Stress and Burnout are significant issues, especially for students balancing multiple responsibilities. Managing stress involves practicing self-care, maintaining a healthy lifestyle, avoiding overachievement and seeking support when needed. Time management and setting realistic goals can also help reduce stress.

Distractions can impede concentration and productivity. Creating a dedicated study space, minimizing interruptions, and using techniques such as the Pomodoro Technique (working in focused intervals with short breaks) can help maintain focus.

Lack of Motivation can be addressed by setting clear, achievable goals, finding relevance in the material, and rewarding oneself for completing tasks. Engaging with peers and instructors can also provide motivation and support.

Access to Technology and reliable internet can be a barrier for some students, particularly in remote or underserved areas. Institutions can help by providing resources such as loaner laptops, internet stipends, and access to on-campus technology.

The application and adaptation of the aforementioned methods create opportunities for collaborative thinking among individuals at different educational levels (secondary, adult), facilitating smooth communication in their current and future joint endeavours.

The Future of Learning in Higher Education

As technology continues to advance and the educational landscape evolves, the future of learning in higher education will likely see further integration of innovative methods and platforms. Trends such as personalized learning, artificial intelligence, and virtual reality are poised to transform how students learn and engage with content.

Personalized Learning uses data and analytics to tailor educational experiences to individual student needs and preferences. Adaptive learning technologies can provide customized resources and support, helping students progress at their own pace and focus on areas where they need improvement.

Artificial Intelligence (AI) has the potential to revolutionize education by providing intelligent tutoring systems, automated grading, and predictive analytics. AI can identify students' strengths and weaknesses, offering personalized feedback and recommendations for further study. This can improve the learning experience by providing targeted support and reducing the administrative burden on instructors.

Virtual Reality (VR) and Augmented Reality (AR) offer immersive learning experiences that can make complex concepts more accessible and engaging. VR and AR can simulate real-world environments and scenarios, allowing students to practice skills and explore topics in a hands-on manner. These technologies can be particularly beneficial in fields such as research, agriculture, engineering, and architecture, where practical experience is crucial.

Gamification involves incorporating game-like elements into the learning process to increase motivation and engagement. This can include earning points, badges, and rewards for completing tasks and achieving goals. Gamification can make learning more interactive and enjoyable, focus-based encouraging students to stay engaged and motivated.

In conclusion, effective learning in higher education is a multifaceted process that involves leveraging various learning platforms, lectures, practical exercises, and e-learning methods. By adopting strategies such as active engagement, time management, collaborative learning, self-directed learning, and utilizing available resources, students can improve their learning outcomes. Addressing challenges such as procrastination, stress, distractions, lack of motivation, and access to technology is also crucial for success. As technology continues to

evolve, the future of learning in higher education will likely see further innovations that enhance the learning experience and better prepare students for their future careers.

The adaptation of these method into secondary and adult education ensures that the individuals participating in the educational system will consistently understand each other.

The course addressed to adults is planned to be delivered in the context of non-formal learning, and although It is based on the material developed for higher education, it is simplified to fit the learning needs and capabilities of adult learning, complemented with topics that are especially relevant and interesting to farmers. An important aspect of course-delivery addressed to adults is the illustration of theoretical issues through case studies and the encouragement of the participating trainees to relate such practical examples to their own experiences, in order to understand how current practices can be changed into regenerative ones.

Gamification in Higher Education: more details – Can studying be a little less painful?

Theoretical Background

Gamification is grounded in several educational theories, including constructivism, behaviorism, and cognitive load theory. Constructivist theory, proposed by Jean Piaget, emphasizes the importance of active learning where students construct knowledge through experience and interaction. Gamification aligns with this theory by providing interactive and immersive experiences that encourage active participation. Behaviorism, associated with B.F. Skinner, focuses on reinforcement and punishment to shape behavior. Gamified elements like points, badges, and leaderboards serve as reinforcements that motivate students to engage in desired behaviors. Cognitive load theory, developed by John Sweller, posits that learners have limited cognitive capacity, and effective instructional design should minimize extraneous cognitive load. Gamification can help manage cognitive load by breaking down complex tasks into manageable, game-like challenges.

Implementation of Gamification in Higher Education

The implementation of gamification in higher education can take various forms, ranging from simple game elements to fully gamified courses. Common gamification strategies include:

1. **Points, Badges, and Leaderboards:** These elements are used to reward students for completing tasks, achieving milestones, and excelling in their studies. Points accumulate over time, badges signify accomplishments, and leaderboards create a sense of competition and achievement.

2. **Quests and Challenges**: Course content can be structured as a series of quests or challenges that students must complete. This approach makes learning more engaging and provides a sense of progression.

3. **Levels and Progression**: Similarly to video games, educational content can be divided into various levels that students must complete to advance. This structure provides clear goals and motivates students to progress through the material.

4. **Immediate Feedback**: Gamification often includes immediate feedback mechanisms that help students understand their performance and areas for improvement. This can be implemented through automated quizzes, interactive simulations, and other digital tools.

5. **Collaboration and Competition**: Gamified courses can include collaborative projects and competitive elements that encourage teamwork and peer interaction. These activities help develop social skills and foster a sense of community.

Benefits of Gamification in Higher Education

The application of gamification in higher education offers numerous benefits:

1. **Increased Engagement and Motivation**: Gamification makes learning more enjoyable and engaging, which can lead to higher levels of motivation and sustained interest in the subject matter. The interactive and dynamic nature of gamified activities can capture students' attention and encourage active participation.

2. **Enhanced Learning Outcomes**: Studies have shown that gamification can improve learning outcomes by promoting deeper understanding and retention of material. The use of game elements can help reinforce key concepts and provide multiple opportunities for practice and application.

3. **Personalized Learning**: Gamified systems can adapt to individual learning styles and paces, providing a personalized learning experience. This customization can help address the diverse needs of students and support differentiated instruction.

4. **Development of 21st Century Skills**: Gamification can help develop critical 21st-century skills such as problem-solving, critical thinking, collaboration, and digital literacy. These skills are essential for success in the modern workforce and are increasingly emphasized in higher education.

5. **Immediate Feedback and Assessment**: Gamified systems often provide real-time feedback and assessment, allowing students to track their progress and identify areas for improvement. This immediate feedback loop can enhance self-regulation and promote a growth mindset.

Challenges and Limitations

Despite its potential benefits, gamification in higher education also presents several challenges and limitations:

1. **Implementation Complexity**: Designing and implementing gamified courses can be complex and time-consuming. It requires careful planning, creativity, and technical expertise to create effective and engaging game elements.

2. **Resource Constraints**: Developing gamified content and acquiring the necessary technology can be costly. Many institutions may face budgetary constraints that limit their ability to fully implement gamification.

3. **Resistance to Change**: Some educators and students may be resistant to the adoption of gamification due to unfamiliarity or skepticism about its effectiveness. Overcoming this resistance requires demonstrating the value and impact of gamified learning experiences.

4. **Risk of Superficial Engagement**: There is a risk that students may focus more on earning rewards and achieving high scores rather than truly engaging with the material. Ensuring that gamified elements align with meaningful learning objectives is crucial – and extremely hard - to avoid superficial engagement.

5. **Equity and Accessibility**: Ensuring that gamified learning experiences are accessible to all students, including those with disabilities, is a significant challenge. Gamified systems must be designed with inclusivity in mind to provide equitable learning opportunities.

Future Directions and Potential

The future of gamification in higher education holds significant potential for innovation and growth. As technology continues to evolve, new opportunities for gamified learning experiences will emerge. Several trends and developments can shape the future of gamification in higher education:

1. **Integration with Emerging Technologies**: The integration of gamification with emerging technologies such as virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) can create immersive and interactive learning environments. These technologies can boost the realism and engagement of gamified experiences.

2. **Data-Driven Personalization**: Advanced data analytics and AI can enable more sophisticated and personalized gamified learning experiences. By analyzing student data, educators can tailor content and challenges to individual needs and preferences.

3. **Expansion of Gamified Platforms**: The development of comprehensive gamified learning platforms can streamline the implementation process and provide educators with the tools and resources needed to create effective gamified courses. These platforms can offer a range of customizable game elements and analytics features.

4. **Research and Evidence-Based Practices**: Continued research on the impact of gamification in higher education can provide valuable insights and evidence-based practices. This research can inform the design and implementation of gamified learning experiences and address existing challenges and limitations.

5. **Collaborative Gamification**: The future may see an increase in collaborative gamification, where institutions and educators work together to develop shared gamified content and resources. This collaboration can reduce costs, enhance quality, and promote innovation.

Conclusion

Gamification in higher education presents a promising approach to enhancing student engagement, motivation, and learning outcomes. By incorporating game-design elements and principles, educators can create interactive and enjoyable learning experiences that cater to diverse student needs and preferences. While there are challenges and limitations to consider, the potential benefits of gamification make it a valuable tool in the pursuit of effective and innovative education. As technology continues to advance, the future of gamification in higher education holds exciting possibilities for transforming the learning experience and preparing students for success in the 21st century.

The adaptation and careful selection of the abovementioned techniques are necessary for the other levels of education.

Learning Approaches and Teaching Methods applied and recommended in REGINA project

Hands-on Learning: Industrial design for regenerative agriculture entails creating and implementing practical solutions for sustainable farming. Engaging students in hands-on learning experiences effectively teaches them how to apply design principles in real-world contexts. This can involve field trips to regenerative farms, internships with sustainable agriculture companies, and project-based learning activities.

Multidisciplinary Approach: Regenerative agriculture encompasses a variety of disciplines, including ecology, agronomy, soil science, and animal husbandry. Industrial design programs for regenerative agriculture should adopt a multidisciplinary approach, enabling students to grasp the complexities of sustainable agriculture and develop solutions that address multiple factors.

Design Thinking: Design thinking, a problem-solving method centred on empathy, experimentation, and iteration, is highly effective for teaching students how to design solutions for regenerative agriculture. This approach includes exercises to help students identify user needs, brainstorm potential solutions, and prototype and test their designs.

Collaboration: Collaboration is crucial in industrial design for regenerative agriculture. Students should be encouraged to work in teams to develop solutions that meet the needs of all stakeholders, including farmers, consumers, and the environment. This can be facilitated through group projects, peer reviews, and presentations.

Sustainability and Ethics: Sustainability and ethics are fundamental to regenerative agriculture. Industrial design programs should educate students on the principles of sustainability, such as reducing waste and using renewable resources. Additionally, students should learn about the ethical considerations in designing sustainable agriculture solutions, including animal welfare and social justice.

The following teaching methods (face-to-face work, cooperative group work, project work) are the most effective ways of presenting the opportunities offered by RA, which are best suited to transfer academic and practical knowledge, combining traditional and modern teaching approaches.

Frontal work involves students learning the same content under the direct guidance of the teacher, through lectures, explanations, discussions and demonstrations. These methods assume that the students are able to learn the content outlined in the given system because they have almost identical prior knowledge. The work of highly qualified lecturers results in the reorganisation of students' prior knowledge and the anchoring of new skills. The method is most successful when the instructor's personality is inspiring and motivating for the students. This method of teaching is most effective when covering large chunks of material.

In **cooperative group work** (2-4-6 students), students work together to learn and are responsible not only for their own progress but also that of their peers. The success of the group depends equally on the individual work of each student. During their activity, groups can collect rewards of different "values", such as (in order of increasing value) a corncob, a tractor, a combine harvester, or a wood plough, a basic plough, a reversible plough. This method is an excellent way to experience cooperation, competition and the development of related skills. The transparent display of the rewards to be collected increases the competitive spirit (e.g. in the implementation of the rally method).

The method of **competition** between groups of students can be implemented in the following steps:

- first, the material to be learned is worked through in a frontal approach (lecture, explanation),
- then a competition or competition among the groups.

Another possible teaching method to transfer the RA knowledge is the **jigsaw puzzle**. In a jigsaw puzzle, the available pieces must be put together to form a whole, meeting the requirements of the game. Each piece carries information on its own (pictures, diagrams, text), but its full meaning is revealed when it is put together with the other pieces.

This method can be used for tasks where the focus is on learning new skills. To achieve this, a considerable amount of source material must be processed, and it is particularly important to select the members of the group in such a way that they are able to solve the tasks assigned to them.

One way to achieve this is by having students conduct independent literary research on the following topics:

- organic matter in soil,
- humic substances,
- consumption of organic matter,
- organic matter in the soil, humus in the soil, organic matter loss, organic matter accumulation,
- humic acids,
- fulvic acids.

By applying and combining these elements of information, students will be able to gain an overview of soil organic matter management and, on this basis, to produce a comprehensive body of material and knowledge.

Project work is a distinct form of collaborative group work where students' communication skills are crucial, while simultaneously, this mode of working enhances those very skills. The project method grants students freedom of choice and fosters a sense of responsibility. Students collaborate in heterogeneous groups of 3-5 individuals, planning the work steps, selecting methods, distributing tasks, and defining each member's responsibilities. Upon completing their independent work, they synthesize and integrate the results. Students must also be prepared to present their findings, which could take the form of a presentation, an interview with farmers, a case study, the development of cultivation techniques for various crops in regenerative agriculture, written materials with photos, or video content.

Afterward, the completed work is evaluated based on various factors, such as:

- The characteristics of the course material,
- The time available,
- The teacher's personality,
- The teacher's methodological approach,
- The material conditions.

Types of assessment recommended in the RA course in the REGINA project

Evaluation in higher education is a critical component of the educational process, serving as a key mechanism through which student learning, instructional effectiveness, and academic progress are assessed. The methods used for evaluation are diverse and multifaceted, reflecting the complexity and varying objectives of higher education institutions. In this section we explore the primary evaluation methods used in higher education, including traditional assessments, alternative assessments, formative and summative assessments, and the growing trend towards holistic and authentic assessments.

Traditional Assessment Methods, such as examinations and quizzes, have long been a staple in higher education. These methods typically involve written tests that assess a student's knowledge and understanding of course material. Examinations can be categorized into several types: multiple-choice questions (MCQs), short-answer questions, and essay-based exams.

Multiple-Choice Questions (MCQs) are a common method due to their efficiency in grading and their ability to cover a broad range of content. They are particularly useful for assessing lower-order cognitive skills, such as recall and comprehension. However, MCQs are often criticized for not adequately assessing higher-order thinking skills, such as analysis and synthesis.

Essay-Based Exams require students to articulate their thoughts in a more extended format, allowing for a deeper assessment of their critical thinking, argumentation, and writing skills. Essays can reveal the depth of a student's understanding and their ability to synthesize information from various sources. However, they are time-consuming to grade and can be subjective.

Short-Answer Questions bridge the gap between MCQs and essays, allowing for more detailed responses while still being more manageable to grade than essays. These questions can assess a range of cognitive skills and provide insight into a student’s understanding without the extensive writing required by essays.

Alternative Assessment Methods

In recent years, there has been a shift towards alternative assessment methods that move beyond traditional exams and quizzes. These methods aim to provide a more comprehensive evaluation of a student's abilities and learning process, for example:

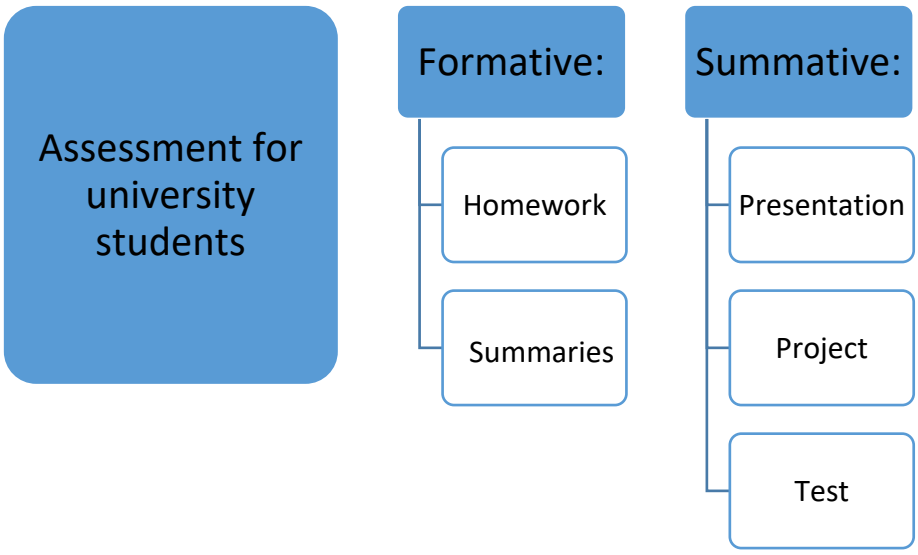
Project-Based Assessments involve students working on complex tasks over an extended period, culminating in a final product such as a report, presentation, or prototype. These assessments encourage the application of knowledge to real-world problems and promote skills such as research, collaboration, and problem-solving. Projects are often interdisciplinary, integrating knowledge from various fields.

Portfolios are collections of student work that demonstrate progress and achievement over time. They can include a variety of materials, such as essays, projects, lab reports, and reflections. Portfolios provide a holistic view of a student's abilities and development and encourage self-assessment and reflection. They are particularly useful in fields that require a demonstration of skills and creativity, such as the arts and education, however, due to the complexity of RA, they can boldly be used in this field as well.

Peer Assessment involves students evaluating each other's work. This method can enhance learning by engaging students in the assessment process and exposing them to different perspectives. It also helps develop critical thinking and evaluative skills. However, peer assessment requires clear criteria and training to ensure fairness and accuracy.

Self-Assessment encourages students to evaluate their own work and learning processes. This method promotes self-regulation, metacognition, and a deeper understanding of personal strengths and weaknesses. While self-assessment can be highly beneficial, it also requires students to be honest and objective, which can be challenging.

Formative and Summative Assessments



Evaluation methods can also be categorized based on their purpose and timing: formative and summative assessments.

Formative Assessments are conducted during the learning process, providing ongoing feedback to both students and instructors. The primary goal is to monitor student learning and provide feedback that can be used to improve teaching and learning and to deepen knowledge. Formative assessments can take a large number of forms, including quizzes, drafts, peer reviews, and in-class activities. They are generally low-stakes and aim to identify areas where students are struggling and need additional support.

Summative Assessments occur at the end of a learning period, such as the end of a course or semester, and aim to evaluate student learning against predefined standards. These assessments are typically high-stakes and include final exams, oral or written exams, end-of-term projects, presentation (PPT, interviews, case study, film, etc.) and standardized tests. Summative assessments are used to determine grades and make decisions about progression and certification. In the RA course in the REGINA project we applied numerical assessment on a five-point scale.

Holistic and Authentic Assessments

There is a growing tendency towards holistic and authentic assessments that aim to evaluate students in a more comprehensive and realistic manner.

Holistic Assessment considers the whole student and their overall development rather than focusing solely on academic achievement. This approach integrates cognitive, emotional, and social aspects of learning. Methods include reflective journals, self-assessments, and peer assessments, all of which contribute to a more rounded understanding of a student's capabilities.

Authentic Assessment involves tasks that reflect real-world challenges and require students to apply their knowledge and skills in practical, meaningful contexts. Examples include internships, service-learning projects, and simulations. Authentic assessments are designed to be more engaging and relevant to students' future careers, helping to bridge the gap between academic learning and professional practice.

Challenges and Considerations

Despite the advancements and diversification of assessment methods, several challenges persist in higher education evaluation.

Fairness and Equity are paramount concerns. Assessments must be designed to be fair and equitable, providing all students with an equal opportunity to demonstrate their abilities. This includes considering diverse learning styles, backgrounds, and potential biases in the design and grading of assessments.

Reliability and Validity are also critical. Assessments must consistently measure what they are intended to measure (reliability) and accurately reflect the students' knowledge and skills (validity). Developing reliable and valid assessments requires careful planning, clear criteria, and regular review and refinement.

Student Engagement and Motivation are influenced by assessment methods. Engaging and meaningful assessments can motivate students to invest more effort and take ownership of their learning. Conversely, assessments perceived as irrelevant or unfair can demotivate students and undermine the learning process.

Resource and Time Constraints pose practical challenges. While innovative assessment methods like project-based learning and portfolios can provide rich insights into student learning, they often require significant time and resources to implement and assess. Balancing the benefits of these methods with practical constraints is a common challenge for educators.

Technological Integration is increasingly relevant in the modern educational landscape. The use of digital tools and platforms for assessments can enhance efficiency, provide new opportunities for interactive and adaptive assessments, and facilitate the collection and analysis of assessment data. However, it also requires investment in technology and training for both students and instructors.

Conclusion

Evaluation methods in higher education are evolving to meet the changing needs of students and society. While traditional methods like examinations and quizzes remain prevalent, there is a growing emphasis on alternative, formative, and authentic assessments that provide a more comprehensive and meaningful evaluation of student learning. These methods aim to not only assess academic achievement but also promote critical thinking, creativity, and real-world application of knowledge and skills.

The ongoing challenge for educators and institutions is to design and implement assessment methods that are fair, reliable, valid, engaging, and feasible within the constraints of time and resources. As higher education continues to evolve, so too must the methods used to evaluate student learning, ensuring that they support the development of well-rounded, competent, and adaptable graduates ready to meet the demands of the future.

How to implement project work in your course?

Types of exercises to improve teaching RA and make learning more engaging at each level:

Project Work

Part I - Getting Acquainted and Warming Up

a) Four Corners Method: This technique allows instructors to assess students' prior knowledge. It identifies which students have similar levels of understanding and interests. We pose four responses to a new topic, categorized numerically:

• I have never heard of it.

• I have heard of it but lack relevant knowledge.

• I have studied it but am not particularly engaged.

• I have learned about it and am interested.

These questions are displayed on A4 moderation cards placed at four points or corners of the room. Students group themselves according to their answers, providing the trainer with valuable insights into the audience's knowledge and interest levels regarding the topic. These groups can serve as a foundation for future collaborative activities.

b) Group Mirror Technique: Facilitating Student Introductions (Group Exercise)

The objective of this method is to help students become acquainted with one another and identify potential common interests, thereby easing initial interactions. This technique is particularly effective before starting collaborative work. A table with specific questions for each group member is prepared, and students fill in their answers. Upon reviewing the completed group mirror, students are encouraged to identify 3-4 peers with whom they share common traits, interests, or experiences. These shared attributes can then be used to form groups for subsequent collaborative activities.

c) Passport Method: Facilitating Student Introductions (Pair work)

The objective of this method is to help students get to know each other through paired interactions. Randomly selected pairs (e.g., using the string method) engage in short, informal conversations. Each student then introduces their partner to the rest of the group. The instructor may give participants the freedom to guide their introductions or ask specific questions, such

as "What kind of music do you like?" or "What is your favourite colour?" Similar to the group mirror method, this technique is particularly effective when used before commencing collaborative work.

II. Orientation, setting goals and ideas

a) Now - Then - Later: Setting Goals and Brainstorming

This method helps students identify and organize the elements and steps of a planned project in chronological order and by difficulty level. The goal is to clarify the next steps and tasks, motivate the group to initiate action, organize ideas, draft the project's initial outline, and assist with further planning.

Using the now-then-later method, students work in small groups to write their project ideas on moderation cards, one by one. Each group arranges the cards on a prepared now-then-later table. If a group finds an idea unfeasible, it is set aside but not discarded, allowing for future discussion. After a group discussion, the arrangement of the cards can be adjusted if necessary. Finally, the groups place the revised moderation cards in their final positions, completing the project plan.

The following points are to be discussed by the groups, with the someone designated to take minutes:

- When is the next project meeting?
- Who is actively involved in the project?
- What tasks need to be completed before the next meeting?
- Who will do what, with what deadline?

b) Group Idea-Mix: Brainstorming, Decision-Making, and Problem-Solving

This method is ideal for tackling complex topics or generating ideas to solve intricate problems. It also serves as a tool to evaluate students' knowledge at both the introduction and conclusion of a topic. Essentially, it involves individual written brainstorming, where students generate ideas in response to 3-4 starter questions during individual work sessions.

All standard brainstorming rules apply: there are no bad ideas, every idea can be valuable, and the more ideas a student collects, the better. Students should not overly censor their thoughts. Once the brainstorming session is complete, the papers are stacked neatly, folded, and organized into piles, one for each guiding question.

Next, form groups corresponding to the number of piles. Students choose which question they would like to work on, evaluate the collected ideas, and then present their findings to the rest of the class.

III. Cooperation, Project Design

Work Plan Poster: Planning and Decision-Making

The work plan technique enables groups to outline the progression of a project, detailing the steps, deadlines, and responsibilities of each member. This method fosters a sense of collective responsibility among students, emphasizing that the project's success relies on their individual contributions and specific tasks. For teachers, it provides a clear overview of group activities, member roles, and the status of the work process.

The work plan poster also serves as a tool to monitor progress, check which tasks have been completed, and manage remaining time. This allows groups to reallocate efforts if someone falls behind. At the project's conclusion, students can quickly review to ensure all tasks are completed. Students fill in the work plan poster during the project planning phase, giving the teacher an ongoing view of the group's activities, roles, and workflow status.

IV. Problem Solving and Knowledge Acquisition

a) Case Study: Problem Solving and Knowledge Acquisition

The aim of this method is to foster problem-solving skills and analytical knowledge through the analysis of specific cases and related documents. Case studies are pivotal for hands-on, task-focused learning that closely mirrors real-world scenarios. Students engage in a detailed study of events and situations in a simplified and focused manner, aiming to derive general insights from specific instances while mastering key concepts.

Students are introduced to a specific case and provided with necessary information to deepen their understanding. They analyse the case from multiple perspectives—both as participants and external observers—using guided questions to aid their exploration. In cases involving multiple stakeholders, groups may focus on analysing the perspective of different actors involved.

b) Presentation: Synthesis

Presentations are conducted following independent work in pairs or groups. Students utilize various tools to communicate the results of their work, sharing specific knowledge they have acquired with others. The assignment may specify how students present their work; however, groups familiar with multiple methods are encouraged to choose the presentation tool that best aligns with their preferences and effectively conveys their message.

V. Evaluation

Mind Map: Repetition and Assessment

A mind map is a method used to organize and visually represent topics and ideas, making it effective for synthesizing information from new material, such as a text, and for reviewing and organizing information. It can also visualize group findings and facilitate communication, functioning as an "idea pool" where learners can express, compare, and modify their ideas.

This structured approach illustrates the connections between ideas and sub-themes related to a given subject. Mind maps can be created individually, in pairs, or in small groups, and then displayed or shared. They are also useful for pre-structuring internet searches, enabling students to identify topics and keywords for more focused online research, enhancing productivity during computer-based work.

VI. Feedback

Competency Cross: Assessment and Feedback

The competency cross method aims to enhance students' self-awareness by helping them identify their strengths, weaknesses, preferences, and areas for improvement. This approach encourages students to reflect on what they excel at, areas they struggle with, and activities they find engaging or challenging, thereby bolstering their motivation.

Students assess their competencies within the subject or field, evaluating how effectively they apply learning techniques and acquire skills. They categorize each competence on a coordinate system. Following individual assessment, students pair up to compare their learning profiles. They discuss why certain competencies are placed where they are and provide each other with tips on enhancing skills and techniques, as well as strategies to cultivate interest in less preferred activities.

Analysing competency checklists yields valuable insights into students' goals, aspirations, learning habits, and characteristics, which informs the planning of teaching and learning processes. Understanding students' prior knowledge and learning styles in relation to a subject significantly influences the effectiveness of their learning experiences.

How to deliver information at secondary and tertiary levels of education and to adult learners?

Face-to-face	Hybrid	Full online
University students	University students	University students
Secondary school students	Secondary school students	
Farmers, other adults	Farmers, other adults	

The REGINA course can primarily be implemented using the three delivery methods listed above. Given the subject's nature and discipline, a fully online solution is deemed the least practical due to the emphasis on practical knowledge. The hybrid method proves to be the optimal choice, integrating online learning while still providing face-to-face teaching to offer students the best practical experience. Some knowledge can still be effectively acquired online.

For secondary school students, both face-to-face and hybrid solutions are recommended. For farmers in Hungary, however, face-to-face teaching alone appears to be the most beneficial and practical option. Partners may choose other approaches based on local specifics and needs.

For farmers and other adult learners, face-to-face teaching appears to be a greatly beneficial option, although hybrid learning is also recommended as a practical solution, because such learning saves time to the trainees, as they do not have the additional burden of transportation to the training venue. The organisers of adult learning should decide about the proper mix of face-to-face and online learning, depending on the profile of the trainees attending the course and their professional obligations and time constraints.

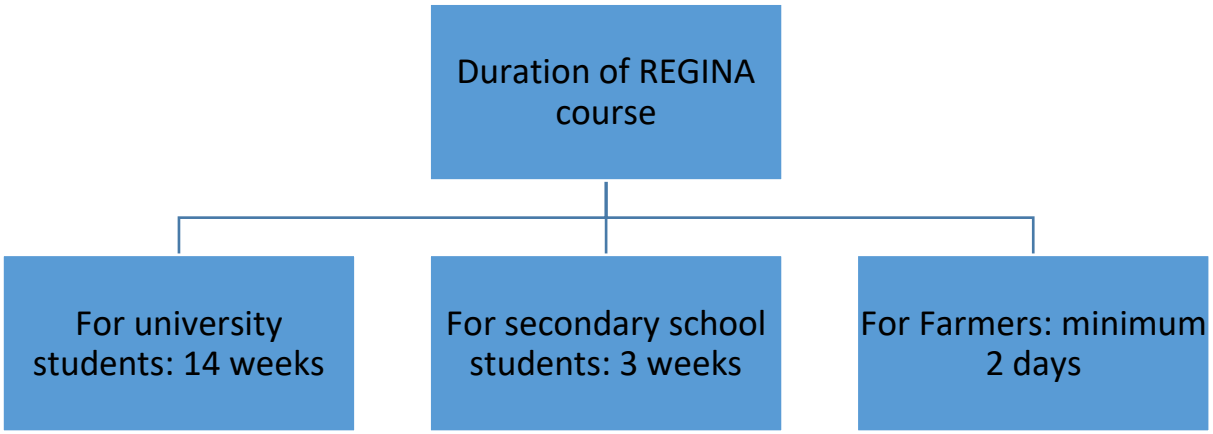
Number of students:

The number of university students participating in the training may vary depending on the capacity of the institution providing the training. In Hungary, group sizes typically range from 5 to 15 students per group.

In secondary schools, the entire class can benefit from the training, although teachers have the discretion to include specific groups of students (such as those interested or involved in talent management) in the course.

For farmers and other adult learners, the number of trainees will depend on local interest, but it is not recommended to exceed 15 participants in face-to-face encounters, so that constructive discussion and exchange of experience can be achieved. This number can be increased if hybrid learning is applied, although it is not recommended to involve more than 25 participants in total, to allow personal engagement of each of them.

Duration of the REGINA course:



For university students, the course spans one semester, typically lasting an average of 14 weeks with 1 to 2 hours per week, inclusive of assessment time.

In secondary schools, a shorter course format may be preferable, such as a 3-week period structured as follows: during the first week, students learn relevant material within a subject framework, covering 1-4 lessons chosen by the teacher. In the second week, they participate in a field trip and receive an independent task, such as creating a PowerPoint presentation about a farm. In the third week, students prepare and present their independent work, which is assessed by the teacher. This section can be adjusted based on input from participating schools.

For farmers and other adults, shorter events are suitable, spanning over a period of 2 days, totalling a minimum of 8 hours of seminar work, including practical work that can be allocated to trainees during the course time. The training material is organised in two modules, each of them consisting of two 2-hourly lessons: the first is devoted to an introduction to regenerative agriculture, addressing the historical context and evolution of regenerative farming, current regenerative agriculture principles and key practices, expected benefits from the implementation of regenerative practices, and an introduction to certification; while the second is devoted to more technical issues, such as soil health, fertilization and biofertilizers; biodiversity conservation and enhancement; and the integrated management of wildlife habitats, pest and weed, water, crop and livestock. The trainer may decide to shorten the duration of the delivered lessons and /or expand the delivery over a longer period of time.

The Characteristics of the Applied Teaching Methods, Techniques and Activities in the REGINA programme

a) Recommended class formats at each level of education:

	Higher Education	Secondary Education	Adult Education
Lectures	☺☺☺	☺☺☺	☺
Seminars/Practicum	☺☺☺	☺☺☺	☺☺☺
Field trips	☺☺☺	☺☺☺	☺☺☺
Guided discussions	☺☺☺	☺	☺☺
Problem-based learning	☺☺☺	☺☺☺	☺☺☺
Project-based learning	☺☺☺	☺	-

b) Characteristics of the recommended class types:

Lectures: Delivered through frontal teaching with comprehensive explanations, where students attentively listen and diligently take notes.

Seminars: Small group sessions focusing on the analysis of practical challenges, involving independent research and tasks assigned to enhance student engagement.

Field trips: Educational excursions to farms featured in PR1 interviews. These trips offer students first-hand exposure to the practical application of RA (Regenerative Agriculture). By interacting with farmers and posing thoughtful questions, students deepen their understanding, which is integral to their project assignments.

Directed discussion. Structured debates centred around key questions in RA. Students articulate arguments and evaluate the merits and drawbacks of both conventional and regenerative agricultural practices.

Problem-based learning: Collaborative problem-solving sessions where students apply their knowledge acquired during field trips and other learning activities to resolve specified challenges.

Project-based learning: Independent project work where students apply previously acquired knowledge to solve assigned tasks. They present their findings, often utilizing formats such as PowerPoint presentations (PPT), to share insights with their peers.

The application of the methods and techniques in the modules of REGINA:

The major units of each module are introduced via **frontal teaching**. PowerPoint presentations and videos are the most commonly used techniques for the introduction of the course material. After covering the major units, the cooperative methods can be applied.

Adjusted to the university timetable, the duration of a lecture is 45 minutes or a multiple of this.

The literature recommended by the lecturer helps the students process the material introduced during the frontal teaching.

Example:

- ***Module 2***
- ***Agronomic aspects of RA***
- ***Soil health and management***

Frontal teaching During the lecture, the lecturer explains the possible positive and negative effects of soil tillage operations on the various physical, chemical and biological processes in the soil.

He/She describes the errors in cultivation and the techniques how to avoid them.

He/She presents the most important aspects of managing soil organic matter. He/She defines the building and decomposition processes in the soil and the relationship between organic matter content and tillage.

(The actual material covered may vary depending on the length of the lecture and may be split into several blocks.)

Co-operative group work: Reaching this part of the lecture, the teacher has several options how to engage students in the process of learning. It is advisable to divide the students into smaller units, forming small groups of 2-4-6 students. Co-operative group work is mainly used during seminars, tutorials or when the total number of students in the group is less than 20. In relation to the topic outlined above, the following options are possible:

Jigsaw puzzle: First, the teacher selects a topic (e.g.: errors in cultivation, organic matter management, soil conservation, soil water management) and prepares a diagram in advance, then a cut-up version of the diagram is given to the group(s) (optionally, the version given out

may include blanks which the students have to fill in with the information having been presented by the lecturer).

The group/s' task is to compile the diagram together based on their prior knowledge. After each puzzle has been successfully completed, the groups can move on to the next task.

Using the puzzles as a starting point, the following cooperative technique can be a viable method to **complete the project task**.

The completion requires the application of what the students have previously learned in theory and what they have experienced, for example during their field trips.

Their task is to prepare a presentation on a topic or problem. The group members allocate the tasks amongst themselves, mutually agreeing which group member is responsible for which subtask and outline the tasks to be done using a **now-then-later chart** or **group brainstorming**.

The ideas are discussed with the help of the teacher, making team orientation and *formative assessment* possible.

The next stage of implementation is **preparing for and giving a presentation** in which the student groups outline the actual problem and the solution/solutions they suggest.

At the end of the presentation, they ask questions from their peers in relation to the topic.

Applying a technique commonly used in **gamification**, groups can earn various "rewards" by presenting the milestones during the task, and the number of these rewards will shape the mark the group can achieve at the final evaluation.

Regarding **evaluation**, students may also self-evaluate their own performance within the group and/or be involved in the evaluation of the other groups.

Application of Digital Tools: the REGINA Platform

The Moodle LMS is a popular, free, open-source, easy-to-develop learning support tool that is used worldwide. The largest number of registered Moodle servers is in the USA (12.826), and within Europe in Germany (10.083). In Hungary, there are 748 sites (559 private), of which 24 servers are associated with Higher Education Institutions. In addition to universities, many conferences, other educational institutions, secondary schools, and business enterprises are also interested in using MLMS.[1]. Moodle is well-suited for both face-to-face and distance learning, and MOOCs in MLMS (paid, certificate courses) are becoming increasingly common in Higher Education.

The 24/7 availability of these courses offers maximum flexibility timewise for learning and is well suited for adults, working learners, and also suited for full-time and distance learners in Higher Education. There is usually more than one thread of electronic communication between the university and the students, who simultaneously read e-materials and communicate with their fellow students, e.g. over the phone or via email, chat (Clark, 2020).

The University of Győr has been working on making education more efficient for almost 20 years, applying learning management systems. The LMS system that has been chosen is Moodle3, which is hosted on the own university servers under the name SzeLearning (www.szelearning.hu).

In addition to the educational materials provided, courses and other resources for projects are also available. For this reason, Moodle was selected for the Regina Platform due to prior experience in this area.

A site has been created for the Regina Platform in alignment with the project's identity. Participants can be managed with the following authorization levels: • Administrator: responsible for managing the site, with full administrative rights

- Teacher: serves as vice administrator, with permissions to create, modify, upload courses, and manage users
- Content Developer: permitted to create, modify, and upload courses
- Student/Farmer: guest or registered user
- Guest

As is customary in Moodle, courses can be offered entirely free of charge, allowing guests and registered users to access courses without a login key, enabling free attendance.

The learning materials of the Regina Platform are divided into the following sections:

[1] https://stats.moodle.org/

Week	Course Description (90 min lecture)	No. Of Module
1	Definition of RA, Social and economic aspects of RA	1
2	No lecture	
3	Rethinking the soil management through RA	2
4	No lecture	
5	Integrated technologies in RA: biosystems engineering including soil metagenomics and bioinformatics, precision agriculture, IoT	2
6	No lecture	
7	Sustainable water management	3
8	No lecture	
9	Reduction of GHG emissions	3
10	No lecture	
11	Cereal cultivation	4
12	No lecture	
13	Horticultural crops	4
14	No lecture	

Week	Course Description (90 min seminar)	No. Of Module
1	Definition of RA	1
2	The holistic approach: agricultural, social, economic, and ecological approach	1
3	Soil health and management	2
4	Integrated technology	2
5	Crop selection and management	2
6	Sustainable water management	3
7	Biodiversity enhancement	3
8	Reduction of GHG emissions	3
9	Rural development aspects	3
10	Industrial crops	4
11	Livestock management	4
12	Agroforestry	4

No. of Field Trip	Course Description 8x45 min field trip 1	No. of Field Trip	Course Description 8x45 min field trip 2
1	Good practices - farm visit	2	Good practices - farm visit

Participants and farmers from different countries will have the opportunity to display content according to their own interests and country. Users can be classified according to previously created groups. After the grouping, the contents can be enabled by roles/groups to access:

The Regina-Moodle course is available on the SzeLearning main page: Regina Erasmus+ Platform (2021-1-HU01-KA220-HED-000027629)

Or directly on this link: https://szelearning.sze.hu/course/view.php?id=13672

The Platform starts with a short introduction to the REGINA course, on its main topics, and the structure of Modules and Topics.

If at any point, users (learners or educators) encounter any technical difficulties, they are free to use the 'Regina Platform Technical Forum'. Posting a question at the forum is very easy. You just need to click on the forum, then select 'add a new discussion topic', enter your subject and message, and then click on 'Post to forum'. The technical forum is supervised by the Széchenyi István University, so do not hesitate to contact them in case of any technical problems or questions. The forum and its content is visible to all participants of the platform, therefore you might also find your answers there (without needing to post a new discussion topic).

Module contents are displayed in a drop-down menu. By selecting the requested Module, the menu will open, and you will see the content right away. When opening the requested Module, first, you will see a short description on the content and topic, as well as the course goals. Then, you will find the actual learning materials categorized in specific Topics. (The number of Topics is different per Modules, also suggesting the depth of the materials.)

All of the Topics starts with a PPT (Power Point Presentation). This gives you an overview of the lesson, and you can use this PPT to download and follow the lesson, make notes or print ahead (in case of an in-class activity). In order to view the PPT, simply click on the content.

All of the Modules contain a short video ('teaser'), which gives you the opportunity to quickly review the content of the Module, while Module 1 also contains video lessons. (cca 15 minutes videos according to the PPT file). All videos are in English, with English subtitles. In order to watch the video, simply click on the 'Play' button, while in the bottom right corner, you can also enlarge the video to full screen.

For all of the Topics, you will also find a file named 'Lesson'. This file contains the explanatory text of the given Topic, that can be used as a self-learning tool, by underlining the most important remarks. In order to open the Lesson, simply click on it.

After finishing with the learning content of the Topic, you will find 2 tools for discussion and evaluation. For reviewing the main points of the lesson, you can use the open questions (in-class activity or individual learners). In order to open the list of discussion questions, simply click on it.

At the end of the Topics, you will also find a short multiple choice quiz. This will help learners to self-evaluate their gained knowledge, by giving automatic feedback on their correct answers. It is advised to only take the test, once the learner has reviewed the previous steps, and in case of a good evaluation, they are ready to move on to the next Topic. (Nevertheless, learners can try to take the tests any time, as they like. The grading method applies the highest grade.) In order to start the Quiz, simply click on it, and on the next page, select 'Attempt quiz now'. When the quiz started, answer the questions by selecting the correct answer to each of the questions that appear on the page. When you are ready, click on 'Finish attempt' at the bottom of the page, confirm the request by 'Submit all and finish', and then you will see your results. For each of the question, you will find a short feedback, whether your answer was correct or

not. After finishing the review, you can select to re-attempt the quiz, or you can navigate back to the course.

At the end of each Module, you will also find further materials for Educators & Teachers. In this session, you will find further supporting materials for teachers, including a detailed (downloadable) lesson plan for your in-class activities. These lesson plans include fully guided 90-minutes lessons, with gamification activities, content, objectives and applied methods. Apart from the lesson plans, further materials are also provided here (like national reports of Regenerative Agriculture overview, success stories and case studies).

Implementation of the REGINA Methodology & Course

Module 1: Regenerative Agriculture Orientation	
Topics	Historical context, Definition of RA, The holistic approach: agricultural, social, economic, and ecological approach The first step to be completed in the module is to describe, define and place RA in the system of agricultural production through the introductory topics listed. Apart from highlighting the importance and impact of RA in the different areas concerned, this module is also used to arouse the interest of the students and to explain the importance of the topic. The interpretation and detailed explanation of the concept of RA defined in the project is carried out in this introductory module. The knowledge acquired here is used by the students elaborating the topic and to examine the different areas of agricultural production in the light of the principles acquired here.
Outcome	Having acquired the material covered in the module, students will be able to recognise the differences between the conventional and the regenerative approach. They will learn the principles of RA. They will be able to recognise the potentials and limitations of RA.
Activities	The teacher will use PowerPoint and/or video presentations to introduce the principles, definition, social and economic aspects of RA to the students and outline the potential ecological impacts. The students will use the basic knowledge acquired to create a knowledge map. During group work, they will create their questions they want to ask from the practitioners actually working in RA, thus extending their knowledge map with the elements of practical applicability. As a result of the group work, a questionnaire or a set of questions will be created, which can also form the basis for an interview. The questionnaire will then be filled in by the farmers or decision-makers visited during the field visits. As an extra activity, interviews may be carried out on the basis of the set of questions they have come up with. The answers given to the questions will be used to complete their knowledge map. The knowledge maps are presented and discussed by the groups.

	The teacher uses the means of a guided discussion/debate to point out any essential elements missed out and the students may incorporate these elements into their work. The result will be a knowledge map in the form of a poster, which summarises the students' knowledge and provides a good basis for understanding the topics covered in detail in the subsequent modules.
Duration	The completion of the module takes 2 weeks.
Assessment	Each topic will end with a maximum 10-question quiz to be completed by the students by the end of the module. The completed knowledge map posters will be assessed at group level.

Module 2: Agronomic aspects of Regenerative Agriculture	
Topics	Main topics of the module: Soil health and management, Crop selection and management, Integrated pest management, Integrated weed management, Integrated technology. In this chapter, the students of the REGINA course will learn about the impact of RA on soil, the crop production technologies applicable for RA, and the crop protection options that can be applied in RA. In the context of soil health, students will learn about soil structure, soil degradation and ways to prevent structural degradation. The issue of soil organic matter management and an overview of soil nutrient supply capacity are topics closely related to these ones. The changes of the organic matter content cause changes in the water, air, heat and nutrient management of the soil. Therefore, these processes should also be examined. On the one hand, all the aforesaid have an impact on the quality of soil tillage, and on the other hand, the tillage itself influences these processes. Discovering these interrelated connections, the students will gain a better understanding of this complex system. We will discuss the aspects of crop structure composition that should be considered in regenerative farming. We will analyse the cultivation technology of different arable crops, with the help of which we will reveal the main aspects causing problems or be well adaptable to regenerative farming. The main steps of how to control pathogens, pests and weeds will be outlined and traditional methods will be compared with solutions supported by Regenerative Agriculture. Particular attention will be paid to field crops that require more attention. The advantages and disadvantages of integrated systems will be discussed along with the adaptability of different technological elements. A critical evaluation of the opportunities and barriers of conventional and regenerative farming will also be included in the module.
Outcome	Having completed the module, students will be able to evaluate the main elements of soil fertility with appropriate weight. They will have the required knowledge on the principles of conservation tillage. They will understand the soil-plant system and be able to evaluate the impact of different crops on the soil and the environment through their cultivation techniques. They are aware of the concept of integrated systems and are able to manage crop production as a whole. They will have the required knowledge on the different types of crop protection and can distinguish intensive, extensive and integrated systems.
Activities	The teacher will introduce the topics of the module to the students over the course of the lectures using PowerPoint and/or video presentations.

	Since RA has already been defined in the first module, the discussion method - as a complementary means to frontal teaching - can also be used. The instructor will use guided, thought-provoking questions to encourage students to form opinions. This method can also be used to introduce elements not yet covered during the frontal teaching, or to revise what has already been mentioned and start to deepen their knowledge. Similarly to the other modules, the students' involvement in the learning process through group work in order to achieve a more detailed mastery of the topics is also recommended. It is advisable to form as many groups as many major topics were covered in the theoretical sessions and to build the project tasks around these. Although choosing some of the topics and focusing on their detailed elaboration later is also viable. The number of students and the preferences of the teacher are the factors that will determine which of the two methods should be applied in the actual teaching environment. The student groups are given a problem (e.g. poor water management due to structural degradation of soil), the outline of which has already been discussed during the frontal teaching. The groups will look for and develop solutions to this particular problem. In their proposals they are expected to apply the RA guidelines. In their presentation of the projects, the students are required to apply a style as attractive and informative as possible, but sleek at the same time. At the end of the presentation of each project, the groups will ask questions from the other students to get feedback on their understanding of what has been perceived from the presentation. Throughout the development of the project assignment, the continuous consultation between the student groups and the instructor is assured, over the course of which the students also present their progress.
Duration	The completion of the module takes about 3 weeks.
Assessment	The main topics will end with a maximum 10-question quiz to be completed by the students by the end of the module. The finished projects will be evaluated by the teacher on the basis of the extent to which the answer/solution to the problem given in advance matches the RA guidelines. The students may also be involved in the evaluation, for example if the teacher organises a competition between the groups.

Module 3: Sustainability Concepts of Regenerative Agriculture	
Topics	Main topics of the module: Sustainable water management, Biodiversity enhancement, Reduction of GHG emissions, Rural development aspects. In the first two modules, the students have learned the fundamentals of RA and had an insight into the relationship between soil and crop management. In this module, knowledge considered to be more specific is imparted. Water management is one of the most important pillars of agricultural production, as water supply disruptions fundamentally change the potentials for agricultural production. To store sufficient water in the soil, it is essential to improve water retention and reduce water loss. As far as possible, efforts should also be made - even in large-scale production - to increase biodiversity, or at least not to reduce it even further. It is important from many aspects, let's just think about pollinating insects. Another big question is reducing greenhouse gas emissions. From the point of view of arable crops, reducing CO2 seems to be the most important viewpoint. Due to the fact that C in crop residues is easily converted into carbon dioxide during aerobic decomposition and released into the atmosphere it is converted into GHG, this phenomenon is also a major carbon loss for the soil, which negatively affects its fertility. Concerning rural development, it should be noted that without agriculture it is an activity difficult to be interpreted, and therefore it is closely connected. Moreover, most of the times there is a higher demand for live-labour in RA, so it can also be of interest in terms of creating jobs.
Outcome	By completing this module, the students will acquire the knowledge required for soil water management and the range of activities having an influence on it. The students will be able to design a tillage system and crop structure that will have a positive impact on soil water management and will contribute to optimal water use. The students will learn about the impact of greenhouse gases on the climate. They will know the role of agricultural production in GHG emissions. Students will understand the relationship between rural development and agriculture, with a special focus on Regenerative Agriculture.
Activities	The teacher will introduce the topics of the module to the students over the course of the lectures using PowerPoint and/or video presentations.

	The involvement of students in the learning process may be achieved by the teacher assigning them a literature research task related to the topics. It is also useful to form small groups of students for this task. As for the literature research, it is advisable to give the groups a larger topic (e.g. soil water management) and to divide the given large topic into smaller parts as a first step. Dividing the topic, the students present it to the teacher. If necessary, the tutor refines and improves the division of the topic made by the students. The next step in the learning process is to find the necessary literature, which also needs to be discussed with the teacher in order to eliminate the irrelevant literature. Next, the students are asked to process the remaining sources of literature. Writing an essay is the most obvious form of processing literature.
Duration	The completion of the module takes about 4 weeks.
Assessment	The main topics will end with a maximum 10-question quiz to be completed by the students by the end of the module. The essay submitted will play the most pronounced part in the evaluation. The students will upload their essays into Moodle's REGINA platform and the teacher will evaluate them.

Module 4: Insights on specific crops and livestock	
Topics	The main topics of the module: Cereal cultivation, Industrial crops, Horticultural crops, Grassland management, Agroforestry, Livestock management. In this module, students will gain an insight into how the cultivation technology of different crops can be adapted with a regenerative approach. The module will cover the technological and crop protection issues involved in the production of the most important cereals, industrial crops and horticultural crops. The module will also address the question of grassland management, particularly regarding extensive technologies, which have a major role to play in enhancing biodiversity and are closely linked to livestock production, markedly, to cattle and sheep farming. The module also covers the fundamentals of forestry and afforestation.
Outcome	After completing the module, students will be able to integrate the RA approach into the cultivation technology of the most important cereal, industrial and horticultural crops. Students will be able to apply the guidelines and knowledge presented in the sessions. They will be able to apply a regenerative approach to farming. The students will know and apply the basics of grassland management and be able to plan for the regeneration of grassland. The students will know the basics of regenerative livestock production.
Activities	The teacher will introduce the topics of the module to the students over the course of the lectures using PowerPoint and/or video presentations. As this module covers a very wide range of knowledge, the emphasis on frontal teaching is much higher than in the previous modules. However, the students need to be given the opportunity to engage. Completing individual tasks in this module seems to be an efficient way of the students' engagement. Randomly, a plant species is assigned to each student and the student works independently to develop a regenerative cultivation technology for that plant species. Alternatively, they can design an intrazonal forest community or a pasture for an animal species.
Duration	The completion of the module takes about 4 weeks.
Assessment	The main topics will end with a maximum 10-question quiz to be completed by the students by the end of the module. The essay submitted will play the most pronounced part in the evaluation process. The students will upload their completed plans into Moodle's REGINA platform and the teacher will evaluate them.

HORIZONTAL MODULE: Field visits & external activities	
Topics	The main objective in this module is: Practical work/assignment (incl. involvement of stakeholders) Apart from participating in field trips, the students meet farmers and representatives of various professional organisations.
Outcome	The students will get to know the farms having been introduced to them in the case studies. Besides having discussions with the experts working in the field, they can gain experience and start to build their professional network.
Activities	During their field trips and meetings with the representatives of the professional organisations, the students are required to make interviews and/or photo documentaries.
Duration	The completion of the module takes 1 week.
Assessment	The interviews and photo-documentaries will be used to produce a publication (leaflet) promoting RA. The completed work is uploaded to the Moodle's REGINA platform and evaluated by the teacher.

ANNEX 1 for Higher Education: Lesson plan example and lesson plan supplement

Lesson Topic: Soil Tillage Errors **Number of Students: All**

Duration (90 min)	Phases	Content	Objectives	Competencies	Applied Methods	Teacher's Activities	Student Activities	Materials and Equipment
2 min	**Greeting Students**	Greeting students ang getting ready for the lesson	Making the students feel comfortable and welcome, starting the lesson	Communication skills	Coaching	Starting conversation, asking questions	Getting ready for the lesson, answering questions	no
3 min	**Introduction**	Introducing the topic: Today's topic is Soil Tillage Errors	Raising interest toward the topic	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 1 - Explore**	Definition of soil tillage errors	Students learn about what soil tillage errors mean	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Types of soil tillage errors	Students get familiarised with the various types of soil tillage errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Possible consequences of errors (soil)	Students learn about the consequences of the soil related errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Possible consequences of errors (plant)	Students learn about the consequences of the plant related errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Possible consequences of errors (yield)	Students learn about the consequences of the yield related errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
15 min	**Phase 2 - Learning**	Techniques of avoiding errors	Students learn about how to avoid the errors	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 2 - Learning**	Role of RA in conserving soil structure	Students learn about the role of RA in soil conservation	Acquisition of new knowledge, crtical thinking	Frontal Teaching	Presenting the material	Taking notes, paying attention	PPT/video, projector
10 min	**Phase 3 - Closure**	Summarising the topic	Synthesize gained knowledge	Communication skills	Group Discussion	Ask and answer questions	Ask and answer questions, give there own ideas	no

Lesson Topic: Soil Tillage Errors **Number of Students: max 20**

Duration (90 min)	Phases	Content	Objectives	Competencies	Applied Methods	Teacher's Activities	Student Activities	Materials and Equipment	Notes
2 min	**Greeting Students**	Greeting students ang getting ready for the lesson	Making the students feel comfortable and welcome, starting the lesson	Communication skills	Coaching	Starting conversation, asking questions	Getting ready for the lesson, answering questions	no	
3 min	**Introduction**	Introducing the topic	Getting feedback on the lecture, clarifying problematic areas	Being able to express their uncertainties, communications skills	Conversation	Attentive listening and answering questions	Taking notes, paying attention, asking questions	no	
5 min	**Phase 1 - Warming-up (Competition Task)**	Collecting and describing the types of soil tillage errors	Students revise the definition of soil tillage errors and their types	Applying new knowledge, crtical thinking, organizing ideas, communication skills	Co-operative Group Work (5 Students/group) Gamification	Giving instructions	Creating a detailed list of the errors and their characteristics	whiteboard/ laptop/ tablet	***TASK*** : Each group collects all the possible problems and characterises them briefly. ***GAMIFICATION:*** The group carrying out the task the most precisely will gain **1 gamification point**.
5 min	**Phase 1 - Warming-up (Competition Task)**	Presentation of the types of soil tillage errors	Students be able to organise their thougths and present them	Improving presentation skills	Group Work (5 Students/group), Gamification	Attentive listening and giving feedback	Presenting their work	whiteboard/ laptop/ tablet	
5 min	**Phase 2 - Research Work**	Allocation of the task to the groups and giving instructions	Students fully understand the task	Communication skills, critical thinking	Coaching	Giving instructions	Taking notes, paying attention	projector, laptop, paper slips, bag	***TASK:*** **Step 1** Teacher makes one person from each group to choose a problem by drawing a piece of paper with the name of the problem from a bag. (Problems: soil compaction, dust formation, clod formation, soil cracking) **Step 2** Each group collects practical examples (videos, pictures, descriptions) of the problem allocated to their group. **Step 3** Applying their findings and the knowledge they gained in the lecture, they are required to make their own conclusions. **Step 4** Students are required to develop and recommend solutions for their specified problem by implying techniques used in RA and traditional agriculture. **Step 5** Students compile a PowerPoint presention on their specific topic.
15 min	**Phase 2 - Research Work**	Collecting the characteristic features of the problems, their possible consequences	Students learn about and be able to realize the characteristic features and the effects of the problem	Acquisition of new knowledge, critical thinking, interpersonal/teamwork skills, leadership skills, activiting existing cognitive structures, organizing new information	Group Work (5 Students/group), Coaching, Conversation, Searching for information on the Internet, Gamification	Assisting the students, answering their questions if needed	Collecting information, Taking notes, Prioritizing information	laptop, tablet, mobile phone	
15 min	**Phase 2 - Research Work**	Compiling the content of the presentation	Students improve their prioritization skills (analyzing, categorizing) and presentation skills, learn how to assign a task to a peer, how to work together, improve their self awareness (strengths and weaknesses)	Communication skills - asking and answering politely, Critical thinking, Prioritization skills, Decision making skills, Leadership skills	Group Work (5 Students/group), Coaching, Planning and Structuring, Conversation, Gamification	Assisting the students, answering their questions if needed	Taking notes, paying attention, asking and answering questions, prioritize the collected information, compile the content of the presentation	laptop, tablet, mobile phone	
10 min	**Phase 2 - Research Work**	Creating the presentation	Students improve their communication skills, prioritization skills, decision making skills and their aesthetic skills	Applying existing knowledge, Critical thinking, Decision making, Communication/interpersonal skills	Group Work (5 Students/group), Coaching, Planning and Structuring, Conversation, Gamification	Assisting the students, answering their questions if needed	Taking notes, paying attention	laptop, tablet, mobile phone	
20 min	**Phase 3 - Presentation**	Delivering the presentation	Students be able to express their findings and ideas effectively and with clarity	Oral presentations skills, controlling body language, managing nervousness, projecting confidence	Group Work (5 Students/group), Presentation, Gamification	Attentive listening, Evaluates Groups' presentation (content and layout), Decides ranking of the groups	Presenting, Taking notes, paying attention, Take constructive criticism, Vote for the best presentation	PowerPoint, projector, laptop	***GAMIFICATION:*** The groups gain gamification points according to their placement. (1st/best presentation - 5 points), 2nd - 4 points etc.) The groups also vote for the best presentation, the winner gets 1 extra gamification points.
10 min	**Phase 4 - Closure**	Summarising the topic	Synthesize gained knowledge	Communication skills	Group Discussion	Ask and answer questions	Ask and answer questions, give there own ideas	PowerPoint, projector, laptop	

	Lesson topic: Field trip		max 20 student	4 group	5 student/group				
Duration (360 min)	**Phases**	**Content**	**Objectives**	**Competencies**	**Applied Methods**	**Teacher's Activities**	**Student Activities**	**Materials and Equipment**	**Notes**
2 min	**Greeting Students**	Greeting students ang getting ready for the field trip	Making the students feel comfortable and welcome, starting the field trip	Communication skills	Coaching	Starting conversation, asking questions	Getting ready for the field trip, asking and answering questions	no	
3 min	**Introduction**	Introducing the topic: Field trip	Raising interest toward the topic	Acquisition of new knowledge	Frontal Teaching	Presenting the material	Taking notes, paying attention	no	
max 60 min	**Phase 1 - Travelling**	Travelling	Getting to the farm	Communication skills, People skills	Coaching, Conversation	Travelling, Engaging with the students	Travelling, Engaging with the teacher and the peers	coach, car, train, bicycle	
30 min	**Phase 2 - Planning**	Arriving at the venue of the field trip. A short presentation of the farm by the owner. Distribution of the form containing interview questions to the Students. Obtaining permission to take photographs from the owner of the farm.	Students get familiarised with the farm and the task	Acquisition of new knowledge, Interpretation skills, Communication skills	Frontal Teaching	Distributing the task and the interview questions	Taking notes, paying attention, clarifying misunderstandings	laptop, notebook	**Questions for: Group 1:** Size of the farm (ha), What is/are the main products of the farm? Can you describe the RA practices you use in the farm? **Group2**: What were the initial steps of launching RA? Did you/the farmer receive any training about RA? Who provided the training? Are you/the farmer generally satisfied with applying RA techniques? **Group 3**: Benefits? Obstacles & difficulties? How have you overcome the difficulties? **Group 4**: Does the farm implement any regenerative agriculture (RA) practices? Do they feel that they have thorough knowledge on RA? Or would they like to know more about RA? For how long have you been using RA practices? For the photo documentation, each group is required to take a minimum of 5 photos.
60 min	**Phase 2 - Group work**	Make the interview with the farmer 15 min/group	Students be able to ask their questions in regard their topic, maintain conversation with an expert in the field and to assess whether they received a relevant answer to their questions.	Asking relevant questions, prioritization skills, critical thinking, teamwork, decision making skills	Coaching, Guided Conversation, Attentive listening	Assists the students when they require help	Taking notes, paying attention, sharing ideas, brainstorming with their group members, start and maintain conversation with the farmer	laptop, notebook, mobile phone	
45 min	**Phase 2 - Group work**	Guided tour in the farm, taking photos	To improve students' ability to concentrate, capacity to identify key points and reaction time	Communication skills, ability to concentrate	Presentation, making photo documentation	Actively listens, assists students when needed	Taking notes and photos, paying attention, collecting ideas and questions	notebook, mobile phone	
45 min	**Phase 2 - Group work**	Groups making their brochures on the farm	Students be able to create a short, informative and eye-catching brochure applying the program called Publisher.	Communication skills, computer skills, organisational skills, prioritizational skills, teamwork	Coaching, Conversation techniques, Co-operative group work	Actively listens, assists the students when needed	Making their brochure presenting the farm. The brochure is illustrated with texts and photos and created in Publisher.	PPT,laptop, notebook, cell phone	
10 min	**Phase 2 - Relax**	Getting ready for leaving	Students getting ready for leaving the farm.	no	Coaching	Assists the students when they require help	Packing their belongings and getting ready for the journey back.	no	
max 60 min	**Phase 2 - Travel**	Travelling back	Coming back to the University	Communication skills, People skills	Coaching	Converses with Students	Starting and maintain conversations, exchanging their experiences	bus, car, train, bicycle	
45 min	**Phase 3 - Closure**	Presenting the brochures, their discussion Evaluation	Students be able to synthesize recently gained knowledge and present its key points in a professional way	Communication skills, Presentation skills, Expressing your ideas, Controlling body language, Managing nervousness	Group Presentation, Group Discussion, Gamification	Asks and answers questions, Evaluates presentations	Present their brochures, Ask and answer questions, Express their own ideas	PPT, projector	**GAMIFICATION**: The groups gain gamification points according to their placement. (1st/best presentation - 5 points), 2nd - 4 points etc.) The groups also vote for the best presentation, the winner gets 1 extra gamification points.

Reward Chart				
	Groups			
weeks	G1	G2	G3	G4
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
Total points	0	0	0	0

Participants				
Students	Group 1	Group 2	Group 3	Group 4
Studnet 1				
Student 2				
Student 3				
Student 4				
Student 5				

Lesson plan supplement

The time schedule of the REGINA course:

In tertiary education, over the 14 weeks of a semester, the total number of lessons of the course per week is:

1 lecture (45 min),

2 seminar/classroom lessons (90 min)

For practicality reasons, **the lectures** are held **every two weeks for 90 minutes** (which means **7 occasions / semester**) and **the seminar lessons** (90 minutes a week) are held only **for 12 weeks** because they also include **2 field trips of 8 lessons each** (12 + 2 occasions).

In total, the number of lessons per semester is 42 lessons divided as follows:

- 7*90 min lecture
- 12*90 min seminar
- 2*8*45 min field trip

The framework of the lessons and the applied methods

A lesson/ an occasion (lectures, seminars and field trips) has several phases:

Greeting the students and **Introduction**

Phase 1: Exploration of the topic / Warming-up activity

Phase 2: Where the actual learning takes place.

Phase 3/4: Students presenting their findings/ Summary of the material covered over the lesson.

Satisfying the requirements of the topic covered during the lesson, the teacher can choose from various methods listed in this document and see below to match the phases described in the lesson plans. The methods we primarily recommend for the individual phases are the following:

Phase	Method
Phase 1 - Warming-up, Explore	Frontal Teaching
	Conversation techniques
	Group Work
	Four corners method
	Group mirror
	Passport method
Phase 2 - Learning, Research Work, Planning, Group work	Frontal Teaching
	Coaching
	Group Work
	Guided Conversation
	Conversation techniques
	Conversation techniques
	Now - then - later
	Group Idea-mix
	Gamification
	Mind map
Phase 3 - Presentation	Group Work
	Presentation
	Gamification
	Case study
Phase 4 - Closure	Group Discussion
	Group Presentation
	Gamification

Parts of the methodology and their elaboration:

Duration: is the time delegated for each task during the lesson

Phase: see above

Content: is the topic covered in that particular phase of the lesson

Objectives: What is the goal of that particular phase of the lesson? What does the Teacher want to achieve?

Competencies: the abilities required to perform that particular task

Applied Methods: the range of methods and activities applied to achieve the objectives (see above)

Teacher's Activities: it describes the Teacher's tasks, what they do or say during the particular task

Students' Activities: it describes the Students' tasks, what they do or say during the particular task

Materials and Equipment: task sheet, materials, relevant ppt slides, the necessary technical equipment that are used during the task

Materials and Equipment
no
PPT/video, projector
PPT/video, projector

In the Materials and Equipment column of the lesson plans, apart from the task sheets/materials and technical equipment used during the lesson, the ppt slides presented to the Students are to be inserted.

The sample lesson plans created for each type of lesson (lectures seminars and field trips) need to be used and adapted to the actual lesson satisfying the preferences of the Teacher and the particularities of the content of the lesson.

In our detailed lesson plans we refrain from including information regarding the exact words of the Teacher's instructions and the presumed answers of the Students, which is a quite common element of lesson plans for primary and secondary education.

Notes: includes any comments, notes, instructions that help the Teacher's work and necessary for delivering that particular task

Notes
TASK : Each group collects all the possible problems and characterises them briefly. ***GAMIFICATION:*** The group carrying out the task the most precisely will gain **1 gamification point**.
TASK: **Step 1** Teacher makes one person from each group to choose a problem by drawing a piece of paper with the name of the problem from a bag. (Problems: soil compaction, dust formation, clod formation, soil cracking) **Step 2** Each group collects practical examples (videos, pictures, descriptions) of the problem allocated to their group. **Step 3** Applying their findings and the knowledge they gained in the lecture, they are required to make their own conclusions. **Step 4** Students are required to develop and recommend solutions for their specified problem by implying techniques used in RA and traditional agriculture. **Step 5** Students compile a PowerPoint presention on their specific topic.

The Notes column contains any remarks, notes or instructions that are not mentioned in the previous ones, but which help the teacher in their work.

The instructor can list the details of the task given to the students, or describe the rules of the games, competitions or reward systems used in the lessons.

Although filling this column with content is optional, it can help other teachers adapt the lesson to their students' needs and level.

It bears less relevance to lesson plans in tertiary than secondary education, where a more sophisticated design is the standard.

Reward System:

In addition to imparting new and practical knowledge on Regenerative Agriculture (RA), a primary objective of our course is to foster active student engagement during lessons. To achieve this, we have embraced gamification principles and devised a reward system aimed at incentivising robust participation.

Implementation of Group Work: Group work constitutes the cornerstone of our instructional approach. Each class comprises a maximum of 20 participants, organized into permanent groups of five individuals each. These groups are established at the onset of the semester and remain unchanged throughout, ensuring continuity and fostering collaborative learning environments.

Participants				
Students	Group 1	Group 2	Group 3	Group 4
Studnet 1				
Student 2				
Student 3				
Student 4				
Student 5				

Delivering tasks (e.g. short presentations, brochures) in Phase 1 and Phase 3 in the seminars, and in Phase 3 in the field trips, the groups can earn points as follows:

Reward Chart				
	Groups			
weeks	G1	G2	G3	G4
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
Total points	0	0	0	0

Gamification and Evaluation System:

a) Gamification Points: Groups in our course earn gamification points based on their presentation performance:

- 1st place: 5 points
- 2nd place: 4 points
- 3rd place: 3 points
- 4th place: 2 points

Additionally, groups vote for the best presentation, with the winning group receiving an extra point.

Accumulated gamification points throughout the semester contribute to the final evaluation.

b) Evaluation Criteria:

Lectures: Each module concludes with a 10-question quiz, contributing to a maximum of 80 points over the semester. Correct answers earn students 2 points each.

Seminars: To successfully complete seminars, students must accumulate a minimum of 10 points from assigned tasks throughout the course.

Gamification points range from 10 to 70, depending on the number of tasks completed.

c) The System of Evaluation – application of a 5-grade scale:

The **final grade** is the arithmetic mean of two elements: the grades given for the theory (quizzes) and the practice (seminar - including the field trip).

Theory:		**Practice:**	
90-100%	excellent	90-100%	excellent
80-89%	good	80-89%	good
70-79%	satisfactory	70-79%	satisfactory
60-69%	sufficient	60-69%	sufficient
< 60%	insufficient	< 60%	insufficient

Although the modules may be completed in an arbitrary order, in order to have a better understanding, we suggest completing them in the prescribed order.

After completing the course, the university students shall earn their credits according to the regulations of their University.

d) Adapting the System

The methodological recommendations outlined here are primarily designed to meet the educational needs of university students, particularly those enrolled at Széchenyi István University. Recognizing the diversity of educational systems among participating institutions, we strongly encourage each institution to tailor these methods according to their specific requirements. This flexibility ensures that learning approaches align seamlessly with their established academic frameworks.

Secondary schools participating in the programme have the flexibility to select specific modules from the REGINA course and integrate relevant components into their existing curriculum. This allows for targeted enrichment without the obligation to implement the entire course.

PART 3: Application possibilities for further learning tiers

Applicable methods of teaching Regenerative Agriculture in agricultural secondary schools

The introduction and teaching Regenerative Agriculture to secondary school students enables them to understand and learn about the more sustainable ways of food production which support environmental renewal. The following methods demonstrate how to teach Regenerative Agriculture in secondary schools in a fruitful way:

1. **Lectures and presentations:** Lectures and presentations seem to be a good way to introduce students to the basics and principles of Regenerative Agriculture. Inviting experts and agricultural organisations gives the students the opportunity to learn about first-hand information on sustainable agricultural practices and the conservation of natural resources.

2. **Field visits:** They provide an excellent opportunity for students to visit farms and organic farms. They allow them to gain personal experience, learn about agroecological methods and discuss the advantages and disadvantages of Regenerative Agriculture practices with the farmers.

3. **Project work:** Students have the opportunity to participate in project work, through which they can learn more about the different aspects of Regenerative Agriculture. For example, they could do projects on soil regeneration, permaculture, organic farming or food waste reduction. This hands-on approach also helps students develop creative thinking and problem-solving skills.

4. **Practical sessions:** In secondary schools, there are opportunities for doing gardening and farming in practical classes on the farm and in school gardens. Students work together to cultivate a small garden or even create a community garden on school grounds. This not only provides hands-on experience, but also helps students to learn about growing plants, the importance of soil life and sustainable irrigation methods in a practical way.

5. **Supporting local initiatives:** Students can be encouraged to support local agricultural initiatives. For example, they can participate in programs that help support local farmers or sell at community markets. Thus, the students will have a deeper understanding of local food chains, the impact on the community of sustainable agriculture and how to get involved in and become an integral part of local community life.

It is important that teaching Regenerative Agriculture needs to be practical and interactive. Students should be given the opportunity to gain first-hand experience and develop their problem-solving skills. This way, they can acquire skills that will help them to have a better understanding of and support sustainable agricultural practices, and when they leave school, in their work.

A detailed explanation of the methods in secondary education

1. Lectures and presentations

Lectures and presentations seem to be an effective way to teach the diverse aspects of Regenerative Agriculture. In this case, the teacher or invited experts give lectures on the principles and practices of Regenerative Agriculture.

During the lectures, the students learn about sustainable agricultural techniques, such as agroforestry, organic farming or ways to preserve soil life. Speakers demonstrate the importance of proper nutrient management, the benefits of soil life conservation and the role of biodiversity in Regenerative Agriculture.

In addition, experts will share their own experiences, success stories and challenges related to sustainable agricultural practices. This can provide inspiring examples for the students and highlight the impact that Regenerative Agriculture practices can have on the environment, society and food security.

The presentations can also provide an opportunity for students to ask questions about Regenerative Agriculture. They will also have the opportunity to discuss how these practices can be applied in their own regions and farms. Case studies and research findings presented in the presentations can provide students with further evidence of the effectiveness and sustainability of Regenerative Agriculture.

Plus, students can be involved in the lectures and presentations through interactive activities. Group work, discussions or even short simulations can be used to increase student participation and develop critical thinking.

Lectures and presentations can be outstandingly useful in introducing students to Regenerative Agriculture and help them understand the principles and importance of sustainable agricultural practices.

2. Field visits

The field visits mentioned in section 2 play a key role for students to gain first-hand experience on Regenerative Agriculture. This allows them to see in practice how these sustainable agricultural practices work and how they transform farms and the environment.

During the field visits, students can visit different farms, such as organic farms, different initiatives in agriculture or regenerative farms. They can experience first-hand sustainable agricultural practices such as ecosystem-friendly farming, agroforestry, how to support soil life or biodiversity conservation.

These visits give students the opportunity to ask their questions from the farmers or professionals, learn about the benefits and challenges of Regenerative Agriculture. Farmers can demonstrate the results of sustainable practices, soil quality improvements, crop health and biodiversity impacts. They can also share their experience on the difficulties resulting from the switch to Regenerative Agriculture and how they have overcome them.

These visits allow the students to compare the differences and benefits between conventional and Regenerative Agriculture. The direct experience help the students to develop a real, personal relationship with farmers.

During the field visits, the students' involvement in the process is of key importance. They should be given the opportunity to actively participate in activities such as farm work, soil testing or food processing. It provides a deeper understanding for the students and allows them to apply the theoretical knowledge they have learned in school in practical lessons.

Field visits allow students to meet real-life situations and enable them to experience sustainable practices and understand their impact.

3. Project work

The project work mentioned in section 3 gives students the opportunity to learn more about and study different aspects of Regenerative Agriculture. The projects allow students to gain practical experience and deepen their understanding of the subject.

The topics of the projects can vary widely. For example, students can develop projects on soil regeneration, permaculture, agroforestry, organic farming or food waste reduction. Through these projects, students can learn about the principles and impacts of regenerative agricultural practices.

Doing their project work, students are required to carry out their own research, collect data, carry out analyses and present their findings. These tasks develop the students' research and analytical skills and they can apply the knowledge they have already acquired to real problems and challenges.

In addition, project work can support the development of students' creative thinking and problem-solving skills. Students can develop ideas and innovative solutions in the field of sustainable agricultural practices. For example, they can design and create their own small garden on school grounds, or develop ways to reduce food waste at school or in their own homes.

It is important that projects encourage co-operative and collaborative work among students. Group work and team activities teach students how to learn from each other, share experience and ideas, and develop innovative solutions together.

One of the primary aims of project work is to give students the opportunity to present and share their projects. Thus, other students and teachers learn about the projects and can draw inspiration from them. This experience also helps the students to improve and develop their presentation and communication skills.

Project work gives students the opportunity to immerse in the topic of Regenerative Agriculture and gain personal experience of sustainable agricultural practices, which helps them think critically and find innovative solutions to agricultural challenges, and build their interest and commitment to sustainable agriculture in the future.

4. Practicums:

The horticulture and field programmes give students the opportunity to get directly involved in hands-on activities that teach them about the fundamental aspects of Regenerative Agriculture. This hands-on experience helps students learn the basic concepts of crop production, the importance of soil life and sustainable irrigation methods.

In secondary schools, these programmes allow students to work together to grow a small garden or even a community garden on their own experimental farm. These programmes allow students to gain direct experience of growing, tending, maintaining and harvesting plants.

The practice of planting encourages students to observe plant growth, study soil structure and its quality and its changes. Above these, they also learn the important aspects of crop care and nutrient supply.

School garden programmes not only provide students with practical experience, but also help them to understand the wider context of sustainable agricultural practices. They can discover the importance of soil life from concerning the health of plants and soil, and learn about the benefits of composting or natural organic fertilisation.

Besides, these programmes also help students understand the concepts of food production and food safety. They learn about the benefits of shortening the food supply chain and the difficulties of growing and producing their own food in a sustainable way.

Overall, these hands-on lessons are important for students to gain practical, hands-on experience in the field of Regenerative Agriculture.

5. Supporting local initiatives

The method described in section 5 covers how to help students get involved in local agricultural initiatives and community projects. This activity helps students to develop a real relationship with the local food producers and to understand how local food systems and food chains work.

Students can be encouraged to get involved in local agricultural initiatives such as community gardens, farmers' markets or supporting the work of local farmers. Thus, they can experience sustainable agricultural practices first hand, to learn about local farmers and the food they produce.

Participating in these activities gives students the opportunity to see both the benefits and challenges of local agricultural production. They can learn about the work of the local producers, the process of food production and the importance of food safety. It also helps them to understand the economic and social importance of local communities and how they can contribute to sustainable agriculture.

The active participation of students in these initiatives helps them to gain a more comprehensive understanding of how local food systems work. They are given the opportunity to talk to local producers, understand and learn about production methods.

In addition, students are encouraged to start their own community projects, such as local small gardens or classroom gardening. By which they are encouraged to apply the principles of Regenerative Agriculture in their own environment and contribute to local food production.

Supporting local agricultural initiatives and participating in community projects provides students not only with theoretical knowledge, but also with real-life experience that will help them become active participants in sustainable agriculture in the future.

A brief summary of the applied methods in secondary education

In secondary schools, there are numerous methods to teach Regenerative Agriculture. Lectures and presentations allow students to learn about the principles and practices of sustainable agriculture. Farm visits to local, neighbourhood farms allow students to experience sustainable good practices first-hand and talk directly to farmers. Through project work, students will have a deeper understanding and study of the different aspects of Regenerative Agriculture. During the programmes organised on the farm, students can directly participate in hands-on activities and learn the basics of sustainable crop production.

Teaching Regenerative Agriculture in a school encourages students to make responsible choices and become active participants in sustainable agricultural practices in the future.

Adaptation of REGINA Content and Methodology in a Secondary School Learning Environment

This integrated example showcases how educational content on regenerative agriculture and agroforestry practices was adapted for secondary school students in Hungary and Slovenia. By simplifying complex concepts and incorporating interactive elements, the lessons aimed to engage students and foster a deeper understanding of sustainability.

The following modules and topics were chosen:

- Historical Context, Definition of Regenerative Agriculture, and Holistic Approach
- Integrated Technologies for Enhancing Soil Management and Smart Farming
- Reduction of Greenhouse Gas Emissions
- Integrated Pest Management
- Agroforestry Practices

These modules were selected because it was felt that understanding the historical background and fundamental concepts of regenerative agriculture is important for students. Regenerative agriculture, a new and evolving approach, aims not only to improve agricultural production but also to enhance the sustainability of the entire food system. Awareness and engagement with such sustainable practices are essential, as they can play a key role in future food security and environmental conservation.

The topic of integrated technologies for soil management and smart farming was considered crucial because soil quality is fundamental for agricultural production. Smart agricultural technologies, such as drones or sensors, enable more efficient soil management and production optimization. This topic demonstrates to students how technology can aid in achieving sustainable agriculture and contribute to the efficiency of food production.

Reducing greenhouse gas (GHG) emissions is recognized as one of the most pressing challenges in today's world, given the severe consequences of climate change. This topic provides an opportunity for students to understand the causes and effects of global warming and to learn how to reduce GHG emissions through various methods, such as alternative energy production or optimizing industrial processes.

The importance of integrated pest management was emphasized because effective pest control is essential for crop cultivation. However, the harmful effects of excessive pesticide use on the environment and human health must be understood. Integrated pest management offers an

approach that considers environmental and economic factors, allowing for effective pest control with minimal environmental damage.

Agroforestry integrates modern forestry practices that require understanding tree characteristics, their cultivation, and their interactions with the environment. This practice promotes sustainable forestry and agricultural practices, aligning with environmental conservation principles. It provides students with a broader perspective on forestry practices, extending beyond traditional forest settings to include agricultural and urban environments.

Overall, these topics were chosen to provide students with a comprehensive understanding of sustainable agriculture and its various aspects, as well as the importance and application of these concepts in real life.

To tailor the topics to the needs and interests of a younger generation, **several adjustments were made** to ensure they were engaging, accessible, and relevant to secondary school students.

Firstly, the language and concepts were simplified to make them more comprehensible to high school students who might lack advanced knowledge in the field. Instead of delving into complex scientific theories or technical jargon, the focus was on conveying the core ideas and practical applications of each topic. This approach allows students to grasp the fundamental principles without feeling overwhelmed by unnecessary details. Additionally, certain topics were simplified to enhance comprehension, while excessively detailed descriptions and analyses of specific actions or events were omitted. However, innovative content was retained, albeit challenging, to acquaint students with modern approaches and advancements.

Interactive elements were also incorporated into the lessons to encourage active participation and critical thinking. Group discussions, case studies, and hands-on activities were included to enable students to apply their knowledge in real-world scenarios. Engaging students in these interactive exercises fosters a deeper understanding of the material and stimulates their curiosity about sustainable agriculture.

Furthermore, the relevance of the topics to students' lives and future careers was emphasized. By highlighting the impact of regenerative agriculture, soil management technologies, GHG emissions reduction, and integrated pest management on global food security, environmental sustainability, and public health, a sense of responsibility and empowerment was instilled in students. The aim was for them to recognize the importance of these concepts in addressing pressing global challenges and to inspire them to become agents of positive change in their communities.

Overall, the goal was to adapt the topics in a way that resonates with high school students' interests, abilities, and aspirations. By making the content engaging, accessible, and relevant, the intention was to inspire curiosity, foster critical thinking, and empower students to become informed and responsible global citizens.

For the adaptation of the lesson to suit the needs of secondary school students, **a variety of teaching methods** were employed to foster active engagement, critical thinking, and experiential learning.

Frontal teaching was utilized to provide a structured framework for presenting key concepts and foundational knowledge. Through clear explanations, visual aids, and interactive demonstrations, a solid foundation of understanding was established among students. This method allowed for direct communication of essential information, ensuring that students grasp the fundamental principles of regenerative agriculture, soil management technologies, GHG emissions reduction, and integrated pest management, as well as agroforestry.

Lectures were interspersed with **discussions** to encourage student participation and critical inquiry. By posing thought-provoking questions and facilitating open dialogue, opportunities were created for students to reflect on the material, share their perspectives, and engage in collaborative sense-making. Discussions also enabled students to deepen their understanding through peer interaction and collective problem-solving.

Case studies served as valuable tools for contextualizing theoretical concepts within real-world scenarios. By analyzing case studies related to sustainable agriculture practices, students could apply their knowledge in practical contexts, identify challenges, and explore potential solutions. This experiential approach not only enhanced comprehension but also fostered critical thinking and decision-making skills.

Group discussions and conversations provided platforms for collaborative learning and knowledge co-construction. Through small-group activities and peer-to-peer interactions, students had the opportunity to exchange ideas, challenge assumptions, and explore diverse perspectives. This collaborative learning environment promoted active engagement and deeper understanding of the subject matter.

Field trips offered unique opportunities for hands-on learning and immersive experiences. By visiting agricultural sites, students were able to observe regenerative practices in action, interact with experts, and gain firsthand insights into sustainable agriculture techniques. Field trips enriched the learning experience by connecting theoretical concepts to real-world applications and fostering a deeper appreciation for environmental stewardship.

The lesson content intersects with various subjects such as biology, chemistry, physics, geography, social sciences, and economics. This interdisciplinary approach facilitates integrated knowledge development and deepens understanding across disciplines. These elements delineate the lesson's structure and objectives, underscoring the pedagogical and methodological approaches employed to enhance the learning experience.

For evaluation purposes, questionnaires originally designed for university-level assessments were adapted and simplified to suit the high school level. Alongside the questionnaires, students'

responses during the material presentations, their level of interest, and any questions raised were monitored. This comprehensive approach aimed to gauge their comprehension and engagement effectively.

In summary, the combination of frontal teaching, discussion, lecture, case studies, group discussion, and field trips provided a multifaceted approach to teaching and learning. Each method was selected based on its ability to promote active engagement, critical thinking, and experiential learning, ultimately enhancing students' comprehension and appreciation of the topics covered in the lesson. In adapting the teaching methods to the secondary education environment, the focus was on tailoring the delivery style, content complexity, and interactive components to suit the cognitive and developmental needs of secondary school students.

ANNEX 2 for Secondary Education: Lesson plan example and lesson plan supplement

MODULE 2 - 05

Integrated pest management

Lesson material: Principles and practical application of Integrated Pest Management (IPM) in regenerative agriculture.

Lesson type: Combination of interactive lecture, group work, and practical demonstrations.

Aim: Understanding the principles of IPM, showcasing its ecological and economic benefits, and developing the ability for practical application.

Tasks:

- Educational tasks: Increasing awareness among students about the importance of sustainable pest management.
- Didactic tasks: Proper presentation and explanation of IPM methods and principles.
- Pedagogical/Psychological tasks: Motivating participants and enhancing commitment to IPM.

Methods:

- Interactive lectures, group work, simulations, practical demonstrations.
- Educational methods: Knowledge formation, development of critical thinking, acquisition of practical skills.

Organizational forms: Lecture, group work, debate, practical sessions.

Tools: PowerPoint presentations, interactive boards.

Connections to other subjects: Crop cultivation, plant protection, agronomy, environmental science.

Time	Content	Requirements	Student activities	Pedagogical approaches	Methods	Organizational forms	Teaching activity	Competencies	Interdisciplinary connections	Tools and visualization
0-5 minutes	Introduction to the topic: Integrated Pest Management (IPM)	Basic understanding of agricultural practices, awareness of common pests and their impact.	Listen and take notes.	Brief overview of the lesson objectives and structure.	Lecture	Whole class discussion	Present the objectives and main topics of the lesson.	Understanding of agricultural concepts, awareness of environmental issues, critical thinking skills.	Biology, Environmental Science	Presentation slides, diagrams, infographics, charts
5-15 minutes	Historical examples of pest infestations and their impact	Knowledge of historical events related to agriculture and pest management.	Engage in a discussion about historical pest infestations and their consequences.	Facilitate the discussion about historical pest infestations and their impact.	Discussion	Group discussion, Q&A	Facilitate group discussions and encourage critical thinking about the historical context of pest management.	Critical thinking, historical awareness, analytical skills	History, Geography	Images, maps, historical documents
15-25 minutes	Pathways of pest dispersal and globalization	Understanding of global trade and environmental factors affecting pest distribution.	Participate in a brainstorming session about pathways of pest dispersal.	Guide the brainstorming session to explore various pathways of pest dispersal.	Brainstorming	Group activity	Organize group activities to explore pathways of pest dispersal and discuss their implications.	Analytical skills, awareness of environmental factors affecting agriculture	Geography, Economics	Diagrams, flowcharts, case studies
25-35 minutes	Introduction to pesticides and biopesticides	Basic knowledge of chemicals and their application in agriculture. Awareness of environmental and health impacts of pesticides.	Engage in a discussion about different types of pesticides and their uses.	Lead a discussion about the classification and uses of pesticides and biopesticides.	Discussion	Group discussion, Q&A	Lead discussions on the advantages and disadvantages of different pest control methods.	Critical thinking, awareness of environmental and health impacts of agricultural practices	Chemistry, Environmental Science	Videos, charts, diagrams

Time	Content	Requirements	Student activities	Pedagogical approaches	Methods	Organizational forms	Teaching activity	Competencies	Interdisciplinary connections	Tools and visualization
35-40 minutes	Advantages and applications of biopesticides	Understanding of environmental sustainability and agricultural practices.	Participate in a debate or role-play scenario discussing the advantages of biopesticides.	Facilitate a debate or role-play scenario to explore the advantages of biopesticides.	Debate, Role-play	Group activity	Organize group activities to simulate real-world scenarios related to biopesticides.	Critical thinking, communication skills, awareness of environmental sustainability in agriculture	Environmental Science, Economics	Scenarios, role-play cards
40-45 minutes	Introduction to Integrated Pest Management (IPM) principles and practices	Knowledge of agricultural practices and pest management strategies. Awareness of ecological balance and sustainability in agriculture.	Engage in a discussion about the principles and practices of IPM.	Lead a discussion on the principles and practices of IPM.	Discussion	Group discussion, Q&A	Facilitate group discussions on the principles and practices of IPM, emphasizing sustainable pest management strategies.	Critical thinking, awareness of sustainable agricultural practices, problem-solving skills	Environmental Science, Agriculture	Diagrams, case studies

Homework example: Have the students create a card game in groups related to plant protection

For example:
Assignment:

Designing "Pest Wars - The Battle of Plant Protection" Card Game

Aim: The aim of the assignment is for you, as students, to design a board game that helps players understand and learn about the importance and methods of plant protection.

Assignment Details:

1. **Group Formation:** Divide the students into groups. Each group needs to determine which topic they will focus on:
    - Pests (e.g., insects, fungi, bacteria)
    - Natural enemies (e.g., predators, parasitoids)
    - Defense options (e.g., pesticides, enhancing biological resistance)
2. **Card Design:** Each group must design and create at least 5-10 cards related to the chosen topic. The cards should include:
    - For pests: The name of the pest, description, and its effects on plants.
    - For natural enemies: The name of the enemy, description, and how it helps protect plants.
    - For defense options: The name of the defense option, description, and how it is applied to protect plants.
3. **Card Formatting:** Each group must format and decorate the cards to make them attractive and easily recognizable.
4. **Designing Game Rules:** Each group must design the rules of the game for the created card game. The rules should include:
    - How players draw cards.
    - How players use the cards.
    - How points are scored and how the winner is determined.
5. **Creating a Prototype:** Each group must create a prototype version of the planned card game. The prototype should include all the planned cards and the game rules.

Submission of Homework: Groups must have the prototype ready for the end of the second week and present it to the other students. Each group must present the game rules and cards during the presentation.

Homework deadline: The deadline for submitting the prototype and game rules is the end of next week.

We hope you enjoy designing and creating the "Pest Wars - The Battle of Plant Protection" card game! Good luck with the project!

MODULE 2 - 07

Integrated technologies for enhancing soil management and smart farming

- **Lesson material:** Precision Agriculture
- **Lesson type:** 45-minute secondary school class
- **Aim:** To introduce students to the concept and technologies of Precision Agriculture and to demonstrate its importance and advantages.
- **Tasks:**
    - Educational tasks: Developing environmental awareness and critical thinking.
    - Didactic tasks: Understanding new concepts, interpreting technological applications.
    - Pedagogical/psychological tasks: Fostering collaboration, and independent thinking.
- **Methods:**
    - Educational methods: Developing consciousness, encouraging values-based thinking.
    - Didactic methods: Interactive lectures, group work, project-based learning.
- **Organizational forms:** Group work, dialogue, class discussion.
- **Tools:** Projector, PowerPoint presentations.
- **Connections with other subjects:** Environmental awareness, mathematics, biology.

Time	Content	Requirements	Student activities	Pedagogical approaches	Methods	Organizational forms	Teaching activity	Competencies	Interdisciplinary connections	Tools and visualization
0-5 minutes	Introduction: Challenges of World Population Growth	Knowledge transfer, raising awareness	Discussion, listening	Interactive lecture	Discussion, presentation	Group discussion	Short presentation on the growth of world population and the importance of agriculture	Critical thinking, social and cultural awareness	Economics, geography	Projector ppt
5-15 minutes	From Agrigulture 1.0 to 4.0	Knowledge transfer: Evolution of agriculture	Listening, note-taking	Interactive lecture	Lecture, group discussion	Classroom community	Presentation on the evolution of agriculture	Creative thinking, digital competence	History, computer science	Projector ppt
15-27 minutes	Benefits from the Application of Smart Technologies	Knowledge transfer: Impact of smart technologies in agriculture	Listening, note-taking	Interactive lecture	Lecture, group discussion	Classroom community	Presentation on the benefits of smart technologies in agriculture	Critical thinking, problem-solving	Computer science, environmental awareness	Projector ppt
27-40 minutes	Precision Agriculture	Knowledge transfer: Concept and technologies of Precision Agriculture	Listening, note-taking	Interactive lecture	Lecture, group discussion	Classroom community	Presentation on the concept and technologies of Precision Agriculture	Analytical thinking, problem-solving	Biology, mathematics	Projector ppt
40-45 minutes	Conclusion: Homework Assignment and Recap	Assignment, recap	Discussion, note-taking	Interactive lecture	Discussion, brief presentation	Group discussion	Brief recap and assignment of homework	Communication skills, creative thinking	Economics, mathematics	Projector, whiteboard ppt

Homework Assignment: Research and write a short essay (500 words) on one of the following topics related to Precision Agriculture:

1. The role of Artificial Intelligence (AI) in improving crop production.
2. The challenges and benefits of implementing Precision Agriculture in developing countries.
3. How Precision Agriculture can contribute to reducing greenhouse gas emissions in the agricultural sector.

MODULE 3 - 03

REDUCTION OF GHG EMISSIONS

Lesson material: The lesson covers the topics of environmental pollution and climate change, including the main facts and connections regarding pollutants, causes, and effects of climate change, as well as the process of global warming.

Lesson type: The lesson offers an interactive, group-based learning experience, allowing students to develop problem-solving skills and practice critical thinking.

Aim: The aim of the lesson is to raise awareness of environmental issues, introduce students to the main facts and connections regarding environmental pollution and climate change, and encourage them to take responsibility for environmental awareness and sustainability.

Tasks:

- Educational tasks: During the lesson, students will have the opportunity to understand the societal and ethical aspects of environmental issues and develop their environmental awareness and empathy toward the natural environment.
- Didactic tasks: Structured tasks will be provided to students to explore and process the content, as well as to develop their critical thinking and problem-solving skills.
- Pedagogical/psychological tasks: Tasks will be designed to promote self-reflection and the development of emotional intelligence among students, while understanding and responding to environmental issues.

Methods:

- Educational methods: Conversations, group discussions, and experiential learning methods will be used to develop students' environmental awareness and ethical sensitivity.
- Didactic methods: Questions, research tasks, and problem-solving exercises will actively engage students in the learning process and help them understand and apply the content.

Organizational forms: Group work and small-group discussions will provide opportunities for students to engage in collaborative thinking and discuss different perspectives.

Connections to other subjects: The content of the lesson relates to various subjects such as biology, chemistry, physics, geography, social sciences, and literature, allowing for an interdisciplinary approach and the deepening of integrated knowledge.

These elements help articulate the structure and objectives of the lesson while emphasizing the pedagogical and methodological approaches used during the learning process.

Time	Content	Requirements	Student activities	Pedagogical approaches	Methods	Organizational forms	Teaching activity	Competencies	Interdisciplinary connections	Tools and visualization
0-5 min	Introduction to pollution and agricultural pollution	Students should have basic knowledge of environmental concepts and the impact of human activities on the environment. They should also be familiar with the concept of pollution and its various forms.	Brief discussion and brainstorming session on the definition of pollution and examples of agricultural pollution.	Engaging students in critical thinking and environmental awareness	Brainstorming, Discussion	Whole-class discussion	Teacher introduces the topic of pollution and agricultural pollution, defining key terms and providing examples.	Critical thinking, Environmental awareness	Environmental Science, Biology, Geography	Whiteboard, Markers
5-15 min	Causes and consequences of pollution	Students should understand the different causes of pollution, including human activities such as industrialization, agriculture, and transportation. They should also grasp the consequences of pollution on the environment and human health.	Presentation of slides detailing the causes and consequences of pollution, with a focus on agricultural pollution.	Presenting information through visual aids and examples to enhance understanding	Lecture, Presentation	Whole-class presentation	Teacher explains the causes and consequences of pollution, emphasizing the role of agriculture in environmental degradation.	Understanding cause-effect relationships, Knowledge acquisition	Environmental Science, Biology, Chemistry	Projector, Slides ppt
15-25 min	Greenhouse gases and climate change	Students should understand the concept of greenhouse gases and their role in climate change. They should also grasp the impacts of climate change on ecosystems and human societies.	Presentation of slides explaining greenhouse gases, their sources, and the effects of climate change.	Presenting information through visual aids and examples to enhance understanding	Lecture, Presentation	Whole-class presentation	Teacher explains the concept of greenhouse gases and climate change, highlighting their importance and impact on the environment.	Knowledge acquisition, Understanding complex systems	Environmental Science, Biology, Geography	Projector, Slides ppt
25-35 min	Global warming and its implications	Students should have a comprehensive understanding of global warming, its causes, and	Discussion on the factors contributing to global	Encouraging collaborative problem-solving and	Discussion, Group Work	Group work	Students discuss the causes and implications of	Critical thinking, Problem-	Environmental Science, Geography,	Whiteboard, Markers

Time	Content	Requirements	Student activities	Pedagogical approaches	Methods	Organizational forms	Teaching activity	Competencies	Interdisciplinary connections	Tools and visualization
		its implications for the environment and human societies.	warming and its implications, followed by a group activity to brainstorm solutions.	critical thinking through group discussions			global warming in groups, brainstorming solutions to mitigate its effects.	solving, Collaboration	Social Studies	
35-40 min	Greenhouse gas emissions and sectors	Students should understand the main sectors contributing to greenhouse gas emissions and their relative impacts on climate change.	Presentation of slides detailing the main sectors contributing to greenhouse gas emissions and their proportions.	Presenting information through visual aids and examples to enhance understanding	Lecture, Presentation	Whole-class presentation	Teacher presents information on greenhouse gas emissions by sectors, highlighting their relative contributions to climate change.	Knowledge acquisition, Understanding global systems	Environmental Science, Economics, Geography	Projector, Slides ppt
40-45 min	Mitigation strategies for agricultural pollution	Students should be familiar with various mitigation strategies for agricultural pollution, including optimizing fertilizer use and adopting sustainable farming practices.	Presentation of slides on different mitigation strategies, followed by a class discussion on their effectiveness and implementation challenges.	Encouraging critical analysis and evaluation of strategies to address environmental issues	Lecture, Discussion	Whole-class discussion	Teacher discusses mitigation strategies for agricultural pollution, prompting students to evaluate their effectiveness and feasibility.	Critical thinking, Evaluation of strategies for sustainability	Environmental Science, Agriculture, Chemistry	Projector, Slides ppt

Homework:

For the next lesson, collect different ideas and tips on how to reduce your carbon footprint in everyday life, such as shopping, eating and energy consumption.

MODULE 4 - 05
AGROFORESTRY

Lesson material: The lesson covers the topics Agroforestry, including the basics, main classification, different practices and benefits.

Lesson type: Frontal teaching supplemented with discussions, encouragement of critical thinking, and practical examples.

Aim: Familiarization with Agroforestry practices and the benefits it brings for both the environment and society, as well as income. Introduction to innovative practices and the integration of forestry into agricultural and urban environments.

Tasks:

- Educational tasks: Students will understand the new concept of Agroforestry and its broader significance. They will also become acquainted with the technology of implementing this practice.
- Didactic tasks: Students are enabled to critically assess examples from their environment and discuss them. So they will develop their critical thinking and problem-solving skills.
- Pedagogical/psychological tasks: Tasks will be designed to promote the development of emotional intelligence among students, while understanding and responding to environmental and social issues.

Methods:

- Educational methods: Conversations, group discussions, problem solving and experiential learning methods will be used to develop students' environmental awareness and ethical sensitivity.
- Didactic methods: Posing questions, leading discussions and problem-solving exercises will actively engage students in the learning process and help them understand and apply the content.

Organizational forms: Small-group discussions will provide opportunities for students to engage in collaborative thinking and discuss different perspectives. Field trips within case studies will provide students with insights into the advantages and disadvantages of implementing Agroforestry and the problems that farmers encounter. This way, students will be able to discuss the presented topic on-site, explore the implementation of this practice, and seek solutions to the problems.

Connections to other subjects: The content of the lesson relates to various subjects such as biology, chemistry, physics, geography, social sciences and economy, allowing for an interdisciplinary approach and the deepening of integrated knowledge.

These elements help articulate the structure and objectives of the lesson while emphasizing the pedagogical and methodological approaches used during the learning process.

Time	Content	Requirements	Student activities	Pedagogical approaches	Methods	Organizational forms	Teaching activity	Competencies	Interdisciplinary connections	Tools and visualization
0-5 min	Introduction to Agroforestry	Students should have basic knowledge of agriculture and forestry.	Brief discussion and brainstorming session on the definition of Agroforestry.	Engaging students in critical thinking about this practice and the examples from their surroundings.	Brainstorming, Discussion	Whole-class discussion	Teacher introduces the topic of Agriculture, defining key terms and providing examples.	Critical thinking,	Environmental Science, Biology, Geography	Projector, ppt, Slides: 1,2
5-25 min	Basics of Agroforestry and main classification	Students should understand the different types of Agroforestry and recognize the practices in their living area	Presentation of slides about classification and examples of good practice.	Presenting information through visual aids and examples to enhance understanding	Lecture, Presentation, discussion with students	Whole-class presentation	Teacher explains the basics of Agroforestry and explain the main classification. During explanation asks the students a questions about this practice in their living area.	Knowledge acquisition, Environment observation and critical thinking	Environmental Science, Biology	Projector, ppt, Slides: 3- 8
25-45 min	Environmental benefits of Agroforestry	Students should understand the concept of preventing erosion and improvement of	Presentation of slides explaining environmental benefits	Presenting information through visual aids and	Lecture, Presentation, discussion, posing questions	Whole-class presentation	Teacher explains the environmental benefits, highlighting	Knowledge acquisition, Understanding impact	Environmental Science, Biology,	Projector, ppt, Slides: 9.10.11

Time	Content	Requirements	Student activities	Pedagogical approaches	Methods	Organizational forms	Teaching activity	Competencies	Interdisciplinary connections	Tools and visualization
		soil structure through Agroforestry	and discussion.	examples to enhance understanding			its importance and impact on the environment.	and holistic approach		
45-65 min	Economic, social benefits and issues of Agroforestry	Students should have a comprehensive understanding of global trade and human societies.	Presentation of slides explaining economic and social benefits and discussion about issues.	Presenting information through visual aids and examples to enhance understanding.	Lecture, Presentation, discussion, posing questions	Whole-class presentation and discussion	Teacher explains the economic and social benefits, highlighting its importance and issues. Teacher poses a questions and leads the discussion.	Knowledge acquisition, Understanding the impact of Agroforestry, critical thinking, Problem-solving.	Environmental Science, Biology, sociologv, active citizenship and economy	Projector, ppt, Slides: 12-15
65-85 min	Planning and examples of Agroforestry	Students understand the importance of planning plantings.	Presentation of slides explaining planning and examples.	Presenting information through visual aids and examples to enhance understanding	Lecture, presentation, discussion.	Whole-class presentation	Teacher explains the importance of planning and examples. Teacher leads the discussion.	Knowledge acquisition.	Environmental Science, Geography, Architecture.	Projector, ppt, Slides: 16-21 .
85-110 min	Agroforestry	Students should understand the concept of Agroforestry.	Working in groups of 4 students. Sketching	Cooperative learning and case study (Planning	Working in small groups, brainstormi	Small groups	The teacher divide students into groups and	Critical thinking, planning,	Environmental Science, Agricultur	paper B2, markers

Time	Content	Requirements	Student activities	Pedagogical approaches	Methods	Organizational forms	Teaching activity	Competencies	Interdisciplinary connections	Tools and visualization
			with markers on paper, collaboration.	the school surroundings as an example of Agroforestry)	ng, group discussion		instructs the groups to sketch the school surroundings as an Agroforestry plantation, taking into account the gain knowledge.	collaboration. Communication skills.	e, Forestry, Urbanism	
110-130 min	Agroforestry	Students should understand the concept of Agroforestry	Reporting and discussion	Cooperative learning, case study	Method of work evaluation	Whole-class presentation and discussion	Leading the reporting and discussion	Knowledge acquisition. Critical thinking. Communication skills.	Environmental Science, Agriculture, Forestry, Urbanism	/
130-135 min	Closure – summarising the topic		Answer questions		Group discussion.	Whole-class presentation	Asks questions	Communication skills.		

Homework:

For the next lesson, bring a photo of an Agroforestry example that you found in your surroundings.

Applicable methods of teaching Regenerative Agriculture in adult education

Introduction: the significance of adult education in Regenerative Agriculture

Regenerative agriculture (RA) has emerged as a critical paradigm shift in recent years' sustainable farming practices, and it has insinuated not only into the curricula of higher education programmes, but into adult education courses. Meanwhile at the universities the future experts can gain an insight into this new concept during their studies, the main aim of educating practising agronomists is to provide them with up-to-date knowledge and information for the purpose of restoring and increasing ecosystem health while ensuring long-term agricultural productivity. The adoption of regenerative practices has gained traction as a promising solution as the global community grapples with escalating environmental challenges. Adult education plays a pivotal role in facilitating the transition to regenerative agriculture among farmers and land managers.

Challenges and Barriers

Despite its promise, the widespread adoption of regenerative agriculture faces challenges. These include initial costs associated with transitioning from conventional methods, access to appropriate training and education, and overcoming ingrained cultural and systemic barriers within the agricultural industry. Additionally, the perceived risks of lower yields during transition periods and market uncertainties can deter farmers from embracing regenerative practices without adequate support and education.

Role of Adult Education in Promoting Regenerative Agriculture

Adult education plays a crucial role in overcoming these barriers by providing farmers with the knowledge, skills, and confidence needed to implement regenerative practices effectively. Tailored educational programs offer practical training in soil health management, biodiversity conservation, and sustainable farming techniques. Workshops, field days, and demonstration farms provide hands-on learning opportunities where farmers can observe regenerative principles in action and interact with experienced practitioners.

Furthermore, adult education fosters a deeper understanding of the ecological and economic benefits of regenerative agriculture. It equips farmers with the tools to conduct farm-scale assessments, analyse ecosystem services, and make informed decisions that enhance both environmental sustainability and profitability. By promoting a systems-thinking approach, adult education encourages farmers to recognize the interconnectedness of soil health, water management, biodiversity conservation, and climate resilience in agricultural systems.

Impact on Sustainable Development Goals

The adoption of regenerative agriculture through adult education aligns with several United Nations Sustainable Development Goals (SDGs). It contributes to Goal 2 (Zero Hunger) by enhancing food security through resilient agricultural practices. RA supports Goal 13 (Climate Action) by mitigating greenhouse gas emissions and promoting climate-resilient farming systems. Moreover, it aligns with Goal 15 (Life on Land) by conserving biodiversity and restoring degraded lands, thereby safeguarding ecosystem services critical for human well-being.

Case Studies and Success Stories

Numerous case studies demonstrate the transformative impact of adult education in promoting regenerative agriculture worldwide. The case studies carried out in REGINA project illustrate how targeted education and support can empower farmers to adopt regenerative practices successfully. These initiatives not only improve soil health and farm productivity but also strengthen community resilience and foster sustainable rural development.

Policy Implications and Support Mechanisms

Effective policies and support mechanisms are essential for scaling up regenerative agriculture through adult education. Governments can incentivize the adoption of regenerative practices through financial incentives, grants for research and innovation, and subsidies for education and training programs. Collaborative partnerships between government agencies, academic institutions, non-governmental organizations, and agricultural stakeholders are crucial for developing comprehensive educational frameworks and disseminating best practices.

Conclusion

In conclusion, adult education plays a pivotal role in advancing regenerative agriculture by equipping farmers and agronomists with the knowledge, skills, and resources needed to the transition towards sustainable and resilient farming practices. Moving forward, continued investment in adult education and capacity-building initiatives is essential for fostering a widespread adoption of regenerative agriculture and achieving sustainable development goals on a global scale. Apart from an initial governmental support, to ensure the continuance of the promising results, a constant and targeted funding is essential.

Useful Methods of Introducing the Good Practices for RA Experts, Farmers and People Interested

Introducing and spreading knowledge on **Regenerative Agriculture (RA)** to adults not participating in the formal educational system requires flexible, engaging, and practical approaches. The following list of practice-based teaching methods can be effective in this context. The composition of the audience will determine which method is applied.

1. **Workshops & Hands-On Demonstrations**

- **Description**: Organizing interactive workshops on regenerative agriculture practices in the field of cover cropping, composting, rotational grazing and agroforestry.
- **Why it works**: Adults learn best through practical, hands-on experiences which provide immediate relevance and application in their field of operation.
- **Key Feature**: Incorporate real-life farm tours or practical demonstrations to allow participants to see the benefits of RA in action.

2. **Peer-to-Peer Learning & Farmer Networks**

- **Description**: They facilitate farmer-to-farmer learning circles or support groups where individuals can share experiences, successes, and challenges related to RA.
- **Why it works**: Peer learning builds trust and community while fostering collaboration and mutual learning.
- **Key Feature**: Using existing networks, co-operatives, or community groups to create a sense of shared responsibility and knowledge exchange.

3. **Field Days & Farm Visits (for a detailed lesson plan see Methodology p78)**

- **Description**: Organizing visits to farms practising regenerative agriculture where participants can witness the benefits first-hand (e.g., soil health, biodiversity, reduced inputs).
- **Why it works**: Field days offer real-world examples and showcase the tangible outcomes of RA, making abstract concepts more relatable.
- **Key Feature**: Using knowledgeable guides or experienced farmers to lead the discussions, explaining the techniques in a clear and compelling way.

4. **Online Webinars & Virtual Learning Platforms**

- **Description**: Offering webinars, video tutorials, and online courses on regenerative agriculture topics, accessible from anywhere.
- **Why it works**: They provide flexibility for adults who may have time constraints and cannot attend in-person events.
- **Key Feature**: Including live Q&A sessions, case studies, and step-by-step video demonstrations to maintain engagement and interactivity.

5. **Community Gardens & Pilot Projects**

- **Description**: The aim is to create local community garden projects that implement RA principles (e.g., permaculture, no-till farming) and invite participants to help manage and learn.
- **Why it works**: Community gardens offer a communal space for learning through doing, while also generating food and environmental benefits.
- **Key Feature**: Ensuring long-term involvement by connecting participants to local RA mentors or agriculture experts who can provide ongoing support.

6. **Storytelling & Testimonials**

- **Description**: The main aim is to share stories of farmers, land managers, or communities who have successfully transitioned to regenerative agriculture through podcasts, blogs, and videos.
- **Why it works**: Storytelling humanizes RA concepts, making them more relatable, and can inspire others by showing that transformation is possible.
- **Key Feature**: Focusing on diverse, local stories to ensure resonance with the audience's specific context.

7. **Participatory Learning & Action Research**

- **Description**: The main aim is to involve participants in small-scale research projects or experiments on their own land or in community settings, testing different regenerative techniques.
- **Why it works**: Action-based learning empowers individuals to explore new practices in a low-risk environment and provides hands-on evidence of RA's effectiveness.
- **Key Feature**: Sharing results and data from these experiments within the community to foster collective learning.

8. **Collaborations with Local Businesses & NGOs**

- **Description**: The aim is to partner with local food businesses, co-ops, or non-profits to organize events, produce RA-related materials, or provide financial and technical support.
- **Why it works**: Local businesses and NGOs can bring resources, credibility, and a larger audience to RA educational efforts, while also creating market linkages.
- **Key Feature**: Co-creating programs with local stakeholders to ensure they meet the needs of the community.

9. **Social Media Campaigns & Influencers**

- **Description**: Using platforms like Instagram, Facebook, or YouTube to spread awareness about RA, featuring short tutorials, success stories, and how-to guides.

- **Why it works**: Social media is a powerful tool for reaching a broad audience, especially those not involved in formal education.
- **Key Feature**: Engaging with influencers in sustainable farming or environmental conservation to increase visibility and interest.

10. **Farm Apprenticeships or Internships**

- **Description**: The aim is to create opportunities for adults to work on regenerative farms through apprenticeships or internships where they can learn through daily tasks and mentorship.
- **Why it works**: On-the-job learning offers practical experience and deeper immersion in RA practices with immediate feedback from experienced practitioners.
- **Key Feature**: Ensuring that the apprenticeship includes structured learning components and progression so that participants gain comprehensive skills.

11. **Farmers' Markets & Local Food Initiatives**

- **Description**: The aim is to use local farmers' markets or food co-ops as platforms to teach customers and farmers about regenerative farming methods through talks, flyers or live demos.
- **Why it works**: These venues attract people already interested in food sustainability and create an informal but engaging learning environment.
- **Key Feature**: Creating visible, interactive displays showing the benefits of RA, like healthier soils, improved water retention, or higher-quality produce.

12. **Citizen Science Projects**

- **Description**: The aim is to engage community members in collecting data (e.g., soil health, water usage) and observing ecological impacts of regenerative agriculture on local land.
- **Why it works**: They involve participants in meaningful scientific research, making them part of the knowledge creation process and deepening their understanding.
- **Key Feature**: Collaborating with agricultural scientists or universities to provide guidance and support for these projects.

13. **Story Mapping & Visual Tools**

- **Description**: Use interactive maps, diagrams, and visual tools to show the impact of RA on landscapes, ecosystems, and communities over time.
- **Why it works**: Visual aids help clarify complex ideas and can engage visual learners who may not respond as well to text-heavy materials.
- **Key Feature**: Utilize GIS technology or time-lapse photography to show how RA practices can transform the land over time.

14. **Radio Programs & Podcasts**

- **Description**: Broadcasting educational content about regenerative agriculture through community radio stations or podcasts targeting adult learners.
- **Why it works**: Radio and podcasts provide accessible and on-demand content for individuals with limited time for formal learning.
- **Key Feature**: Developing engaging, storytelling-based content with interviews, case studies, and tips from RA experts.

15. **Community-Led Workshops & Events**

- **Description**: The aim is to encourage local community leaders or successful RA practitioners to host workshops or events sharing their experiences and knowledge.
- **Why it works**: Community-led initiatives create a sense of ownership and are often better received than externally-led programs.
- **Key Feature**: Focusing on local contexts and practical knowledge that is directly applicable to the participants' environments.

Conclusion

By employing a combination of these methods, knowledge on **Regenerative Agriculture** can be effectively spread to adult learners in diverse communities. The key is to make learning practical, relevant, and accessible, while encouraging community collaboration and self-driven exploration.

Indicative structure and content of adult education course (as implemented in Greece)

The content of modules presented in the Higher Education chapter has been selectively used, simplified and reduced in volume, to suit the needs and capabilities of the targeted adults, mostly farmers and the other interested individuals.

The learning content can be then indicatively organized in two modules, which can be delivered in two lessons each. The number of lessons can vary, depending on the interest, availability and learning capabilities of the trainees. This is an issue to be decided by the trainer.

Every lesson is complemented by case studies and other hands-on methods as suggested above, showcasing best practices on the different topics included in the lesson, thus setting the stage for discussion and experience exchange among trainees.

The structure of the Modules is presented below, as piloted with a group of farmers, agronomists and interested individuals in Greece.

Module 1 includes the following topics

1.1 Introduction to Regenerative Agriculture

- Overview of Regenerative Agriculture principles
- Historical context and evolution of regenerative farming
- Movements, definition and principles of Regenerative Agriculture
- Importance and benefits of regenerative practices (for soil health, biodiversity, and climate resilience)
- Key Practices of Regenerative Agriculture (cover cropping, crop rotation, no-till farming, agroforestry, and holistic grazing…)
- Agroecology and Ecosystem Services
- Holistic approach & management
- Case studies of key regenerative practices

1.2 Regenerative Agriculture Certification

- Explore different regenerative farming certification schemes.
- Criteria and standards for certification
- Emerging trends in regenerative agriculture and certification
- Case studies of certified regenerative farms

Module 2 includes the following topics

2.1 Soil Health and Management

- Fundamentals of soil science/ Soil structure and composition
- Importance of soil microbiology and soil organic matter

- Living soils & plant symbiosis
- Practices for improving soil health, including cover cropping, crop rotation, and reduced tillage
- Fertilization and biofertilizers

2.2 Biodiversity Conservation

- Understanding biodiversity and its role in agricultural ecosystems
- Strategies for enhancing biodiversity on the farm, such as agroforestry, hedgerows, and wildlife corridors
- Wildlife Habitat Management
- Integrated Pest & Weed Management

2.3 Water Management - Sustainable Water Use

2.4 Crop and Livestock Management (Polyculture, Agroforestry, Food Forest, Grassland management)

2.5 Case Studies and Best Practices on the above topics

Summary

By completing the course, university students, secondary school students, farmers:

- Can understand and correctly apply the basic concepts related to Regenerative Agriculture, and are able to define RA.
- Understand the concepts of Regenerative Agriculture and can critically evaluate different soil management practices and methods. They can select the methods fitting into the RA approach and to plan preparation or the soil for different crops (taking climatic and soil conditions into account).
- Understand the principles of plant nutrition. He/she applies a critical view on the questions of nutrient management and can develop a nutrient management plan in line with the RA approach. He/She could analyse soil test results and make recommendations for fertiliser selection.
- Can plan the crop structure of a farm based on RA guidelines, to set up crop rotations. They bear the ability to select cover crops, green manure crops, catch crops and to integrate them into the crop structure. They can critically evaluate the elements of a crop rotation and make improvements where necessary.
- Can identify steps towards sustainable water management, to apply guidelines for soil cultivation and crop structure to conserve moisture.
- Know and understand the role of biodiversity growth, which to be accomplished, they can plan and implement changes in crop production.
- Understand the role of RA in reducing GHG emissions, recognise the economic, environmental, and social benefits and bearing these elements in mind, they can plan farming processes.
- Understand the role of RA in rural development.

The methodological recommendations developed herein are primarily tailored to the needs of university students, particularly to the ones studying at the Széchenyi István University. Naturally, the educational system of the institutions participating in the programme may vary from this, so we highly recommend each institution to adapt the suggested methods according to their own needs, thus providing the opportunity to learn in a way that suits their normal course of studying.

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