Pilot Implementation Report

Deliverable 3.3

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Executive Summary

The B4C pilot projects demonstrated how biochar and Circular Carbon Economy (CCE) concepts can be successfully integrated into vocational education, adult learning and professional development across a variety of sectors. A total of 17 pilot courses for VET (AE) Learners and two professional development projects (for VET Trainers and Carbon Managers) were implemented by the project partners, covering construction, horticulture, agriculture, and Circular Carbon Management.

While the thematic focus varied considerably, all pilots were based on a common competence-oriented learning approach combining self-directed learning, practical experimentation, collaborative project development[1] and reflection.

The experience reports reveal that the B4C methodology is highly adaptable to different target groups and learning environments. Participants not only acquired technical knowledge on biochar production, applications and carbon management, but also developed transversal competences such as systems thinking, teamwork, innovation, problem-solving and sustainability-oriented decision-making. Across all pilots, practical relevance and direct applicability were identified as key success factors.

A particularly important finding concerns the role of the trainers and facilitators. The pilots consistently showed a shift from traditional teacher-centred instruction towards learner-centred facilitation, coaching and collaborative knowledge creation. Methodologies such as Design Thinking, Design-Based Collaborative Learning and competence validation enabled learners to actively engage in solving authentic challenges while developing concrete products, prototypes and implementation concepts.

The pilots generated a broad range of outcomes, from biochar-concrete prototypes and horticultural applications to climate-farming concepts, biomass utilisation scenarios and regional carbon management projects. Many learning resources, methodologies and project concepts remain available for future use and demonstrate strong transfer potential across sectors and educational contexts.

Overall, the pilot experiences confirm that the B4C approach provides an effective framework for linking vocational learning with innovation, sustainability and real-world problem solving. The following chapters synthesise the lessons learned regarding development, contents, methodology, outcomes, impact, sustainability, transferability and professional development across all partner pilots.

[1] 10 practical pilot projects were developed in the framework of the pilot course phase, reported in WP5 (accredited courses).

1. The B4C Pilot Report – Partner-Specific Analysis by Key Sectors

1.1. Introduction

The B4C project was established to bridge gaps in sustainability education across various levels and sectors of education—primarily focusing on Vocational Education and Training (VET).

At its core, B4C combines the teaching and implementation of biochar based Circular Carbon Economy with design thinking, collaborative, constructive and competence-based learning, and eventually validation. The overarching goal is to develop not only technical understanding of biochar production and application, but also transfer these competences in concrete learning projects which also includes the acquisition of transversal competences such as critical thinking, collaboration, empathy, and entrepreneurial spirit.

Trainers and facilitators played a pivotal role in implementing the B4C methodology across Europe. Each facilitator underwent a Train-the-Trainer programme, covering B4C's theoretical and methodological foundations. They were equipped with domain specific (biochar and the CCE related) competences and facilitation competences in relation with competence oriented learning and the LEVEL5 validation system (to assess competence development), and frameworks for design-based collaborative learning (DBCL) and -research (DBCR).

Following the training, partners were responsible for conducting pilot implementations—adapting B4C in ways suitable to their institutional context, target group, and thematic focus. The purpose of these pilots was threefold: 1) to test and refine the B4C approach in specific learning pathway in diverse contexts, 2) to validate whether the proposed competences could be realistically acquired in practice, and 3) to offer trainers and learners a unique opportunity to engage in real-world CCE action. The pilots serve as a backbone to B4C's research phase, evidencing how learning processes anchored in real-life challenges can transform both learners and VET approaches.

1.2. Development Process

The development process across B4C partners reflected the flexibility and modular nature of the methodology. The trainers of each partner transferred the B4C-approach to their specific VET learning offers for their professional target groups:

IFSB, LU, developed and piloted a competence-oriented learning pathway introducing biochar as an innovative and sustainable material for three courses in the construction sector in LU. The pilot courses addressed the increasing need to reduce the carbon footprint of construction materials while promoting Circular Carbon Economy principles and climate-friendly building practices.

DEULA Nienburg, DE, developed a coherent suite of three complementary learning activities addressing biochar applications, Circular Carbon Economy (CCE), and sustainability-oriented innovation in agriculture. The learning offer combined introductory awareness raising, practical experimentation, and teacher training to support the integration of biochar and circular resource management concepts into agricultural vocational education and training (VET).

ASTREDHOR, FR, developed 3 courses and a suite of complementary learning activities introducing biochar as an innovative bio-based material for ornamental horticulture, landscaping, and urban green infrastructure. The learning offer combined awareness-raising, professional training, and demonstration-based learning to support the integration of biochar into horticultural and landscape management practices.

Folkuniversitetet (FUU), SE, developed a set of three complementary pilot courses designed to introduce biochar and Circular Carbon Economy (CCE) concepts into vocational and adult education. The pilots addressed different educational contexts, ranging from teacher training and curriculum development to practical horticultural experimentation and community awareness raising. Together, they created a progressive learning pathway that supports both sustainability literacy and the practical application of biochar-related knowledge.

blinc eG developed a series of competence-oriented learning projects that transferred the B4C methodology into real-world development contexts. The pilots combined vocational, professional, and community-based learning and focused on enabling participants to design and implement Circular Carbon Economy (CCE) projects based on biochar and residual biomass utilisation. Unlike traditional training courses, the learning activities were embedded in authentic regional development challenges, allowing participants to learn while co-creating practical solutions.

1.3.Contents

IFSB

The construction pilots focused on the use of biochar as an innovative component in sustainable building materials. Participants explored biochar production processes, carbon sequestration mechanisms, material properties and quality requirements, as well as practical applications in concrete and construction elements. Particular emphasis was placed on biochar-concrete mixtures, prototype production, compressive strength testing and the balance between environmental performance and technical standards. The content linked climate mitigation directly to construction practice and material innovation.

FUU

The Swedish pilots used biochar as a vehicle for broader sustainability education. Contents covered biochar production, carbon cycles, climate change mitigation, Circular Carbon Economy principles, soil health, water retention and urban gardening applications. Participants also explored environmental communication, citizen engagement and curriculum development. Practical activities included biochar trials in cultivation systems, observation and monitoring tasks, awareness campaigns and the creation of educational resources that linked scientific understanding with everyday sustainability practices.

ASTREDHOR

The horticultural pilots addressed biochar applications in ornamental production, nurseries, landscaping and urban green infrastructure. Participants explored pyrolysis processes, biochar properties, carbon storage mechanisms, soil fertility, growing media and water management. Practical examples included biochar use in container production, substrate optimisation, urban greening projects, tree planting, green infrastructure and pollution mitigation. The courses also addressed

implementation barriers, economic considerations and professional decision-making in sustainable landscape management and horticultural production systems.

DEULA

The agricultural pilots combined technical and environmental perspectives on sustainable farming. Contents included carbon cycles, Circular Carbon Economy principles, biomass utilisation, nutrient management, biochar production and agricultural applications. Specific examples addressed biochar use in soils, composting systems, slurry treatment, nutrient retention and emission reduction. Additional modules focused on climate-friendly farming practices, systems thinking and Design Thinking methodologies. The courses encouraged participants to analyse agricultural sustainability challenges and develop practical, innovation-oriented responses suitable for vocational education contexts.

blinc

The blinc pilots addressed the entire biochar value chain within real-world sustainability and climate-management projects. Participants explored biomass resource assessment, pyrolysis technologies, carbon management systems, CO_2 accounting, climate farming concepts and regional Circular Carbon Economy development. Concrete examples included roadside verge biomass utilisation, municipal green waste management, adapted biochar production technologies, climate-resilient farming systems, compost and slurry applications, water retention substrates and carbon sequestration calculations. The content was strongly linked to the development of practical project concepts and regional implementation scenarios.

1.4. Methodology

IFSB

The IFSB pilots applied a strongly practice-oriented methodology that reflected the realities of the construction sector, additional to an online seminar. Separate learning pathways were developed for planners and site workers, allowing participants to engage with content relevant to their professional roles. The methodology combined classroom instruction, technical discussions, demonstrations and hands-on experimentation. Participants produced biochar-concrete mixtures, manufactured prototypes and tested material properties. Reflection sessions linked practical observations to sustainability objectives and professional decision-making in construction projects.

FUU

FUU adopted a participatory and learner-centred methodology based on exploration, experimentation and co-creation. The pilots combined online learning, collaborative workshops, practical gardening activities, community engagement and curriculum development exercises. Learners actively investigated biochar applications through observation, experimentation and reflection rather than passive knowledge acquisition. Digital collaboration tools, peer learning and public awareness activities played an important role. The methodology encouraged participants to become multipliers who could transfer knowledge into educational and community contexts.

ASTREDHOR

ASTREDHOR combined awareness-raising, professional online training and demonstration-based learning. The methodology integrated webinars, expert presentations, facilitated discussions, case studies and practical demonstrations using biochar samples. Participants were encouraged to connect the information directly to their own professional environments and implementation challenges. The progressive learning design allowed participants to move from introductory knowledge to applied problem-solving. Peer exchange between practitioners from different horticultural and landscaping sectors further enriched the learning process and stimulated knowledge transfer.

DEULA

DEULA employed a competence-oriented methodology centred on Design Thinking and Collaborative Open Learning. Traditional teaching inputs were combined with group work, problem-solving tasks, practical demonstrations and innovation workshops. Learners analysed real agricultural challenges, generated ideas, developed solutions and reflected on implementation options. Farm-related examples and practical applications ensured relevance for vocational learners. The methodology placed strong emphasis on systems thinking, teamwork and creativity, enabling participants to move beyond technical knowledge towards innovation and practical application.

blinc

The blinc pilots applied Design-Based Collaborative Learning (DBCL) as their core methodology. Learning was embedded in authentic regional development projects, enabling participants to learn while solving real-world challenges. The methodology combined asynchronous e-learning, expert workshops, excursions, biomass analyses, stakeholder mapping, Design Thinking processes and collaborative prototyping. Learners worked in interdisciplinary teams to develop project concepts and implementation scenarios. A distinctive feature was the integration of competence assessment through LEVEL5, allowing participants to continuously reflect on and validate their learning and development process.

1.5.Outcomes

IFSB

The most tangible outcome was the successful production and testing of biochar-enhanced concrete elements under realistic conditions. Participants acquired practical experience with material preparation, mixing procedures and prototype production while gaining a better understanding of the opportunities and limitations of biochar in construction materials. The pilot generated increased confidence among both planners and practitioners regarding the feasibility of integrating carbon-storing materials into future construction projects and vocational training programmes.

FUU

The pilots generated a diverse range of educational and practical outputs. Teachers developed new learning materials and teaching concepts, while learners carried out biochar experiments and sustainability-related observation activities. Public awareness resources and community engagement activities were also created. A key outcome was the successful integration of biochar and Circular Carbon Economy concepts into educational settings, demonstrating that complex climate-related topics can be translated into accessible learning experiences for diverse audiences.

ASTREDHOR

Participants gained practical knowledge about biochar applications in horticulture and landscaping and were able to assess its relevance for their own professional contexts. The pilots increased understanding of how biochar can contribute to soil improvement, water management and climate resilience in ornamental production and urban green spaces. Several participants identified concrete opportunities for future implementation, while the demonstration activities provided practical evidence supporting the adoption of biochar-based solutions within the horticultural sector.

DEULA

The agricultural pilots resulted in a deeper understanding of climate-friendly farming practices and the role of biochar within sustainable agricultural systems. Participants developed practical ideas for improving nutrient management, reducing emissions and increasing resource efficiency. Teachers and trainers created educational concepts that can be incorporated into agricultural VET programmes, while learners strengthened their ability to analyse agricultural challenges and develop innovative responses using Circular Carbon Economy principles and Design Thinking approaches.

blinc

The blinc pilots generated four concrete project concepts and strategic development scenarios. Outcomes included biomass potential analyses, stakeholder assessments, carbon management calculations, climate-farming concepts and prototype Circular Carbon Economy projects. Participants developed realistic implementation pathways for municipal green waste utilisation, roadside biomass valorisation and farm-based carbon management systems. Several pilots progressed beyond learning activities and produced decision-support information for local authorities, climate managers and agricultural practitioners, creating direct links between learning and regional development.

1.6.Impact

IFSB

The pilot contributed to raising awareness of biochar as a viable construction material among both technical planners and construction workers. By demonstrating practical applications and testing procedures, it reduced uncertainty regarding biochar-concrete solutions and stimulated interest in future experimentation and implementation. The pilot also strengthened dialogue between different professional groups within the construction sector and helped position carbon-storing materials as a realistic option within sustainable building strategies.

FUU

The impact extended beyond the immediate learner groups and reached educators, community stakeholders and local citizens. The pilots demonstrated that biochar can serve as an effective entry point for sustainability education and climate action. Participants became multipliers who transferred knowledge into classrooms, community projects and local sustainability initiatives. The combination of environmental awareness, practical experimentation and educational innovation contributed to broader engagement with Circular Carbon Economy principles and climate-responsible behaviour.

ASTREDHOR

The pilots increased awareness and acceptance of biochar among horticultural and landscaping professionals who had previously had limited exposure to the topic. Participants gained confidence in assessing potential applications and discussing biochar within their professional networks. The demonstrations helped bridge the gap between research and practice, while the focus on urban greening, soil management and climate resilience aligned biochar with current priorities in the horticulture sector. This created favourable conditions for future adoption and knowledge dissemination.

DEULA

The pilots strengthened the integration of sustainability and Circular Carbon Economy concepts into agricultural vocational education. Participants developed a more systemic understanding of climate challenges and resource management within agriculture. The introduction of Design Thinking encouraged a more innovative mindset among learners and educators. Beyond technical knowledge gains, the pilots contributed to a stronger culture of experimentation and problem-solving within agricultural training environments, supporting the long-term modernisation of vocational education.

blinc

The blinc pilots generated impact not only at learner level but also within regional development processes. Several project concepts directly informed discussions among climate managers, local authorities, NGOs and agricultural stakeholders. The pilots demonstrated how competence-oriented learning can support the development of practical climate and sustainability initiatives. By linking learning to real projects, the activities contributed to decision-making processes, strengthened regional cooperation networks and increased awareness of biochar-based Circular Carbon Economy solutions as viable instruments for climate mitigation and adaptation.

1.7.Sustainability

IFSB

The sustainability of the pilot is supported by its close alignment with existing vocational training structures in the construction sector. The developed training modules, practical exercises and prototype production activities can be integrated into future courses with limited additional investment. As the demand for low-carbon construction materials continues to grow, the learning content remains highly relevant. The pilot also established a foundation for further experimentation with biochar-based building materials and future cooperation between training providers and industry actors.

FUU

The sustainability of the Swedish pilots lies primarily in the integration of biochar and Circular Carbon Economy concepts into educational practice and community activities. The developed learning materials, teaching approaches and awareness resources can continue to be used by teachers and organisations after project completion. By training educators and engaging local communities, the pilots created multiplier effects that support the long-term dissemination of sustainability-related knowledge. The flexible methodology also allows adaptation to other environmental and climate-related topics.

ASTREDHOR

The pilot outcomes can be sustained through ASTREDHOR's existing advisory, research and professional training activities. The training materials, case studies and demonstration formats can be reused in future courses and professional development programmes. As biochar applications are increasingly linked to soil health, climate resilience and urban greening strategies, the relevance of the content is expected to grow further. The pilot also strengthened networks between researchers, advisors and practitioners, supporting ongoing knowledge exchange and future implementation activities.

DEULA

The sustainability of the DEULA pilots is reinforced by their compatibility with existing agricultural VET programmes and continuing professional development activities. The learning units, practical examples and Design Thinking methods can be integrated into regular training provision without significant structural changes. The pilots also contributed to building institutional capacity among teachers and trainers, ensuring that knowledge and methodologies remain available beyond the project duration. The strong connection to current agricultural challenges further supports long-term relevance and utilisation.

blinc

The blinc pilots were designed with sustainability in mind by linking learning directly to ongoing regional development processes. The digital learning platform, competence assessment tools, Design Thinking resources and project concepts remain available for future use. Several project ideas developed during the pilots continue beyond the training phase through local stakeholder networks, climate management initiatives and agricultural innovation projects. The strong focus on capacity building among facilitators and participants further increases the likelihood that the methodology and project outcomes will continue to generate value over time.

1.8. Perspective/Transfer

IFSB

The pilot demonstrated strong transfer potential across the construction sector, particularly in occupations dealing with sustainable materials, building design and site implementation. The methodology can easily be adapted to other bio-based construction materials such as hemp, wood composites or recycled aggregates. The combination of theoretical understanding and practical testing provides a transferable model for introducing emerging sustainable technologies into vocational training. Future applications may also include continuing professional development for architects, engineers and construction managers.

FUU

The FUU approach is highly transferable to a wide range of educational contexts, including adult education, VET, schools and community learning initiatives. The pilots demonstrated that biochar can be used as a practical entry point for addressing broader themes such as climate change, sustainability, circular economy and environmental citizenship. The participatory learning methods and educational resources can be adapted to different target groups and topics, making the approach suitable for a wide range of environmental and sustainability education programmes.

ASTREDHOR

The horticultural pilots offer significant transfer potential to other green-sector professions, including urban greening, forestry, environmental management, landscape architecture and nature-based solutions. The awareness-raising and demonstration-based learning formats can easily be replicated by advisory organisations, training providers and professional associations. Furthermore, the growing interest in climate adaptation, biodiversity enhancement and sustainable soil management creates favourable conditions for transferring the approach to a broader range of environmental and land-management contexts.

DEULA

The DEULA pilots demonstrated that Circular Carbon Economy concepts can be effectively integrated into agricultural vocational education and continuing professional development. The methodology can be transferred to other agricultural sectors, including livestock production, horticulture, forestry and renewable energy. The Design Thinking approach proved particularly transferable, providing a framework for addressing a wide range of sustainability challenges beyond biochar. The pilots also offer a model for integrating innovation, systems thinking and climate action into vocational training curricula.

blinc

The blinc pilots demonstrated the highest level of transferability across sectors and contexts. The methodology was successfully applied in municipal climate management, agricultural development, sustainability management and climate-farming initiatives. The combination of e-learning, Design-Based Collaborative Learning, Design Thinking and competence validation provides a flexible framework that can be adapted to almost any sustainability-related challenge. The pilots further showed that the approach can support not only learning processes but also real-world innovation, stakeholder cooperation and regional development projects, making it particularly suitable for future VET, adult education and higher education contexts.

1.9. Professional Development

IFSB

The pilot enabled trainers and experts to strengthen their ability to connect sustainability concepts with vocational practice. Particular gains were reported in designing competence-oriented learning activities that combine theoretical understanding with hands-on experimentation. Trainers improved their capacity to facilitate interdisciplinary exchange between planners and practitioners and to integrate innovation topics into established vocational training programmes.

FUU

Professional development was particularly evident among educators who expanded their competences in learner-centred facilitation, project-based learning and sustainability education. Participants gained experience in combining scientific topics with community engagement and public awareness activities. The pilots also strengthened educators' confidence in developing flexible learning environments that encourage active participation, experimentation and co-creation.

ASTREDHOR

The pilots enhanced facilitators' ability to translate scientific research into practical professional learning opportunities. Trainers reported improved competences in communicating complex environmental topics to diverse audiences and in designing learning experiences that support knowledge transfer into professional practice. The combination of demonstration activities and professional dialogue proved especially valuable for advisory and extension work.

DEULA

Teachers and trainers reported significant gains in facilitating competence-oriented and innovation-driven learning processes. The Design Thinking methodology helped shift the trainer role from knowledge provider towards learning facilitator and coach. Participants strengthened their skills in moderating collaborative problem-solving processes and integrating sustainability and Circular Carbon Economy concepts into vocational education and training.

blinc

The strongest professional development effects were reported by blinc facilitators and external experts. The pilots accelerated the transition from teacher-centred instruction towards learner-centred facilitation and Design-Based Collaborative Learning. Trainers strengthened competences in coaching interdisciplinary teams, moderating innovation processes, supporting project development and implementing competence assessment and validation. Several facilitators described this as a fundamental change in their professional understanding of teaching and learning.

Cross-partner conclusion

Across all pilots, professional development extended beyond domain-specific expertise and focused primarily on new educational roles and methodologies. Facilitators increasingly adopted the role of moderator, coach and learning designer rather than traditional instructor. The combination of competence-oriented learning, collaborative project development, Design Thinking and practical experimentation proved highly effective in strengthening innovation, facilitation and systems-thinking competences. The experience reports suggest that the B4C methodology has substantial potential for modernising vocational and professional education by linking competence development directly to real-world sustainability challenges.

2. Pilot Learning projects and detailed experience reports

2.1. Building with Carbon-Storing Materials (IFSB)

2.1.1. Project Description

Summary

The B4C pilot project developed by IFSB focused on introducing Biochar as a sustainable and innovative material for the construction sector. The initiative responded to the growing need to reduce the carbon footprint of construction materials while supporting circular economy value chains.

Biochar represents a promising solution because it:

- Captures and stores CO2 in a stable form

- Contributes to Climate change mitigation
- Can be integrated into construction materials such as concrete
- Supports the transition toward sustainable construction practices

The pilot project was implemented through two complementary learning pathways:

- A theoretical awareness and knowledge development pathway for white-collar professionals
- A practical skills development pathway for blue-collar professionals

The final results included increased awareness of Biochar applications, hands-on experimentation with Biochar-based concrete, and the identification of potential technical trade-offs such as slightly reduced compressive resistance.

2.1.2. Experience Report




Development process

IFSB's Biochar pilot training was developed to translate sustainability concepts into practical learning experiences for construction professionals. The approach combined theoretical knowledge and hands-on experimentation, targeting both white-collar professionals (Brevet Q participants) and blue-collar workers (masons).

In our case, the staged learning sequence—**concept understanding, application, observation, and reflection**—proved to be an effective framework for introducing innovative materials in vocational training.

Positive and key aspects:

- Dual training pathway addressing both technical decision-makers and field professionals
- Strong integration of theory and practical exercises
- Use of real construction materials and working conditions
- Focus on linking sustainability to professional practice

Main challenges / hurdles:

- Explaining performance trade-offs between sustainability and mechanical resistance

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- Ensuring consistent mixing procedures during practical exercises
- Managing expectations regarding new material performance

Contents:

The training addressed core elements of **Sustainability Literacy** and **Education for Sustainable Development (ESD)** in the construction sector. Participants learned how material choices can contribute to climate change mitigation and circular economy strategies.

Contents:

- Climate change mitigation and carbon storage
- Circular economy principles in construction
- Sustainable construction materials
- Environmental impact of building processes
- Balance between environmental performance and structural safety

Potential transferability to other programmes:

- Sustainable construction and green building modules
- Concrete technology and materials training (other materials can be considered of course)
- Circular economy and decarbonization programmes
- Continuing professional development (CPD) courses

Methodology

The methodology combined *theoretical instruction* with *experiential learning* and *collaborative problem-solving.* The training design successfully reflected the principles of learner-centered vocational education.

Key methodological elements that we applied:

- Collaborative group work during practical exercises (this was particularly interesting as we had numerous trainees / students)
- Hands-on experimentation with Biochar-based concrete
- Observation and discussion of material behavior
- Continuous feedback and reflection sessions

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Design Thinking approach:

- Identification of sustainability challenges
- Exploration of innovative material solutions
- Testing through practical exercises (masons were keen to learn and explore)
- Evaluation of performance and feasibility

a. COL&V

Therefore, we can assume (and hope!) that the concept of **Collaborative, Open, and Learner-Centered Vocational learning (COL&V)** was successfully transferred into the training design and implementation.

From the trainers' perspective, the following elements of the COL&V approach were clearly visible during the pilot:

Collaborative learning => Participants worked together in small groups during practical exercises, sharing responsibilities and discussing observations (see pictures).

Open learning => Participants were encouraged to ask questions, express doubts, and propose alternative solutions.

Learner-centered learning => Training activities were adapted to participants' professional backgrounds and experience levels.

b. **Design Thinking,**

Elements of **Design Thinking** were applied during the development and delivery of the training activities, particularly in the practical phase.

The process followed a simplified Design Thinking cycle:

Understanding the problem => trainees explored the environmental challenges associated with traditional construction materials.

Ideation => trainees discussed potential applications of Biochar in construction.

Experimentation => trainees tested the material by mixing concrete and producing structural elements (posts and cubes).

Evaluation => trainees observed and discussed the performance of the material.

This iterative process supported experiential learning and encouraged participants to adopt a problem-solving mindset. We were pleasantly surprised by the implication of the masons and the amount of questions asked. Please keep in mind that Biochar is a material that is completely "unknown for most of the participants / trainees.

Outcomes

The pilot resulted in visible competence development among participants and demonstrated the feasibility of integrating innovative materials into vocational training.

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Competence development observed:

- Improved understanding of sustainable construction materials
- Ability to prepare and use Biochar in concrete mixtures
- Increased awareness of environmental responsibility
- Enhanced professional judgment regarding material performance

Of course, as previously mentioned, trainees / participants successfully developed tangible prototypes during the training activities. The following products were produced:

Concrete outputs produced:

- Concrete posts (poles) made with Biochar-based mixtures
- Standardized 15 cm concrete cubes prepared for compression testing

Impact

The training concept implemented within the B4C project can be considered innovative in comparison with traditional learning offers in the construction sector.

Traditional construction training often focuses on established materials and standard procedures. In contrast, this pilot introduced participants to an evolving technology and encouraged critical evaluation of its performance.

This forward-looking approach aligns with the ongoing transformation of the construction sector toward low-carbon and circular economy practices.

The" brevet Q" (white collars) public was more open minded towards technology, new materials and a sustainable / green materials approach. The masons (blue collars) were more traditionally-oriented as materials are concerned. But, after both a theoretical and practical approach, they understood the positive implications of Biochar usage in the construction sector.

Both publics gave a positive feedback at the end.

To summarize:

Innovative elements of the concept:

- Introduction of an emerging low-carbon material
- Integration of environmental and technical competencies
- Combination of theory and practical experimentation
- Focus on climate change mitigation in vocational training

Learner /trainees feedback:

- High interest in practical activities

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- Positive perception of working with new materials
- Recognition of the relevance of sustainability in construction
- Requests for more testing and extended practical session

Perspective

The first implementation of the Biochar pilot provided a strong foundation for future training activities. The results demonstrate that innovative materials can be successfully introduced into vocational education when supported by structured learning design and practical experimentation.

The approach must be tailored made however accordingly to the addressed public of learners / trainees.

Elements to maintain:

- Integration of theory and practice
- Hands-on learning activities
- Group-based experimentation
- Structured feedback and reflection

Elements to improve:

- Additional laboratory testing of material properties (more explanations, rather than coming with a “ready to go” recipe)
- Standardized mixing procedures (again, this was quite complicated fort he masons)
- Longer practical training sessions
- More technical data and performance monitoring (for IFSB as well as for the trainees)

Professional Development

The Biochar pilot demonstrated that innovative and sustainable materials can be effectively introduced into vocational education through structured learning design, practical experimentation, and continuous professional reflection.

Key learning outcomes for IFSB trainers:

- Improved knowledge of sustainable construction materials (Biochar is still something “unusual” and completely new for most trainers)
- Experience in designing experimental learning activities
- Enhanced ability to communicate sustainability concepts (this pilot clearly allowed us to go the “extra mile” and exit our comfort zone)

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- Increased competence in innovation-focused training delivery (again, new materials such as Biochar are opening teaching and learning pathways)

Future possible applications:

- Low-carbon construction training (additionally to the ones that already exist)
- Circular economy programmes
- Green skills development initiatives
- Climate-resilient construction education

2.2. Bringing Biochar into VET (FUU)

2.2.1. Project Description

- Summary

In Sweden, biochar is an emerging but still specialized topic within education. It has been mainly integrated into higher education and professional development contexts, such as through courses at Luleå University of Technology and research initiatives at the Swedish University of Agricultural Sciences (SLU). However, biochar is not yet widely included in primary, secondary, or vocational education (VET) programs. This indicates a clear gap and a strong need to introduce biochar education earlier in the learning pathway, especially in VET, where sustainability skills are increasingly demanded by the labour market.

Folkuniversitetet offers a wide range of exciting courses related to the environment, nature, sustainable development, and climate. In addition, there are specialized courses focusing on animals, hunting, and botany. However, despite this broad educational offer, the concept of Biochar and its potential benefits for sustainability, soil health, and climate action has not yet been integrated into the curriculum. This pilot project aims to address this gap by equipping VET teachers with the knowledge and tools needed to incorporate Biochar into existing and future course offerings.

The primary objective of the Pilot Project is to integrate the concept of biochar into educational programs within vocational education and training (VET) by fostering the collaboration among VET teachers through a set of participatory activities such as roundtables, learning modules creation contests, and methodological recommendations development.

The results of the project will be:

- Enhanced awareness of the sustainability (VET) teachers about the topic of biochar and its benefits for the sustainable practice.
- Enhanced capacity of VET teachers to integrate topic of biochar into their teaching practices.
- A collection of a Digital Tools designed to facilitate the teaching and learning of biochar.

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- Developed Methodological Recommendations aimed at supporting VET teachers in integrating biochar-related topics into their curricula.

2.2.2. Experience Report

Development process

The development and realisation of your learning course concept (sum up of the most important things here)

The experiences you made with the development (e.g., what was the most successful part of it, what was challenging)

The development of the learning concept focused on introducing biochar and Circular Carbon Economy (CCE) into vocational education and training (VET) through a structured teacher-focused pilot. The process was based on a clear gap identified in the educational system: while sustainability is increasingly present, biochar remains largely absent from VET curricula.

The learning concept was designed as a step-by-step learning pathway, combining knowledge-building, peer exchange, and practical application. It included four main components:

1. Introduction to biochar and its applications,
2. Roundtable discussions to identify needs and gaps,
3. Independent development of biochar-integrated learning modules,
4. Co-creation of methodological recommendations.

One of the most successful elements of the development process was the strong collaborative dimension. The roundtable discussions allowed participants to share real challenges from their teaching practice, which directly informed the module development phase. This ensured that the outputs were grounded in real educational needs.

However, a key challenge was the translation of a scientific concept into pedagogically accessible content. Many participants initially struggled to move from understanding biochar theoretically to designing structured teaching modules. This required additional facilitation, examples, and templates to support the transition from knowledge to application.

2. Contents:

The learning concept addressed core elements of Sustainability Literacy and Education for Sustainable Development (ESD), with a strong focus on practical implementation in VET.

The main content areas included:

- Introduction to biochar and its scientific foundations
- Biochar applications in sustainable agriculture, soil improvement, and climate mitigation

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- Principles of the Circular Carbon Economy
- Integration of sustainability topics into VET curricula
- Curriculum design and innovation, including development of learning modules

These topics were embedded into practical tasks rather than taught as standalone theory. Participants were encouraged to connect biochar to their specific vocational fields and teaching contexts.

The concept demonstrated strong potential for embedding into existing programmes, for example:

- As part of environmental or sustainability-related courses
- As a case study within climate or circular economy modules
- As a project-based learning activity in vocational training

Methodology

The pilot successfully implemented the concept of **Collaborative Online Learning and Virtual Exchange (COL&V)** through a combination of synchronous sessions and independent work.

Key methods included:

- Synchronous online learning (Zoom-based sessions)
- Facilitated discussions and roundtables
- Collaborative work using digital tools (Miro, Mentimeter)
- Task-based and project-based learning

The concept also incorporated elements of **Design Thinking**, particularly during:

- Identification of educational gaps (roundtable discussions)
- Ideation of solutions (brainstorming activities)
- Prototyping (development of learning modules)
- Structuring solutions (methodological recommendations)

Outcomes

Participants developed:

- **Knowledge** of biochar and its role in sustainability
- **Skills** in designing structured learning modules and integrating new content into curricula
- **Attitudes** reflecting increased motivation to incorporate sustainability and innovation into teaching

A key result of the pilot was the creation of tangible outputs:

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- **Prototype learning modules** integrating biochar into VET
- **Draft methodological recommendations** for curriculum integration
- A set of **digital tools and teaching resources**

Impact

In how far was the concept innovative (in contrast to other learning offers)?

Were your learners satisfied? How was the feedback?

The concept can be considered innovative compared to traditional VET training approaches because it:

- Introduces an **emerging sustainability topic (biochar)** into VET
- Focuses on **teacher empowerment and co-creation of content**
- Combines **sustainability education with curriculum innovation**
- Uses **participatory and design-based learning methods**

Feedback from participants was overall very positive. They particularly valued:

- The interactive and collaborative format
- The relevance of the topic to current sustainability challenges
- The opportunity to create their own teaching materials

Perspective

You should draw conclusions from your first launch: what would remain in a next round in your programme, what would you want to improve.

Based on the first implementation, several improvements can be identified:

What should remain:

- The structured learning pathway
- The collaborative and participatory approach
- The strong focus on practical outputs (modules and recommendations)

What should be improved:

- Provide more examples of completed learning modules
- Offer clearer guidance and scaffolding during independent tasks
- Allocate more time for peer feedback and reflection
- Include follow-up support for implementation in real teaching settings

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Professional Development

It is also interesting to know what you yourself has learnt (as trainers). What was new for you and what will you use in future, maybe also in other courses?

From the trainers' perspective, the pilot provided valuable learning and professional growth.

Trainers gained:

- Deeper understanding of **biochar and circular carbon economy concepts**
- Practical experience in **facilitating co-creation processes**
- Enhanced skills in **digital and online facilitation tools**
- Experience in applying **design thinking in education**

A key insight was the importance of **balancing content expertise with pedagogical support**, especially when introducing new and complex topics.

The experience will be directly applied in future training programmes, particularly in:

- Designing **interactive and learner-centred courses**
- Integrating **sustainability topics into VET**
- Using **collaborative and design-based methodologies**

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2.3. Biochar Urban Garden Booster (FUU)

2.3.1. Project Description

- Summary

At Folkuniversitetet, adult learners enrolled in the Gardening course participated in a student-led micro-experiment focused on using biochar to improve soil quality in small urban gardens. These settings included school gardens, community plots, and rooftop planters. Learners investigated how biochar influences plant growth, water retention, and soil health.

This pilot was selected because it offers an accessible and hands-on entry point into the carbon cycle and the circular economy. By observing and measuring differences between biochar-amended and non-amended soil, students developed both practical skills and scientific literacy.

The final result of the pilot was a comparative dataset documenting measurable differences between biochar-treated and untreated soil plots, collected and analysed by the students themselves.

2.3.2. Experience Report

Development process

The development of the Biochar Urban Garden Booster pilot followed an iterative design process rooted in the B4C project methodology. The core concept – applying biochar in accessible urban

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garden settings – was chosen deliberately to lower the entry threshold for adult learners unfamiliar with soil science or carbon concepts.

The most successful element of the development phase was identifying the right scale: by keeping the experiment small (individual planters or paired beds) and the measurement tools simple (moisture meters, rulers, observation sheets), we were able to focus learner energy on observation and thinking rather than complex equipment management.

The main challenge was sourcing biochar reliably and ensuring consistent quality across plots. Some time was spent communicating to learners why experimental consistency matters – a challenge that ultimately became a valuable learning moment about scientific rigour.

1. Contents:

The pilot embedded several core themes from sustainability literacy and Education for Sustainable Development (ESD):

- Carbon cycle and climate mitigation through soil carbon sequestration
- Circular economy: turning biomass waste into a valuable soil amendment
- Interconnections between soil health, plant health, water use, and climate

2. Methodology

The COL&V concept (Collaborative, Open, Learner-led, Values-based learning) was transferable and worked well in this context. Learners had genuine ownership of their plots and were responsible for their own data, which enhanced motivation and engagement.

Design thinking elements were integrated into the experiment design phase: learners brainstormed hypotheses, decided which variables to measure, and iterated on their data-collection approach. This was new for many participants but was received positively, with learners appreciating the agency it gave them.

3. Outcomes

Clear competence development was visible across the cohort. Learners who had no prior knowledge of biochar were able to explain its function by the end of the pilot, and many expressed genuine interest in applying what they learned in home gardens or community projects.

The key product/prototype was a comparative dataset compiled by the group, showing measurable differences between biochar-amended and control plots in terms of soil moisture retention and, to varying degrees, plant growth. This dataset served as a concrete, tangible outcome of the learning.

4. Impact

The pilot was innovative in its combination of hands-on experimentation with circular economy theory in a gardening context. Most standard horticulture courses do not link practical soil work to climate science and systemic sustainability thinking in this way.

Learner feedback was positive. Participants highlighted the satisfaction of seeing tangible results from their own plots, and several expressed that the experiment changed how they think about soil and

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waste. A small number of learners expressed initial frustration with the pace of plant growth, which is a natural constraint of biological experiments.

5. Perspective

We intend to retain the core structure of the pilot in future rounds: the comparative micro-experiment format, the student-led data collection, and the connection to carbon sequestration. These elements were the most impactful.

For improvement, we would extend the observation period (ideally 6–8 weeks rather than 3–4) to capture more pronounced plant growth differences, and we would introduce more structured discussion sessions linking findings to broader sustainability themes. Provision of a shared digital data platform could also enhance collaboration and data consistency.

6. Professional Development

As trainers, the pilot deepened our own understanding of biochar as a climate solution and of the practicalities of scientific experimentation in a non-laboratory adult education setting.

The experience of integrating design thinking into a practical horticultural session was new to us and will inform how we approach other hands-on modules going forward. We also developed a stronger sense of how to scaffold learner-led inquiry – giving enough structure to ensure productive outcomes while leaving space for genuine discovery.

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2.4. Biochar Awareness Hub (FUU)

2.4.1. Project Description

- Summary

The Biochar Awareness Hub pilot aimed to create a small, interactive learning and dissemination space where students and community members could explore the concept of biochar and the Circular Carbon Economy (CCE).

The pilot was developed in response to the limited awareness of biochar and its potential role in climate mitigation, soil improvement, and circular economy practices. By establishing a dedicated awareness hub, the project positioned students as active facilitators of knowledge transfer and sustainability ambassadors within their communities.

The main objectives were to:

- Increase awareness about biochar and its environmental benefits
- Provide a space for interactive learning and demonstration
- Encourage dialogue between students, citizens, and local stakeholders

2.4.2. Experience Report

Development process

The development of the Biochar Awareness Hub was a highly collaborative and iterative process. The concept evolved from a simple awareness activity into a structured learning experience combining theory, practice, and community engagement.

One of the most successful aspects was the strong involvement of students in co-creation. They took ownership of the hub design and content, which significantly increased their motivation.

The main challenge was translating complex scientific concepts (such as carbon sequestration) into simple and accessible formats for a general audience.

Contents:

The pilot addressed key elements of Sustainability Literacy and Education for Sustainable Development (ESD), including:

- Climate change mitigation
- Circular economy principles
- Sustainable agriculture

These topics were successfully embedded into VET programmes, especially those related to agriculture and environmental studies, but also proved relevant for construction and technical education.

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Methodology

The project successfully applied elements of:

- Collaborative Open Learning (COL) through teamwork and peer exchange
- Design Thinking, especially during the ideation and development phases

Design thinking proved particularly effective in encouraging creativity and problem-solving, although some students initially needed guidance to adapt to this approach.

Outcomes

Clear competence development was observed among learners:

- Improved understanding of sustainability concepts
- Enhanced communication and presentation skills
- Increased ability to work collaboratively

Students also developed tangible outputs, including:

- Educational materials
- Demonstration experiments
- A fully functional Biochar Awareness Hub

Impact

The concept proved innovative due to:

- Its combination of physical space and educational approach
- Active involvement of students as facilitators
- Direct engagement with the community

Feedback from participants and visitors was very positive. Learners reported increased confidence and a sense of contribution to environmental awareness.

Perspective

For future implementation:

- The co-creation approach should definitely remain
- More time should be allocated for the development phase
- Additional digital tools (e.g., interactive media) could enhance the hub

There is also potential to scale the hub concept to other institutions.

Professional Development

It is also interesting to know what you yourself has learnt (as trainers). What was new for you and what will you use in future, maybe also in other courses?

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As trainers, we gained:

- New experience in applying design thinking in VET
- Improved skills in facilitating participatory learning
- Deeper understanding of how to communicate sustainability topics effectively

These insights will be applied in future training programmes and projects.

2.5. Webinar pilot on Biochar in ornamental production (ASTREDHOR)

2.5.1. Project Description

Summary

This pilot aimed at delivering a webinar to technical advisors in ornamental production. The webinar focused on the properties of Biochar, its potentials in the ornamental crop sector. One online session of 1 hour was organised and gathered 25 participants. The objective was to strengthen technical knowledge and support the practical use of biochar among technical advisors and their growers. The results of many years of experimental research projects were also presented to give insights and concrete feedback on using this material.

2.5.2. Experience Report

Development process

The pilot was adapted into a webinar format, designed to deliver concise, targeted content to professionals while maintaining interaction. Compared to longer or in-person formats, the challenge was to balance time constraints with content depth, ensuring key concepts were clearly conveyed. The structure was built around short thematic sequences (10–20 minutes) followed by discussion, which helped maintain attention and engagement in an online setting. The content was tailored to participants working in ornamental horticulture and landscape management, ensuring relevance to their daily practices.

Contents:

The webinar covered four main components:

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-Introduction to biochar and project context, including links to EU sustainability objectives
-Biochar fundamentals: production (pyrolysis), properties, and functions
-Applications in ornamental horticulture (seedling and pot production, based on experimental results)
-Applications in landscape management (soil improvement, carbon storage, urban uses), including examples, successes, and barriers.

Each part was directly linked to practical professional contexts.

Methodology

This approach ensured both knowledge transfer and active participation, despite the short format:

-Short, focused presentations adapted to online delivery
- Interactive discussions integrated throughout the session
- Q&A moments after each step to ensure understanding
- Use of concrete examples and experimental results
-Guided navigation of the B4C website to support practical uptake

Outcomes

Participants gained a clear overview of biochar fundamentals and applications in a limited time. They were able to identify potential uses of biochar in their professional contexts, to get a better understanding of its benefits for soil and sustainability, to reflect on its practical implementation in projects and discover tools to support its adoption (supplier mapping).

Impact

The webinar contributed to:
• Raising awareness of biochar as an innovative and sustainable solution
• Strengthening technical understanding in a short time frame
• Encouraging reflection on practical implementation

Despite the short duration, the interactive format enabled active engagement and knowledge uptake.

Perspective

Future developments could provide follow-up materials or sessions to deepen knowledge. The short webinar format proved effective for awareness-raising and first-level training and could be replicated for broader audiences.

2.6.Training sessions pilot on Biochar in landscape projects (ASTREDHOR)

2.6.1. Project Description

- Summary

This pilot focused on delivering classroom-based training sessions on soil fertility and management in landscape projects, with a specific emphasis on integrating biochar. Two sessions were organised: one during a professional forum in Nantes in collaboration with UNEP (French association of landscapers), and

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one in the Colmar region. The objective was to strengthen technical knowledge and support the practical use of biochar among landscape professionals and related stakeholders.

2.6.2. Experience Report


Development process

The pilot was developed as a structured, classroom-based training format targeting small groups of professionals with specific technical needs. Unlike the demonstration-based pilot, this format allowed for more in-depth explanations and interaction. The content was adapted to participants working directly in landscape design and management, ensuring strong relevance to their daily practices. The sessions, organised in Nantes and Colmar, were integrated into professional contexts (training forum and regional session), which facilitated engagement but required a balance between theory and practical applicability.

Contents:

Introduction to soil fertility and project context

The training introduced key principles of soil fertility and management in landscape projects, highlighting current challenges such as soil degradation, resource efficiency, and climate adaptation.

Biochar fundamentals

Biochar production through pyrolysis and its main physical and chemical properties were presented, focusing on characteristics relevant for soil and landscape applications.

Biochar as a bio-based and circular solution

The sessions emphasised the role of biochar in circular economy approaches, particularly its potential to valorise biomass and contribute to carbon storage.

Applications of biochar

Different applications were discussed, including soil structure improvement, carbon sequestration, growing media, urban green spaces, construction, and pollution mitigation, with links to real professional situations.

Methodology

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A more formal training approach was used, combining:

- Structured classroom teaching
- Case-based discussions linked to participants' work
- Interactive exchanges and experience sharing
- Concrete examples to support understanding

This approach enabled both knowledge transfer and reflection on practical implementation.

Outcomes

Participants developed a clearer understanding of soil fertility management and the role of biochar in landscape projects. They were able to identify relevant applications in their own professional contexts and showed interest in integrating biochar into their practices. Discussions were more in-depth than in the demonstration pilot, leading to more concrete reflections on implementation.

Impact

The pilot contributed to strengthening technical knowledge among professionals and raised awareness of sustainable soil management solutions. The targeted group format allowed for meaningful exchanges and facilitated the appropriation of concepts. Feedback highlighted the relevance of linking biochar to practical landscape challenges

Perspective

Future sessions could further develop practical case studies and include more applied exercises or project-based work. The one-day format proved effective but could be extended to deepen technical aspects. The targeted training approach should be maintained and potentially replicated with other professional groups.

Professional Development

Trainers strengthened their capacity to deliver structured, technical training on biochar and soil management. They gained experience in adapting content to different professional audiences and in facilitating exchanges on practical applications. This pilot also reinforced their ability to connect circular economy concepts with concrete field practices.

2.7. Demonstration and workshop pilot on Biochar potentials (ASTREDHOR)

2.7.1. Project Description

- Summary

The pilot focused on introducing biochar and its potential applications in landscaping, gardening, and urban green spaces.

It was implemented as an onsite demonstration and workshop session during the professional open-day event Salon Normandie Paysage et Végét'Hall in Northern France.

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The pilot was chosen to reach a diverse and non-academic professional audience and raise awareness of biochar as a nature-based and circular solution

Objectives:

- Improve understanding of biochar production, properties, and environmental benefits
- Showcase concrete applications in gardens and urban contexts

From this session we expect increased awareness and interest among landscape actors and knowledge transfer on biochar integration ithin green and urban practices.

2.7.2. Experience Report

Development process

The pilot was developed as a compact, accessible learning experience suitable for a busy professional event. Content was adapted to a non-academic audience with diverse professional backgrounds. The integration into an existing event facilitated participant engagement but required concise delivery.

Contents:

Introduction to B4C Project Context

The B4C projects promote bio-based and circular solutions by supporting the valorisation of biomass. They aim to foster sustainable practices, reduce environmental impacts, and encourage the use of innovative materials such as biochar across sectors.

Biochar Fundamentals

- Production process
  Biochar is produced from biomass through pyrolysis, a thermal process under limited oxygen that converts organic materials into a stable carbon-rich product.

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- Physical and chemical properties
  Biochar is characterised by high carbon content, porosity, and surface area. It can improve water retention, nutrient availability, and has generally stable and sometimes alkaline properties.

Biochar as a Bio-based and Circular Solution

Biochar contributes to circular economy principles by transforming organic waste into a valuable material while enabling long-term carbon storage. It supports resource efficiency and reduces reliance on fossil-based products.

Applications of Biochar in

- Soil structure improvement
  Enhances soil aeration, water retention, and microbial activity, contributing to improved fertility and resilience.
- Carbon sequestration
  Stores carbon in a stable form over long periods, helping mitigate climate change.
- Growing media
  Acts as a sustainable component in substrates, reducing peat use and improving plant growth conditions.
- Urban green spaces
  Improves soil quality in urban environments and supports vegetation in challenging conditions.
- Urban construction
  Can be integrated into building materials to improve properties and reduce the carbon footprint.
- Pollution mitigation
  Adsorbs contaminants (e.g. heavy metals, pollutants), contributing to soil and water remediation.

Methodology

Experiential and demonstration-based learning was prioritised.

Design-thinking elements were implicitly applied through:

- Problem-solution discussions
- Practical examples

Collaborative learning occurred through exchanges between professionals.

Outcomes

Participants showed increased understanding of biochar applications. No formal prototypes were developed, but practical implementation ideas were discussed. Strong interest expressed in future applications.

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Impact

The pilot was innovative in introducing biochar to professionals not usually exposed to it. Positive informal feedback from participants. The hands-on approach was particularly appreciated.

Perspective

In future editions more time could be allocated for discussion and case studies could be added.

The core structure and demonstration approach should be maintained.

Professional Development

Trainers strengthened their ability to communicate complex sustainability topics to diverse audiences. Trainers have new insights gained on adapting B4C tools to short formats and events.

2.8.From Garden Waste to Biochar: A Low-Tech Pyrolysis Approach (blinc)

2.8.1. Project Description:

Summary

The learning project focused on raising awareness about the potential of biomass resources in allotment gardens (Schrebergärten) and demonstrating how biomass can be transformed into a valuable climate protection and soil improvement product through pyrolysis.

The project was implemented with X tenants sharing a plot in an allotment garden colony in Göttingen, Germany. The idea emerged from the observation that considerable amounts of biomass are generated every year in allotment gardens through pruning, weeds, grass clippings, and other plant residues. Most of this biomass is either composted or disposed of without considering its additional value for carbon sequestration and soil enhancement.

The main objectives were to help participants understand biomass flows within their garden plot, calculate the amount of biomass produced annually, learn about the principles and benefits of biochar production, and gain practical experience in producing and applying biochar.

During the workshop, participants estimated the annual biomass production of their plot and identified the proportion that was currently underutilized and suitable for conversion through low-tech pyrolysis. The benefits of pyrolysis and biochar for climate protection, soil health, nutrient and water retention were discussed. In a hands-on activity, participants produced biochar using a mini-Kon-Tiki kiln, activated the biochar with stinging nettle tea, and applied it directly to the garden soil.

An additional "Stakeholder and Biochar Network Mapping" exercise was carried out to assess the wider impact of the approach. Participants extrapolated the biomass calculations from their plot to the entire allotment garden colony and estimated the potential quantities of biochar and carbon that could be stored if more gardeners adopted the practice. This exercise encouraged participants to think beyond their own garden and consider collective action within the community.

The workshop concluded with a discussion on involving tenants from other plots and exploring future collaboration opportunities. As a result, participants developed a new perspective on biomass as a

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valuable resource and gained practical knowledge about circular bioeconomy solutions at the local level. Furthermore, participants recognized the potential of biochar not only as a soil amendment and climate mitigation tool, but also as a catalyst for community building, cooperation, and collective action within the allotment garden community.

- Target group

The target group consisted of X adult members of a shared allotment garden plot in Göttingen. The participants were between approximately 26 and 45 years old and represented diverse professional backgrounds, including students, social workers, nature conservation practitioners, forestry scientists, and consumer protection professionals.

Most participants had practical gardening experience but little prior knowledge of biochar production, pyrolysis technologies, or the role of biomass management in climate protection and circular economy concepts.

2.8.2. Experience Report

Development Process

One advantage during the development and implementation of the project was that the target group was easy to engage. As active gardeners, participants were already familiar with biomass management and regularly encountered the challenge of dealing with surplus pruning residues from shrubs and trees. Many reported that woody biomass occupies valuable space in compost piles for long periods because it decomposes only slowly. Because participants already experienced this issue in their everyday gardening practice, they immediately recognized the relevance of the topic and were very open to exploring alternative biomass management approaches. This existing awareness provided a strong foundation for discussions about pyrolysis, biochar production, and circular resource use. Rather than introducing a completely new problem, the workshop offered a practical solution to a challenge that participants were already facing.

2. Contents

The project addressed key themes of Education for Sustainable Development (ESD), including circular carbon economy, climate change mitigation, soil health, sustainable resource management, and community participation.A particular strength was the systems perspective. Participants connected local gardening practices with broader environmental challenges and explored how local actions can contribute to global sustainability goals.The concept can easily be transferred to other allotment gardens, environmental education programmes, adult education and schools.

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3. Methodology

The workshop successfully applied Collaborative Open Learning and Validation (COL&V) principles. Participants actively contributed their own experiences, jointly analysed biomass resources, and developed ideas for future cooperation.The learning process also reflected key stages of Design Thinking. Participants explored a real-world challenge, analysed their local situation, developed ideas, tested a practical solution through biochar production, and reflected on opportunities for wider implementation. The opportunity to move directly from analysis to action was highly appreciated by participants.

Outcomes

The most significant outcome was a visible shift in perception. Participants increasingly viewed biomass not as waste but as a valuable resource. Competence development was evident at several levels. Participants gained knowledge about biochar and circular economy concepts, developed practical skills related to biomass assessment and biochar application, and strengthened positive attitudes towards climate-friendly resource management. Concrete outputs included a biomass assessment, a stakeholder map, produced biochar, and initial ideas for a wider allotment garden biochar initiative.

5. Impact

The concept was innovative because it combined systems thinking, practical experimentation, and community engagement within a single learning activity. An interesting outcome was that discussions increasingly focused on community building. Participants identified opportunities to involve other gardeners and local actors, recognizing biochar as a potential catalyst for cooperation and collective action. Feedback was very positive. Participants particularly appreciated the practical approach and the opportunity to transform surplus pruning residues into a useful product for their garden.

6. Perspective

The combination of biomass assessment, biochar production, and a future scaling scenario should remain central to future workshops. Future improvements could include follow-up activities that encourage participants to observe and exchange experiences regarding the development of their garden beds after biochar application. Such activities could help maintain curiosity, strengthen peer learning, and keep participants engaged over a longer period of time. Involving representatives of the allotment garden association from the outset could further strengthen opportunities for wider adoption within the garden colony and support the development of community-led biochar activities.

7. Professional Development

One of the most important insights for us as trainers was the importance of reaching learners in the right setting. Because the workshop addressed a real challenge that participants already faced in their everyday gardening activities, motivation and engagement were high from the beginning. We also learned how much responsibility can be entrusted to learners when a topic is practically relevant. Participants contributed their own ideas, observations, and research, requiring less expert input than expected. This reinforced our belief that learner-centred approaches work particularly well when participants are motivated to solve a problem that is meaningful to them. In future courses, we will continue to focus on authentic learning environments, real-world challenges, and giving learners more space for self-directed exploration and exchange.

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2.9. Educational Toolboxes for Biochar & Circular Carbon Economy (blinc)

2.9.1. Project Description

Summary

The learning project focused on the development of educational toolboxes (“Bildungskoffer”) on the topic of biochar and Circular Carbon Economy. The objective was to create practical, modular, and easily accessible learning materials that support vocational education and training (VET), public outreach activities, and informal learning settings.

The project resulted in the creation of one general educational toolbox and several thematic experiment toolboxes. The general toolbox provides background information on the carbon cycle, biomass resources, biochar production, carbon sequestration, Circular Carbon Economy concepts, and a wide range of biochar applications. It also contains examples of existing biochar-based products and innovative use cases from agriculture, horticulture, construction, water treatment, and industry.

In addition, several experiment toolboxes were developed. Each toolbox contains materials, instructions, and educational resources that allow learners to explore specific properties and applications of biochar through hands-on activities. The experiments include biochar production with a small-scale pyrolysis stove, biochar-enhanced seed bombs, biochar concrete, biochar-based growing media, and water filtration using biochar.

The educational toolboxes were developed by the project team in collaboration with trainers and educational practitioners. They were designed for flexible use in vocational schools, environmental education programmes, workshops, exhibitions, and public events.

A particular innovation of the project is the dual learning approach. Vocational students can use the toolboxes not only as learners but also as facilitators who communicate knowledge about biochar and climate-friendly solutions to the interested public. This strengthens both technical competences and communication skills while supporting community engagement and sustainability awareness.

The first practical validation of the toolboxes took place during the international THREE C Network Conference 2026 in Kassel, Germany, where participants from science, business, education, public administration, agriculture, and civil society interacted with the educational materials and provided valuable feedback.

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2.9.2. Experience Report





Development Process

The development of the educational toolboxes was a highly collaborative process involving the project team and experienced trainers. One of the main challenges was translating complex scientific concepts such as carbon sequestration, pyrolysis, and Circular Carbon Economy into educational materials that could be understood by diverse target groups.

A key success factor was the modular structure of the toolboxes. By combining a general knowledge toolbox with practical experiment kits, learners could access information at different levels of complexity and according to their interests.

2. Contents

The project addressed central themes of Education for Sustainable Development (ESD), including climate change mitigation, circular economy, resource efficiency, innovation, and sustainable production systems.

Particular attention was given to presenting both opportunities and limitations of biochar applications. The educational materials encourage critical thinking while demonstrating concrete examples of climate-friendly innovations.

3. Methodology

The project successfully combined theoretical learning with practical experimentation. Participants could directly experience how biochar is produced, how it functions in different applications, and how scientific principles translate into real-world solutions.

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The educational toolboxes also supported peer learning and communication-based learning. Learners were encouraged to explain concepts to others, answer questions, and facilitate discussions.

Outcomes

The project resulted in a comprehensive set of educational materials that can be used in vocational education, public outreach, and environmental education programmes.

Participants developed knowledge about biochar and Circular Carbon Economy concepts, practical skills through experimentation, and communication competences through interaction with other learners and visitors.

The completed educational toolboxes provide a long-term resource that can be reused and adapted for future educational activities.

5. Impact

The first practical validation took place during the THREE C Network Conference 2026 in Kassel. The conference brought together researchers, businesses, municipalities, agricultural practitioners, environmental initiatives, educators, and citizens interested in climate-resilient regional development.

The diverse audience provided an excellent testing environment. Feedback indicated that the combination of practical experiments and accessible information materials helped participants understand complex sustainability concepts more easily. The modular structure allowed people with very different levels of prior knowledge to engage with the topic.

The project demonstrated that biochar can serve not only as a technical innovation but also as an effective educational tool for promoting climate action and Circular Carbon Economy concepts.

6. Perspective

The educational toolboxes should continue to be used and further developed in vocational education and public engagement activities.

Future improvements may include the development of additional experiment modules, digital learning materials, and multilingual resources. Further testing with vocational students and educational institutions will help refine the materials and strengthen their educational impact.

The concept also offers strong potential for transferability to other educational contexts and sustainability topics.

7. Professional Development

One of the most important lessons learned was the value of hands-on learning when communicating complex sustainability topics. Participants engaged most strongly when they could directly interact with materials, conduct experiments, and discuss practical applications.

The testing phase also highlighted the importance of combining scientific accuracy with accessible communication. The project team gained valuable experience in designing educational resources that are both technically sound and engaging for non-expert audiences.

These insights will influence future educational activities and support the development of additional learning resources on Circular Carbon Economy and climate innovation.

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2.10. From Circular Carbon Economy to Sustainable Construction (blinc)

2.10.1. Project Description

Summary

The learning project focused on exploring the potential of biochar as an innovative component in earthen construction materials. The project combined practical material development, demonstration activities, and hands-on learning experiences to introduce learners and interested stakeholders to the emerging field of biochar-clay composites.

Biochar-clay materials are gaining increasing attention as sustainable building materials due to their potential to combine carbon storage, moisture regulation, low environmental impact, and improved thermal performance. While research in this field is still developing, biochar-clay composites offer promising opportunities for climate-friendly construction and building renovation.

As part of the project, different mixtures of clay plaster and biochar were developed and applied as interior plaster finishes in an office building. The demonstration surfaces contain varying proportions of biochar and allow visitors to directly compare different material compositions and visual appearances. These installations serve as long-term demonstration objects that can be visited by learners, professionals, and interested groups.

The project was implemented by the project team in collaboration with skilled craftspeople. The learning process focused on experimenting with different mixtures of clay and biochar, understanding material properties, and applying the mixtures in real construction settings.

A second learning environment was created during the THREE C Network Conference 2026 in Kassel. Conference participants were invited to actively engage with the topic through practical workshops. Participants prepared their own biochar-clay mixtures, experimented with different material compositions, and produced small test samples in the form of earthen dry-construction boards and earthen bricks. Additional natural materials such as hemp fibres, hemp shives, and willow weaving materials could be incorporated into the mixtures, allowing participants to explore different approaches to sustainable material design.

The workshop was complemented by information on current scientific developments regarding biochar-clay composites and their potential use in sustainable construction. Through practical experimentation and discussion, participants gained insight into how Circular Carbon Economy principles can be integrated into the building sector.

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2.10.2. Experience Report

Development Process

The pilot project emerged from the idea of connecting Circular Carbon Economy concepts with practical applications in sustainable construction. While biochar is already being explored in fields such as agriculture, horticulture, and water treatment, its potential in construction remains relatively unknown to many learners and practitioners.

The project team collaborated closely with skilled craftspeople to develop and test different biochar-clay mixtures. A central part of the process involved experimenting with varying proportions of biochar and clay while exploring how additional natural materials such as hemp fibres, hemp shives, and willow weaving materials influence the properties of the mixtures.

One important outcome of the development process was the creation of demonstration surfaces within an office building. These applications transformed the project from a purely experimental activity into a real-world learning environment that can continue to be used for educational purposes.

2. Contents

The project addressed several key topics relevant to Education for Sustainable Development (ESD) and vocational education:

- Circular Carbon Economy.
- Climate-friendly construction.
- Natural building materials.
- Carbon storage in buildings.
- Earthen construction techniques.
- Material innovation and experimentation.
- Resource efficiency.
- Sustainable renovation and retrofit solutions.

The project also highlighted the relationship between scientific research, craftsmanship, and practical implementation by connecting current developments in biochar-clay research with hands-on learning activities.

3. Methodology

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The educational approach was strongly practice-oriented. Participants learned primarily through experimentation, observation, discussion, and reflection.

The project combined several educational methods:

- Demonstration-based learning.
- Inquiry-based learning.
- Hands-on experimentation.
- Collaborative learning.
- Peer-to-peer exchange.
- Experiential learning.

Rather than focusing on theoretical instruction alone, participants directly interacted with materials, tested different formulations, and observed how material choices influence the final product. This approach encouraged curiosity, creativity, and problem-solving skills.

The demonstration applications in the office building also enabled participants to connect laboratory-style experimentation with real construction practice.

Outcomes

The project successfully created both physical demonstration objects and educational learning opportunities.

Participants gained knowledge about sustainable construction materials and developed a deeper understanding of how biochar can contribute to climate-friendly building solutions. Through the practical workshops, learners acquired experience in preparing and processing biochar-clay mixtures and evaluating different material compositions.

The demonstration surfaces provide a long-term educational resource that can be used for future learning activities, site visits, and discussions with different target groups.

The workshop activities also demonstrated that complex concepts such as carbon storage in building materials can be communicated effectively through practical experience.

5. Impact

A significant opportunity to validate the project concept was provided by the THREE C Network Conference 2026 in Kassel. The conference brought together participants from science, industry, education, municipalities, agriculture, and civil society who shared an interest in climate-resilient development and Circular Carbon Economy solutions.

The workshop format enabled participants to engage actively with the topic rather than simply receiving information. By producing their own biochar-clay mixtures and test components, participants developed a more tangible understanding of material properties and sustainability concepts.

The project generated considerable interest because it demonstrated how buildings can contribute not only to reducing emissions but also to storing carbon. This perspective challenged common assumptions about construction materials and stimulated discussions about future applications.

The combination of scientific background information, practical experimentation, and real-world demonstration applications proved highly effective in engaging participants from diverse professional and educational backgrounds.

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6. Perspective

The pilot project demonstrated significant potential for further educational and practical development.

Future activities could include:

- Additional testing of material formulations.
- Expansion of demonstration areas.
- Development of educational toolkits focused on sustainable construction materials.
- Integration into vocational training programmes for construction and renovation trades.
- Collaboration with educational institutions and sustainability initiatives.
- Development of multilingual learning resources and workshop formats.

The project also offers opportunities for stronger cooperation between vocational education, research institutions, craftspeople, and sustainability practitioners.

7. Professional Development

The project provided valuable insights into the educational potential of material experimentation. One important lesson learned was that participants develop a much deeper understanding of sustainability concepts when they can physically interact with materials and directly observe their properties.

The collaboration between the project team and craftspeople also highlighted the importance of combining scientific knowledge with practical expertise. The exchange between different professional perspectives enriched both the learning process and the development of the material formulations.

Another important insight was the value of demonstration objects as long-term learning resources. The installed biochar-clay plaster applications continue to create opportunities for discussion and learning long after the initial workshop activities have been completed.

The experience strengthened the team's ability to design educational activities that connect sustainability, innovation, craftsmanship, and practical problem-solving.

Co-funded by the European Union

2.11. Climate Farming Project (blinc)

2.11.1. Project Description

Starting with 4 experts for adapted technologies in developing countries we carried out a blended learning concept which was extended with 3 students and one climate farmer from Northern Hesse.

It consisted of self-learning courses 1&2, related to introduction of biochar properties, application scenarios and the CCE economy plus the agricultural bioeconomy course.

It originated in the challenge on how to introduce the CCE with relatively small budgets but still on high quality and how to envisage the climate effect of the biochar applications in agriculture.

The programme was delivered between March and June 2026 in blended learning based on:

1. The asynchronous B4C learning platform, courses 1 and 2
2. 6 synchronous online sessions
3. Four F2F project development workshops
4. Final Competence validation

The output of this course is a prototype concept of potential biochar applications in the ecosystem of a farm, basically for:

- Soil improvement
- Water storage capacity
- Utilisation of residual biomass
- Addition to slurry, compost and horse dung
- Calculation of CO2 sequestration potential

2.11.2. Experience report

Co-funded by the European Union

Development Process

All participants with rather similar backgrounds, it was even possible to integrate also computer experts in the carbon management course

In the final stage the finalised LMS was of big advantage as well as expert inputs from THREE C network experts.

The concept was quite clear to the particpants:

- Knowledge input
- Exchange and discussions and entry in stage 1 of the design thinking (challenge definition)
- Expert inputs connected to the objectives
- Idea generating on specific sector and purpose (clilate farming)
- Involvement of adapted technology approach based on the research tasks and outcomes (intermediate technology for biomass conversion)
- Ideation on an array of climate relevant actions on the farm
- Finishing the concept and prototype development
- Essay and competence validation.

Transfer of own Contents

The whole course is about sustainability, focusing on the theme of biochar and product development based on biochar and the CCE. Based on experiences with other courses we focused on adapted technologies as starting point to avoid long and fruitless discussions on technology, financing and funding in connexion to a carbon management approach which facilitates the identification of carbon saving potentials.

LMS courses (general and agricultural bioeconomy courses) could easily be connected and the synchronous online sessions facilitated also international participation

The modules and units were introduced also in other contexts, therefore we can see a high transferability.

Adaptability of Methodology

The facilitators from blinc but also external experts acquired facilitation competences regarding

- Structuring and conceptualisation according to competence levels
- Delivery according to the personal and professional situations and contexts
- Designing of learning offers with a focus on concrete outcomes
- Meaningful support in the prototyping phase

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For the learners (students farm managers and again the experts) the methodology delivered a valuable approach to implement also other climate relevant projects (to learn from and within the development process), also among each other and with different expert groups.

Outcomes and Impact

Within this concept we tried to combine several objectives:

- Introduction of the B4C approach as blended learning approach on local level
- Transferrable approach and resources: We used the asynchronous online material as knowledge input which can be retrieved by biochar lay people who can build up their knowledge in stages (unit by unit).
- Development of a constructive CPD incl. teamwork on innovative application scenarios
- We wanted to implement a "culture" or at least a consciousness for the biochar based CCE
- The CPD should develop:
    - Teaching Competence development for our trainers and experts (EQF5/6)
    - Participants' competences related to EQF4/5
    - Domain specific competences to develop biochar based bioeconomy project in a concrete agricultural setting to promote climate friendly management to make the farm mor resilient
    - The validation concept worked well especially in this context without fixed curricula and based on rather flexible learning programme. The validation was embedded in the learning process (as first e-learning units) and only the last LEVEL5 assessment was declared as such. However, the learners could refer back to their first results (the profile) and also reflect on what they have analysed in connection with the sustainability profile of their institution.

Perspective

We will continue to plan and deliver our courses and learning projects according to this methodology. This relates to learning offers in VET but it should be transferred also to AE and HEI, in which specific learning projects can be initiated.

We achieved a high level of commitment of students and experts from the field since all involved were committed to develop the biochar-based approach for resilient farms in this short sub-project.

Professional Development

As also highlighted in other projects, the methodology that we experienced within the B4C programme means a big change from a teacher centred to a learner centred approach.

We could transfer a lot of learning time in concrete development time which increases the acceptance of all learners and trainers involved.

The students really enjoyed it and could be activated in a way that most of us haven't yet experienced.

The contents and practical application could take up the curiosity of the learners and collaborators and due to the reasonable project setting, everybody involved was highly motivated to go further with this project..

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2.12. Local CCE Development Project in Edertal County

2.12.1. Project Description

The course was facilitated by 3 B4C trainers from blinc eG, who transferred the B4C concept in the local context. It is a CPD for a group of experts who intended to start a circular carbon economy project in the county of Waldeck Frankenberg.

This course was carried out with an interdisciplinary group of 7 participants participated in a Continuing Professional Development Training for the biochar based Circular Economy. Four experts are full time Climate Managers working in local municipalities in counties in Northern Hesse, employed to organise climate adaptation and mitigation actions. Two other persons joined from regional NGOs and 1 expert from an agricultural machinery sharing group which is also responsible for the regional composting plant.

The participated in the course programme and developed their local pilot project.

The programme was delivered in blended learning based on:

5. Three synchronous online sessions
6. A specific asynchronous B4C learning platform
7. Four F2F project development workshops
8. Final Competence validation

2.12.2. Experience report

Development Process

The course for the local climate managers was one of the most challenging contexts, since we were invited to deliver it in the course of an existing group which was stuck in their developing process, since the county administration had other priorities than the NGOs.

However, the moderation and basic information on biochar and the local CCE brought a common starting point, which facilitated an approach of exchange on the local feasibilities.

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The excursions to the pilot plants were perceived as inspiring, as well as an expert input on the connection to local sewage water plants.

All in all the level of expertise was partly very high, however it turned out to be important to accompany the development process with profound expertise on the potentials, opportunities but also the limitations of the biochar production, especially when it comes to the conversion of grass materials.

Based on these exchanges the design processes were developed up to a point where a basic concept was derived on the availability of biomass of all regional structures in the county (potential analysis).

The concept was connected to a potential site which could be run by the local Maschinenring, which is responsible for the waste management in the county.

In the final session this potential was fed in the administrative processes, which shall be continued after the county elections in spring/summer 2026.

In parallel another project with 6 international participants (5 DE, FR, UK) was started which focused on the "adapted technology" aspect.

Transfer of own Contents

The whole course is about sustainability, focusing on the theme of biochar and product development based on biochar and the CCE. Here the focus is on the production processes relating to grass and roadside verges as one of the most challenging input materials.

In the course of the project the main learning effect was NOT to focus on the technical implementation only but to develop structures on how to implement biochar driven CCE with the roadside verge project.

Within the design thinking process the objectives shifted to "adapted" technology implementation and the connexion to a carbon management approach which facilitates the identification of carbon saving potentials.

The modules and units were introduced also in other contexts, therefore we can see a high transferability.

Adaptability of Methodology

The learning agents (moderators/facilitators) acquired facilitation competences regarding

- Structuring and conceptualisation according to competence levels
- Delivery according to the personal and professional situations and contexts
- Designing of learning offers with a focus on concrete outcomes
- Meaningful support in the prototyping phase

For the learners (climate managers) the methodology delivered a valuable approach to implement also other climate relevant projects (to learn from and within the development process), also among each other and with different expert groups.

Outcomes and Impact

Within this concept we tried to combine several objectives:

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- We used the asynchronous online material as knowledge input which can be retrieved by biochar lay people who can build up their knowledge in stages (unit by unit).
- We organised the CPD as a teambuilding event
- We wanted to implement a “culture” or at least a consciousness for the biochar based CCE
- The CPD aimed also at the development of competences in the following fields:
    - CCE and biochar
    - Design thinking
    - COL (developing a competence-oriented learning concept in rather informal contexts
    - Had a clear development agenda (constructive learning)
    - Besides, we were able to implement a high quality – and also competence level related – validation approach
    - starting from L2 entry assessment on CCE,
    - eventually level L4metacognitive level assessing and demonstrating the competence development.
    - The validation aspect of the pilot is highly innovative because the integration of “good/appropriate competence assessment and validation is a very challenging topic per se, and especially difficult in informal learning contexts.
    - The validation concept worked well especially in this context without fixed curricula and based on rather flexible learning programme. The validation was embedded in the learning process (as first e-learning units) and only the last LEVEL5 assessment was declared as such. However, the learners could refer back to their first results (the profile) and also reflect on what they have analysed in connection with the sustainability profile of their institution.

Perspective

We will continue to plan and deliver our courses and learning projects according to this methodology. This relates to learning offers in VET but it should be transferred also to AE and HEI, in which specific learning projects can be initiated. The principle, that the learners design these projects is a great move since this “challenge” step is on the one hand.

Professional Development

The methodology that we experienced within the B4C programme means a big change from a teacher centred to a learner centred approach. This was highlighted by all 3 trainers and also the invited expert, who carried out the session in Edertal on 26.02.2026.

Most of us have heard about it but could not really understand and perceive what was meant with “learner centred” and “learning to learn”. Before the CPD these ideas were more buzz words and concrete examples and introductions were missing. I think that for the first time we understood the feasibility and impact of this kind of learning. The students really enjoyed it and could be activated in a way that most of us haven’t yet experienced.

In a nutshell: This was one of the very rare CPDs for educational professional which really brought about something NEW in terms of methodology and teaching and learning approach.

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On the one hand we have to trust the self-organisation abilities of the learners and have to refrain ourselves from too much instruction and prepared content. On the other hand we have to "navigate" the learners' teams through their development processes – which is far more than just a product development exercise but an innovative form of instructional design which is more about moderating and facilitating than about presenting pre-formatted solutions. We also have to accept that we are not in a superior position but should happily welcome ideas and prototypes that are better than what we ourselves would have developed. Once we accept that, our role becomes more that of a colleague and a critical friend then the one of an instructor.

2.13. Biochar in Slurry (DEULA)

2.13.1. Project Description

Summary

This learning activity is designed as a practice-oriented vocational education project focusing on the role of biochar within nutrient management and slurry systems. The educational approach combines sustainability-related agricultural topics with collaborative learning, experimentation and Design Thinking methodologies.

The learning activity should help participants understand current environmental challenges related to manure and slurry management, particularly nutrient losses, ammonia emissions and inefficient resource use within agricultural systems.

Facilitators should guide learners through a combination of:

- theoretical input,
- practical experimentation,
- collaborative analysis,
- and problem-solving activities.

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2.14. Experience Report

Development process

The development and realisation of the learning course concept was strongly influenced by the intention to combine theoretical knowledge with practical application and collaborative learning. The pilot was designed around a clear thematic focus on biochar in slurry management, which allowed for a structured yet flexible learning process. A key element in the development phase was the preparation of teachers through a Design Thinking workshop, where the overall concept and learning pathway were created.

During the development process, one of the most successful aspects was the clear connection between real agricultural challenges and the learning activities. This helped to ensure a high level of relevance and engagement among the learners. At the same time, some challenges emerged, particularly regarding the integration of the pilot into existing training schedules and institutional frameworks. Adjusting the timing and aligning the pilot with ongoing courses required flexibility and coordination. Nevertheless, the development phase provided a strong foundation for the successful implementation of the pilot.

Contents:

The project addressed several key contents related to Sustainability Literacy and Education for Sustainable Development (ESD). These included circular economy principles, resource efficiency, emission reduction, and the environmental impact of agricultural practices, particularly in relation to slurry management. The topic of biochar served as a linking element, connecting ecological, economic and practical dimensions of agriculture.

The content proved to be highly relevant for vocational education and could be effectively embedded into existing programmes. In particular, it can be integrated into modules related to soil management, fertilisation, nutrient cycles and environmental protection. The systemic perspective introduced through the concept of Circular Carbon Economy provides an additional framework that can enrich agricultural training in a sustainable way.

Methodology

The methodology applied in the project was based on the principles of collaborative, open and learner-centred approaches. The concept of COL&V (Collaborative Open Learning and Validation) could be successfully transferred into the learning environment. Learners were actively involved in the

process and took responsibility for their own learning, which contributed to a high level of engagement.

Design Thinking was applied both in the preparation phase with teachers and in the implementation phase with learners. The method proved to be very effective in structuring the learning process and supporting creativity, problem-solving and iterative thinking. While the shift from a teacher-centred to a facilitator role was initially challenging for some trainers, it ultimately led to a more dynamic and interactive learning environment.

Outcomes

The project resulted in visible competence development among the learners. Participants demonstrated an improved understanding of agricultural systems, particularly with regard to nutrient cycles and environmental impacts. They were able to analyse problems, interpret experimental results and develop solution-oriented approaches.

Although the learners did not develop fully elaborated products, they created meaningful prototypes in the form of application concepts and solution strategies. These outcomes reflect a successful transfer of knowledge into practice and indicate the development of both technical and transversal competences, such as teamwork, communication and problem-solving.

Impact

The impact of the project was clearly reflected in the high level of learner motivation and participation. Compared to traditional teaching formats, the pilot offered a more interactive, practice-oriented and learner-centred approach. This was perceived as highly engaging by the participants.

The concept can be considered innovative, particularly due to the integration of Design Thinking, experimentation and real-world problem-solving into vocational education. Feedback from learners was very positive, especially regarding the hands-on experiment and the opportunity to work collaboratively. The project also contributed to raising awareness of sustainability issues and circular economy approaches in agriculture.

Perspective

Based on the first implementation, several conclusions can be drawn for future iterations. The overall structure and methodology of the pilot should be maintained, as they proved to be effective and well-received. In particular, the combination of Design Thinking, practical experimentation and collaborative learning should remain a central element.

However, improvements could be made by allowing more time for practical activities and experimentation. The integration of real farm data and closer cooperation with agricultural enterprises would further enhance the relevance of the learning experience. In addition, expanding the experimental component with more advanced methods could provide deeper insights and strengthen the scientific dimension of the pilot.

Professional Development

From a professional development perspective, the project provided valuable learning opportunities for the trainers involved. It introduced new teaching approaches, particularly in the field of learner-

centred education and facilitation. Trainers developed competences in moderating group processes, supporting collaborative learning and designing competence-oriented learning environments.

One of the most important learning outcomes for the trainers was the shift in perspective from knowledge transmission to learning facilitation. The experience of applying Design Thinking in a vocational education context was particularly valuable and will be transferred to future courses. Overall, the project contributed to a sustainable development of teaching practices and strengthened the ability to implement innovative educational approaches.

2.15. Biochar in Agriculture and Circular Carbon Economy (DEULA)

2.15.1. Project Description

Summary

This learning activity is designed as an introductory vocational training course on biochar, sustainable agriculture and Circular Carbon Economy approaches. The course should provide learners with both theoretical understanding and practical reflection opportunities related to biomass resources, carbon cycles and the agricultural applications of biochar. The training should focus on helping participants understand current sustainability challenges within agriculture, particularly in relation to climate protection, soil management and resource efficiency. Trainers should connect the topic of biochar with broader discussions about sustainable farming systems and circular resource management. The course should combine scientific input with collaborative learning activities and practical agricultural examples. Learners should be encouraged to actively discuss sustainability-related agricultural challenges and reflect on how biochar applications may contribute to more sustainable agricultural systems. The educational approach should support learner-centred participation, collaborative reflection and interdisciplinary thinking. Trainers are encouraged to create an open learning atmosphere that allows participants to exchange experiences and jointly explore innovative agricultural approaches.

2.16. Experience Report


Development process

The development of the course was strongly connected to the increasing relevance of sustainability and climate-related topics within agriculture and vocational education. The aim was to create a

learning environment in which participants could develop a deeper understanding of Circular Carbon Economy and the role of biochar within sustainable agricultural systems.

The course combined theoretical input with collaborative and reflective learning activities. One of the most successful aspects was the integration of scientific and agricultural perspectives into practical discussions about sustainability and resource efficiency.

Participants showed a high level of interest in the topic, particularly regarding the practical potential of biochar in agriculture. One challenge during the implementation was the complexity of the topic, especially when discussing carbon cycles and Circular Carbon Economy concepts. Therefore, it was important to connect theoretical explanations with practical agricultural examples.

Contents:

The course addressed several important aspects related to Sustainability Literacy and Education for Sustainable Development (ESD). Key topics included Circular Carbon Economy, biomass utilisation, carbon cycles, climate protection and sustainable agricultural systems.

The topic of biochar served as a linking element between environmental, agricultural and climate-related perspectives. Participants explored how sustainability concepts can be integrated into agricultural education and practical farming systems.

The content can easily be integrated into vocational programmes related to agriculture, environmental protection, soil management and sustainability education.

Methodology

The methodology of the course combined presentations, discussions and collaborative learning activities. Participants were actively involved in reflections and group discussions, which supported a learner-centred educational approach.

The workshop atmosphere encouraged exchange of experiences and critical reflection on agricultural sustainability challenges. Participants appreciated the combination of scientific input and practical agricultural relevance.

Collaborative learning approaches proved to be particularly effective in supporting discussion and interdisciplinary thinking.

Outcomes

The participants developed a stronger understanding of Circular Carbon Economy principles and the role of biochar within agricultural systems. They improved their ability to analyse sustainability-related agricultural challenges and to reflect on innovative solutions.

Participants also strengthened competences related to communication, critical thinking and collaborative learning. Through discussions and reflection activities, they developed first ideas for integrating sustainability topics into vocational education and agricultural practice.

Impact

The course represented an innovative educational approach because it connected sustainability, climate protection and agricultural practice within a collaborative learning environment.

Participants particularly appreciated the practical relevance of the topic and the opportunity to discuss future-oriented agricultural approaches. The combination of theoretical knowledge and interactive discussion created a motivating learning atmosphere.

The feedback from participants was highly positive, especially regarding the interdisciplinary and practice-oriented character of the training.

Perspective

The course demonstrated the strong potential of sustainability-related agricultural education within vocational training. Future implementations could include more practical activities, field visits or experiments related to biochar production and application.

The overall structure of the course should remain because the combination of theory, discussion and collaborative learning proved to be highly effective. In future courses, additional practical demonstrations could further strengthen learner engagement and practical understanding.

Professional Development

The course provided valuable professional development opportunities for both trainers and participants. It strengthened competences related to sustainability education, collaborative learning and interdisciplinary agricultural teaching.

One important learning outcome was the recognition that sustainability-related agricultural topics can be communicated most effectively when theoretical knowledge is combined with practical examples and collaborative reflection.

The course also strengthened awareness of the importance of Circular Carbon Economy approaches within future-oriented agricultural education.

2.17. Design Thinking – Teaching Biochar in Agriculture (DEULA)

2.17.1. Project Description

Summary

This workshop is designed as a preparatory training activity for vocational school teachers and trainers working in agricultural education. The objective of the workshop is to support educators in developing learner-centred and participatory approaches for teaching sustainability-related agricultural topics, using biochar in agriculture as a practical example.

The workshop should introduce Design Thinking as a methodology for vocational education and training. Facilitators are encouraged to guide participants through collaborative learning processes in which educational challenges can be analysed from the perspective of apprentices.

The learning activity should focus on the question:

How can sustainability-related agricultural topics such as biochar become more understandable, practical and motivating for apprentices?

The workshop should not primarily focus on theoretical knowledge transfer. Instead, facilitators should encourage participants to actively develop educational ideas, prototype learning activities and reflect on innovative teaching approaches within agricultural vocational education.

The educational process should combine:

- sustainability-related agricultural topics,
- participatory learning approaches,
- collaborative reflection,
- and Design Thinking methodologies.

The workshop can serve as a preparation activity for later pilot projects and sustainability-oriented learning modules within vocational agricultural education.

2.17.2. Experience Report

Development process

The development of the Design Thinking workshop was closely connected to the objective of preparing vocational teachers and trainers for innovative sustainability-oriented teaching approaches

within agricultural education. The main idea behind the course was to explore how the topic of biochar in agriculture can be transferred into practical and learner-centred educational activities for apprentices.
During the preparation phase, particular attention was given to the integration of Design Thinking methodologies into vocational education. Instead of focusing on traditional lecture-based teaching, the workshop was intentionally structured as a collaborative and participatory learning environment. The participants were encouraged to actively experience the methods themselves and to jointly develop educational ideas and concepts.
One of the most successful aspects of the workshop was the strong interaction between participants from different educational and professional backgrounds. The open workshop atmosphere encouraged discussion, creativity and exchange of experiences. Participants showed a high level of motivation and engagement throughout the activities. In particular, the collaborative brainstorming sessions and group discussions proved to be highly effective.
A challenge during the implementation was the shift from traditional teacher-centred educational approaches towards facilitation-oriented and learner-centred methods. Some participants initially found it unfamiliar to move away from classical teaching structures. However, this challenge became an important learning process and contributed significantly to the overall success of the workshop.

Contents:

The workshop addressed several important aspects related to Sustainability Literacy and Education for Sustainable Development (ESD). Central topics included sustainable agriculture, climate protection, Circular Carbon Economy and the role of biochar within agricultural systems.
The participants explored how sustainability-related agricultural topics can be integrated into vocational education through practical and collaborative learning approaches. In particular, the workshop focused on the question of how apprentices can be motivated to actively engage with complex sustainability topics instead of only receiving theoretical information.
The educational approaches and concepts developed during the workshop can easily be integrated into existing vocational programmes related to agriculture, soil management, environmental protection and sustainability education.

Methodology

The workshop successfully transferred the concept of collaborative and learner-centred learning into practice. Participants actively engaged in discussions, brainstorming sessions and problem-solving activities.
Design Thinking proved to be a highly suitable methodology for vocational education because it encouraged creativity, participation and reflection. The workshop atmosphere was characterised by openness, exchange and practical collaboration.
The methodology also demonstrated how vocational education can move from traditional knowledge transfer towards competence-oriented and participatory learning processes. Participants appreciated the opportunity to directly experience the Design Thinking process themselves and to jointly develop innovative educational ideas.

Outcomes

The workshop resulted in visible competence development among the participants. Teachers and trainers developed a stronger understanding of learner-centred educational methodologies and sustainability-oriented vocational education.
Participants created first educational concepts and workshop ideas for introducing apprentices to the topic of biochar in agriculture. In addition, they strengthened competences related to facilitation, communication, teamwork and collaborative planning.
Although no fully developed teaching products were created during the workshop, the participants developed meaningful concept drafts and methodological approaches that can serve as a foundation for future pilot activities and vocational learning modules.

Impact

The workshop represented an innovative educational approach within agricultural vocational education because it combined sustainability-related agricultural topics with Design Thinking and participatory learning methodologies.
Compared to traditional teaching approaches, the workshop offered a significantly more interactive and practice-oriented learning environment. Participants particularly appreciated the collaborative group work and the possibility to jointly develop educational ideas and concepts.
The feedback from participants was highly positive. Many participants stated that the workshop provided new perspectives on vocational teaching and demonstrated how complex sustainability topics can be made more accessible and motivating for apprentices.

Perspective

Based on the experiences from the first implementation, the overall workshop structure and methodology should remain central elements in future training activities. In particular, the combination of sustainability topics with Design Thinking and collaborative learning proved to be highly effective.
For future workshops, more practical examples, case studies and experimental activities could further strengthen the transfer into vocational practice. In addition, the educational concepts developed during the workshop could be expanded into complete pilot modules and learning activities for apprentices.
The workshop also demonstrated the strong potential of participatory and learner-centred methodologies within agricultural vocational education and highlighted the importance of methodological innovation in sustainability education.

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Professional Development

From a professional development perspective, the workshop provided valuable learning opportunities for both trainers and participants. The workshop introduced innovative educational methodologies and strengthened competences related to facilitation, collaborative learning and competence-oriented education.

One of the most important learning experiences was the understanding that sustainability-related agricultural topics can be communicated more effectively through participation, experimentation and collaborative problem-solving than through purely theoretical instruction.
The workshop also strengthened awareness of the importance of creativity, reflection and learner participation within modern vocational education and training.

3. Courses for Professionals

3.1. Continuing Professional Development for VET Trainers

3.1.1. Course description

1. Introduction

The Continuing Professional Development (CPD) course for vocational education and training (VET) professionals was developed within the Erasmus+ project B4C – Biochar and Circular Carbon Economy to strengthen the competences of teachers, trainers and educational developers in the emerging field of biochar and Circular Carbon Economy (CCE).

The course recognised that the transition towards climate-neutral and circular production systems requires educational professionals who are capable of designing competence-oriented learning environments and facilitating interdisciplinary innovation. Consequently, the programme combined domain-specific knowledge on biochar with modern educational methodologies, enabling participants not only to understand technical concepts but also to integrate them into vocational education.

The pilot was delivered as a highly blended learning programme consisting of four interconnected phases:

- self-directed online preparation using the B4C Moodle platform and the open Biochar Course;
- two synchronous online sessions introducing the learning environment and collaborative working methods;
- a five-day face-to-face workshop in Göttingen combining expert inputs, practical workshops, excursions and collaborative design activities; and
- two online follow-up sessions supporting reflection, transfer and the development of institutional learning projects.

More than twenty VET professionals from several European countries participated in the pilot. Their diverse professional backgrounds created an interdisciplinary learning environment that encouraged peer learning, international exchange and collaborative innovation.

This report documents the educational concept, implementation and outcomes of the pilot and provides a practical reference for future editions of the programme.

2. Course Concept and Objectives

The CPD programme was designed to enable vocational educators to integrate biochar and Circular Carbon Economy topics into their own educational practice while simultaneously strengthening competence-oriented teaching methods.

The course pursued four complementary objectives:

- developing a sound understanding of biochar technologies and Circular Carbon Economy principles;
- strengthening competence-oriented educational design based on the B4C Competence Framework and LEVEL5 methodology;

- enabling participants to design and facilitate challenge-based learning projects; and
- creating an international community of educational practitioners able to cooperate beyond the project.

The programme combined technical knowledge, educational methodology and collaborative innovation, preparing participants to become multipliers within their own institutions.

3. Didactic Design

The programme followed the educational philosophy developed within B4C and combined Competence-Oriented Learning and Validation (COL&V), Design-Based Collaborative Learning (DBCL), Design Thinking and the LEVEL5 competence model.

Learning was organised as a continuous pathway rather than a sequence of isolated training events.

Participants first acquired common background knowledge through online learning before meeting during the intensive face-to-face workshop. During this week, theoretical inputs alternated with collaborative workshops, practical demonstrations, excursions and reflective sessions. Afterwards, participants transferred their learning into their own institutional contexts while discussing progress during two online reflection meetings.

The blended design ensured continuous interaction before, during and after the face-to-face phase while allowing sufficient flexibility for self-directed learning.

4. Course Implementation

The pilot was implemented over approximately two months.

The online preparation familiarised participants with the Moodle platform, the Biochar Course and the competence framework while establishing the learning community through two introductory Zoom meetings.

The face-to-face week in Göttingen combined expert lectures, laboratory visits, excursions to practical biochar applications, collaborative design workshops and project work. Participants worked in international groups and developed prototype educational concepts addressing practical Circular Carbon Economy challenges.

The transfer phase focused on adapting these concepts to the participants' own organisations. Two online sessions enabled peer feedback, reflection and discussion of implementation experiences.

5. Learning Activities

The programme deliberately employed a wide range of learner-centred methods.

These included:

- expert presentations;
- guided discussions;
- collaborative workshops;
- Design Thinking;
- group assignments;

- excursions and field visits;
- practical demonstrations;
- peer learning;
- reflective practice; and
- project presentations.

Rather than treating participants as recipients of information, these methods encouraged active participation and collaborative knowledge construction.

6. Pilot Learning Projects

A central element of the programme was the development of collaborative learning projects.

Working in international teams, participants identified authentic educational challenges related to biochar and Circular Carbon Economy and developed prototype learning concepts suitable for implementation within their own institutions.

The projects demonstrated how competence-oriented educational design can be adapted to different vocational contexts and provided valuable practical experience in interdisciplinary collaboration.

Many concepts subsequently formed the basis for local pilot activities carried out by the project partners.

3.1.1. Experience Report

Learning Experience

Participant feedback confirmed that the combination of online preparation, intensive face-to-face collaboration and supported transfer created a highly effective learning environment.

The blended format allowed participants to arrive with a common knowledge base, making the face-to-face workshop highly interactive and practice-oriented.

The international composition of the group was consistently regarded as a major strength, enabling participants to exchange experiences across different educational systems and professional cultures.

The collaborative development of learning projects strengthened ownership of the educational concepts and supported the transfer of learning into everyday professional practice.

Results and Impact

The pilot successfully demonstrated the feasibility of the B4C educational approach.

Participants strengthened both their domain competences in biochar and Circular Carbon Economy and their pedagogical competences in competence-oriented curriculum design.

The programme also produced a series of prototype learning projects, strengthened institutional cooperation among partner organisations and established a European community of practice for vocational educators.

Beyond the immediate learning outcomes, the pilot provided valuable validation of the B4C Competence Framework, Learning Design and digital learning environment.

The pilot confirmed the effectiveness of combining online learning with intensive face-to-face collaboration and structured transfer activities.

Several recommendations emerged:

- maintain the blended learning pathway;
- continue using authentic regional challenges as learning contexts;
- strengthen peer learning and interdisciplinary collaboration;
- provide sufficient time for collaborative project development;
- further expand the repository of practical implementation examples; and
- continue supporting participants through the emerging THREE C educational community.

These lessons will inform future editions of the programme, which will be offered in 2027 in DE and the UK.

3.2.Carbon Manager Course

3.2.1. Course Description

Introduction

The Carbon Manager Course was developed within the B4C project in collaboration with the Interreg Cascade project to prepare professionals for implementing Circular Carbon Economy (CCE) solutions at regional level.

Whereas the Continuing Professional Development course concentrated on educational innovation for VET trainers, the Carbon Manager Course addressed the practical planning, coordination and implementation of regional biochar value chains for professionals who aim to invent practical bioeconomy scenarios in their working or living contexts.

The course responded to the growing demand for professionals capable of connecting technical, environmental, organisational and economic aspects of carbon management. Participants explored how residual biomass can be transformed into stable carbon products while simultaneously supporting climate mitigation, regional value creation and circular bioeconomy development.

The pilot followed a highly blended learning approach consisting of five online learning sessions and a four-day collaborative workshop integrated into the European conference on biochar, sponge cities and climate resilience. Throughout the programme participants worked in international teams on authentic regional implementation scenarios, applying the Circular Carbon Management System (CCMS) and developing prototype projects for their own regions.

More than twenty participants from municipalities, research organisations, universities, advisory services, SMEs and regional initiatives took part. Their interdisciplinary expertise created an ideal environment for collaborative planning and transnational exchange.

This report documents the concept, implementation and outcomes of the pilot and serves as a practical reference for future Carbon Manager programmes.

Course Concept and Objectives

The Carbon Manager Course was designed as an implementation-oriented training programme supporting the transition from knowledge acquisition to regional action.

The course pursued five complementary objectives:

- developing a comprehensive understanding of Circular Carbon Economy principles and biochar value chains;
- introducing the Circular Carbon Management System (CCMS) as a practical planning and decision-support tool;
- strengthening participants' ability to analyse regional biomass resources, stakeholder networks and application opportunities;
- supporting the collaborative development of regional implementation projects; and
- establishing a European network of Carbon Managers capable of initiating Circular Carbon Economy activities in their own regions.

Unlike conventional technical courses, the programme combined systems thinking, stakeholder cooperation, carbon accounting and project development into one integrated learning process.

Didactic Design

The educational concept followed the principles of Competence-Oriented Learning and Validation (COL&V) and Design-Based Collaborative Learning while placing strong emphasis on authentic regional challenges.

Learning was organised as a sequence of interconnected activities.

Participants first explored the theoretical foundations of Circular Carbon Economy during online sessions addressing biomass recovery, conversion technologies, biochar applications and regional carbon management. These sessions also introduced the Design Thinking process and established international working groups.

The intensive face-to-face workshop provided opportunities for collaborative project development, practical demonstrations, networking and participation in the European conference. During the subsequent online sessions participants refined their regional scenarios, applied the CCMS, prepared carbon balances and evaluated their implementation concepts.

The course therefore moved progressively from knowledge acquisition to collaborative planning and finally towards practical implementation.

Course Implementation

The pilot was organised over approximately six months and combined synchronous online learning with an intensive collaborative workshop.

The first online sessions introduced participants to biochar technologies, regional biomass analysis, stakeholder mapping and the Circular Carbon Management approach.

The face-to-face collaboration week represented the practical core of the programme. Participants attended conference sessions, visited demonstration activities and worked in transnational teams to develop regional Circular Carbon Economy concepts. Practical workshops focused on biomass assessment, stakeholder analysis, value chain design, carbon calculations and prototype development.

The final online sessions supported the completion of regional implementation concepts, the preparation of carbon balances and the evaluation of project results.

This blended learning pathway enabled participants to continuously develop and refine their regional implementation strategies.

Regional Carbon Management

The central educational innovation of the course was the introduction of regional carbon management as an integrated planning approach.

Rather than focusing exclusively on biochar production, participants learned to analyse complete Circular Carbon Economy systems covering:

- regional biomass resources;
- recovery and logistics;

- pre-treatment and conversion technologies;
- biochar quality;
- product development;
- long-term applications;
- stakeholder cooperation; and
- regional governance.

The Circular Carbon Management System (CCMS) provided the methodological framework for analysing upstream and downstream carbon flows, estimating carbon sequestration potential and comparing alternative regional scenarios. Participants learned how carbon accounting can support strategic decision-making and the development of evidence-based implementation plans.

Prototype Development

Prototype development formed the practical core of the pilot.

Participants worked in international teams on authentic implementation challenges such as municipal biomass utilisation, agricultural biochar applications, co-location of pyrolysis with biogas plants, odour reduction in livestock farming and strategic regional implementation planning. The teams progressively developed complete implementation concepts, including biomass assessments, stakeholder analyses, regional value chains, SWOT analyses, carbon calculations and prototype presentations.

The Design Thinking process guided participants from problem identification to the presentation of feasible regional business cases.

This collaborative approach transformed theoretical knowledge into practical implementation concepts that can be further developed after the course.

3.2.2. Experience Report

Learning Experience

Participants consistently valued the practical and interdisciplinary nature of the programme.

The combination of expert inputs, collaborative workshops, conference participation and regional project development enabled participants to experience the complexity of Circular Carbon Economy implementation while working on authentic regional challenges.

The international working groups encouraged exchange between different professional backgrounds and regional contexts. Participants appreciated the opportunity to compare approaches, discuss practical barriers and jointly develop transferable implementation concepts.

The application of the CCMS helped participants understand carbon management not merely as carbon accounting but as a strategic process supporting regional planning and stakeholder cooperation.

Results and Impact

The pilot demonstrated that implementation-oriented competence development can effectively support the introduction of Circular Carbon Economy initiatives.

Participants strengthened their competences in biomass analysis, stakeholder engagement, regional planning, carbon management and collaborative project development.

The course produced several prototype implementation concepts that can be further developed within participating regions. It also validated the practical applicability of the Circular Carbon Management System and strengthened the European network of professionals working on regional carbon management.

Beyond the direct learning outcomes, the programme contributed to the emerging THREE C community by preparing a first generation of Carbon Managers capable of supporting future regional implementation projects.

9. Lessons Learned

The pilot confirmed that regional implementation can best be learned through collaborative project development rather than classroom teaching alone.

Important lessons included:

combine online preparation with intensive collaborative workshops;

use authentic regional case studies;

integrate carbon calculations into practical planning exercises;

involve stakeholders from different sectors;

provide opportunities for peer learning and networking; and

continue developing prototype projects beyond the duration of the course.

These experiences will inform future editions of the Carbon Manager Programme.

Perspectives

The Carbon Manager Course successfully demonstrated how competence-oriented learning can prepare professionals to initiate and coordinate Circular Carbon Economy activities within their own regions.

By combining systems thinking, technical knowledge, stakeholder cooperation, Design Thinking and carbon management tools, the programme created a practical learning environment that directly supports regional climate action.

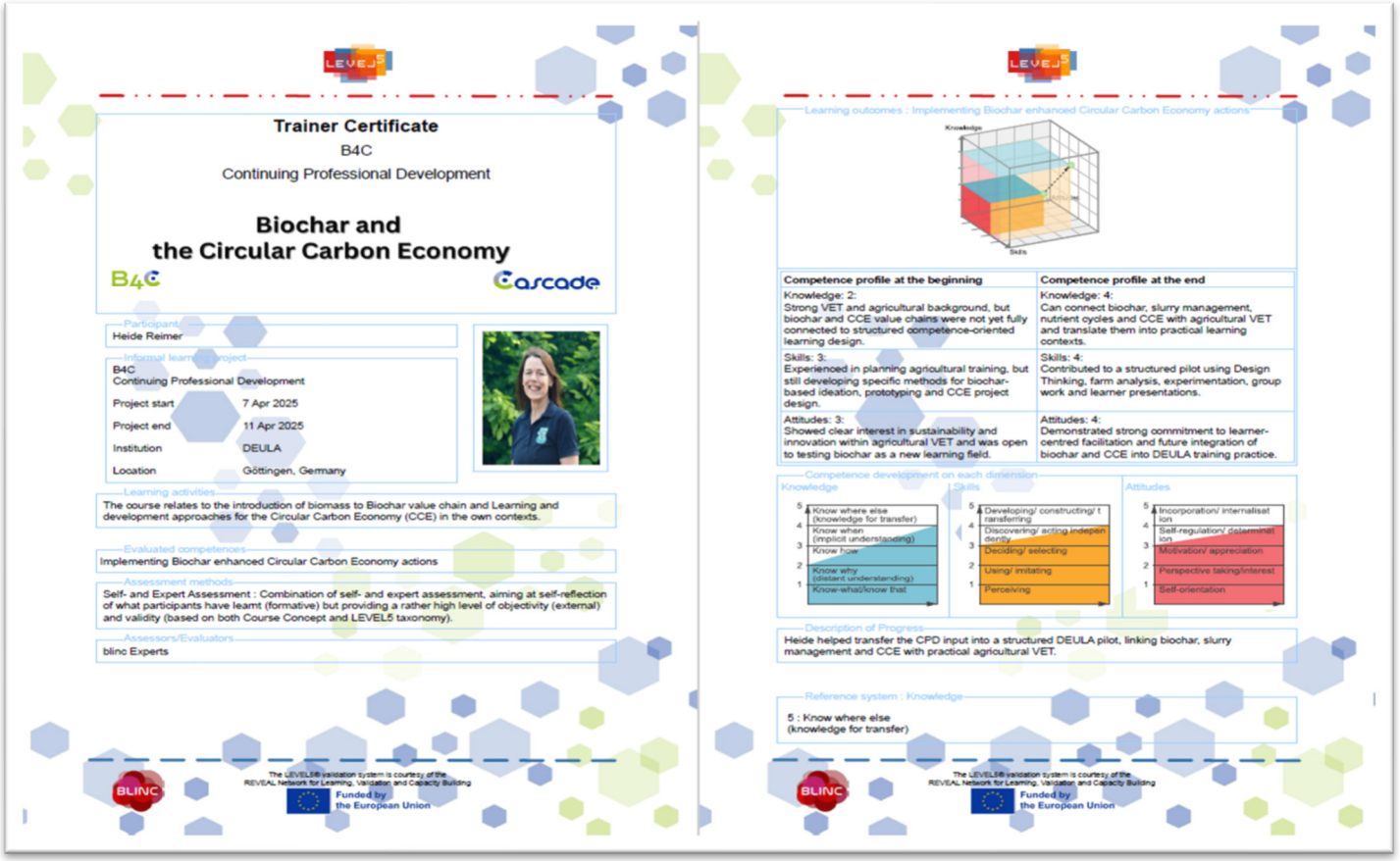
The course complements the B4C Continuing Professional Development programme by shifting the focus from educational design to implementation. Together, both programmes establish the educational pathway of the emerging THREE C / B4C professionalisation programme: educators are prepared to teach the Circular Carbon Economy, while Carbon Managers are equipped to implement it.

Future editions will continue within the THREE C network and support the expansion of regional Circular Carbon Economy initiatives across Europe.

4. Annex – Validation and Certificates

The learner validation of the competence-oriented learning courses was carried out based on the LEVEL5 taxonomy and the respective learning field incl. the learning outcome descriptions. Validations were carried out for VET Trainers (CPD) and VET learners. 2 LEVEL5 certificates are attached in this document.

Certificate for a trainer for the B4C CPD programme, learning progression and learning outcome descriptions on the 2nd page of the certificate.



Trainer Certificate

B4C

Continuing Professional Development

Biochar and the Circular Carbon Economy

Participant: Heide Reimer

Informal learning project:

B4C	Continuing Professional Development
Project start	7 Apr 2025
Project end	11 Apr 2025
Institution	DEULA
Location	Göttingen, Germany

Learning activities: The course relates to the introduction of biomass to Biochar value chain and Learning and development approaches for the Circular Carbon Economy (CCE) in the own contexts.

Evaluated competences: Implementing Biochar enhanced Circular Carbon Economy actions

Assessment methods: Self- and Expert Assessment : Combination of self- and expert assessment, aiming at self-reflection of what participants have learnt (formative) but providing a rather high level of objectivity (external) and validity (based on both Course Concept and LEVEL5 taxonomy).

Assessors/Evaluators: blinc Experts

The LEVEL5® validation system is courtesy of the REVEAL Network for Learning, Validation and Capacity Building

Funded by the European Union

Learning outcomes : Implementing Biochar enhanced Circular Carbon Economy actions

Competence profile at the beginning	Competence profile at the end
Knowledge: 2: Strong VET and agricultural background, but biochar and CCE value chains were not yet fully connected to structured competence-oriented learning design.	Knowledge: 4: Can connect biochar, slurry management, nutrient cycles and CCE with agricultural VET and translate them into practical learning contexts.
Skills: 3: Experienced in planning agricultural training, but still developing specific methods for biochar-based ideation, prototyping and CCE project design.	Skills: 4: Contributed to a structured pilot using Design Thinking, farm analysis, experimentation, group work and learner presentations.
Attitudes: 3: Showed clear interest in sustainability and innovation within agricultural VET and was open to testing biochar as a new learning field.	Attitudes: 4: Demonstrated strong commitment to learner-centred facilitation and future integration of biochar and CCE into DEULA training practice.

Competence development on each dimension

Knowledge: 5 Know where else (knowledge for transfer); 4 Know when (implicit understanding); 3 Know how; 2 Know why (distant understanding); 1 Know-what/know that

Skills: 5 Developing/ constructing/ transferring; 4 Discovering/ acting independently; 3 Deciding/ selecting; 2 Using/ imitating; 1 Perceiving

Attitudes: 5 Incorporation/ internalisation; 4 Self-regulation/ determination; 3 Motivation/ appreciation; 2 Perspective taking/interest; 1 Self-orientation

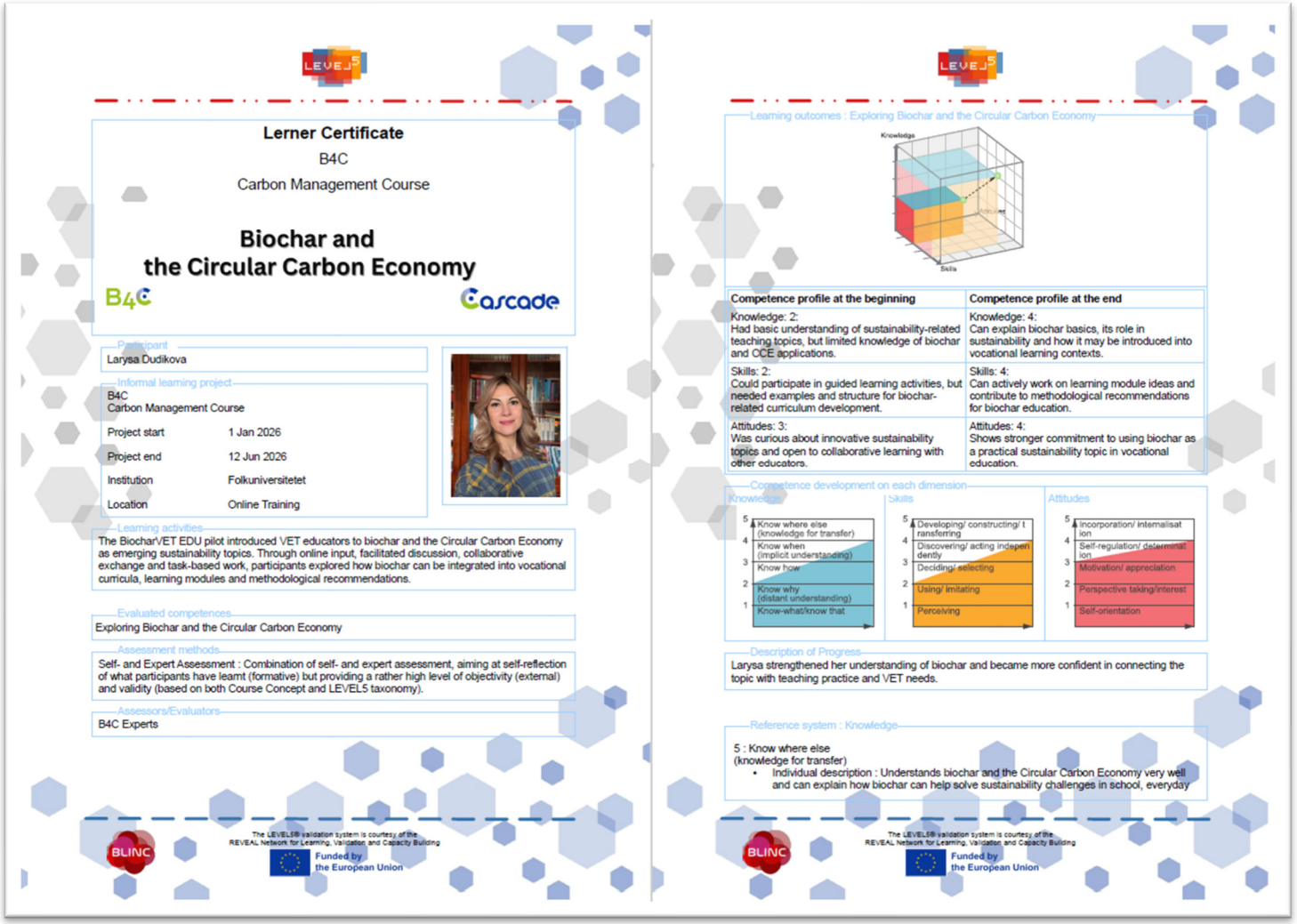
Description of Progress: Heide helped transfer the CPD input into a structured DEULA pilot, linking biochar, slurry management and CCE with practical agricultural VET.

Reference system : Knowledge: 5 : Know where else (knowledge for transfer)

The LEVEL5® validation system is courtesy of the REVEAL Network for Learning, Validation and Capacity Building

Funded by the European Union

Certificate for a Learner of the Carbon Manager course, learning progression and learning outcome descriptions on the 2nd page of the certificate.



Lerner Certificate

B4C

Carbon Management Course

Biochar and the Circular Carbon Economy

Participant

Larysa Dudikova

Informal learning project

B4C
Carbon Management Course

Project start	1 Jan 2026
Project end	12 Jun 2026
Institution	Folkuniversitetet
Location	Online Training

Learning activities

The BiocharVET EDU pilot introduced VET educators to biochar and the Circular Carbon Economy as emerging sustainability topics. Through online input, facilitated discussion, collaborative exchange and task-based work, participants explored how biochar can be integrated into vocational curricula, learning modules and methodological recommendations.

Evaluated competences

Exploring Biochar and the Circular Carbon Economy

Assessment methods

Self- and Expert Assessment : Combination of self- and expert assessment, aiming at self-reflection of what participants have learnt (formative) but providing a rather high level of objectivity (external) and validity (based on both Course Concept and LEVEL5 taxonomy).

Assessors/Evaluators

B4C Experts

The LEVEL5® validation system is courtesy of the REVEAL Network for Learning, Validation and Capacity Building

Funded by the European Union

Learning outcomes : Exploring Biochar and the Circular Carbon Economy

Competence profile at the beginning	Competence profile at the end
Knowledge: 2: Had basic understanding of sustainability-related teaching topics, but limited knowledge of biochar and CCE applications.	Knowledge: 4: Can explain biochar basics, its role in sustainability and how it may be introduced into vocational learning contexts.
Skills: 2: Could participate in guided learning activities, but needed examples and structure for biochar-related curriculum development.	Skills: 4: Can actively work on learning module ideas and contribute to methodological recommendations for biochar education.
Attitudes: 3: Was curious about innovative sustainability topics and open to collaborative learning with other educators.	Attitudes: 4: Shows stronger commitment to using biochar as a practical sustainability topic in vocational education.

Competence development on each dimension

Knowledge: 5 Know where else (knowledge for transfer); 4 Know when (implicit understanding); 3 Know how; 2 Know why (distant understanding); 1 Know-what/know that

Skills: 5 Developing/ constructing/ transferring; 4 Discovering/ acting independently; 3 Deciding/ selecting; 2 Using/ imitating; 1 Perceiving

Attitudes: 5 Incorporation/ internalisation; 4 Self-regulation/ determination; 3 Motivation/ appreciation; 2 Perspective taking/interest; 1 Self-orientation

Description of Progress

Larysa strengthened her understanding of biochar and became more confident in connecting the topic with teaching practice and VET needs.

Reference system : Knowledge

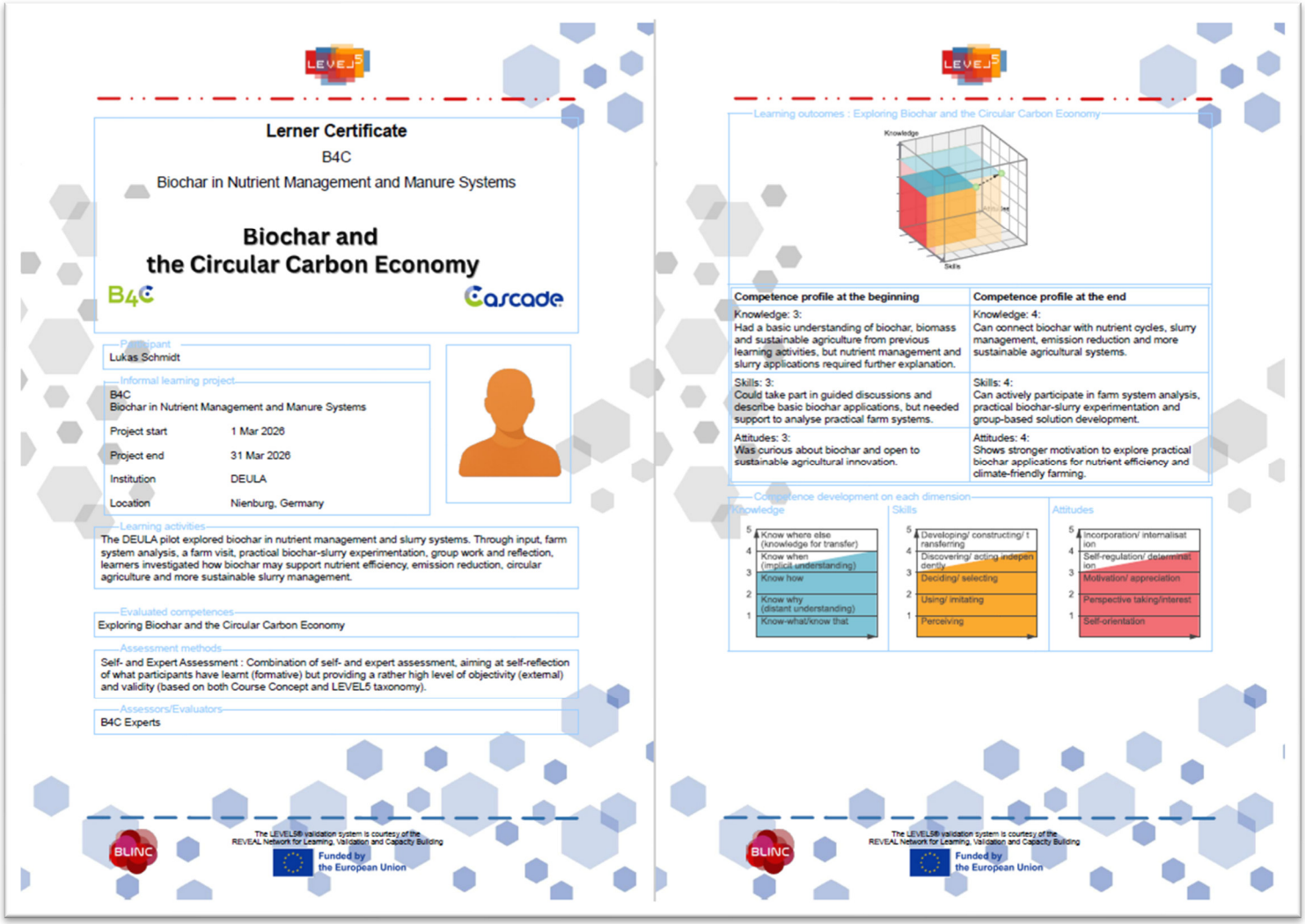
5 : Know where else
(knowledge for transfer)

- Individual description : Understands biochar and the Circular Carbon Economy very well and can explain how biochar can help solve sustainability challenges in school, everyday

The LEVEL5® validation system is courtesy of the REVEAL Network for Learning, Validation and Capacity Building

Funded by the European Union

Certificate for a Learner in a local VET project at Deula, learning progression and learning outcome descriptions on the 2nd page of the certificate.



Lerner Certificate

B4C

Biochar in Nutrient Management and Manure Systems

Biochar and the Circular Carbon Economy

Participant

Lukas Schmidt

Informal learning project

B4C
Biochar in Nutrient Management and Manure Systems

Project start	1 Mar 2026
Project end	31 Mar 2026
Institution	DEULA
Location	Nienburg, Germany

Learning activities

The DEULA pilot explored biochar in nutrient management and slurry systems. Through input, farm system analysis, a farm visit, practical biochar-slurry experimentation, group work and reflection, learners investigated how biochar may support nutrient efficiency, emission reduction, circular agriculture and more sustainable slurry management.

Evaluated competences

Exploring Biochar and the Circular Carbon Economy

Assessment methods

Self- and Expert Assessment : Combination of self- and expert assessment, aiming at self-reflection of what participants have learnt (formative) but providing a rather high level of objectivity (external) and validity (based on both Course Concept and LEVEL5 taxonomy).

Assessors/Evaluators

B4C Experts

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Funded by the European Union

Learning outcomes : Exploring Biochar and the Circular Carbon Economy

Competence profile at the beginning	Competence profile at the end
Knowledge: 3: Had a basic understanding of biochar, biomass and sustainable agriculture from previous learning activities, but nutrient management and slurry applications required further explanation.	Knowledge: 4: Can connect biochar with nutrient cycles, slurry management, emission reduction and more sustainable agricultural systems.
Skills: 3: Could take part in guided discussions and describe basic biochar applications, but needed support to analyse practical farm systems.	Skills: 4: Can actively participate in farm system analysis, practical biochar-slurry experimentation and group-based solution development.
Attitudes: 3: Was curious about biochar and open to sustainable agricultural innovation.	Attitudes: 4: Shows stronger motivation to explore practical biochar applications for nutrient efficiency and climate-friendly farming.

Competence development on each dimension

Knowledge

5 Know where else (knowledge for transfer)
4 Know when (implicit understanding)
3 Know how
2 Know why (distant understanding)
1 Know-what/know that

Skills

5 Developing/ constructing/ transferring
4 Discovering/ acting independently
3 Deciding/ selecting
2 Using/ imitating
1 Perceiving

Attitudes

5 Incorporation/ internalisation
4 Self-regulation/ determination
3 Motivation/ appreciation
2 Perspective taking/interest
1 Self-orientation

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