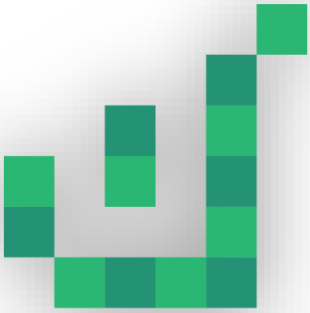
Co-funded by the European Union



USAGE-NG

Up-skilling Agricultural Engineering
Next Generation

Best Practice Guide for a Mobile, Micro-Credential-Aligned Learning Environment

Work Package n°: **5**
Activity n°: 5.2

Date - Version: **21.03.2025 – 1.4**

Document prepared within the USAGE-NG Project with the support of the Erasmus+ Programme of the European Union: 2022-1-AT01-KA220-HED-000089504.

Co-funded by the European Union

Contents

Co-funded by the European Union

1 Overview

This guide provides an overview of flexible, learner-centred learning pathways and the integration of mobile learning and micro-credentials in higher and adult education. It highlights good practices (with an emphasis on European examples) and offers a step-by-step implementation framework for developing mobile, micro-credential-based modules in agricultural higher education. Key frameworks such as the European Qualifications Framework (EQF), European Credit Transfer System (ECTS), and validation of non-formal/informal learning (VNFIL/RPL) are addressed. Annexes include a checklist for institutions, dos and don'ts, and case examples with commentary. All recommendations aim to be practice-oriented for university-level practitioners.

Co-funded by the European Union

2 Flexible Learning Pathways and Learner-Centred Approaches – Importance for mobile and Theoretical Overview

Flexibility in Learning as a Priority: In modern education policy, creating flexible learning pathways is recognized as crucial for widening participation and fostering lifelong learning. Global higher education enrolment has expanded and diversified in the past decades, with learners of various ages, backgrounds, and needs entering or returning to education. Flexible pathways enhance the resilience of education systems – the more options and adaptability built in, the better institutions can accommodate changing learner profiles and external challenges. This is especially relevant in contexts like European small and medium-sized farms, where adult learners (farmers, professionals in rural areas) require education that can fit around work schedules, seasonal workloads, and remote locations. (UNESCO International Institute for Educational Planning 2022)

Learner-Centred Education: Flexible learning goes hand-in-hand with learner-centred approaches. A learner-centred (or student-centred) approach means designing education around the learner's needs, preferences, and active involvement, rather than around rigid curricula or instructor convenience. It provides learners greater autonomy, control over what, when, and how they learn, and encourages self-direction. This approach is rooted in adult learning theory (andragogy). Malcolm Knowles' principles of adult learning emphasize that adults need to know the relevance of what they learn, prefer self-direction, bring a wealth of prior experience, are ready to learn things that align with their real-life roles, are problem-oriented in their learning, and are motivated more by internal drivers than external ones. In practice, this means that curricula for adults (such as smallholder farmers or mid-career learners) should clearly connect to real-world applications, allow learners to pace their study, respect and build on their existing knowledge, and solve immediate problems. A learner-centred, flexible module might let a farmer choose learning modules most relevant to their farm (e.g. a module on drought-resistant crops), study at times of the year when farming is less demanding and obtain credit for prior knowledge or experience through assessment rather than repeat content they already know. (Park University 2025)

Flexible Learning Pathways for Skills Development: Flexible pathways are especially important for skills development and upskilling/reskilling in fast-changing fields. In agriculture, for example, the introduction of digital farming technologies and the need for climate-smart practices mean farmers and agronomists must continuously update their skills. Lifelong learning opportunities that are accessible and modular help meet this need. The UNESCO Education 2030 Agenda underscores flexibility as key to inclusion, asking how systems can enable all individuals, *"whatever their age, gender, financial situation, education level, and skills,"* to access and progress in learning. Flexible pathways (such as short courses, online modules, recognition of prior experience) make education more inclusive by removing traditional barriers. They also promote equity – for instance, enabling a rural farmer with family obligations to earn a micro-credential online rather than attend a semester on campus. (UNESCO International Institute for Educational Planning 2022)

From a theoretical standpoint, flexibility and learner-centredness contribute to higher motivation and engagement. Giving learners control and relevant content increases their ownership of learning. Research and practice have shown that when learners can personalize their path, they are more likely to stay engaged and complete the program.

Flexibility also reduces stress by letting learners balance study with work/life (e.g. self-paced learning can reduce time pressure). Particularly for adult learners, who often juggle jobs and families, the ability to "learn anytime, anywhere" via mobile or blended formats is a game-changer. In summary, a flexible, learner-centric approach is not only pedagogically sound but also practically necessary to equip today's diverse learners with the skills they need for evolving challenges. (Pal 2025)

EU Policy Context – Lifelong Learning and Micro-Credentials: At the policy level, the European Union has strongly endorsed flexible, learner-driven learning pathways as part of its lifelong learning strategy. Notably, the 2022 Council Recommendation on micro-credentials explicitly supports the development and recognition of short, targeted learning experiences across the EU. Micro-credentials – a key focus of this guide – have gained significant traction in European higher education as tools to provide flexible, targeted, and accessible learning opportunities for lifelong learners and working professionals. They are seen as a way to bridge skill gaps in the workforce by offering just-in-time learning that is often industry-recognized, thus enhancing employability while promoting social inclusion. European Higher Education Institutions (HEIs) increasingly view micro-credentials as a strategic means to diversify their student base (attracting non-traditional learners like adult returners, part-time students, etc.) and to broaden their societal impact by upskilling the general population. This is very relevant for the agricultural sector: universities can reach out beyond full-time degree students to farmers, advisors, and agri-entrepreneurs with short courses on, say, precision farming or farm business management. By leveraging flexible, mobile learning and micro-credentials, institutions fulfill the dual mission of lifelong learning and knowledge transfer to the community. (European Commission 2025)

In the specific context of European farming communities, flexible and mobile learning addresses the "digital gap" often observed in rural and remote areas. For example, the EU-funded USAGE-NG project highlighted that connecting university learners with farmer associations and farmers can help address the digital divide in small-scale farming, bringing modern skills to traditionally underserved groups. Learner-centred design in this context means meeting farmers "where they are" – both literally (through mobile delivery, local language content, field-based exercises) and figuratively (acknowledging their prior know-how and focusing on practical solutions). By doing so, flexible learning environments become a vehicle for inclusive skills development, ensuring that even those in remote mountain farms or family-run farms can participate in upskilling initiatives.

Flexible learning pathways, underpinned by learner-centred pedagogy, are essential for contemporary skills development. They empower learners by providing choice, relevance, and support, which is especially crucial for adult learners in sectors like agriculture that are undergoing rapid technological and environmental changes. European policy and higher education trends reinforce this importance, with micro-credentials emerging as a prime instrument to operationalize flexibility and lifelong learning. In the next section, we delve deeper into best practices in teaching and course design that leverage these concepts – focusing on mobile learning delivery, micro-credentialing, modular course structure, and inclusive design principles. (UNESCO International Institute for Educational Planning 2022)

3 Good Practices in Mobile Learning and Micro-Credentials

This section collects and identifies good teaching and program practices for implementing mobile learning and micro-credentials in higher education and adult learning. Emphasis is placed on modularity, flexible modules, and inclusive design, with examples primarily from Europe (with brief mention of notable non-EU cases for context). "Mobile learning" here refers to educational content and experiences delivered via mobile devices (smartphones, tablets) or otherwise readily accessible on-the-go, which is a key mode for reaching learners such as busy adults or field-based practitioners (like farmers). Micro-credentials refer to certified short courses or learning modules that yield a smaller unit of certification than a traditional degree, often documented digitally (e.g. as badges or certificates) and ideally stackable towards larger qualifications. Below are best practices across several dimensions: curriculum design, technology platform use, teaching methods, assessment, and support, all tailored to a mobile, modular learning environment.

3.1 Modular Design and Micro-Credential Frameworks

Adopt a Modular Curriculum Structure: A cornerstone of flexible, mobile learning is to break the curriculum into modules or short units that can stand alone or be combined. Each module should target specific competencies or topics and be deliverable in a compact format (for example, a 5 ECTS credit course on a defined topic). Modular design aligns naturally with micro-credentials: each module can be a micro-credential on its own or part of a series. A good practice is to ensure these modules are coherent and standardized so that they can be recognized across institutions. In the USAGE-NG project, for instance, work was done to review and further develop existing smart farming and IoT course modules at TUM (Technical University of Munich) to make them accessible for smallholder farmers. This involved redesigning content into smaller units and focusing on sustainability and digital skills. By doing so, participants can acquire a mix of targeted skills (e.g. "IoT sensors in precision agriculture") without committing to a full semester course and later combine multiple modules if they seek a larger credential.

Align Micro-credentials with EQF and ECTS: A best practice for quality and recognition is to align micro-credential modules with established frameworks like the European Qualifications Framework (EQF) and use the European Credit Transfer and Accumulation System (ECTS) for credit weighting. The EQF alignment means defining the learning outcomes of each micro-credential in terms of the level of knowledge, skills, and responsibility/autonomy corresponding to EQF level 5, 6, 7, or 8 (for higher education, typically levels 6–8 for Bachelor's/Master's/Doctoral or 5 for short-cycle). Using EQF levels ensures transparency about the complexity and depth of the module, facilitating cross-country recognition. Similarly, assigning ECTS credits quantifies the workload and makes it easier for learners to accumulate and transfer credits from micro-credentials towards formal degrees. For example, a micro-credential might be set as 5 ECTS (approximately 125 hours of study) to represent a short course. USAGE-NG's module framework explicitly followed this approach: the project's micro-credential framework was aligned to EQF and ensured each module had a workload of 5–6 ECTS, with learning outcomes and assessment designed accordingly. By adhering to such frameworks, the micro-credentials are not isolated offerings but become portable and stackable – a learner could combine several 5 ECTS micro-credentials (say in Smart Farming, GIS for agriculture, Farm Business Management) to form a larger certified program or even get exemptions in a degree program later. (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024)

Ensure Stackability and Pathways: Good practice in micro-credential design also involves planning for stackability – i.e., allowing multiple micro-credentials to be combined into a larger credential or qualification. The European approach encourages that micro-credentials be stackable into larger awards (like a diploma or even counted toward a Bachelor's/Master's). This means designing modules so that they are not repetitive overlap but complementary and maintaining robust records of learner achievement for later aggregation. For instance, one might design a set of three micro-credentials on "Climate-Smart Agriculture" that together cover a broad competence; any two of them could perhaps count as an elective in a Master's program, but all three plus a capstone might yield a University Certificate. Clearly communicate to learners how micro-credentials can connect: e.g., *"Complete any 4 of the 6 available micro-credential courses to earn an Advanced Certificate"*. This incentivizes continued engagement. As noted in an OEB review, the European Commission's recommendation highlights stackability as key, enabling progressive building of skills without committing upfront to a long program. A modular, stackable structure is beneficial for adult learners on farms who may initially only want one specific skill (e.g. drone usage for crop monitoring) but later decide to pursue more modules – the system should welcome that and count earlier learning towards new goals. (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024)

Standardize Credential Documentation: Each micro-credential should come with clear documentation (often called a credential supplement or digital badge metadata) that details the learning outcomes, EQF level, credit value, assessment method, and issuing body. This transparency is a best practice ensuring credentials are meaningful to third parties (employers, other universities). For example, a digital badge issued for a "Precision Irrigation Micro-Credential – 5 ECTS at EQF Level 6" could include in its metadata: *learning outcome: "Learner can design and implement a sensor-based irrigation plan to optimize water use"; assessment: "practical project + quiz"; provider: "University X"; date; etc.* The European Union is even developing tools like the European Digital Credentials for Learning and EUDI Wallet to standardize and securely share such credentials. While technical details can be handled by institutional systems, educators should be aware of these standards and ensure all necessary info is recorded when designing the micro-credential. (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024)

Example – Micro-Credential in Practice (EU): As an illustration, the USAGE-NG project partners are producing a *"Handbook for micro-credential development"* that outlines criteria and standard elements for micro-credentials, ensuring they complement EU standards and focus on quality, transparency, relevance, valid assessment, clear learning pathways, recognition, and learner-centred design. They specifically integrate guidelines on Recognition of Prior Learning (RPL) and Validation of Non-Formal/Informal Learning (VNFIL) so that micro-credentials can be combined and recognized across different education systems. This means if a smallholder farmer has prior experience or training (say an unaccredited workshop on organic farming), there could be mechanisms to validate that learning and perhaps award a micro-credential or exempt part of a module – thus truly embodying flexibility. A later section (Part 3) will delve more into RPL/VNFIL in implementation, but it's highlighted here as a design consideration: building micro-credentials with an eye toward recognizing learning that happens outside the formal classroom. (Council of the European Union 2022)

Notable Global Context (Brief): The micro-credential movement is not limited to Europe. One notable example is New Zealand, one of the first countries to incorporate micro-credentials into its regulated qualifications framework in 2018. New Zealand's system allows micro-credentials at any level of their framework and for varying credit sizes, subject to the same quality assurance as traditional qualifications. They were introduced to make the education system more responsive and to offer short, relevant training options that can quickly upskill workers or provide pathways into full qualifications. Early results in NZ showed micro-credentials effectively upskilled learners on the job, even giving some their *"first formal credential"* which is a testament to their power in reaching those who might not otherwise engage in long programs. In the United States and elsewhere, industry-led micro-credentials have also proliferated (e.g., Google Career Certificates in IT, data analytics, etc.). These are often online courses that universities begin to integrate or recognize. For instance, universities in the U.S. have started partnering to grant credit for completion of certain industry certificates (through ACE credit recommendations), effectively bridging non-academic and academic learning. The lesson for EU practitioners is to remain aware of these developments: they highlight the importance of partnerships (with industry, with qualification authorities) and the need for robust quality assurance so that micro-credentials, whether developed in-house or recognized from outside platforms, maintain credibility. (Study From Work 2023)

3.2 Effective Practices in Mobile Learning Delivery

Mobile-Friendly Content and Platforms: A key aspect of "mobile learning" is optimizing content and delivery for use on smartphones or tablets. Good practice is to choose platforms or Learning Management Systems (LMS) that support mobile access and to design learning materials in a mobile-responsive way. During the research phase of USAGE-NG, BOKU conducted an analysis of top e-learning tools and mobile learning platforms, comparing solutions like TalentLMS, Adobe Captivate Prime, and Docebo for their mobile learning features (see Activity 5.1 Report). The takeaway is that the platform should allow seamless access via app or mobile browser, offline access, if possible (for learners with poor connectivity), and intuitive interfaces for small screens. Universities might either use a mobile-optimized LMS (many modern LMS have mobile apps) or dedicated mobile learning apps. When developing content, adhere to microlearning principles: break content into short segments (e.g., 3-10 minute videos, concise text sections) so learners can progress in small bursts on their phone. For example, instead of a 2-hour lecture recording, provide a series of 5-minute video demos or mini-lectures each focusing on one subtopic. This aligns with how people tend to use mobile devices in short intervals. Microlearning approaches make it easier for students to digest complex topics in bite-sized chunks, increasing retention and accommodating busy schedules. (Pal 2025)

Interactive and Multi-Media Learning: Mobile learning should leverage the multimedia capabilities of modern devices. Good practices include incorporating videos, interactive quizzes, infographics, and even augmented reality (AR) or simple simulations when relevant. Short quizzes or polls can be inserted between content segments to reinforce learning and keep learners engaged. Interactive content not only improves understanding but also prevents the "passive scrolling" problem. For instance, in a module about Smart Farming sensors, a short video demonstrating drone imagery analysis might be followed by an interactive exercise where learners tap on parts of an

image to identify issues (pest damage, water stress, etc.). Mobile devices support such interactions well. Gamification elements (badges, progress bars, short challenges) can motivate learners to continue through content on their own. The platform evaluation done in USAGE-NG considered user reviews and interface design – one should pick tools that are user-friendly and engaging. Additionally, using push notifications (sparingly) can re-engage learners ("Reminder: you have a new lesson available today") and thereby improve completion rates for mobile courses.

Social Learning and Community: Even in mobile or online settings**,** social learning is important for engagement. Best practices include integrating discussion forums or chat groups where learners can interact – possibly directly from their mobile devices. WhatsApp or Telegram groups moderated by instructors, for example, have been used in some adult learning contexts as an informal complement to the LMS. In higher education context, a more controlled environment like an LMS discussion board or a tool like Piazza or Slack may be suitable. The idea is to avoid the isolation that can come from self-paced learning. Encouraging learners (e.g., young agricultural students and local farmers in a mixed course) to share experiences or problem-solve together can enrich the learning. In a European example, the USAGE-NG project's modules emphasized *"user needs, real-life use cases, and storytelling"* in their materials, partly to make the content relatable and spark discussion among participants (like sharing their own farm's mapping challenges). This approach of contextualization can prompt peer learning: one farmer's story becomes a case the whole group learns from. Mobile platforms can support this by allowing easy sharing of photos, voice messages (for those who prefer speaking to writing), etc., which is particularly useful for adult learners who might be more comfortable showing something from their farm or describing an issue verbally.

Inclusive and Accessible Design: Inclusive design in mobile learning means making sure that content is accessible to learners of all backgrounds and abilities. On a technical level, ensure compliance with accessibility standards (e.g., WCAG 2.x for content). This includes providing captions or transcripts for video/audio (important both for those with hearing impairments and for non-native language speakers), using high-contrast text and legible font sizes for readability on small screens, and designing navigation that is simple (large touch targets, clear icons, etc.) so that even those with limited tech experience or motor difficulties can use it. Inclusive design also means cultural and linguistic inclusion: for European small farmers, offering content in their local language or with translation is key. A survey of agricultural training offers in the USAGE-NG project found that in many cases learners prefer local language content, even though the subject matter might be available in English. Thus, providing multilingual support or at least glossaries for technical terms in the local language can improve inclusivity. Additionally, inclusive design welcomes users from diverse backgrounds by ensuring that nothing in the learning environment unintentionally excludes someone. As Nielsen Norman Group defines it: *"Inclusive design welcomes users from diverse backgrounds, ensuring that factors such as race, gender, and religion do not hinder their digital experiences."*. In practical terms, this could mean using diverse examples and case studies (e.g., not only examples from one region or gender role), being mindful of imagery and language, and being sensitive to the varying contexts learners bring. For instance, when designing a mobile course on farm business, include scenarios of small family farms, women-led farms, etc., not just one stereotype, so more learners see themselves in the material. (Kohler 2023)

Offline Access and Flexibility: Given that some rural learners may have unreliable internet, a good practice is to enable offline use of materials. Many mobile learning apps allow content to be downloaded when the user has connectivity and then accessed offline in the field. Even a simple PDF handout or an e-book version of key content can be a lifesaver for someone in a remote area. USAGE-NG recognized this in developing an *"offline course about innovations"* for situations where connectivity is an issue. They piloted a hybrid approach and evaluated preferences for online vs offline sessions. The learning here is to offer a blended approach when possible - perhaps an initial face-to-face or live online session to build rapport, followed by mostly asynchronous mobile work, and concluding with an in-person practical exercise or assessment. Pilot courses in the project (e.g., at UNIBZ – Free University of Bolzano) used such a hybrid format: an *"Introduction to Smart Agriculture Technologies for Mountain Ecosystems"* course (3 ECTS) combined online lectures with in-person lab sessions in South Tyrol. This hybrid design allowed wider participation (learners could attend virtually for theory) while still giving a hands-on experience to those who could travel for the practical parts. The success of that pilot underscores the value of flexibility: offering multiple modes (online, mobile, face-to-face) to maximize inclusion and effectiveness.

Engagement and Motivation: Maintaining learner motivation in a mobile learning context is an ongoing challenge. Good practices to address this include setting up a clear structure and milestones in the course (so learners see their progress), providing frequent feedback (even if automated quizzes or periodic instructor check-ins), and creating a narrative or challenge that sustains interest. For example, one could design a course around a problem-based storyline: "Over the next 4 weeks, you will gradually develop a digital farm plan for a hypothetical mountain farm facing climate change. Each module, delivered via mobile lessons, adds a piece to this plan." Storytelling techniques like this make learning more engaging. Moreover, acknowledging achievements through badges or even simple instructor praise in a forum can boost morale. In the mobile context, sending encouraging messages or highlighting user contributions (e.g., "Learner of the Week") can help maintain a sense of community and commitment. It's also beneficial to collect learner feedback during the course via mobile polls or short surveys – this can identify if engagement is dropping and allow mid-course adjustments. The pilot evaluations in USAGE-NG, for instance, helped reveal that training trainers (multipliers) may be more effective than directly training end-user farmers in some cases. Such insights, gained through trying different formats, can guide future practice: in that case, it suggested a strategy to focus on educators or extension officers who will then use the mobile modules with farmers, rather than expecting every farmer to self-study individually. Adapting the delivery model based on feedback and context is itself a best practice – one size does not fit all in mobile learning.

3.3 Teaching Methods and Assessment Strategies for Micro-Credentials

Active Learning and Practical Orientation: For both higher education students and adult learners, especially in fields like agriculture, incorporating active learning methods is critical. Good practices here include using case studies, project-based assignments, and practical tasks that learners can perform (even remotely). A micro-credential should ideally culminate in a tangible outcome or demonstration of skill – for example, a mini-project where the learner applies new knowledge to their own farm or a simulated scenario. In a mobile learning environment, this might be facilitated by asking learners to upload photos or data from their environment, complete a digital lab activity, or

participate in a role-play scenario via a mobile app. The USAGE-NG pilot courses put emphasis on *guided excursions and field exercises* (for those in the region) and integrated exercises in courses to reinforce skills like using sensors or GIS tools. While not all learners can join physical activities, instructors can design mobile-friendly equivalents – e.g., an app-based simulation of sensor data for those who cannot access a lab. The key is to avoid purely theoretical teaching; instead, let learners *do something* with every module (even if it's a small quiz or a reflection relating theory to practice). This approach resonates with adult learning theory (adults are problem- and task-oriented) and keeps engagement high. (Park University 2025)

Assessment as Learning: In micro-credentials, assessment is not just for grading but is part of the learning process. Best practice is to use continuous assessment methods that provide feedback and reinforce learning. Short quizzes embedded in mobile modules, quick polls, and knowledge checks are useful for formative assessment. For summative assessment (the final demonstration for earning the micro-credential), consider practical assessments such as a portfolio, project, or authentic task relevant to the field. For instance, to earn a micro-credential on "Digital Farm Management," a learner might be required to submit a brief farm management improvement plan using one of the smart tools learned. Alternatively, an oral assessment via video call could be used, where the learner explains a concept or solves a problem live (this also verifies their identity/competence, addressing any credibility concerns in fully online settings). Valid assessment that truly measures the stated learning outcomes is crucial for micro-credentials. The EU approach to micro-credentials stresses the need for assessments to be reliable and rigorous, as these credentials must carry weight for employers or further study. Quality assurance guidelines (like the ESG in higher education) should be applied: for example, have clear grading rubrics, second assessors or moderators for quality, and perhaps external examiners for important micro-credentials to ensure standards. (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024)

Recognizing Prior Learning (RPL) and Experience: A hallmark of flexible, learner-centred practice is recognizing that adult learners may already possess many of the skills or knowledge a course aims to impart. Integrating RPL/VNFIL (Validation of Non-Formal and Informal Learning) into the micro-credential process is a strong recommendation. Practically, this could mean offering pre-assessment or diagnostic tests that allow learners to "test out" of certain modules if they prove competence. Or it could involve a process where learners submit evidence of prior experience (e.g., a work portfolio, a reference, or an interview with an assessor) to earn credit or exemption. Many institutions have RPL policies – aligning micro-credentials with those is wise. BOKU's Department of Lifelong Learning, for example, specializes in validating prior learning in connection with qualification frameworks and has applied that expertise to developing micro-credentials for mobile learning. This means that in their programs, a farmer who has, say, 10 years of tractor operation experience might not need to take an introductory module on farm mechanization; instead, they could go straight to an advanced module or receive the micro-credential upon completing an assessment task that verifies their competency. Incorporating RPL not only respects the learner's time and knowledge, it also strengthens the credibility of the micro-credential (since it shows the credential truly represents skills held by the individual, not just seat time). However, it requires a robust mechanism – clear criteria, trained assessors, and sometimes extra guidance for learners to prepare RPL evidence. (Villalba-García 2021)

Quality Assurance in Teaching and Assessment: Ensuring teaching quality in a mobile, micro-credential context requires some adaptation of standard QA practices. Peer review of content (having colleagues or experts review the module content for accuracy and clarity) is important since materials are often self-paced and the "teaching" is embedded in them. If using automated grading (for quizzes), periodically audit the question bank to ensure clarity and fairness. Encourage or require instructor presence in discussions to guide learners – although the learning is mobile, learners benefit from knowing an expert is monitoring progress and available for questions. The European Commission's recommendations call for *robust quality assurance mechanisms* for micro-credentials, aligned with existing frameworks like the ESG (for higher ed) or EQAVET (for vocational). In practice, this could mean that the micro-credential courses go through the same internal program approval process as larger courses, include student feedback evaluations, and undergo periodic review. Because micro-credentials are short, one risk is to treat them too informally – but consistent QA ensures their long-term value. Another practice is to collect data on outcomes: e.g., track how many learners of a micro-credential go on to improved jobs or further study. This ties teaching to impact, which is something evaluators may look for. (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024)

Inclusive Teaching Methods: In terms of pedagogy, instructors should adopt methods that accommodate diverse learners. This includes Universal Design for Learning (UDL) principles: providing multiple ways of explaining concepts (text, video, diagrams) and multiple ways for learners to engage or demonstrate knowledge. For example, some learners might prefer writing a reflection, others might record a short audio or video of themselves explaining what they learned – allowing choice in assignments can be very empowering for adult learners. Inclusive teaching also means being mindful of the varying contexts of learners. In a pan-European micro-credential, one might have participants from different countries or regions; an instructor should avoid parochial examples or acronyms that some might not know or at least explain and provide background. Setting ground rules for respectful communication in forums (especially if farmers, students, and academics are all learning together) fosters an inclusive environment where everyone feels safe to contribute. The learner support aspect (addressed also in Part 3 implementation) is part of teaching: ensuring there are channels to ask for help, clarifying expectations, and providing timely responses to queries all constitute good teaching practice in an online/mobile context.

European Examples of Good Practice: Many European universities and consortia are pioneering mobile and micro-credential learning. For instance, the European MOOC Consortium launched a Common Micro-Credential Framework (CMF) a few years ago, and universities like the Open University (UK) and Wageningen University (NL) have offered micro-credentials via MOOC platforms that can count for credit. Similarly, the EIT (European Institute of Innovation & Technology) communities (e.g., EIT Food, EIT Climate) have developed short online courses and badge systems targeting professionals. These typically emphasize real-world challenges and use a project-based approach, aligning with what we've described. Another example: Ireland's micro-credentials initiative (under its Human Capital Initiative) has multiple universities creating certified short courses, often delivered online, in areas such as sustainability, data science, etc., for workforce upskilling. Early lessons from those indicate that collaboration with industry ensures relevance, and providing learners with career

support alongside the course can greatly enhance outcomes. (European MOOC Consortium 2019)

Non-EU Note: Outside Europe, platforms like Coursera and edX have "Specializations" and "MicroMasters" which bundle courses into micro-credentials. One notable practice from those is the use of proctored online exams to lend credibility (learners take an identity-verified exam for the MicroMasters, which then can be recognized by universities for credit). European providers of micro-credentials may consider similar measures when appropriate for high-stakes assessment.

In conclusion, successful mobile learning and micro-credential implementation relies on intentional design: modular, targeted courses aligned with frameworks, delivered via accessible and engaging mobile platforms, and taught with methods that actively involve the learner and assess meaningful skills. European projects like USAGE-NG illustrate these principles by combining mobile delivery with local relevance (smart farming needs), leveraging micro-credentials to certify skills (like a module in precision ag), and focusing on inclusive, quality-controlled teaching. In the next part, we translate these best practices into a concrete implementation process – outlining steps and recommendations for institutions aiming to set up their own mobile, micro-credential-based learning modules, particularly in agricultural higher education.

4 Implementation of Mobile Micro-Credential Modules in Agricultural Higher Education

In this section, we provide practical guidance for universities and educational institutions on how to develop and implement mobile, micro-credential-based learning modules, with a focus on agricultural higher education (though the steps are broadly applicable). We cover planning and design through to delivery and evaluation, highlighting the role of frameworks (EQF, ECTS), recognition (VNFIL/RPL), institutional support, assessment strategies, support mechanisms for learners and faculty, and technical/platform considerations. The aim is to offer a step-by-step or thematic roadmap that administrators and educators can follow to ensure a high-quality, successful implementation. This is informed by both the general best practices discussed earlier and specific insights from the USAGE-NG project and its partners (BOKU, TUM, UNIBZ, ENAMA).

4.1 Planning and Design Stage

Establish Institutional Support and Strategy: First and foremost, an institution should embed the development of micro-credentials and mobile learning into its broader strategy. This means securing support from leadership (deans, rectors) and aligning with the institution's mission. For example, if a university's strategic plan emphasizes lifelong learning or digital innovation, frame the micro-credential initiative as advancing those goals. It's wise to create a cross-departmental working group or task force for the initiative, including academic leaders, IT support, quality assurance staff, and faculty from the target discipline (agriculture in our context). Institutional support is crucial: it may involve dedicating a budget, staff time, and perhaps incentives (e.g., recognizing faculty workload for developing these modules). BOKU's experience as coordinator in USAGE-NG showed the value of having a dedicated team to oversee content development, technical

integration, and quality benchmarks. Make sure roles and responsibilities are clear from the start: e.g. who is designing content, who is reviewing it, who handles platform setup.

Needs Assessment and Audience Analysis: Conduct an education needs assessment for the skills area you're targeting. In agriculture, this might mean surveying industry (farmer associations, agribusinesses) to identify skill gaps (e.g., "Many farmers lack knowledge in farm data analysis" or "need training in integrated pest management"). It also means analysing the target learners: Are they full-time students, working adults, or a mix? What is their baseline digital skill level? What access do they have to devices and internet? *The USAGE-NG project's Work Package 2* did a comprehensive analysis of *"smart farming education needs"* through international comparisons and a survey of farmers, which helped identify priority topics and digital access issues. Such data ensures your modules are relevant and pitched at the right level. For instance, if targeting small-scale farmers in mountainous regions, the content might need to start at a more basic level and be offered in the local language, and offline materials would be important due to connectivity issues. On the other hand, if targeting MSc students in agriculture, the level can be higher and one can assume good internet/computer access on campus.

Define Module Topics and Structure: Based on the needs assessment, define the portfolio of micro-credential modules to be developed. Each module should have a clear focus and outcome. It's helpful to map these onto the EQF levels early on – e.g., a module on "Farm Drones for Crop Monitoring" might be intended at EQF level 6 (Bachelor's level, requiring applying knowledge to solve problems) whereas a module on "Agricultural Policy for Sustainability" might be level 7 (Master's level, involving critical evaluation of policy frameworks). Decide on the credit value (ECTS) for each – commonly 3, 5, or 6 ECTS for micro-credentials in higher ed. Ensure the workload (hours of study) aligns with the credit (for example ~125 hours for 5 ECTS). Plan the modularity such that modules can stand alone but also complement each other. This might involve a core module plus several specialized ones, or a set of independent electives. In the USAGE-NG WP3 development, partners planned single modules offered by different partners, structured as short courses, which could later be grouped. They also considered pre-requisites and sequencing, e.g., perhaps the IoT basics module should ideally come before a data analytics module. Outline these relationships but also maintain flexibility (not too many strict pre-requisites, as that reduces flexibility).

Integrate Frameworks and Accreditation: At the planning stage, liaise with your institution's academic affairs or accreditation body to integrate the micro-credential modules into official structures. This could mean getting them approved by a curriculum committee, and determining how they will be documented (will they appear on transcripts? Will the university issue a certificate or diploma supplement for them?). Clarify the use of EQF and ECTS in all official descriptions. If the institution is in a country with a National Qualifications Framework (NQF), consider seeking formal alignment or even inclusion of the micro-credential in the NQF (some countries are now listing micro-credentials on frameworks, as NZQA did in New Zealand). Also, design the micro-credential credential itself, perhaps a digital badge or a certificate. For EU projects, ensure the design follows the EU's recommended standard: including *name of learner, title of micro-credential, provider, description of learning outcomes, EQF level, credits, mode of learning (online/blended), duration/dates, assessment method, and if*

applicable a grade or mark. Having this defined early will help when it comes time to issue credentials. (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024)

Policy for RPL/VNFIL: Decide how you will handle Recognition of Prior Learning in these modules. Perhaps set up an application process where an individual can submit evidence to skip a module or to be granted the micro-credential without doing the course if they can prove the competencies. For example, if a very experienced farm manager wants the micro-credential on "Farm Business Planning," you might allow them to compile a portfolio of business plans they've done and a reflection, which assessors evaluate. Not all micro-credentials need an RPL route but having it for at least some can increase uptake (experienced professionals might be more inclined to engage if they know their prior experience is valued). BOKU's Lifelong Learning department has expertise in RPL and NQF alignment which proved useful in establishing these procedures along common Guidelines guidelines (Cedefop and European guidelines on VNFIL) to ensure the process is fair and robust. You might need to train faculty or external assessors to conduct RPL assessments. (Meghnagi, Micol Tuccio, Michele 2022; CEDEFOP 2015)

Quality Planning: Set quality benchmarks for content and delivery. Define, for instance, that each module will undergo peer review, that learning outcomes will adhere to the institution's standard wording conventions, and that assessment methods will be vetted. Plan to pilot test the content with a small group or within the partnership (as USAGE-NG did with pilot courses at TUM and UNIBZ, which provided feedback for refinement). Also plan how to evaluate the micro-credential courses once launched – e.g., student feedback surveys and an overall impact evaluation after a year. Having these in the project plan ensures you can monitor success and iterate.

4.2 Development and Technical Implementation Stage

Content Development: With planning done, the next step is content creation. Assemble a team of subject matter experts (professors, researchers) and instructional designers if available. For mobile learning, instructional design input is valuable to adapt content to online/mobile pedagogy. Develop detailed syllabi for each micro-credential module, clearly stating learning outcomes, topics, activities, and assessment. Ensure each learning outcome is tied to some content and some assessment. The content should be digitally native – rather than simply taking a traditional lecture and putting it online, consider how to make it interactive and engaging from the get-go. For example, for a module on "Smart Farming Technologies," instead of a long text on drones, you might create a short video demonstration filmed in the field (perhaps at the university's experimental farm or a partner's farm) and then follow it with a short quiz or a discussion prompt about how that technology could be applied by a learner.

Platform Setup and Compatibility: Concurrently, set up the technological platform. If your university already has an LMS (like Moodle, Canvas, etc.), evaluate if it meets the needs for mobile access and micro-credential delivery. You may consider using a specialized platform or plugin for issuing digital badges. Many LMS now integrate with badge issuers (e.g., Badgr or Open Badge Factory). Ensure that SCORM or other e-learning standards are adhered to if you plan to share content across systems. For instance, if one partner develops a module and another wants to host it in their LMS, packaging it as a SCORM package ensures it can be imported with content and quizzes intact. ja If you plan to disseminate to low-income or other countries, sticking to

common standards and lightweight formats (e.g., HTML5 content rather than something requiring very high bandwidth) is important. Do a test: access the content on various devices (Android phone, iPhone, tablet, laptop) and different browsers to iron out any compatibility issues.

Integration of EQF/ECTS Info: During development, label all materials and descriptions with the appropriate level and credits. For example, on the course landing page, it should clearly say "EQF Level 6 – 5 ECTS – Undergraduate/Professional Level". This keeps both learners and other institutions aware of the level of the material. It's also useful to include a brief competency statement like "This micro-credential corresponds to a bachelor's level course; it requires prior basic knowledge of agronomy." That sets expectations. Provide this info in any digital certificate that will be issued as well.

Assessment Development: Create the assessments and decide how they will be administered online. For quizzes, use the LMS quiz tool; for assignments, set up submission portals. If you require something like a proctored exam, decide whether to use an online proctoring service or an in-person event. Given our focus on mobile learning, asynchronous authentic assessments are often preferable to high-stakes exams. Design rubrics for grading any open-ended work to maintain consistency. If multiple instructors or institutions are involved in teaching different iterations of the micro-credential, having clear rubrics and example answers helps standardize assessment. Also determine passing criteria: for example, does the learner need 50% overall to pass, or to pass every quiz, etc. Communicate these clearly in the course instructions.

Faculty Training and Engagement: It is likely that faculty or trainers may need orientation to teach/facilitate in the mobile micro-credential environment. Host workshops or training sessions for instructors on how to use the LMS, how to engage students online, and how to handle the specific demands of adult learners. Share insights on moderating forums, providing feedback online, and managing time (teaching an online micro-credential can blur time boundaries; set expectations that instructors should log in at least once a day to check forums, for instance). Faculty might also need support to adjust their teaching style, for instance, moving from giving 90-minute lectures to recording 10-minute video segments. Encourage them by perhaps providing instructional design assistance or examples of successful online teaching. Emphasize the benefits: these micro-credentials can reach a larger audience and have significant real-world impact, which often appeals to academic staff. Additionally, ensure faculty know how to handle the RPL process if it's in place, i.e., how to evaluate a prior learning portfolio, etc., so they are not caught off guard.

Learner Support Setup: Plan for how learners will be supported once the module is live. This includes technical support (e.g., a helpdesk if they have trouble logging in or using the app) and academic support (tutors or office hours for content questions). Draft a learner guide or FAQ for the course that covers: how to navigate the platform, how to get help, netiquette guidelines for online discussion, and tips for successful mobile learning (like time management, finding a good study space). Particularly for adult learners or those less experienced with online learning, providing such guidance is a best practice. Some projects create a short "orientation module" or onboarding video that new learners go through before the content starts, just to familiarize them with everything. Given that we might have non-traditional learners (farmers, etc.), avoid

assuming prior knowledge of academic systems – explain acronyms, grading, and expectations clearly.

Pilot and Feedback: If possible, do a dry run or pilot delivery with a small group (maybe internal staff or a few friendly students) to get feedback on the content difficulty, platform usability, etc. USAGE-NG delivered *pilot courses at TUM and UNIBZ* on smart farming topics, which not only educated those cohorts but also led to developed and updated learning materials based on the feedback. For example, a pilot might reveal that some instructions were unclear or a video didn't work on certain phones, or that students particularly enjoyed one interactive element and wanted more. Incorporate this feedback quickly before scaling up.

4.3 Delivery and Operation Stage

Launching the Micro-Credential: When launching, have a clear communications plan. Promote the new module to the target audience. For higher education students, integrate it into course catalogs or lifelong learning offerings. For external learners (like farmers, professionals), you might advertise through channels like agricultural extension services, farmer associations, social media, and project networks. In EU contexts, leveraging networks (as USAGE-NG did by building a network of experts and potential partners) can help get the word out. Clearly articulate the value proposition in communications: e.g., "Earn a Micro-Credential in Precision Viticulture – a flexible online course (5 ECTS) that you can complete on your phone, at your own pace, to boost your skills in smart farming. Aligned with EU standards and recognized by XYZ University." For EU evaluators, demonstrating that there is demand and that outreach is done (especially to underrepresented groups) is important.

Facilitating the Course: Once learners are enrolled, ensure active facilitation. Assign instructors or moderators to welcome students, encourage introductions (community building), and keep an eye on progress. Monitor participation data – many LMS will show who has logged in, who has completed what – and gently nudge those who are falling behind (e.g., an email or message like "Hi, we noticed you haven't accessed the course in 2 weeks, is everything okay? Can we assist you in continuing?"). During delivery, it might become evident if additional support materials are needed. For example, if multiple learners ask the same question about an assignment, the instructor can post an announcement clarifying it for all. Flexibility is key: adult learners might be called away for a harvest or work emergency, so consider accommodating slight extensions or offering alternate schedules if feasible. The goal is to maintain rigor while understanding the context of your learners (particularly relevant in agriculture where timing can be at the mercy of weather/season).

Assessment and Credential Awarding: Implement the assessments as planned. For automated parts, ensure the quizzes function properly and grades are recorded. For human-graded parts, schedule graders and ensure quick turnaround if possible – timely feedback is even more appreciated in a short course. Once learners complete, have a process for awarding the micro-credential. This could be automatically issuing a digital certificate/badge through the LMS or manually sending certificates. The certificate or badge should ideally be **verifiable** (e.g., a digital badge that can be clicked to view its metadata and verify authenticity via the issuing platform). If using Open Badges (a common standard), make sure all the metadata (learning outcomes, level, etc.) is included in the badge. Keep a record in the student information system if possible, so

that if later they enroll in a full program, their micro-credential can be recognized for credit (this is where connecting it with the university's credential registry or NQF is useful). (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024)

Quality Assurance during Delivery: Possibly have an observer or evaluator sit in on the course (or review the online interactions) to ensure quality is maintained. Gather data: completion rates, learner satisfaction from surveys, any technical issues encountered. If something is not going as expected (e.g., too many drop-outs at a certain point), investigate the cause: Is the content too difficult there? Is there a lack of support? Being responsive in real-time can save a cohort. For instance, if many are failing a quiz, an instructor might decide to host a live Q&A session or release an extra explainer to clarify that topic.

Recognition and Follow-up: After credentialing, make sure learners know how they can use their micro-credential. For example, provide guidance on adding it to their CV or LinkedIn, and encourage them to share feedback or success stories (this can help with future promotion). If the micro-credential is part of a larger pathway (say, stackable towards a diploma), inform the learner of next steps: *"Now that you've completed Module 1, you might consider Modules 2 and 3 which together will earn you an Advanced Certificate"*. Also, where appropriate, direct them to any process for transferring the credit if they want it recognized in a formal program. This is where having institutional policies in place pays off – e.g., the university might allow someone who completes 3 micro-credentials to enrol in a related postgraduate certificate with those credits. Make sure such pathways are clear and the admin support is ready to assist, so learners don't feel their effort exists in a silo.

Instructor and Staff Debrief: After the run, have a debrief meeting with all involved. Discuss what worked and what could be improved. Document these insights for the next iteration. Continuous improvement is a hallmark of best practice and demonstrates a reflective approach to quality.

4.4 3.4 Evaluation, Scaling and Sustainability

Impact Assessment: Beyond immediate learner feedback, evaluate the broader impact. This could be tracking how many learners applied their skills in practice. For an agricultural micro-credential, perhaps follow up in 6 months with participants to ask: did you implement something you learned (e.g., start using a farm app, change a practice)? Did it help your farm or job? Collecting such outcomes can show if the learning had practical benefits. In an EU context, where funders and evaluators are interested in *impact*, having data or testimonials (e.g., "10 farmers reported higher crop yields after applying knowledge from the course") is powerful. USAGE-NG's overall aim was to *enhance capabilities in modern agricultural engineering and climate-resilient practices* – measuring such enhancements (even qualitatively via interviews) would be an important part of evaluating success. Additionally, track numbers: enrolment, completion rates, demographics of learners (did you reach the intended audience like small-scale farmers? if not, why?). This information can identify any gaps (perhaps more outreach needed to women farmers, or a need to adjust timing to avoid harvest season, etc.).

Quality Assurance and Accreditation (Ongoing): If not done initially, consider seeking formal accreditation for the micro-credential program from a national body or through partnerships (for example, some micro-credentials might be accredited as

continuing professional development by industry bodies). Also, integrate the micro-credential offering into the institution's regular QA cycle (like periodic program reviews). This ensures it remains up-to-date and maintains academic standards. Given technological fields, plan for content updates – e.g., smart farming tech evolves, so modules should be reviewed at least annually to incorporate new developments or policy changes. The *Handbook for micro-credential development* mentioned in USAGE-NG would presumably also serve as a quality reference; similarly, your institution may create its own guidelines ensuring each micro-credential is developed and delivered with rigor.

Scaling Up and Mainstreaming: If the pilot modules are successful, consider scaling up the initiative. This could mean developing more modules (maybe in other subjects – e.g., branching from agricultural engineering into agribusiness or sustainability), or increasing capacity (allowing more learners per cohort, or opening it to global audiences if originally local). To scale, ensure the platform can handle it and staff are available. It might involve training more instructors or facilitators to handle additional cohorts. Also, integrate the micro-credentials into marketing for the university's programs. For instance, a Master's program might advertise that it accepts certain micro-credentials for credit, or conversely, that it offers micro-credentials as intermediate milestones (some universities issue micro-credentials to students as they progress, to mark partial completion – that could be another model).

Institutional Support for Sustainability: To sustain the initiative beyond initial project funding or novelty, incorporate it into the institution's budgeting and reward systems. Ensure that teaching micro-credentials counts in faculty workload models or that revenue from fee-paying micro-credential learners is allocated appropriately. Many European universities are exploring models to monetize or at least cover costs of micro-credentials (since not all are funded by grants). Determine if the micro-credentials will be free, freemium, or paid – and if paid, set a pricing strategy that is fair for the target audience (perhaps lower than traditional courses, but enough to contribute to costs). For farmers and local SMEs, sometimes sponsorships or public funding can subsidize the cost; it's worth exploring partnerships (e.g., a Ministry of Agriculture funding places for farmers, or an agritech company sponsoring a cohort as part of their community outreach). The dissemination efforts in USAGE-NG (WP5.4) aimed to engage private firms, NGOs, and associations to take up the mobile courses. Such cooperation can be win-win: stakeholders help promote and maybe support the courses, and in return they get a pipeline of upskilled people or even some branding. (UNESCO Institute for Lifelong Learning 2022)

Platform and Technology Evolution: Keep an eye on technology trends. Mobile learning is a fast-evolving space – new apps, better tools for interactivity, AI-based personalized learning, etc. Over time, consider integrating such enhancements. For instance, an AI tutor could be added to the platform to answer common questions, or VR could be used for a virtual farm tour experience. However, always weigh these against access – ensure not to introduce tools that increase the digital divide (e.g., requiring a VR headset might exclude most of your current learners). But if, say, an AR plant identification feature in a smartphone app becomes feasible, that could greatly enrich an agronomy course.

Community and Network Building: One of the less tangible but important aspects for sustainability is building a community of practice around these micro-credentials.

Encourage alumni of the micro-credential courses to stay connected – perhaps via a Facebook or WhatsApp group for all who completed "Smart Farming" courses, where they can share updates or new developments. This keeps the learning ongoing and can also help with word-of-mouth marketing. It also provides a feedback loop to the institution: these alumni can tell you what further training they need, which might inspire new modules.

Documentation and Reporting: Since this guide also targets EU evaluators, it's worth noting the importance of documentation. Keep records of everything – how the course was set up, the pedagogical innovations, the results achieved – as these can feed into reports for accountability and also papers/presentations to share good practice. The USAGE-NG project, for instance, is likely to produce reports or academic outputs on their pilot findings and the competencies gained. Your institution can similarly contribute to the growing knowledge base on micro-credentials and mobile learning by documenting and publishing case studies or data. This not only helps the broader community but also positions the institution as a leader in educational innovation, attracting potential partnerships and funding for future initiatives.

Adapting to Feedback: Finally, create a mechanism for continuous feedback even beyond formal evaluations. As cohorts go through, collect suggestions and observe any unintended outcomes. Perhaps some learners found an alternate use for the platform or combined modules in a way you didn't foresee – learn from that. Flexibility must be maintained: policies and structures should be updated as needed. For example, if you notice a significant number of enrolees are actually from outside your initial target (say, many from other countries taking the course), you might consider adding subtitles in more languages or adjusting examples to be more globally relevant. Or if mostly younger university students join and few farmers, you might shift outreach or adjust the schedule or context to better appeal to practitioners.

In summary, implementing mobile, micro-credential-based learning modules is a multi-faceted process. By following a structured approach – from planning with strong institutional frameworks and understanding learner needs, through careful content and platform development, to active delivery and ongoing improvement – institutions can create sustainable, high-impact programs. In the agricultural education context, this approach promises to upskill current and future professionals in a flexible manner, helping European small and medium-sized farms meet the challenges of digital transformation and sustainability transitions. The next sections of this guide provide additional resources: annexes with a practical checklist, dos and don'ts, and case examples to illustrate these recommendations in action.

5 Conclusion

Mobile, micro-credential-aligned learning can materially improve access to smart farming education for European small-sized farms, but only if institutions treat it as a pedagogical and organisational reform, not as a mere technical "mobile-compatible" repackaging. The evidence synthesised in this guide points to a clear pattern: flexible, modular pathways aligned with EQF/ECTS and backed by credible assessment and recognition are necessary, yet insufficient on their own. Sustainable uptake depends on learner-centred design, strong learner and faculty support, and a deliberate shift toward

contextualised, practice-oriented learning that respects seasonal workloads, rural connectivity constraints, and the tacit expertise of practitioners.

For universities and adult education providers, the pragmatic route is to start with a small portfolio of stackable micro-credentials, pilot them in real farming contexts, and institutionalise what works through quality assurance, recognition procedures (including RPL/VNFIL where feasible), and platform interoperability. The most robust implementations will combine mobile-first microlearning units with guided support (tutoring, facilitated peer exchange, or adaptive assistance) to avoid the typical drop-off seen in purely self-directed formats. In short: mobile delivery increases reach; guided, quality-assured design secures learning impact and recognition.

6 Annexes

6.1 Checklist for Developing Mobile Learning Modules (Micro-Credential-Based)

Using checklists, institutions can systematically ensure they cover all critical aspects when developing and implementing mobile, micro-credential-based learning modules. Adapt the list as needed to your context (some items may vary if, for example, you're using an existing platform or skipping RPL), but generally this provides a comprehensive guide from inception to evaluation.

6.1.1 Institutional Readiness & Strategy

- **Align with Strategy:** Ensure the micro-credential initiative is included in institutional strategy documents (e.g., as part of lifelong learning or digital innovation goals). Obtain leadership support (budget, policy).
- **Form a Working Group:** Create a team with academics, instructional designers, IT, and QA personnel to oversee development. Assign clear roles (content lead, technical lead, etc.).
- **Policy Framework:** Develop or update policies on micro-credentials: credit recognition, quality assurance, enrolment (e.g., whether non-traditional learners need to register as students), and fee structure if any.

6.1.2 Needs Assessment & Design

- **Identify Skill Needs:** Conduct surveys or consult industry to pinpoint skills gaps and topics in demand (e.g., climate-smart farming practices, digital tools).
- **Define Target Audience:** Profile the learners (education level, digital access, language, time availability) to tailor content and support.
- **Module Outline:** Define each micro-credential module's title, scope, learning outcomes, EQF level, and ECTS credits. Ensure outcomes are specific and assessable.
- **Stackability Plan:** Map out how modules relate. Decide if they can stack into a larger certificate or if they are standalone. Clarify prerequisites or recommended sequence (keep it flexible where possible).
- **RPL Pathways:** Establish how Recognition of Prior Learning will be handled. Create guidelines for applicants and assessors (e.g., what evidence is needed to claim a micro-credential via experience).

6.1.3 Content and Platform Development

- **Instructional Design:** Break content into digestible units (short videos, readings, quizzes) suitable for mobile use. Apply multimedia and interactive elements. Follow accessibility standards (captions, alt text, etc.). (Pal 2025)
- **Platform Selection:** Choose an LMS or mobile learning platform that supports responsive design and possibly offline access. Test on common devices and browsers.
- **Standards Compliance:** Use interoperable content standards (SCORM, xAPI) if needed for portability. Ensure data privacy and GDPR compliance on the platform (especially if enrolling external learners).
- **Content Peer Review:** Have subject matter experts review each module for accuracy, clarity, and level alignment before finalizing.
- **Assessment Design:** For each outcome, develop an assessment (quiz, assignment, project). Create rubrics and guidelines. Determine passing criteria and feedback mechanisms. If external accreditation or stackability is intended, ensure assessment is robust and documented.
- **Digital Credential Setup:** Design the digital badge or certificate format. Include necessary metadata (learner name, module name, level, credits, date, issuing institution, learning outcomes). Choose a platform for issuing badges (e.g., Open Badges compliant service). (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024)

6.1.4 Quality Assurance & Accreditation

- **Module Approval:** Go through internal course approval processes (faculty board or similar) to legitimize the micro-credentials within the university's offerings.
- **Align with QA Frameworks:** Align with European QA frameworks: e.g., ensure learning outcomes and assessment follow Bologna guidelines; apply ESG standards for delivery and review. (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024)
- **Benchmarking:** If possible, compare with similar offerings (other universities, MOOC platforms) to benchmark content and workload. Adjust if your module is significantly heavier or lighter than typical.
- **Pilot Testing:** Run a small pilot or at least a walkthrough with test learners/staff. Collect feedback on content difficulty, user experience, and technical issues. Tweak content and platform as needed before full launch.
- **Trainer/Staff Training:** Train instructors and support staff on the platform, the pedagogical model (learner-centred facilitation), and any new technology or tools being used.

6.1.5 Delivery & Support

- **Learner Orientation:** Provide an orientation module or guide for learners (how to navigate, how to seek help, netiquette, time management tips for online learning).
- **Mentoring & Moderation:** Ensure instructors or moderators are assigned to welcome learners, moderate discussions, and answer questions in a timely manner. Define expected response times (e.g., reply to forum questions within 24h).
- **Technical Support:** Set up a support channel (helpdesk email/chat) for technical issues. Have IT on standby during initial launch weeks when new users onboard.
- **Monitor Engagement:** Use analytics to track participation (logins, progress). Reach out proactively to inactive learners or those struggling (nudges or personal emails offering support).

- **Assessment Integrity:** If using online exams or graded assignments, ensure academic integrity. Implement measures like plagiarism checks for assignments, or proctoring for exams if necessary. However, favour authentic assessments that are harder to cheat on (projects, personalized tasks).
- **Issuing Credential:** Upon completion, have a smooth process to issue the micro-credential certificate/badge. Ideally, this is automated. If manual, batch process it promptly after course end. Include instructions to learners on how to use/share their new credential (e.g., "download your certificate here" or "you will receive an email with your badge").

6.1.6 Post-Course Evaluation & Continuous Improvement

- **Collect Feedback:** Gather learner feedback via surveys or focus groups on the content, platform, and overall experience. Look for patterns and suggestions.
- **Review Outcomes:** Analyse completion rates, pass rates, and if possible, learning outcomes achievement. Did most learners meet the outcomes? If not, identify gaps (maybe the content needs revision or prerequisites need to be clarified).
- **Stakeholder Feedback:** If relevant, get input from employers or industry partners on the performance of learners or relevance of skills gained. This can validate the micro-credential's effectiveness or highlight adjustments needed for industry alignment.
- **Update Content:** Plan periodic content updates. Assign responsibility to a content owner to review and update, say, annually or as new research/technology emerges.
- **Scale Decisions:** Decide on future runs (frequency, cohort size), and any new modules to develop. Use the initial success to possibly secure more funding or internal support to expand.
- **Maintain Community:** Keep alumni engaged through follow-up communications or communities of practice (optional but adds value and fosters word-of-mouth promotion).
- **Document and Report:** Document the process and outcomes for internal records and any required reports (e.g., to funders or accreditation agencies). Include what went well and what will be improved next iteration – this closes the QA loop.

6.2 Dos and Don'ts for Mobile Micro-Credential Implementation

These Dos and Don'ts serve as quick reference guidelines to complement the more detailed sections of the report. Adhering to these can help ensure the implementation of mobile micro-credential courses is effective, learner-friendly, and achieves its intended outcomes.

Dos:

- **Do centre the learner experience:** Design everything from the learner's perspective. Use simple navigation, chunked content, and self-paced structures. Always ask, "Is this flexible and useful for the learner?". For example, do provide options for learners to choose learning paths or elective topics within a module. (Pal 2025)
- **Do ensure content is mobile-optimized:** Create content with mobile devices in mind – short videos, readable text (no large dense PDFs!), interactive elements that work on a touchscreen. Test on a phone yourself. If it's hard for you to read or interact with on a phone, it will be for learners too.

- **Do incorporate active and real-world learning:** Include activities like case studies, quizzes, photo-assignments, or mini-projects that get learners to apply knowledge. In agricultural topics, encourage them to relate material to their farm or local context (e.g., take a soil sample and analyse it as part of the course).
- **Do maintain quality and academic rigor:** Even though micro-credentials are short and online, they should meet the same academic standards as traditional courses. Have clear learning outcomes, valid assessments, and quality checks. This ensures the micro-credential is respected and recognized.
- **Do align with frameworks and standards:** Use EQF levels and ECTS credits to facilitate recognition. Issue credentials in a standard format (like Open Badges) so they're portable and verifiable. Following the European approach (transparency, QA, portability) builds trust in your micro-credentials. (Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill 2024, 2024)
- **Do provide robust support to learners:** Offer timely help – whether technical troubleshooting or academic guidance. Adult learners especially may need encouragement if they've been out of formal education, so be responsive and approachable. Acknowledge that many are juggling other responsibilities; flexibility and understanding from instructors go a long way.
- **Do gather and use feedback:** Actively seek learner feedback during and after the course. Use it to improve future iterations. Show learners you listen – e.g., "Based on your feedback, we've added an extra example in Lesson 3" – this can increase their engagement and trust.
- **Do consider inclusion and accessibility:** Make sure your mobile learning is inclusive. Provide alternatives (transcripts, audio descriptions), avoid jargon or explain it, and be mindful of diverse cultural contexts. For instance, if using images of farmers, use diverse representations. If some learners have limited internet, consider offering an offline option like a downloadable packet. (Kohler 2023)
- **Do validate and recognize prior learning:** Be open to different pathways. If a learner can demonstrate they already have the skills a module teaches, find ways to assess and credit them. This flexibility is core to a learner-centred approach and can motivate experienced practitioners to engage (they won't feel it's a waste of time repeating known material).
- **Do engage stakeholders and build partnerships:** Work with industry, local organizations, and others when developing content to ensure relevance and to get support in implementation. Partners can help with case studies, equipment for demos, or even funding. Also, communicate with national bodies (like qualification authorities) if you aim for formal recognition or want to plug into national upskilling initiatives.

Don'ts:

- **Don't simply repurpose lecture slides without adaptation:** Taking a 50-slide lecture and putting it online **as-is** will likely fail. Content that works in a classroom might not in a solo mobile format. Avoid text-heavy slides or long video lectures. Instead, break content into engaging, interactive pieces. Don't assume learners will slog through a 2-hour video on their phone – they won't.

- **Don't overload or overwhelm learners:** Avoid too much content or too many tools. It's easy to get ambitious and include every detail, but micro-credentials should be focused. Don't exceed the advertised workload significantly – if it's 5 ECTS (~125 hours), keep it around that. Overloading can lead to dropouts. Also, don't require the use of too many different apps or platforms; stick to one hub if possible to reduce cognitive load.
- **Don't neglect community-building:** A common pitfall in online learning is to focus only on content and forget the social aspect. Don't let learners feel isolated. Failing to provide interaction opportunities or instructor presence can reduce motivation and completion. So, don't set it on autopilot; be there to facilitate.
- **Don't ignore technical constraints of your audience:** For a rural/agricultural audience, assuming everyone has high-speed internet or the latest smartphone is a mistake. Don't design a course that requires constant high bandwidth (like 4K video streaming) or proprietary software that won't run on mobile. If connectivity is an issue, don't schedule live mandatory webinars frequently; use asynchronous delivery.
- **Don't make assumptions about prior knowledge:** Be careful not to assume learners know how to study online or are familiar with your academic system. Don't skip clear instructions for tasks, and don't use university-specific jargon (like "ECTS" or "learning outcomes") without explanation for external learners. Also, in content, if some may not have a formal background in the subject, provide primers or resources to get them up to speed.
- **Don't compromise on assessment integrity:** While flexibility is key, do not let assessments become an afterthought or too lax. Avoid only using unproctored multiple-choice exams for high-stakes if cheating could be a concern. Don't give certificates without a meaningful assessment of competence; doing so could undermine the credibility of your micro-credential.
- **Don't forget about faculty and staff support:** It's not just learners who need help; instructors might struggle with new technology or pedagogical approach. Don't assume all faculty will intuitively know how to teach online or engage mobile learners. Provide training and don't launch them into it unsupported.
- **Don't treat micro-credentials as isolated or second-rate offerings:** A "don't" for mindset – don't view micro-credentials as less important than degree courses. They should be integrated into the academic ecosystem and given resources and recognition. If institutional attitudes dismiss them as peripheral, the quality and sustainability will suffer.
- **Don't violate data privacy or ignore ethics:** With online platforms, be careful about data. Don't use apps that harvest data in ways learners aren't aware of, and don't share learner information without consent. Also, be ethical in research – if you are experimenting with a new method, ensure learners know and consent if you plan to analyse their data for research.
- **Don't lose sight of the practical impact:** Don't design in an academic bubble. For vocational areas like agriculture, never lose the connection to the field. Avoid overly theoretical content with no linkage to real practices. Each module should answer "How will this help the learner in real life?" If you can't answer that, a rethink is needed. Don't be afraid to drop content that is "nice to know" in favour of what's "need to know" for skills application.

6.3 Case Examples and Commentary

Case Example 1: Hybrid Mobile Learning Course for Mountain Farmers (UNIBZ, Italy)
The Free University of Bozen-Bolzano (UNIBZ) piloted a course titled "Introduction to Smart Agriculture Technologies for Mountain Ecosystems" (3 ECTS). It combined online mobile-friendly learning with in-person lab sessions. Over Nov 2023–Feb 2024, learners (including local farmers and students) engaged with online lectures and interactive content on their own schedule, then attended a few scheduled hands-on exercises at UNIBZ's agricultural innovation lab. Topics covered included stability tests for machinery on slopes, optical sensor usage, and precision spraying technologies. The online component featured short video explainers and quizzes accessible via smartphone, while the in-person component let participants physically see and try the technologies. An e-learning platform was also used to provide foundational IoT knowledge as a preparation. An interesting finding was that the project confirmed *"training trainers (multipliers) will be more efficient... than directly targeting small-scale farmers"*, suggesting that future iterations focus on engaging agricultural extension officers or local farm advisors who can then pass on knowledge to many farmers.

Commentary: This case illustrates a flexible approach where crucial practical learning (like using sensors) that cannot be fully replicated online was still incorporated through minimal face-to-face sessions, while the bulk of theory was delivered in a mobile format to maximize accessibility. It addressed a regional need (mountain farming tech) in the local languages (Italian/German). The success (good completion and positive feedback reported) highlights that a blended model can work well for adult learners: the mobile component gives flexibility, and the occasional in-person meet provides motivation, networking, and hands-on experience. It's also a good example of partnership: UNIBZ likely collaborated with local experimental farms and the provincial advisory services to run the field excursions. The insight about focusing on training trainers is valuable – it shows adaptability in targeting and that sometimes the indirect route (educating those who will educate others) has a greater multiplier effect in lifelong learning projects.

Case Example 2: Micro-credential Modules Aligned with EQF/ECTS (TUM & BOKU)
Description: Under the USAGE-NG project, Technical University of Munich (TUM) and University of Natural Resources and Life Sciences Vienna (BOKU) collaborated to develop modular courses in smart farming that could be recognized across countries. For instance, they took existing master's-level content on IoT in Agriculture at TUM and repackaged it into micro-credential modules of 5 ECTS each. One deliverable was a planned MOOC titled "Fighting Climate Change – Smart Farming and IoT Technologies for Small-Scale Farmers". This Module is essentially a micro-credential (with an estimated 5 ECTS workload) aimed at a broad audience of learners across Europe. It covers a range of topics (drones, GNSS for mapping, sensor networks, etc.) and is delivered fully online via a MOOC platform. The framework for these modules was aligned to EQF levels 6 to 8, ensuring that each module's difficulty corresponded to undergraduate or graduate standards as appropriate. BOKU's role included ensuring that the micro-credential design meets European standards.

Commentary: This case demonstrates a cross-border approach to micro-credentials. By pre-defining that each module will carry 5–6 ECTS and be at a certain EQF level, it laid the groundwork for mutual recognition – a student at BOKU could take a TUM-created

module and vice versa, with the credit transferable. It also shows innovation in content delivery.

Case Example 3: National Framework Integration – New Zealand Micro-Credentials

Description: Although outside the EU, New Zealand's micro-credential system provides a model for integration into formal frameworks. In 2018, the New Zealand Qualifications Authority (NZQA) introduced micro-credentials into its regulated system. For example, a micro-credential in "Agricultural Data Analysis" could be listed at Level 5 on the NZ Qualifications Framework and carry, say, 10 credits (which is roughly comparable to 5 ECTS). One early micro-credential was a course on agribusiness management for dairy farm managers, developed with industry input, and delivered mostly online. NZQA's rules required that such micro-credentials meet an identified industry or community need, not duplicate existing quals, and have a reliable assessment method. These micro-credentials are subject to the same quality assurance as larger qualifications. They are often used for upskilling employees; for instance, a company might encourage staff to earn a micro-credential in "Safe Tractor Operation" which was developed by an industry training organization and approved by NZQA. Many micro-credentials in NZ serve either as entry pathways into higher study or as stand-alone upskilling—learners have earned their *"first formal credential"* through them in some cases. (Study From Work 2023)

Commentary: The NZ case underscores a few points: **governmental recognition** (which in Europe is analogous to alignment with NQFs/EQF and possibly inclusion in national qualification catalogs) can accelerate acceptance of micro-credentials. It effectively blurs the line between formal and non-formal learning, which is something Europe is also trying to do with VNFIL and micro-credentials. The NZ experience shows high uptake especially at lower qualification levels for quick upskilling. For EU universities, this hints that micro-credentials can be used to bring in learners who might not normally engage with higher education—like offering a Level 4 or 5 micro-credential (technically below traditional HE level but meeting a vocational need) through a university's lifelong learning wing, potentially attracting a new segment of learners. The case also demonstrates rigorous quality processes: micro-credentials had to be regularly reviewed and show industry support. The lesson is that collaboration with external stakeholders and formal QA processes yields credentials that are trusted by employers and learners alike. European institutions might emulate this by working closely with bodies like professional associations or extension services to ensure each micro-credential has a clear purpose and standard. (New Zealand Qualifications Authority 2024)

Case Example 4: Google Career Certificates in University Programs (USA)

Description: A number of U.S. universities have begun integrating Google's online career certificates (in IT support, data analytics, etc.) into their offerings. For instance, the University of Texas System partnered with Google so that students could earn a Google IT Support Certificate alongside their degree, with the university granting academic credit for it. One approach was embedding the online certificate content into a course and having faculty supplement it with contextual activities. Students who completed the certificate got credit (through ACE recommendations, it was valued at up to 12-15 credits) and a co-branded university micro-credential. This effectively created a micro-credential pathway where an industry credential and academic credit were integrated. Students benefitted by gaining an immediately market-recognized certificate (Google)

and progress toward their degree. The university benefitted by offering a cutting-edge, in-demand skill program without developing all content from scratch, instead contextualizing and augmenting it.

Commentary: This case shows a model of **public-private partnership in micro-credentials**. The "don't reinvent the wheel" lesson is key: if a high-quality micro-credential exists externally (like Google's, which are rigorously developed and widely recognized by employers), universities can use it rather than compete with it. For European context, think of potential collaborations with, say, EIT digital courses, or AWS cloud certificates, etc., in an academic program. It also underscores the importance of **credit recognition** – the reason this works is that the American Council on Education (ACE) evaluated the Google certificates and recommended them for credit, so universities have an assurance of quality. Europe could analogously use the new EU approaches to recognition of micro-credentials or work via ENIC-NARIC networks to evaluate external micro-credentials for academic credit. The outcome here – students being *"broadly educated and specifically skilled"* – resonates with the idea that micro-credentials can supplement traditional curricula to produce graduates who not only have a degree but also specific job-ready skills. For institutions, it's a strategy to improve employability of their students (an EU priority) without sacrificing the broader education. It's a "do" in terms of being innovative with curriculum design, but a potential "don't" would be not to outsource everything – in this case, the universities didn't just farm out credit to Google, they integrated and contextualized it, which is crucial for coherence and maintaining academic ownership.

7 References

CEDEFOP (2015): European guidelines for validating non-formal and informal learning. Luxembourg. Online verfügbar unter https://www.cedefop.europa.eu/files/3073_en.pdf, zuletzt geprüft am 25.12.2025.

Council of the European Union (2022): Council Recommendation of 16 June 2022 on a European approach to micro-credentials for lifelong learning and employability. Online verfügbar unter https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022H0627(02), zuletzt geprüft am 30.12.2025.

Den Hertog, Paul Schoerg, Kerstin Widger, Laura Wylie, Neill (2024): Micro-credentials: small change with a big impact. Hg. v. OEB Insights - OEB Global. Online verfügbar unter https://oeb.global/oeb-insights/micro-credentials-small-change-with-a-big-impact/, zuletzt aktualisiert am 29.12.2025.

European Commission (2025): Micro-credentials in higher education. Are they boosting digital and green skills for the twin transition? Unter Mitarbeit von Mabel Sanchez Barrioluengo, F. Biagi und G. Di Pietro. Luxembourg: Publications Office.

European MOOC Consortium (2019): The Common Microcredential Framework (CMF). Hg. v. European Association of Distance Teaching Universities (EADTU). Online verfügbar

unter https://emc.eadtu.eu/common-microcredential-framework, zuletzt geprüft am 31.12.2025.

Kohler, Tanner (2023): Accessibility and Inclusivity: Study Guide. Hg. v. Nielsen Norman Group. Online verfügbar unter https://www.nngroup.com/articles/accessibility-inclusivity-study-guide/, zuletzt geprüft am 29.12.2025.

Meghnagi, Micol Tuccio, Michele (2022): The recognition of prior learning: Validating general competences. Hg. v. OECD Publishing. Online verfügbar unter https://www.oecd.org/content/dam/oecd/en/publications/reports/2022/04/the-recognition-of-prior-learning_f83256d2/2d9fb06a-en.pdf, zuletzt geprüft am 30.12.2025.

New Zealand Qualifications Authority (2024): Aotearoa New Zealand’s early micro-credentials journey: Improving relevance and responsiveness. Online verfügbar unter https://www2.nzqa.govt.nz/about-us/publications/insights-papers/improving-relevance-and-responsiveness/, zuletzt geprüft am 30.12.2025.

Pal, Rahul (2025): Flexible Learning: Know Its Key Features, Importance, Benefits, Examples. Hg. v. 21K School. Online verfügbar unter https://www.21kschool.com/in/blog/flexible-learning/, zuletzt geprüft am 29.12.2025.

Park University (2025): Adult Learning Theory: How Adults Learn Differently. Online verfügbar unter https://www.park.edu/blog/adult-learning-theory-how-adults-learn-differently/, zuletzt geprüft am 29.12.2025.

Study From Work (2023): The relevance of micro-credentials according to NZQA. Online verfügbar unter https://studyfromwork.co.nz/2023/07/05/the-relevance-of-micro-credentials-according-to-nzqa/, zuletzt geprüft am 29.12.2025.

UNESCO Institute for Lifelong Learning (2022): Global Report on Adult Learning and Education (GRALE 5): Citizenship education. Online verfügbar unter https://unesdoc.unesco.org/ark:/48223/pf0000381857, zuletzt geprüft am 31.12.2025.

UNESCO International Institute for Educational Planning (2022): Flexible learning pathways in higher education. Hg. v. International Institute for Educational Planning. Online verfügbar unter https://www.iiep.unesco.org/en/projects/flexible-learning-pathways-higher-education#:~:text=Global%20enrolment%20in%20higher%20education,situation%2C%20education%20level%2C%20and%20skills, zuletzt geprüft am 29.12.2025.

Villalba‐García, Ernesto (2021): Validation of non‐formal and informal learning: The hero with a thousand faces? In: *Euro J of Education* 56 (3), S. 351‐364. DOI: 10.1111/ejed.12468.