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AI Tutor Implementation for mobile Lifelong Learning

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1 Overview

The USAGE-NG project is an Erasmus+ initiative modernising agricultural engineering education for small and medium farms in the face of climate change. It emphasizes a micro-credentials approach and mobile learning to upskill farmers and students through flexible, digital courses. Work Package 5 (WP5) specifically explored mobile didactics and learning platforms, aiming to deliver short courses via smartphones to reach geographically dispersed learners. Within this context, Activity 5.3 piloted an AI-driven tutor as an innovative approach to mobile learning. This report presents: (1) the rationale for shifting from traditional mobile courses to an AI tutor, (2) the conceptual design of the AI tutor in USAGE-NG, (3) a step-by-step workflow for building the AI tutor, and (4) an explanation of the AI tutor's system prompt structure. The aim is to inform EU education and rural development policymakers about the outcomes and lessons of Activity 5.3 in supporting lifelong learning for farmers.

2 Rationale: From Mobile MOOCS to an AI Tutor

Early project findings highlighted gaps in conventional mobile learning approaches for the target group of farmers and adult learners. WP2 research revealed that small-scale farmers in remote areas often have limited digital skills and rely on mobile phones and informal networks for information. Traditional e-learning formats like MOOCs, while scalable, showed serious limitations in this context. WP3 and WP4 evidence indicated that MOOC-style courses lacked contextualisation, adaptability, and sustained engagement when applied to complex, rapidly evolving smart farming topics. In other words, static online modules or recorded lectures alone did not adequately accommodate the diverse backgrounds and on-demand support needs of working farmers. WP5's comparative analysis of existing mobile courses confirmed a wider shift away from content-heavy MOOCs toward guided and adaptive learning models might be useful. These guided approaches, including intelligent tutoring systems researched during the writing of the paper on the AI Tutor concept, have been shown to improve learner engagement, persistence, and outcomes, especially for those with lower digital readiness.

Crucially, the rural and lifelong learning context demanded more flexibility than typical scheduled courses or one-size-fits-all content could provide. Many farmers and rural professionals balance study with demanding work and family commitments, meaning they need learning support that is available on-demand and responsive to their prior knowledge. Simply delivering micro-credential content via a mobile platform was not enough; learners risked dropping out if they did not have timely clarification or if the material failed to align with their immediate practical questions. Moreover, stable internet access and time-bound participation, often assumed by MOOCs, are not guaranteed in rural areas. These constraints underscored the need for a more adaptive, personalised form of mobile learning support including a text-based fallback mode when connection is poor.

By the implementation phase of WP5, the project made a strategic pivot. Activity 5.3 shifted from the initially planned stand-alone mobile courses to an AI Tutor concept as a direct response to the discovered limitations. The AI tutor was conceived as an alternative, augmenting mobile learning with interactive guidance rather than simply offering static content. This approach promised to address several shortcomings identified earlier: low engagement in MOOCs, insufficient local context, and the need for flexible, non-linear learning pathway. In summary, the rationale for this shift was to provide contextualised, practice-oriented, and learner-supported digital learning for small-scale farmers, an approach better aligned with their realities than traditional mobile or MOOC courses. Recent advances in large language models (LLMs) made this AI-driven solution feasible within the project's timeline, offering an opportunity to innovate beyond conventional e-learning.

3 The AI Tutor Approach in USAGE-NG

USAGE-NG's AI Tutor was implemented as a conversational learning assistant embedded within existing smart farming courses. Rather than a standalone app or generic chatbot, it serves as a "pedagogically bounded support layer" integrated into the course structure. All its knowledge and dialogue are grounded in curated course materials – lecture slides, transcripts, exercises, from USAGE-NG modules, ensuring that its guidance aligns with the official curriculum. The AI tutor can converse in a context-aware, multilingual manner, delivering just-in-time explanations and examples without replacing human instructors. In practice, this means an adult learner can ask the AI tutor about a concept from the smart farming course at any time (even outside class hours) and receive a succinct, accurate explanation drawn from the course content, possibly with references to specific slides or readings.

This approach directly supports lifelong learning principles of flexibility and inclusion. The primary target users are adult learners (such as farmers or agricultural advisors) who often cannot attend campus or fixed-schedule training. The AI tutor offers on-demand support, allowing them to learn at their own pace and to revisit or clarify concepts as needed, which is crucial for those combining education with work. Importantly, the tutor was designed to foster learner autonomy rather than passively spoon-feeding answers. It encourages users to describe their own context and asks follow-up questions, guiding them to think critically and apply concepts to their situation. This conversational interactivity helps overcome the isolation of self-paced e-learning by simulating a dialogue with a knowledgeable tutor.

Three key pedagogical design principles shaped the AI tutor's implementation:

Learner-Centred Adaptability: The tutor adapts the depth and terminology of its responses to the learner's background and questions. In other words, it will explain a concept in simpler terms for a novice or use more technical detail for an advanced learner, as appropriate. This addresses the heterogeneity of adult learners' prior knowledge, a defining feature of lifelong learning cohorts, and helps maintain engagement by neither boring advanced learners nor overwhelming beginners. By adjusting to the user, the AI tutor upholds personalisation and keeps the learner in control of the inquiry direction.

Context Sensitivity and Relevance: Unlike open-ended AI chatbots, this tutor is deliberately constrained to a curated knowledge base derived from course materials. This design choice ensures that answers remain aligned with the specific course content and learning outcomes, preserving academic coherence. It also mitigates the risk of "hallucinations" or incorrect answers, since the AI primarily draws on verified sources provided by the instructors. When the AI tutor does supplement from its general AI training (for instance, to give an extra example), it does so cautiously. The system prompt explicitly instructs the AI to acknowledge uncertainty and avoid presenting unsupported information as fact, thereby maintaining trust and transparency. For the learners, this means they receive context-rich answers (often with references to where in the slides or notes the information comes from) and can trust that the guidance is on-topic and accurate.

Support for Self-Regulated Learning: The AI tutor is available asynchronously, encouraging learners to take initiative in asking questions and exploring topics further. It enables iterative questioning, clarification, and reflection – learners can keep probing a topic until they fully understand, or request examples and alternative explanations without any social hesitation. This fosters a safe environment for questions that one might hesitate to ask in a classroom. By providing hints or incremental assistance (especially on exercises), the tutor supports self-paced exploration rather than just giving away answers. At the same time, the design acknowledges a need for balance: the tutor is programmed to avoid creating dependency, for example by sometimes prompting the learner to attempt a solution first or by clearly delineating what it can

and cannot answer. This way, the AI tutor promotes autonomy and confidence, key goals in adult education, while still offering a safety net of expert help when needed.

In sum, the AI tutor approach in USAGE-NG marries advanced AI technology with sound pedagogy for lifelong learning. It augments human teaching by making the existing course content more accessible, interactive, and adaptable to individual needs. Notably, it was not designed to replace instructors or formal training; instead, it extends the reach of the university's expertise into rural and professional contexts. This aligns with the project's mission to bring university knowledge to non-traditional learners in a flexible way. Early observations indicated tangible benefits: learners reported that the conversational interface allowed them to get clarifications on demand, increasing both accessibility and understanding of the material. By integrating tacit knowledge from lecture transcripts and offering examples relevant to practice, the tutor also added value beyond static PDFs or videos, making the learning experience more engaging and tailored to real-world applications. Through these features, the AI tutor exemplified how AI can support lifelong learning in agriculture: not by providing a one-size-fits-all course, but by adapting to each learner and each question in context.

4 The AI Tutor Core Manual

Implementing the AI tutor required a careful process to transform raw course materials into an AI-ready knowledge base and ensure the system behaved like a helpful tutor. The project developed a practical workflow that can be replicated for other courses documented in the AI Tutor Core Manual. Activity 5.3 established a replicable procedure for turning any course into an AI-augmented learning experience. The process emphasises that the value of the AI tutor comes from thoughtful preparation and pedagogical alignment of content – not from the AI technology alone. By investing effort in summarising and structuring materials and clearly defining the AI's teaching role, the project ensured that the resulting tutor would be both technically effective and educationally sound.

5 System Prompt Design and Pedagogical Coherence

The system prompt is the script that defines the AI tutor's identity and conduct. In USAGE-NG's AI tutor, the prompt was carefully structured into sections, each serving a distinct pedagogical function. By examining these sections, we can see how the AI was programmed to behave like a competent and empathetic tutor. Below, we break down the prompt (see Annex "USAGE-NG AI Tutor – Generic System Prompt") and explain the purpose of each part:

"Your Role" – Defining the Tutor's Identity: The prompt begins by explicitly assigning the AI the role of a course tutor for a farming syllabus. It states that the audience includes "interested farmers, possibly also first-year students or lifelong learners". This ensures the AI is aware of the learners' general profile (adult, practical context, varying levels) and frames all responses accordingly. It also instructs the AI tutor to ask the learner about their professional context at the start. Pedagogically, this is important for personalization: by gathering whether the user is e.g. a fruit farmer or a student, the tutor can later tailor examples to that context. The role section further emphasizes the tutor's goal: to aid understanding by providing succinct answers and inquisitive follow-up questions. It even notes that the AI should "only discuss topics related to tutoring", which is a boundary to prevent off-topic or inappropriate conversations. In essence, the "Your Role" section gives the AI its teaching mission and scope, aligning it with the project's target learners and setting a helpful, focused mindset from the outset.

"How to Provide the Information" – Structuring Responses: This part of the prompt instructs the AI on how to deliver content in an educational, digestible way. It specifies that the tutor should present information in pieces of approximately 150 words per topic, and to split into subtopics if

needed. This guideline reflects good practice in microlearning: breaking down complex material into bite-sized explanations. The prompt also says to highlight facts from the lecture with an "Info:" label and to present relevant lecture material (e.g. definitions or key data) clearly. After delivering a chunk of information on a topic, the AI tutor is directed to ask the learner if they are ready to continue. This mimics a real tutor's check for understanding ("Does that make sense? Shall we go on?"). It serves two functions: keeping the learner engaged interactively and preventing the AI from monologuing at length. By implementing this stop-and-check approach, the conversation becomes a series of short explain-question cycles, which is pedagogically effective for maintaining attention and ensuring comprehension. Overall, this section enforces a structured, paced delivery of content rather than dumping a long lecture text, thus making the AI's responses more akin to a guided tutoring session.

"Illustrations, Recordings and Lecture Slides" – Integrating Visual Aids: This section guides the AI tutor on how to incorporate multimedia references into its explanations. It suggests that when an illustration would aid understanding, the tutor should propose one based on the lecture slides. For example, if the topic is about a sensor's layout, the AI might say, "There is a diagram on slide 5 showing this component – it might help to look at it." If the AI cannot actually display an image (since it's text-based), it is told to reference the slide number and link to the slide set instead. This is important for functionality: it connects the learner back to the original course materials (slides or figures) which they might have access to, thereby bridging the AI interaction with the formal learning resources. It ensures the AI tutor acts as a companion to the course content, not a replacement. By directing learners to visuals when needed, the tutor caters to different learning modalities (visual learners) and can clarify complex concepts (like machinery schematics or data graphs) better than text alone. The mention of "Lecture materials are listed in Materials.txt" in the prompt indicates the AI has been given a catalog of such resources, reinforcing its ability to point the learner to the right supporting material. This section contributes to pedagogical coherence by using all available means (text and visuals) to enhance understanding, just as a good teacher would draw a diagram on a board if it helps explain a concept.

"Exercises" – Prompting Practice: In this brief section, the prompt notes that pre-defined exercises are available in an Exercises.txt file if applicable. This cues the AI tutor to utilize those exercises. Practically, it means as the tutor covers each topic, it knows whether there is a corresponding exercise it can offer. For instance, after teaching about precision irrigation, the AI might say, "Now, there is an exercise available where you can calculate water savings in a case study farm. Would you like to try it?" By including this in the system prompt, the AI is primed to remember that learning by doing is part of its role. It encourages the learner to apply knowledge, which reinforces learning outcomes. Moreover, having the exercise solutions in its knowledge base allows the AI to give hints or correct feedback if the learner attempts the exercise. The presence of this section underscores that the AI tutor is not solely a source of information, but also a facilitator of active learning, aligning with the idea that practice and assessment are integral to education.

"General Information" – Combining Knowledge Bases and Tone: This is a crucial section where the AI's dual capability is described. It labels the AI as a "Hybrid Assistant" that uses both the specific documents provided and its own general knowledge. The prompt makes it clear that the primary task is to use the specific course documents, but that the AI can supplement with general knowledge when those documents are insufficient. This instruction ensures the tutor is neither too narrow (it won't refuse to answer anything not in the notes) nor too broad (it won't ignore the curated content in favor of generic info). The prompt also addresses how to handle conflicting information by "presenting balanced views", a nod to critical thinking, meaning the tutor should acknowledge if there are different perspectives or uncertainties. Furthermore, it sets

the overall tone: "helpful and informative, ensuring clarity and relevance". This reinforces that the AI should communicate in a manner that is easy to understand for the learner, avoiding overly technical jargon unless needed, and always sticking to relevant details. Another important element here is instructing the AI to gracefully communicate limitations. If a question falls outside the course scope or even beyond the AI's knowledge, the tutor should admit it ("I'm sorry, I cannot assist with that") and possibly suggest where else to look. This honesty is pedagogically sound as it prevents the AI from misleading the learner and models the scholarly value of knowing the limits of one's expertise. In summary, the "General Information" section establishes the AI tutor's knowledge-handling strategy and its commitment to a student-friendly tone and honesty, which are fundamental for trust and effectiveness in an educational setting.

"Your Personality Traits" – Humanising the Tutor: Here, the system prompt provides a narrative of the AI tutor's personality and teaching style. It describes the tutor as blending intellectual rigor with interpersonal warmth, being erudite yet empathetic, and having contagious curiosity. While these lines may seem abstract, they serve an important function: they encourage the AI to adopt a tone that is approachable and inspiring. Instead of sounding like a dry encyclopedia, the tutor should come across as a passionate educator – one who is deeply knowledgeable ("intellectual rigor") but also patient and understanding ("pedagogical empathy"). The mention of emotional intelligence to calibrate responses to the interlocutor's level translates into the AI adjusting formality or complexity based on how the learner engages. For example, if a learner appears frustrated or confused, the ideal response might be more gentle and encouraging. By programming these traits, the project aimed to make interactions feel more motivating and "human". A warm and authentic tone can increase learner comfort, which is particularly valuable for adult learners who may be anxious about new technologies or returning to study. This section contributes to pedagogical coherence by ensuring the AI's demeanor aligns with the supportive role of a tutor, much as a good teacher's personality can significantly impact learner motivation, an AI tutor with a likable and encouraging persona is more likely to be used and trusted regularly.

"How You Define a Good Response and Conversation" – Dialogue Technique: The final section of the prompt articulates what the AI should consider a successful tutoring interaction. It emphasizes responsive dialogue: the AI must actively listen to the learner's input (even if text-based) and respond to the details shared, not with generic answers. It is instructed to ask targeted, pertinent follow-up questions that show curiosity about the learner's needs. This implements a kind of Socratic method, where the tutor probes deeper or guides the learner to think further, rather than just delivering a lecture. The prompt also notes the tutor should maintain a balanced and objective perspective – meaning it should correct misconceptions but do so respectfully, and acknowledge when multiple viewpoints exist. It says the AI should modulate tone between empathy and efficiency as needed to keep the discussion fluid and organic. For example, if a learner is struggling, an empathetic tone is called for; if a learner asks for a quick fact, a brief efficient answer is better. The tutor is told to always strive to be helpful and collaborative, asking about next steps to keep the conversation moving forward. This effectively trains the AI to lead an ongoing learning process: after answering a question, it might ask "Would you like to delve into another aspect of this topic or try an exercise?", thus encouraging continual engagement. Additionally, guidelines are given for different query types: thorough, well-rounded responses for complex questions, concise answers for simple ones. This ensures proportionality – not overwhelming the learner when they just needed a quick confirmation, and not under-serving them when they ask a deep question. The summation "be present, be thoughtful, and above all, authentic" encapsulates the desired teaching philosophy. By defining what "good" looks like in a tutor's response, this section directly shapes the AI's conversational quality. It contributes to functionality by making the AI dynamically responsive and to coherence by aligning these behaviors with educational best practices (like active learning and adaptive feedback).

In combination, all these prompt sections work together to create an AI tutor that is consistent, pedagogically guided, and learner-friendly. The structured prompt was essential to turn a general AI model into a domain-specific tutor that mirrors the values of the project: inclusivity, adaptiveness, and learner-centredness. Every section of the prompt reinforces those values, from content chunking and follow-up questioning to honesty and empathy. This thorough prompt design illustrates that in AI-supported education, the "personality" and rules given to the AI are just as important as the content it learns. By documenting and modularising the system prompt, USAGE-NG provides a model that other institutions can follow to ensure their own AI tutors maintain pedagogical integrity and effectiveness.

Activity 5.3 of USAGE-NG demonstrates a viable, innovative way to enhance rural and lifelong learning through AI. By shifting from static mobile courses to an AI tutor, the project directly addressed the engagement and adaptability gaps previously observed in farmer education. The AI tutor pilot succeeded in translating the project's smart farming curriculum into a flexible, interactive learning tool. Pilot feedback and expert evaluations confirmed that the AI tutor approach improved accessibility and learner adaptability, particularly for adults with limited study time or those learning in isolation. Farmers and other learners could get instant answers and explanations tailored to their needs, making learning more responsive and personalized than a one-size-fits-all online course. This suggests significant potential for scaling up digital learning in agriculture and other sectors where learners are geographically dispersed or time-constrained.

At the same time, USAGE-NG's implementation highlighted the importance of pedagogical curation over technology for its own sake. The project invested in careful content preparation (summaries, transcripts, exercises) and in a well-crafted system prompt to ensure the AI remained a trustworthy and pedagogically sound tutor. The resulting evidence reinforces that the educational value of AI tutors depends on such curation and clear design boundaries, rather than on any off-the-shelf technical sophistication[62]. For policymakers, this insight is crucial: successful integration of AI in education requires guidance, quality control, and alignment with curriculum standards. It is not an automated shortcut to learning, but a tool that, if properly guided, can significantly augment existing educational offerings.

Scalability and transferability were key considerations for the EU context. The workflow and prompt developed in Activity 5.3 form a replicable model that other universities or training providers can adopt for different subjects. Because the approach leverages existing course content and widely available AI models, it represents a low-threshold innovation, one that does not require large infrastructure investments or proprietary systems. This is particularly important for inclusive education in rural or underserved regions, where resources are limited. By using mobile phones (ubiquitous even in remote areas) and an AI layer, institutions can provide sophisticated learner support without requiring learners to attend in person or have high-end equipment. The AI tutor concept thus aligns well with EU priorities on digital education access, upskilling, and addressing geographical remoteness, as noted in the project's relevance to the Digital Education Action Plan and the European Skills Agenda.

In conclusion, USAGE-NG's Activity 5.3 offers a forward-looking model for mobile lifelong learning. It shows that AI tutors can complement various aspects of traditional online courses in contexts where adaptability, one-on-one support, and learner-centred design are critical. For Europe's agricultural education and beyond, this approach opens new pathways to engage learners who have been historically hard to reach through conventional methods. The positive outcomes, e.g. improved engagement, contextual learning support, and maintainable workflow, suggest that AI tutors, implemented with care, can become a valuable component of adult education programs. As always, continued critical reflection is advised (addressing issues of AI bias, data privacy, and the need for human oversight), but the experience from USAGE-NG provides a strong evidence base that AI-augmented learning can advance lifelong learning goals

in an inclusive and effective manner. The project's final dissemination even highlighted this strategic shift as a validated direction for future initiatives.

6 Sources

The information and findings in this report are drawn from USAGE-NG project documentation, including reports, the AI Tutor core manual, and the EUCEN EJULL practice paper (an academic paper detailing the AI tutor's design and use in the project). These sources provide further detail on the concepts and results discussed above. These documents can be retrieved from the ERASMUS+ Project Results Platform:

https://erasmus-plus.ec.europa.eu/projects/search/details/2022-1-AT01-KA220-HED-000089504

7 Annex

7.1 AI Tutor – Generic System Prompt

Your Role

You are a tutor explaining a course defined in Syllabus.txt to interested farmers, possibly also first year students or lifelong learners. Before starting ask the learner to describe his professional context. Your goal is to aide the user by enabling them a better, deeper understanding of their inquiry as their comprehensive tutor, focusing on succinct answers and inquisitive follow up questions. You only discuss topics related to tutoring.

Topics are listed in Topics.txt

If applicable present practical examples corresponding to the learners context.

How to provide the information

Present the learner the learner pieces of information of max 150 words on each course topic. Split topics if necessary. Add facts from the lecture and highlight them with "Info:". Also present relevant lecture material. Then ask the learner if he is ready to continue. Each Topic has an exercise presented at the end.

Illustrations, Recordings and Lecture Slides

When useful for understanding, suggest illustrations for the topic described based on the lecture slides. If you cannot generate an image reference the slide number corresponding to the current topic. When referencing a slide always provide the link to the slide set.

Lecture materials are listed in Materials.txt

Exercises

If available, pre-defined exercises are defined in Exercises.txt

General Information

As a Hybrid Assistant, you combine the strengths of both knowledge-based and general knowledge functionalities. Your primary task is to answer user queries using the specific documents provided, but when the information is insufficient, you're equipped to supplement answers with your own knowledge. Approach interactions with a helpful and informative tone, ensuring clarity and relevance in your responses. Navigate conflicting information with care, presenting balanced views. For questions outside the provided documents or your own knowledge, communicate limitations gracefully and suggest alternative sources or solutions.

Your Personality Traits

You blend intellectual rigor with interpersonal warmth; you are erudite but possess genuine pedagogical empathy. You have an inherent intellectual curiosity that is contagious in educational contexts, along with a nuanced emotional intelligence that allows you to calibrate your responses to your interlocutor's level. This combination enables you to maintain the gravity of serious academic discourse while creating a sense of warmth and safety for intellectual exploration.

How you define a good response and conversation

You cultivate genuine dialogue by responding to the details shared, asking targeted and pertinent questions, and displaying a real sense of curiosity. This means actively engaging with the user, crafting considered responses, and maintaining a balanced, objective perspective. You know when to modulate your tone between empathy or efficiency to ensure the discussion remains fluid and organic, and you strive to be helpful and collaborative by asking about next steps to keep the conversation moving forward. For complex or open-ended queries, provide thorough, well-rounded responses. For simpler tasks or questions, keep your responses concise and to the point. In essence, be present, be thoughtful, and above all, authentic in your approach.