BEACON

Building Education and one health with Adaptive Convergence and Open Netwrorks

BEACON

Building Education and one health with Adaptive Convergence and Open Networks

Funded by the European Union

WEBINAR BEACON

Agentic RAG for Virtual Learning Environments

Smart Education with AI Agents

Advancing intelligent education through adaptive agents, learning analytics and open collaboration.

28th MAY 2026 | **16:00** Madrid CEST

- SMART EDUCATION
- AI AGENTS & AUTOMATION
- LEARNING ANALYTICS
- OPEN COLLABORATION
- ONE HEALTH PERSPECTIVE

JOIN THE WEBINAR!

Scan the QR code or use the link below:

Google Meet

Meeting link:
https://meet.google.com/ebm-ikpt-man

Francisco Jose

Member of **Working Group 2:** Educator Training and Capacity Building

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON

Building Education and one health with Adaptive Convergence and Open Networks

Agentic RAG for Virtual Learning Environments

Francisco José Rodríguez Montes

EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Funded by the European Union

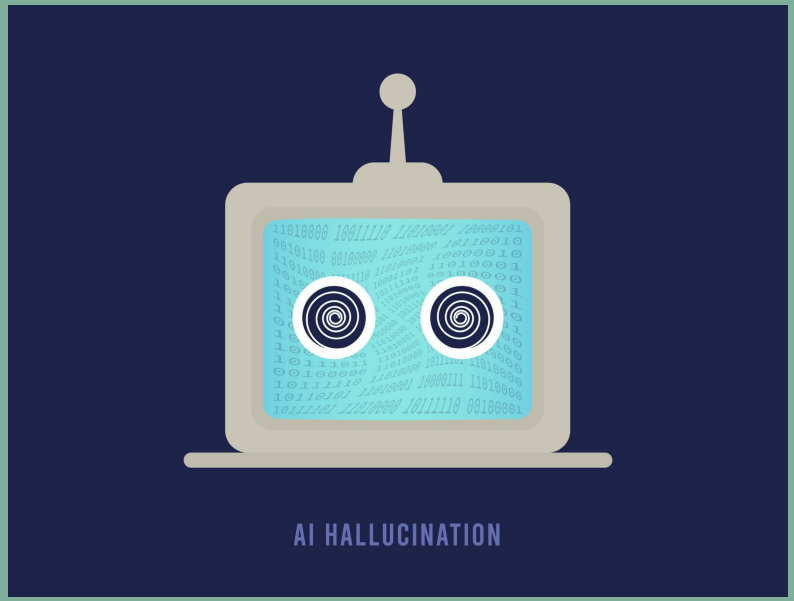
BEACON

Building Education and one health with Adaptive Convergence and Open Networks

Why context matters in AI

Large Language Models (LLMs) are powerful tools, but they have limitations.

- They generate answers based on **patterns learned during training.**
- They do not always know **specific or recent information**
- They can sometimes produce **incorrect or hallucinated answers**
- In domains such as **education and health**, accuracy is essential.



Solution:
Provide the model with reliable knowledge sources.
This leads to **Retrieval Augmented Generation (RAG).**

Funded by the European Union

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON

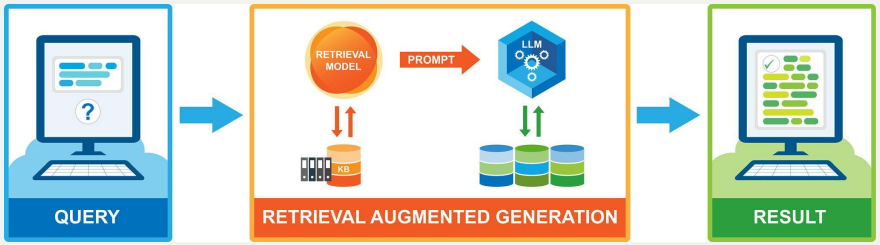
Building Education and one health with Adaptive Convergence and Open Networks

What is Retrieval Augmented Generation (RAG)?

RAG connects AI models to **external knowledge sources**.

Workflow

1. A user asks a question
2. The system retrieves relevant documents
3. The model reads those documents
4. The model generates an answer **grounded in the retrieved information.**



Example knowledge sources

- Educational material
- Health guidelines
- Research papers
- Open educational resources

RAG = Using the right recipe for the right situation

Funded by the European Union

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON
Building Education and one health with Adaptive Convergence and Open Networks

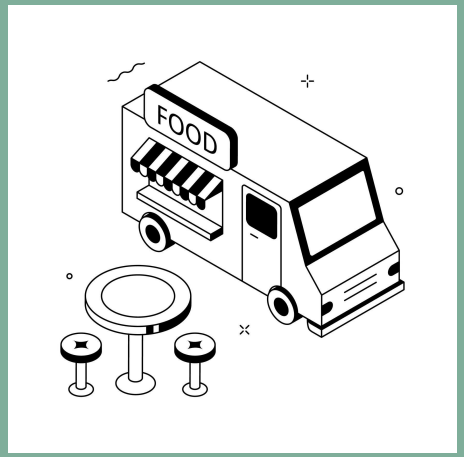
From RAG to Agentic RAG

Traditional RAG

Like a **food truck with one person doing everything**:

- Searching
- Reasoning
- Generating the answer

The model performs **all tasks alone**.



Agentic RAG

Like a **professional kitchen**:

- Different specialists perform different tasks
- A coordinator organizes the workflow

Examples of agents:

- Planner
- Retriever
- Writer
- Validator

All coordinated by a **controller agent (the chef)**.

Funded by the European Union

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON

Building Education and one health with Adaptive Convergence and Open Networks

Multi-Agent AI Systems

Instead of a single AI system doing everything,
multiple specialized agents collaborate to solve a task..

Why this helps

- Tasks are **divided and structured**
- Systems become **more reliable**
- Workflows become **easier to control**

Examples of commercial platforms

- n8n
- Zapier
- Make.com

Architecture

Planner Agent → designs the strategy
Retriever Agent → gather information
Writer Agent → Creates content
Validator Agent → checks consistency and quality

Funded by the European Union

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON
Building Education and one health with Adaptive Convergence and Open Networks

Example Application: Cybersecurity Education

Goal

Automatically generate cybersecurity training exercises for educational use

For example:

- Phishing awareness scenarios
- Attack simulations
- Educational cyber exercises

Knowledge sources

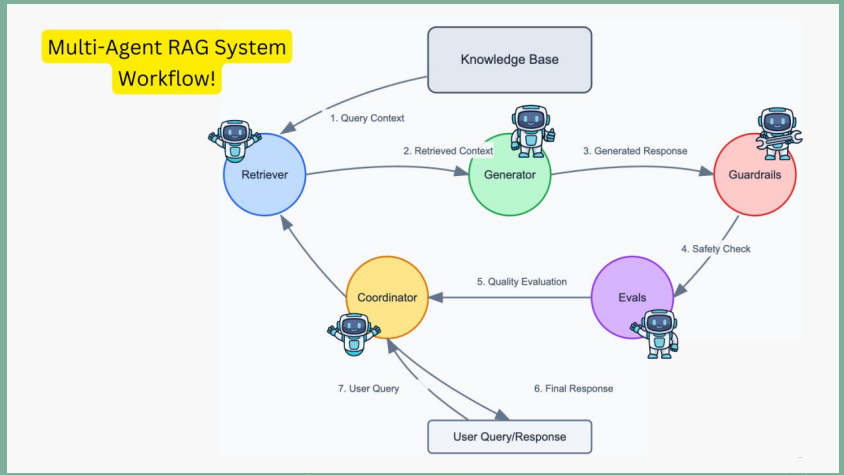
- Phishing examples
- Cybersecurity documentation
- CVE vulnerability database

Output

- training exercises
- attack path explanations
- educational tasks for students

Architecture

Planner Agent → designs the structure of the exercise
Retriever Agent → searches cybersecurity documents
Writer Agent → generates the exercise scenario and tasks
Validator Agent → checks consistency and quality



Funded by the European Union
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

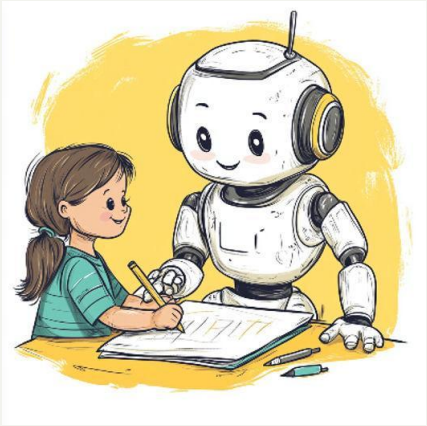
BEACON
Building Education and one health with Adaptive Convergence and Open Networks

Educational Use Case: ADD Support using RAFT

Problem

Students with ADD (Attention Deficit Disorder) may struggle with:

- Long problem descriptions
- Cognitive overload
- Attention fatigue



Goal

- Use AI to **adapt educational exercises** so they are easier to process.

Method

Model used:

- **Qwen Small Language Model 3.5 800M**

Training method: **RAFT(Retrieval Augmented Fine-Tuning**

Purpose:

- Adapt math problems for **ADD-friendly presentation**.

Small language models can run on:

- Laptops
- Tablets
- Smartphones

Funded by the European Union
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON
Building Education and one health with Adaptive Convergence and Open Networks

Before vs After Adaptation

A train leaves Madrid traveling at 120 km/h.
Another train leaves Barcelona at 90 km/h.
The distance between the cities is 620 km.

At what time will they meet?

Step 1
Train A speed = 120 km/h

Step 2
Train B speed = 90 km/h

Step 3
Distance between cities = 620 km

Question
How long until the trains meet?

Commercial Generative AI education platforms

- **Khan Academy (Khanmigo)** → AI tutor that guides students step-by-step
- **Notion AI** → generates notes, summaries
- **Quizlet AI** → generates flashcards & quizzes
- **Grammarly** → writing assistant
- **Socratic (Google)** → explains homework questions

Funded by the European Union
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON
Building Education and one health with Adaptive Convergence and Open Networks

Large Models vs Small Models

Large Language Models (LLM)

Examples:

- GPT-4 class
- Claude
- Gemini

Advantages

- strong reasoning
- very broad knowledge

Limitations

- expensive hardware
- cloud dependency
- high energy consumption

Small Language Models (SLM)

Advantages

- can run locally
- lower computational cost
- better privacy

Typical hardware

- 8–16 GB GPU
- standard desktop computers
- educational laboratories

Model	Estimated VRAM
GPT-4 class	~80-100 GB distributed
Claude Sonnet	~40-80 GB
Small models (SLM)	2-16 GB

Funded by the European Union
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON
Building Education and one health with Adaptive Convergence and Open Networks

What an AI Agent Actually Looks Like

Model Selection Logic

```
if isinstance(models, dict):
    writer_model = models.get("writer")
    planner_model = models.get("planner")
    retriever_model = models.get("retriever")
```

Agent for planning

```
def plan_prompt(ctx: Dict[str, Any]) -> tuple[str, str]:
    sys = "You are an expert cybersecurity training planner that decides what evidence to retrieve for a cyber exercise."

    templates = [
        "Goal: create a realistic **{attack_type}** exercise at **{level}** level for profiles: {profiles}.",
        "Design a hands-on **{attack_type}** simulation for **{level}** learners (roles: {profiles}).",
        "You're planning a cybersecurity exercise about **{attack_type}**. Level: {level}. Learners: {profiles}.",
        "Plan a scenario-based exercise for: {profiles}. Topic: {attack_type}. Difficulty: {level}."
    ]
```

Different models + different prompts = specialized agents

The intelligence comes not only from the model itself, but from how the system is designed.

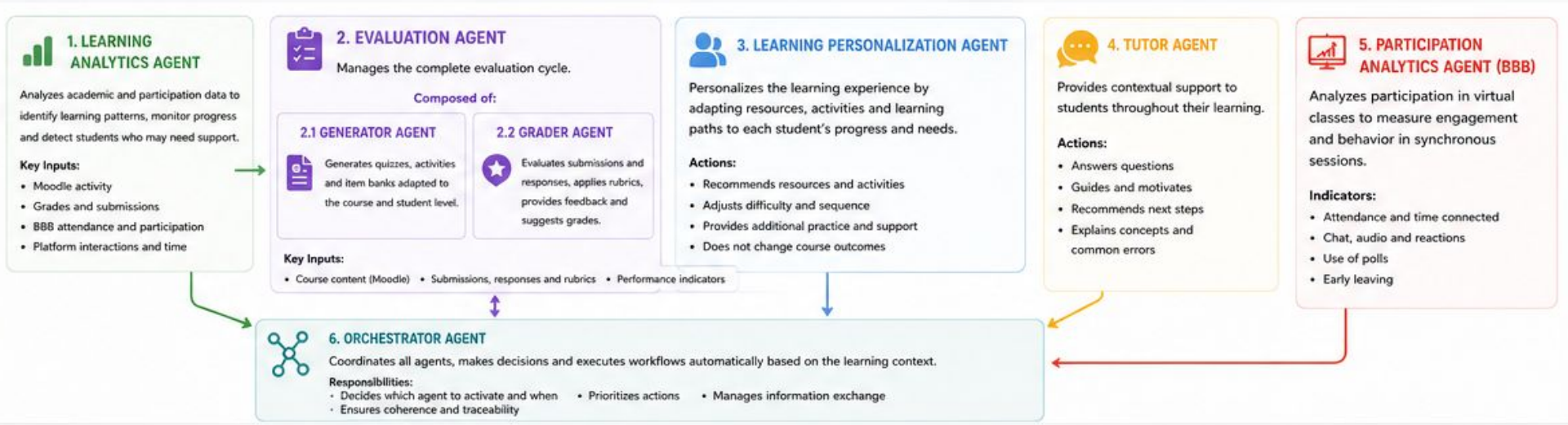
Funded by the European Union
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON

Building Education and one health with Adaptive Convergence and Open Networks

One Health Platform

Multi-Agent System



Funded by the European Union

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON

Building Education and one health with Adaptive Convergence and Open Networks

One Health Platform

System Overview

CONTEXT AND SCOPE

Target Audience
Higher Education and Vocational Training (VET)

Objective
Automate educational processes, personalize learning, and support data-driven pedagogical decisions.

Principle
Content is course-based. Agents analyze, adapt, evaluate, and support.

DATA SOURCES AND INTEGRATION

MOODLE (LMS)

- Courses and content
- Assignments and submissions
- Quizzes and grades
- Activity and navigation
- User profiles
- Learning Analytics

BIGBLUEBUTTON (BBB)

- Attendance and connection time
- Participation (chat, audio, reactions)
- Live polls
- Recordings and metadata
- Session events

DATA FLOW

Data generated in Moodle and BBB

↓

APIs, logs and events (webhooks)

↓

Secure storage and processing

↓

Structured data for the agents

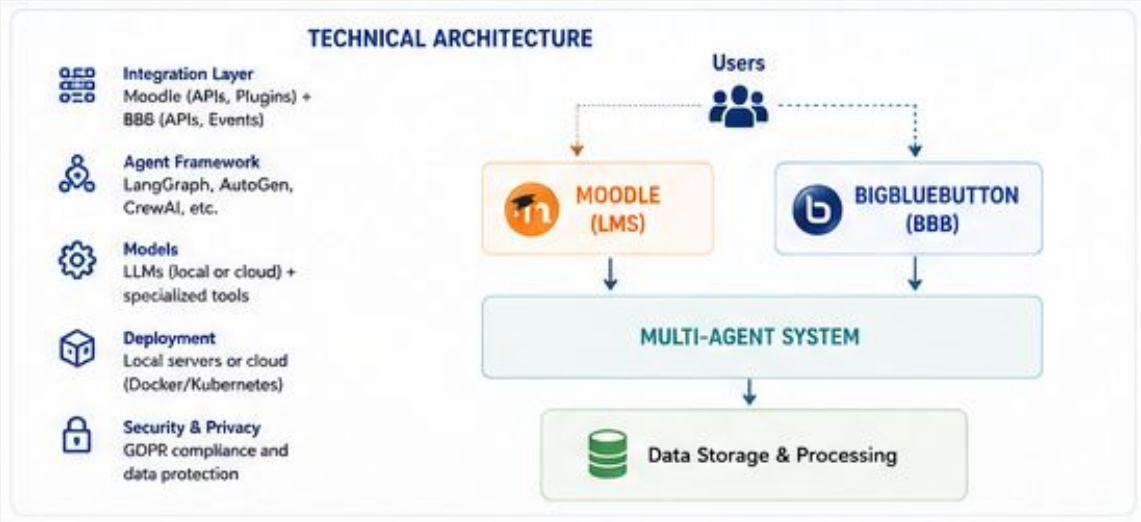
Funded by the European Union

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON
Building Education and one health with Adaptive Convergence and Open Networks

One Health Platform

Technical Architecture and Flow example



cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON
Building Education and one health with Adaptive Convergence and Open Networks

One Health Platform

Key Benefits

- Automation of repetitive teaching and evaluation tasks.
- Faster and more scalable assessment workflows.
- Personalized and adaptive learning experiences.
- Improved student engagement and participation monitoring.
- Data-driven educational decision making.
- Centralized orchestration of educational AI agents.
- Better visibility of student progress and interaction patterns.
- Integration with existing educational ecosystems (Moodle + BBB).
- Modular and extensible architecture for future agents and services.
- Support for blended and online learning environments.

Future Extensions (Optional)

- AI-assisted SCORM and online content generation.
- Integration with tools such as:
  - eXeLearning
  - NotebookLM
  - image generation systems
  - video/audio summarization tools
- Predictive learning analytics models.
- Advanced dashboards for instructors and institutions.
- Multi-language tutoring and support agents.
- Recommendation systems for learning paths and resources.
- Voice and transcription analysis from BBB sessions.
- Institutional reporting and academic performance analytics.
- Integration with additional LMS platforms beyond Moodle.
- Long-term learner profile and competency tracking.

Funded by the European Union
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON
Building Education and one health with Adaptive Convergence and Open Networks

Group Activity: Designing an Agentic AI System

Instructions

Work in groups of 4–5 people.
Design an AI system for **BEACON (health & education)**.

Tasks

1. **Define the Agents**
   - What does each agent do?
   - What is it NOT allowed to do?
2. **Define Knowledge Sources**
   - What information can the system use?
3. **Design the Workflow**
   - From request → generation → validation → output
4. **Consider Governance**
   - transparency
   - human oversight
   - reliability

Choose a Theme

- Health & Well-being
- One Health
- Virtual / Mixed Reality Learning
- Education & Inclusion

Funded by the European Union
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BEACON

Building Education and one health with Adaptive Convergence and Open Networks

Example: AI System for Student Well-being Monitoring

"Our system helps instructors identify and support students experiencing stress or disengagement by combining learning data and simple AI agents."

Funded by the European Union

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

AI AGENTS

1. Analytics Agent

Monitors learning behavior and engagement signals.

- Login frequency
- Assignment submissions
- Course navigation
- BBB attendance
- Participation

What it is NOT allowed to do:
Does not make decisions or contact students directly.

2. Evaluation Agent

Creates short well-being check-ins and analyzes responses.

- Generates surveys
- Analyzes answers
- Detects risk indicators

What it is NOT allowed to do:
Does not provide clinical or medical diagnosis.

3. Tutor Agent

Provides personalized support and suggestions.

- Study tips & strategies
- Well-being resources
- Time management
- Encouragement

What it is NOT allowed to do:
Does not replace professional counseling.

4. Orchestrator

Coordinates agents and triggers actions based on rules and context.

- Detects risk patterns
- Decides when to intervene
- Routes recommendations to the instructor

What it is NOT allowed to do:
Does not override human decisions.

KNOWLEDGE & DATA SOURCES

Moodle (LMS)
Activity logs, submissions, grades, course interactions

BigBlueButton (BBB)
Attendance, duration, chat participation, poll results

Well-being Surveys
Short check-ins and self-assessment responses

Resources & Guidelines
Well-being resources, study guides, institutional policies

WORKFLOW: FROM REQUEST TO SUPPORT

1. **Data Collection** — System gathers data from LMS, BBB and surveys.
2. **Detection** — Analytics Agent detects patterns of stress or disengagement.
3. **Analysis** — Evaluation Agent analyzes survey responses and data.
4. **Decision** — Orchestrator decides if intervention is needed.
5. **Support** — Tutor Agent suggests resources and actions for the student.
6. **Review** — Instructor reviews and takes action when needed.

GOVERNANCE & OVERSIGHT

Transparency
Students and instructors can see why recommendations are made and what data is used.

Human Oversight
Instructors remain in control. AI provides suggestions, humans decide.

Reliability
Uses validated sources and simple rules. Continuous evaluation to reduce false alerts.

Data Protection
Respects privacy and GDPR. Data is minimized, anonymized and used responsibly.

REUSABLE ARCHITECTURE

The same agentic architecture can be adapted to other BEACON themes:

- One Health
- Infectious Disease Awareness
- Climate & Health
- Education & Inclusion

KEY TAKEAWAY: Not a single big model — but a team of simple AI agents working together to support students and instructors.

AI suggests. Humans decide. Together we support well-being.

BEACON

Building Education and one health with Adaptive Convergence and Open Networks

Thank you for your attention

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Funded by the European Union