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WHITE PAPER

Human-AI Co-Thinking: Transforming Swiss Education

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MAY 2025



Executive Summary

While thousands of children already interact daily with artificial intelligence (AI), often without guidance or preparation, our education system stands at the dawn of a transformation that is as inevitable as it is necessary.

Imagine a Switzerland where every student masters the art of co-thinking with artificial intelligence as naturally as writing or mathematics. This is the horizon that AI Swiss envisions for tomorrow's Swiss education. **Human-AI co-thinking** — this ability to communicate with AI systems to amplify one's intellectual capabilities while developing a sixth sense to discern their cognitive dissonances — would be established as a fundamental competency from the earliest years of schooling.

Conceptualized and field-tested by AI Swiss with businesses and the general public, co-thinking draws inspiration from human-AI interaction components with proven benefits in cutting-edge academic and economic sectors. It fundamentally differs from current AI usage paradigms: neither a tool with which one converses passively, nor a system to which entire cognitive processes are delegated, nor a tutor offering personalized learning paths. Rather, it involves developing a form of AI literacy that enables one to approach any AI system with which one can converse in natural language.

Co-thinking transcends the human-AI interaction modes favored by current AI interfaces like ChatGPT, Claude, or Gemini. It recognizes and exploits the most fundamental constraints of any conversational AI system, present and future: like a human, AI cannot read our intentions from our thoughts. Nor can it evaluate or verify aspects requiring embodied human experience — such as contextual judgments or complex ethical reasoning. These constraints necessitate teaching interaction modes where humans can maintain their essential role of evaluation and verification at all times, while developing their ability to communicate effectively with AI despite cognitive dissonances — regardless of the underlying AI system.

Co-thinking is therefore primarily a pedagogical approach for understanding how to interact with any intelligence, artificial or otherwise, whose language we understand but whose cognitive nature differs from that of a human — sometimes very subtly. Its foundations can be learned without digital tools, particularly through metacognitive reflections and role-playing games where humans pretend to be AI systems. While necessary for approaching existing AI systems, it reveals its full practical potential when exercised on systems specifically designed for beneficial human-AI synergy, preserving human cognitive autonomy.

For AI Swiss, integrating co-thinking as the foundation of AI literacy in education is not a futuristic vision but an inevitable evolution, despite significant challenges.

Beyond teacher training, questions of equitable access to technology arise, as well as data protection, maintaining balance between innovation and preserving pedagogical fundamentals, and orchestrating such a transformation in our federal system. This white paper lays the foundations for an essential dialogue with all educational stakeholders — the true architects of this pedagogical transformation — to make Switzerland a global pioneer in effective, ethical, and responsible human-AI co-thinking.

By orchestrating this transformation with the rigor and consensus-building spirit that characterizes it, Switzerland could not only distinguish itself from nations that confine AI to the role of a supplementary tool, but also shape an exceptional educational model. National mastery of co-thinking would lay the foundations for a new era of Swiss excellence, permeating the entire social, economic, and cultural fabric, and reinforcing Swiss excellence in innovation and the knowledge economy.

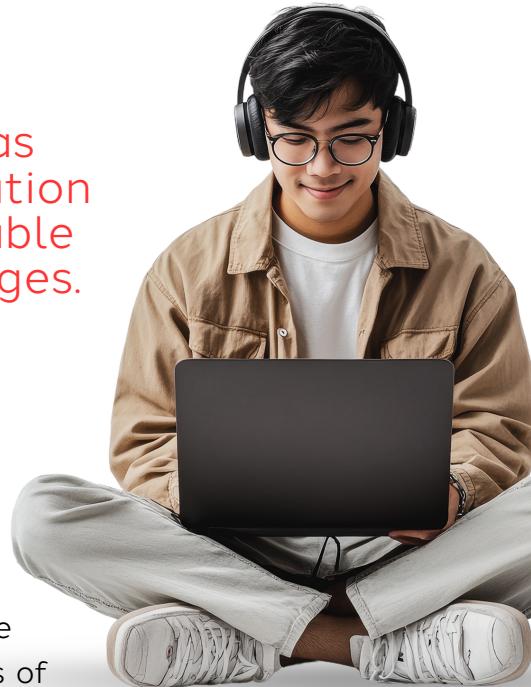


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INTRODUCTION:

**AI as a
thinking partner**

Current Large Language Models (LLMs) represent a historic first: artificial systems that demonstrate forms of intelligence that could be called intuitive across a remarkably broad spectrum of human concepts. They don't just excel in language, but also produce fragments of reasoning, common sense, theory of mind, and even ethics — dimensions long considered the exclusive domain of human intelligence. This technological transformation is already profoundly reshaping numerous professional sectors and beginning to transform educational practices worldwide.

Despite their unprecedented sophistication, existing AI systems face fundamental limitations: they lack a human body to perceive the world through the same sensations and feelings, and don't even have the capacity to act upon this world to empirically verify hypotheses — the basis of the scientific method and human learning. These constraints, which are unlikely to change, require a framework for interaction with AI: a form of human-AI co-thinking where humans remain capable of ensuring their key role of verification and evaluation, while continuously enriching themselves through their dialogues with AI.



"Current AI systems fundamentally lack sufficient self-verification capabilities to serve as the basis for fully autonomous systems. The only viable interaction for the coming years will be with AI as generator and human as verifier; in short cycles, as humans are generally unwilling to verify large amounts of content," explains Dr Charles-Edouard Bardyn, Vice-President and Scientific Director of AI Swiss.



This scientific reality demands a profound paradigm shift in our educational approaches: the challenge is not to delegate complex intellectual tasks to AI, but to learn to co-think effectively with it. Students are already spontaneously exploring new forms of intellectual collaboration, whether to structure essays, solve complex problems, or conduct innovative creative projects. Faced with this inevitable transformation, current educational frameworks — even the most advanced — still offer only partial responses that we must transcend.

BEYOND CURRENT FRAMEWORKS:

AI as a fundamental cross-cutting competency



In 2024, UNESCO published competency frameworks for AI for teachers and students in the context of the Global Education Agenda 2030 (UNESCO, 2024a, 2024b). This framework structures 15 essential competencies across five dimensions: human-centred mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning — all organized according to three progression levels: acquire, deepen, and create. This ambitious initiative aims to map the integration of AI into educational practice.

In Switzerland, the State Secretariat for Education, Research and Innovation (SERI) had already identified two strategic priorities in 2019: “Ensuring the transmission of adequate competencies” and “Ensuring transparent and responsible use of AI in education” (SERI, 2019a). More recently, Swissuniversities adopted a position favoring “pragmatic and dynamic integration of these technologies in teaching and assessments,” calling on higher education institutions to support the academic community in identifying opportunities and risks inherent in these new tools (swissuniversities, 2024). In French-speaking Switzerland, the Directorate General for Post-Compulsory Education (DGEP) has established a working group dedicated to artificial intelligence in upper secondary education (DGEP, 2024).

Despite these advances, the latest “Artificial Intelligence Index Report 2025” from the Stanford Institute for Human-Centered AI reveals a mixed reality on a global scale: “Thus far, very few countries (e.g., Ghana, South Korea, Netherlands) include AI education in their curricula explicitly; countries more often flag the importance of AI education in the national education strategy conversation without providing a detailed implementation plan” (Stanford Institute for Human-Centered AI, 2025). The report also emphasizes that “countries on a global scale have been quicker to develop guidance and policies for the use of AI in education as opposed to developing national standards for teaching AI” — a symptom of a reactive rather than proactive approach to this fundamental transformation.

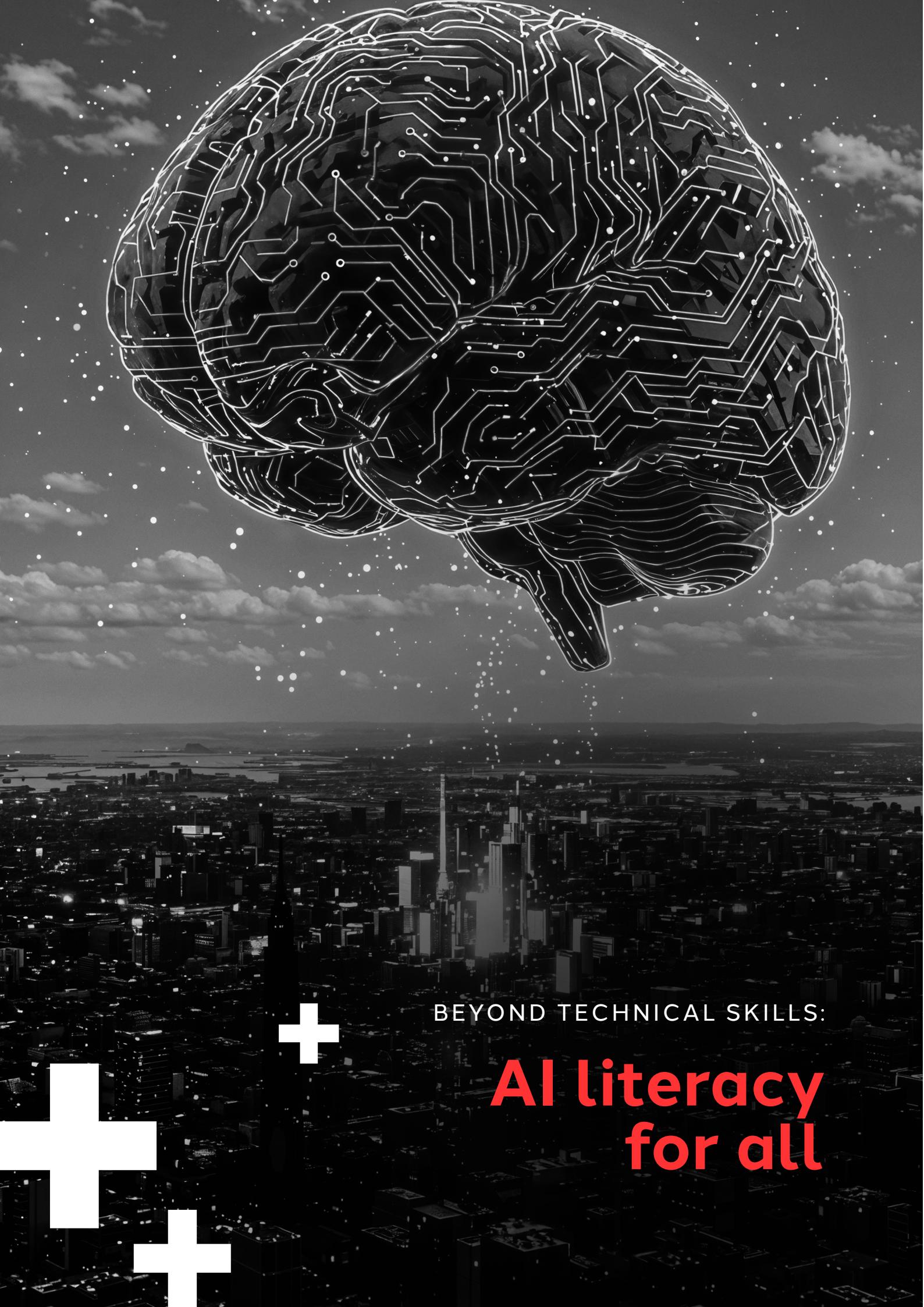
This trend is confirmed even in higher education where, paradoxically, one would expect more agility in innovation: “Most existing university policies and guidance around AI pertain to how students use AI for assignments; guidance on AI education itself tends to be relegated to the department level (primarily in computing departments)” (Stanford Institute for Human-Centered AI,

2025). This compartmentalization reflects the absence of a holistic vision of AI as a fundamental cross-cutting competency.

In parallel, practical resources such as methodological guides (EDHUMAN, 2024), (Piekoszewski-Cuq, 2025) or (Quiquempois & Goémé, 2025) are emerging to support teachers in the daily adoption of these technologies. While these tools provide a valuable foundation for training educational stakeholders, they often position AI as an assistant serving existing pedagogical practices, rather than as a catalyst for profound transformation of the pedagogical relationship itself.

AI Swiss welcomes these initiatives, while noting that they represent only a partial response to contemporary educational challenges.

Recent scientific literature, detailed in the appendix, as well as AI Swiss's concrete experience with Swiss businesses and the general public, demonstrate that AI brings its most significant value not as a simple tool or mentor, but as a true intellectual partner — thus positioning human-AI co-thinking as a key competency for tomorrow's education.



BEYOND TECHNICAL SKILLS:

**AI literacy
for all**

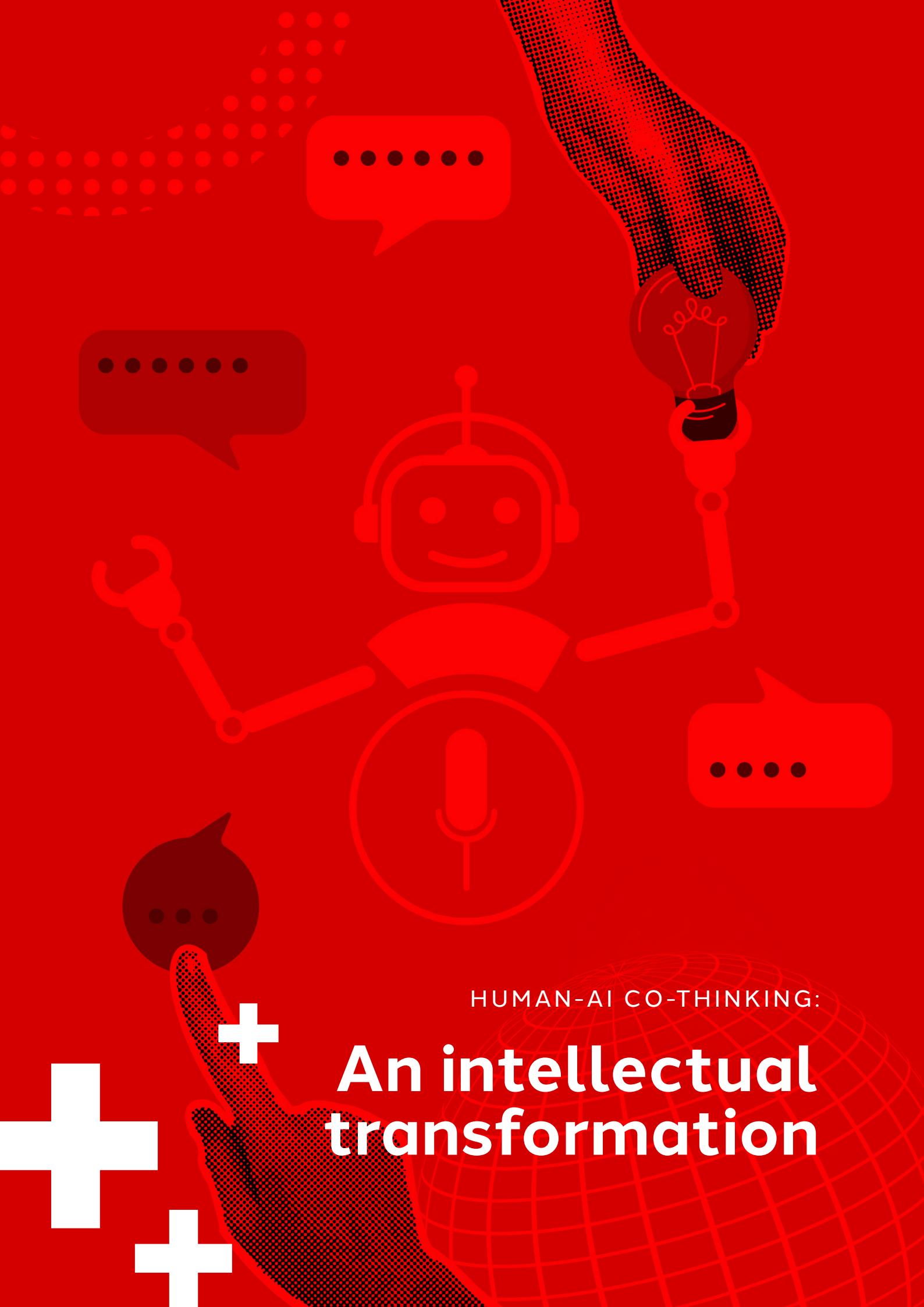
The “Artificial Intelligence Index Report 2025” from Stanford establishes a fundamental distinction between three often conflated concepts: **AI in education** — the use of AI tools in teaching and learning processes; **AI literacy** — fundamental understanding of the mechanisms, uses, and risks associated with these technologies; and **AI education** — which enriches AI literacy with the technical skills necessary for designing AI systems, including analysis of underlying data and identification of potential biases (Stanford Institute for Human-Centered AI, 2025).

AI Swiss deliberately places AI literacy at the heart of its strategic vision, based on clear empirical evidence: this form of fundamental understanding generates the broadest societal benefits.

While AI in education mainly offers incremental improvements to existing practices, and AI education remains the domain of technical specialists, AI literacy emerges as a universal competency in a world where AI is already everywhere.

Although often confined to the computer science domain, this literacy must transcend traditional boundaries between disciplines. Contrary to the dominant position that argues that “AI education cannot exist in isolation” and “must align with broader computer science education efforts” (Stanford Institute for Human-Centered AI, 2025), AI Swiss advocates for a much more inclusive vision: AI literacy, culminating in mastery of human-AI co-thinking, can and must flourish independently of disciplinary silos.

This conviction rests on an undeniable reality: just as a computer user creates daily value without mastering electronic circuit design or software architecture, knowing how to create algorithms or AI systems is not necessary to excel in new forms of human-AI intellectual collaboration.



HUMAN-AI CO-THINKING:

An intellectual transformation

Human-AI co-thinking, developed by AI Swiss through its hands-on experience with businesses and the general public, represents a fundamental shift in our relationship with technology. It's no longer about considering artificial intelligence as a simple tool or autonomous assistant, but envisioning it as an intellectual partner. This approach aims to amplify human cognitive capabilities not by delegating thought, but by cultivating a new form of critical dialogue and intellectual collaboration.

A sixth sense for cognitive dissonances

At a time when certain conversational AI systems are crossing the threshold of the Turing test in specific contexts (Jones & Bergen, 2025), the challenge for every citizen is no longer to understand the internal mechanisms of these systems, but to develop keen sensitivity — a true “sixth sense” — toward the nuances, possibilities, and limits of human-AI interactions.

The challenge as well as the opportunity lies in a central paradox: current conversational AI systems, particularly LLMs, function as “black boxes” whose internal mechanisms escape even their creators. In contrast, their communication interface is remarkably transparent: they can dialogue in natural language with a mastery that can make them superficially indistinguishable from a human.

For AI Swiss, AI literacy must therefore involve a fundamental cross-cutting competency: the ability to communicate and think effectively with various black boxes that appear human, while developing a sixth sense to detect, throughout interactions, the cognitive dissonances that reveal the artificial nature of the thinking partner.

It is in this evolved form of communication — human-AI co-thinking — that the true transformative potential of post-ChatGPT AI systems lies.

A new cognitive paradigm

Co-thinking radically transcends previous paradigms of human-machine interaction. Unlike simple use of digital tools where the machine passively executes predefined commands, it establishes true cognitive synergy: human and AI together construct thinking, each actively enriching the other's thought process. We can distinguish:

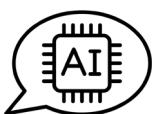


■ **Co-thinking vs traditional human-machine collaboration:**

While classic collaboration uses passive tools to execute pre-defined instructions, co-thinking involves true co-construction, where AI actively contributes to the thinking process by sharing intellectual effort and proposing new perspectives.



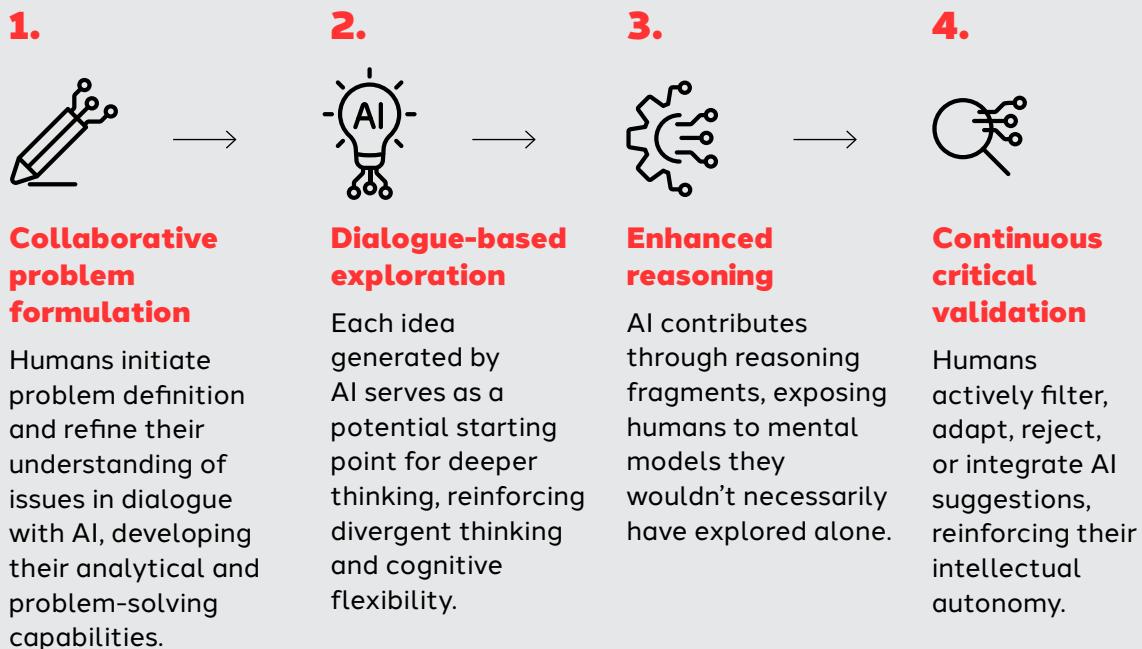
■ **Co-thinking vs AI-assisted learning:** Where assisted learning (personalized tutorials, adaptive exercises, etc.) primarily aims to impart knowledge more efficiently, co-thinking fundamentally transforms the learning process itself. It no longer just trains students to use a tool, but teaches them to think in partnership with artificial intelligence, using higher-level metacognitive capabilities.



■ **Co-thinking vs passive AI consultation:** The difference is significant between simply asking an AI system for an answer (delegation) and establishing true iterative dialogue where questions and answers mutually enrich each other (co-construction). Teaching thus moves from “knowing how to use AI” to “knowing how to think with AI.”

A multifaceted cognitive paradigm

Co-thinking is not a rigid process. It can be as rich as human linguistic interactions, including for example:



A concrete example: in a classroom transformed by co-thinking, a student faced with a complex problem doesn't simply ask AI for the solution, but engages in exploratory dialogue: they submit hypotheses that AI helps develop, question received suggestions, reformulate the problem in light of new perspectives, and finally critically integrate AI contributions into their own thinking. This dynamic process, guided by the teacher, simultaneously develops the student's intellectual autonomy and their ability to amplify their thinking through this shared intelligence.

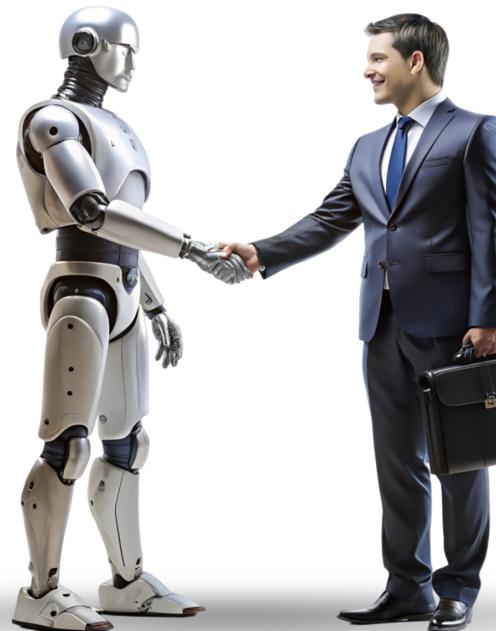
A method, not a tool

Research on the educational impact of conversational AIs like ChatGPT has flourished since late 2022, but suffers from fundamental methodological weaknesses. In particular, most studies neglect to specify how AI is integrated into the learning environment, in what context, for what purpose, etc. They treat AI as a tool rather than a method. These weaknesses make it difficult to interpret observed effects and don't allow distinguishing passive use, which can encourage "cognitive offloading," from constructive interaction (Weidlich et al., 2025; Wang & Fan, 2025).

This is precisely where co-thinking positions itself differently: it doesn't simply introduce an AI tool, but defines pedagogical principles to make the best use of human-AI interaction — regardless of the nature of the underlying AI.

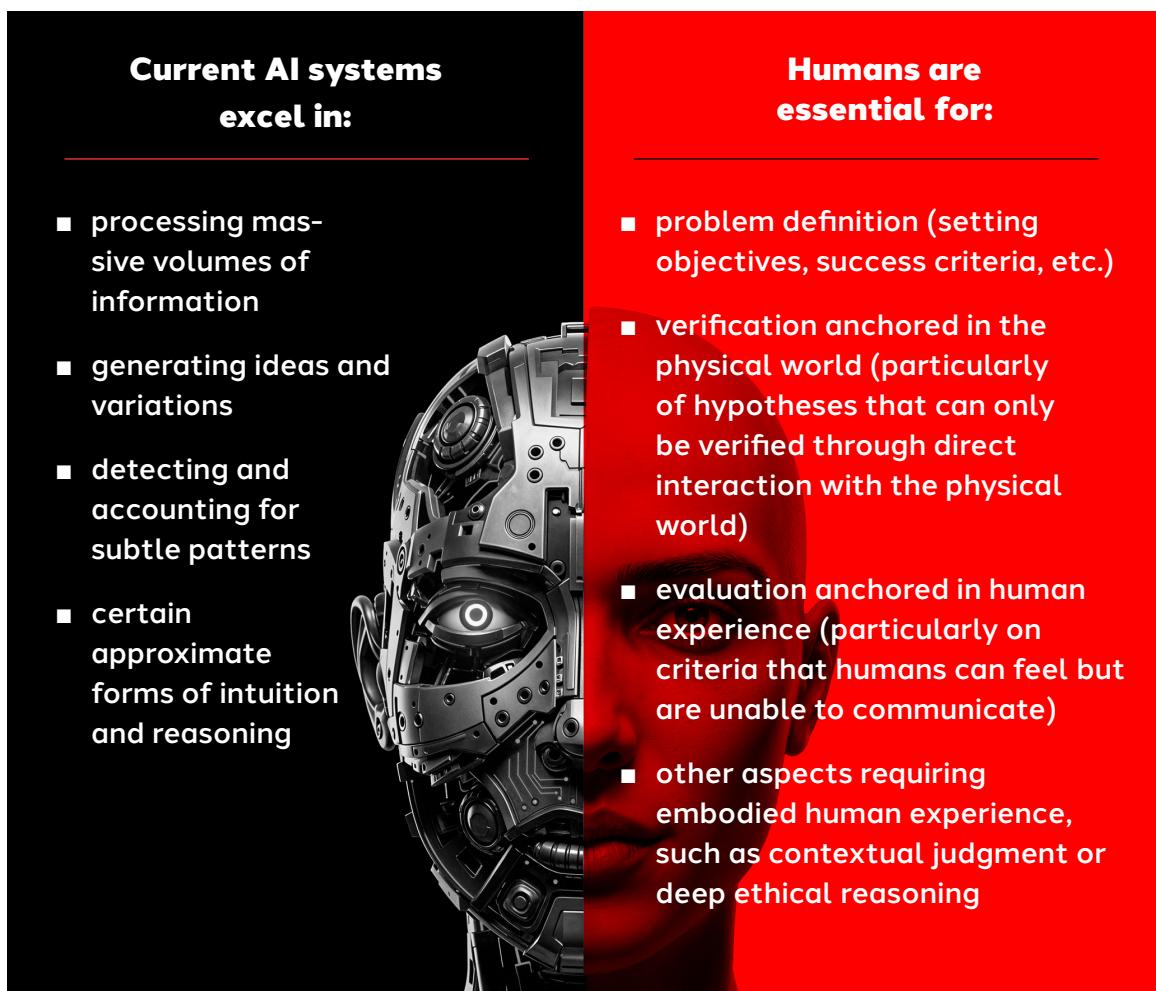
It specifically counteracts cognitive offloading, notably by not allowing AI to execute long cognitive sequences without human intervention, and by engaging learners in structured critical dialogue through practices that stimulate their metacognition (reflection on their own thought processes) and encourage active and continuous evaluation of AI-generated information.

Learning co-thinking is also not limited to direct student-AI interaction. It includes interactions where teachers take, for example, a mediator role, simulations and role-playing where teacher or student plays the role of AI. It involves engaging in deep metacognitive reflection on the very nature of any intellectual collaboration with “black boxes,” artificial or human, with or without digital tools.



An alliance of complementary cognitive forces

Regardless of the richness of the interactions, co-thinking must operate within the framework of fundamental limitations of AI systems — present and future — like a physical theory must respect phenomena such as gravity. Far from being an obstacle, this structuring framework forms a founding principle:



In other words, regardless of AI system progress, humans will always need to communicate their needs — physical constraints don't allow sufficient access to their brain to deduce them. As long as AI lacks a body, humans will remain irreplaceable for interacting with the physical world on their behalf. And as long as AI lacks a body allowing a perspective (particularly sensory) similar to ours, humans will remain the only ones capable of performing any evaluation requiring embodied human experience.

Co-thinking as developed by AI Swiss deliberately integrates these structural constraints inherent to AI to establish a lasting paradigm, transcending technological cycles. In particular, the critical role of verification and evaluation that falls to humans requires continuous engagement rather than prolonged delegation in any human-AI interaction. In other words, AI must not be able to execute long cognitive sequences without human intervention — contrasting with current trends that favor increasingly autonomous systems, where humans intervene at best occasionally to improve the performance of the AI system itself (“human-in-the-loop” approaches).

A collaborative process as natural as possible

In practice, co-thinking requires a human-AI interaction environment that minimizes the physical-digital barrier inherent in current systems. Humans must be able to communicate in natural language — written or oral — through interfaces adapted to their development and skills, making the experience accessible to the widest possible audience.

Beyond simple dialogue, AI must also be able to act as an extension of human intentions, operating in a secure and controlled digital space: by creating and modifying documents, conducting internet or database searches, accessing tools like calculators, etc. These action capabilities are essential to eliminate the cognitive load associated with navigating between physical and digital worlds, allowing humans to focus on higher value-added cognitive aspects.

A progressive and inclusive approach adapted to all ages

While UNESCO and existing Swiss frameworks favor a cautious approach toward AI as a tool, AI Swiss therefore proposes a complementary strategic vision: making human-AI co-thinking a fundamental 21st-century competency.

As AI systems become part of most professional and personal contexts, the ability to use them as cognitive partners will increasingly determine economic and social opportunities. Mastery of co-thinking could therefore become as fundamental as reading or mathematics.

This position aligns perfectly with priorities identified in federal policy for education, research and innovation (ERI) 2021-2024, which recognizes that “the skills necessary for using AI must be acquired during their time in school as well as through lifelong continuing education to avoid polarization of society between people with these skills and others” (ERI, 2020). Co-thinking developed by AI Swiss directly responds to this need by proposing progressive development of these skills from elementary school, thus ensuring that all students, regardless of their socio-economic background, can master this new form of augmented intelligence.

In practice, integrating co-thinking must follow a progression adapted to students' cognitive development stages, ensuring coherent pedagogical continuity. To illustrate this gradual approach, here's how co-thinking could be structured at each level:

ELEMENTARY (4-8 YEARS)

Intuitive and playful discovery: Students explore AI possibilities and limitations through structured activities combining play, interactive storytelling, and guided questioning.

Guided dialogue: They learn to formulate simple and relevant questions, evaluating responses with the teacher's supportive guidance.

Concrete example: A lesson sequence where students collectively propose a character and location, then invite AI to co-create a short story. Guided by the teacher, they then analyze realistic and imaginary elements, developing their ability to question generated content.

ELEMENTARY (8-12 YEARS)

Methodical collaboration: Students use AI as a thinking partner in well-designed thematic projects, reinforcing their ability to structure their thinking.

Emerging critical thinking: They progressively develop the autonomy necessary to evaluate the relevance, accuracy, and usefulness of AI suggestions.

Concrete example: A project on local biodiversity where students ask AI to explore various solutions to a well-defined environmental problem, carefully evaluating the feasibility and sustainability of each proposal.

MIDDLE SCHOOL (12-15 YEARS)

Subject-based co-thinking: Students naturally integrate AI into learning different subjects, enriching their understanding of fundamental concepts in each area.

Deep metacognition: They analyze their own collaboration process with AI, developing reflective awareness essential to independent learning.

Concrete example: In a history class, students use AI to examine different historical interpretations of an event, then analyze how the way they ask questions influences the nature of the responses they get.

HIGH SCHOOL (15-19 YEARS)

Sophisticated co-thinking: Students master sophisticated forms of collaboration with AI, integrating epistemological and ethical considerations into their intellectual approach.

Responsible creation and innovation: They use AI as an amplifier of creativity and quality in complex projects, while developing keen awareness of underlying societal issues.

Concrete example: In a senior thesis, students methodically document their co-thinking process with AI, including their initial requests, necessary reformulations, and their critical evaluation protocol of sources, demonstrating how this collaboration enriched their thinking while preserving their intellectual independence.

Early and methodical introduction of co-thinking presents several significant advantages:

- It allows students to establish a balanced and thoughtful relationship with AI from the beginning of their educational journey.
- It promotes natural and gradual adoption of co-thinking, preventing resistance often observed during late introductions of new cognitive practices.
- It responds to a fundamental social equity need, ensuring that all students, regardless of their socio-economic context, acquire key AI literacy skills.

Among younger children, AI exposure must remain deliberately limited, occasional, and always complementary to fundamental development activities (motor, sensory, social, and emotional) that remain the absolute priority, thus preserving the essential balance between AI exposure and respect for child development stages. Learning must also not focus on direct interaction with digital tools. It can rely mainly on activities where teachers serve as intermediaries to this interaction, on role-playing simulating dialogues with AI, and on constant development of metacognition regarding the intellectual collaboration process.

An asset for Switzerland

A coherent approach to human-AI co-thinking would offer Switzerland the opportunity to develop an unprecedented innovation ecosystem. Rather than entering a losing race for computational power — a domain where economies of scale inevitably favor technological giants — Switzerland could distinguish itself by democratizing a new form of augmented intelligence, thus creating fertile ground for high value-added applications throughout society. AI Swiss has observed this: most companies we've encountered already recognize the strategic value of co-thinking skills. Relegating teaching these skills to the curriculum periphery would risk creating a concerning social divide between students benefiting from family exposure to these technologies and those without it.

The report of the interdepartmental working group “Artificial Intelligence” to the Federal Council in 2019 (SERI, 2019b) highlights that “Switzerland has an innovation policy that it doesn’t implement within the framework of a single and global ‘innovation strategy,’ but in a decentralized manner, within several policy domains that are both autonomous and coordinated by theme.”

This decentralized approach, which has demonstrated its relevance and effectiveness, gives institutional and private actors valuable scope to develop diversified and contextualized responses to the challenges and opportunities offered by AI.

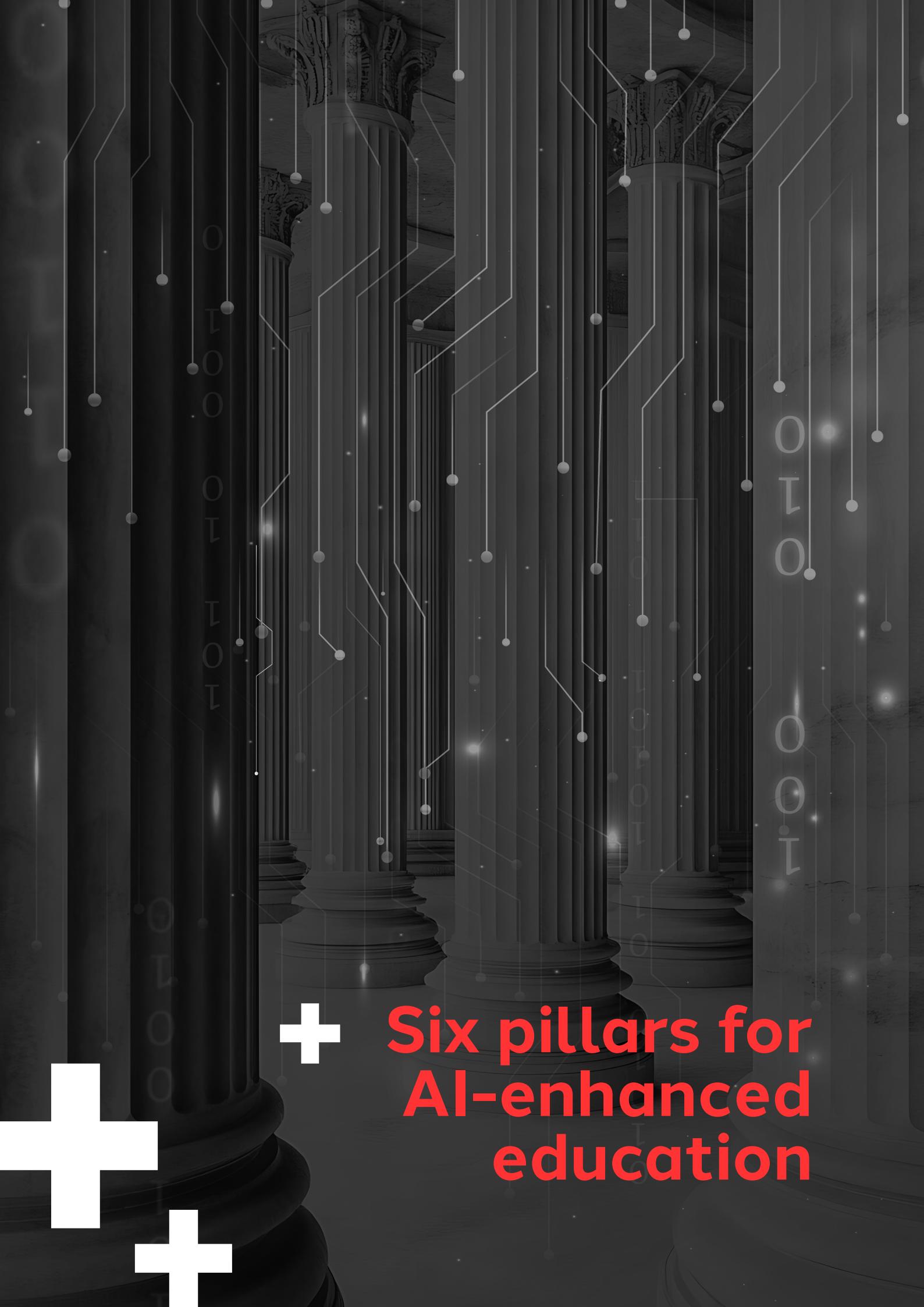
Our co-thinking proposal naturally fits into this Swiss philosophy, by proposing a framework that is both coherent and adaptable, respectful of the autonomy of various educational system actors, while conveying a much more transformative vision than current approaches.



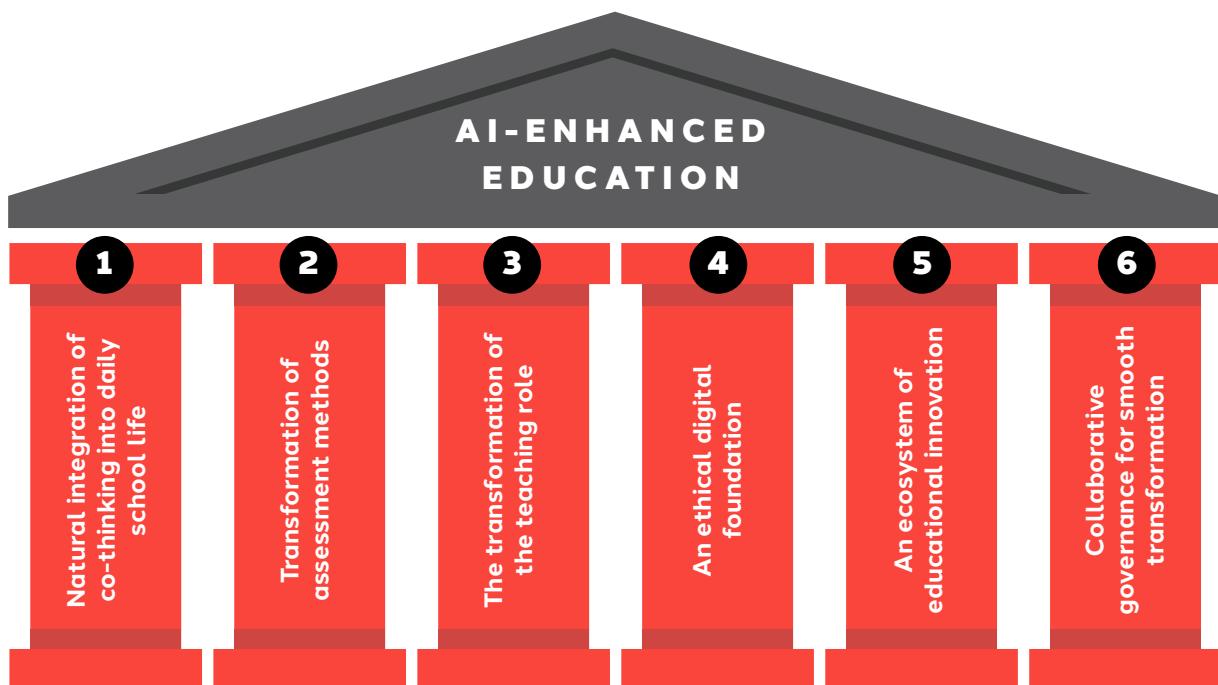
International comparisons detailed in the appendix reveal that several nations (including China and the United States) have already adopted ambitious strategies for integrating AI into their educational systems. Switzerland, with its tradition of globally recognized educational excellence and its proven federalist system, is ideally positioned to develop a distinctly Swiss middle path — an approach that honors its institutional and cultural specificities while thoughtfully incorporating best practices observed globally.



Six pillars for AI-enhanced education



AI Swiss proposes six pillars to realize its vision of transforming our educational approaches in the age of artificial intelligence:



01

Natural integration of co-thinking into daily school life

Co-thinking is learned like writing: through regular practice serving varied learning objectives, following a carefully planned progression. It fully respects existing curricula: each teaching activity can integrate a human-AI collaborative dimension without distorting the fundamental objectives of the curriculum.

Crossing boundaries between subjects

Co-thinking can be integrated into each subject and interdisciplinary project. For example:

- In language arts, students can explore different narrative structures with AI before writing their own story, thus developing their creativity while learning narrative text mechanisms.

- In science, they can co-formulate hypotheses around a natural phenomenon, then design a rigorous experimental protocol using co-thinking to test them.
- In history, they can examine various perspectives on the same historical event presented by AI, refining their critical thinking to identify biases and contextualize these viewpoints.

Co-thinking itself can be applied by teachers to build programs perfectly adapted to their context. AI Swiss has tested this approach: engaging in dialogue with a public LLM by providing this white paper as context allows generating highly personalized co-thinking programs.

Smooth integration

Smooth integration of co-thinking requires thoughtful balance between educational innovation and preservation of fundamentals. The framework suggested by AI Swiss is organized around three principles:

1. Progression adapted to student development

AI Swiss suggests, as a guideline, that time devoted to co-thinking learning could represent less than 5% in elementary grades, and evolve progressively toward 10-15% for older students (middle and high school), without interfering with existing educational objectives since most conventional teaching activities can be revisited and enriched by co-thinking.

- Elementary (4-8 years): Largely favor activities without technology with occasional and playful experiences with co-thinking.
- Elementary (8-12 years): Maintain predominance of traditional activities while introducing more structured co-thinking projects.
- Middle School (12-15 years): Progressively balance traditional approaches and co-thinking, gradually increasing the latter's role.
- High School (15-19 years): More broadly integrate co-thinking while preserving spaces for learning without technology.

2. Clear boundaries for educational spaces

Certain learning domains must remain largely preserved from AI, such as initial reading and writing learning, mental math basics, fine motor development, hands-on artistic expression, and direct social interactions.

Conversely, other domains can be particularly enriched by co-thinking, such as exploring complex systems, analyzing multiple perspectives, collaborative creation, and interdisciplinary problem-solving.

Thoughtful boundaries prevent the risk of “cognitive complacency” — this natural tendency to place excessive confidence in AI-generated responses and reduce one’s own intellectual effort. By preserving learning spaces without technology, teachers can help students develop keen awareness of their own capabilities and the specific value that co-thinking brings.

3. Rhythmic alternation rather than mixing

Effective integration could rely on:

- Daily alternations between moments of technological immersion and periods of complete disconnection.
- Weekly or monthly cycles with periods dedicated to enhanced exploration and others to traditional learning.
- Transition rituals helping students become aware of different learning modes.

02

Transformation of assessment methods

Integrating human-AI co-thinking requires rethinking traditional assessment paradigms. AI Swiss proposes a restructuring around a key principle: valuing the intellectual process at least as much as the final result.

From result assessment to recognition of the co-thinking process

Faced with artificial intelligences capable of quickly producing remarkably high-quality work, assessment centered primarily on results becomes outdated. Co-thinking requires evaluating new dimensions, such as:

- Balance between AI contributions and expression of the student’s own thinking
- Relevance and precision of questions formulated by the student
- Their ability to refine their thinking throughout dialogue
- Judgment exercised in considering AI responses
- Metacognitive ability to analyze their own co-thinking process

Assessment methods adapted to co-thinking

Several methods can facilitate evaluation of these dimensions, such as:

A co-thinking journal

Students can compile a systematic collection of excerpts from their dialogues with AI and reflections on their co-thinking process, including for example:

- Progressive problem formulation: how students defined, specified, and reformulated their question or objective
- Guidance choices: how students directed AI toward productive paths or redirected it when facing dead ends
- Critical evaluation: how students analyzed, selected, and integrated AI proposals into their own thinking
- Metacognition: how students became aware of their own intellectual approaches and adapted them

Complete dialogues can be archived and accessible as needed.

A social evaluation dimension

Assessment can be enriched with a social dimension through concrete and simple-to-implement mechanisms:

- Sharing circles where each student presents a key co-thinking moment and receives feedback and questioning from peers
- Live demonstrations where students explain their AI interaction approach in real-time on a new problem
- Structured peer evaluations where students analyze each other's journals according to a clear rubric
- Constructive discussions between different approaches to the same problem, revealing the diversity of co-thinking paths
- Collective summaries identifying the most effective strategies and pitfalls to avoid in different subjects

Enhanced evaluators

Teachers themselves can benefit from co-thinking in their evaluation work:

- By efficiently analyzing all student-AI dialogues according to pre-defined criteria

- By identifying complex recurring patterns in student-AI interactions
- By generating personalized summaries that highlight each student's strengths and areas for improvement
- By progressively developing, through co-thinking, increasingly relevant and nuanced evaluation criteria

This meta-application of co-thinking creates a positive cycle: the teacher refines their own understanding of the cognitive processes involved while gaining time and quality in evaluation, allowing them to focus on student support.

03

The transformation of the teaching role

AI Swiss's vision positions teachers as architects of enhanced learning experiences, orchestrating productive dialogue between human and AI. This evolution requires training that goes beyond simple technical mastery to achieve genuine pedagogical expertise in co-thinking.

AI Swiss proposes that professional development programs integrate the study of cognitive mechanisms of human-AI collaboration, supervised experimentation with innovative teaching scenarios, and reflective analysis of practices.

Such training would develop teachers' cognitive agility while building their ability to design learning experiences where technology and pedagogy mutually reinforce each other.

Tomorrow's teacher could thus master several essential competencies: designing learning situations where AI plays a catalytic role without substituting for human thinking; supporting students in developing critical dialogue with AI systems; recognizing moments when artificial intelligence provides a relevant teaching tool; and analyzing student-AI interactions to continuously refine their approaches.

A major challenge: adequately preparing teachers

Stanford's "Artificial Intelligence Index Report 2025" reveals a major challenge: even among computer science (CS) teachers, the sense of preparation remains insufficient. In the United States, "despite the 81% of CS teachers who agree that using AI and learning about AI should be included in a foundational CS learning experience, fewer than half of high school CS teachers feel equipped to teach AI." This sense of inadequacy intensifies at lower levels: 46% at high school, 44% at middle school and only 34% at elementary level (Stanford Institute for Human-Centered AI, 2025).

These figures are particularly concerning since they involve computer science specialists, the discipline from which AI predominantly emerges. The situation is necessarily more critical in other teaching domains, where training in artificial intelligence technologies is often limited or non-existent. In Switzerland, although data is lacking, this trend is also observed, with significant variations according to subjects and linguistic regions.

An opportunity to revitalize the teaching profession

Faced with the teacher shortage in Switzerland — with an estimated need for 76,000 new teachers by 2031 according to the Federal Statistical Office (RTS, 2022) — the integration of co-thinking represents a unique opportunity. Far from being an additional burden, it could, for example:

- Reduce cognitive load by automating certain administrative tasks, freeing time for high-value human interactions
- Break down silos between subjects by facilitating interdisciplinary projects through AI systems that establish connections between different domains
- Refocus teaching work on its irreplaceably human dimension: personalized support, social-emotional development, creativity and critical thinking
- Open new professional perspectives by creating specialized roles (AI coordinator, enhanced learning experience designer, etc.)

This revitalization could not only re-energize current teachers, but also attract new talent to a profession undergoing complete reinvention.



76,000
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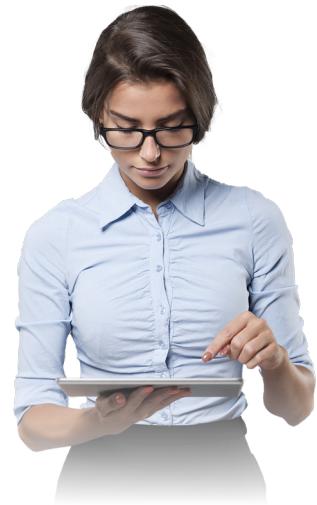
Progressive training grounded in practice

To effectively support teachers without overloading them, AI Swiss proposes for example:

- A modular training pathway spread over several years, with progressive and realistic objectives
- A “just-in-time” rather than “just-in-case” approach, allowing skills to be acquired when they become relevant in practice
- Training volunteer teachers (1 for every 10-15 colleagues for example) to become “co-thinking facilitators” within their institution
- Partnerships with teacher education universities (HEP) to integrate co-thinking into initial training

The transformation of the teaching role can only succeed if it is co-constructed with those primarily concerned, valuing their pedagogical expertise and their in-depth knowledge of the field.

Technological innovation must serve humanity and not the reverse, thus preserving the very essence of the act of teaching.



04 An ethical digital foundation

The implementation of human-AI co-thinking requires an infrastructure that is both technological and ethical, evolving at the pace of educational needs. This infrastructure must go beyond purely technical considerations to embody the fundamental values of the Swiss education system: equitable access, personal data protection, transparency and educational relevance.

AI Swiss proposes the following guiding principles:

- Guarantee equitable access between cantons, municipalities and types of institutions, paying particular attention to peripheral areas where the digital divide could worsen inequalities

- Establish an exemplary data protection framework for minor students, compliant not only with the European General Data Protection Regulation (GDPR) but also with the specific requirements of Swiss legislation
- Design interfaces adapted to different stages of cognitive development, from elementary to high school
- Favor systems that allow students to understand the underlying mechanisms of AI, thus transforming each interaction into a learning opportunity

To realize this vision, educational institutions must have complete digital ecosystems rather than fragmented solutions. These ecosystems must integrate AI platforms specifically designed for the Swiss educational context, with interfaces adapted to students' developmental level, respecting Swiss linguistic and cultural characteristics, providing functionalities aligned with our educational tradition of excellence. The transparency of their operation would allow teachers and students to understand the underlying mechanisms of AI interactions, thus fostering critical understanding of AI systems.

A robust ethical framework must also govern any AI infrastructure, notably defining the limits of AI use in school contexts, the responsibilities of different actors — from authorities to teachers — and data governance mechanisms. This framework could be established collaboratively, involving teachers, parents, students, digital ethics specialists and developers, and regularly revised to adapt to technological developments and feedback from experience.

The emergence of large language models like ChatGPT has followed a common pattern in innovation: technology preceded the identification of the most relevant uses, particularly in education.

The corresponding conversational interfaces, designed for the general public, were deployed before their optimal educational applications were fully explored. AI Swiss advocates for a reversal of this model: starting from specific educational needs to design dedicated interfaces that orchestrate human-AI interaction according to the educational and developmental requirements of each age. This reversal of the innovation flow — from use case to technology, rather than the other way around — would guarantee solutions truly adapted to

the Swiss educational ecosystem, respectful of its values and aligned with its fundamental educational objectives.

AI Swiss already observes the emergence of solutions like “Claude for Education” (Anthropic, 2025a) that offer specific guarantees for the educational context: absence of advertising, reinforced controls against inappropriate content, and privacy protections adapted to sector requirements. These pioneering initiatives, while promising, are only a beginning. A true co-thinking infrastructure will require sovereign interfaces differentiated according to students’ age and smooth integration into the existing educational ecosystem.

05 An ecosystem of educational innovation

For human-AI co-thinking to integrate quickly and sustainably into Swiss classrooms, AI Swiss proposes an ambitious educational innovation ecosystem, anchored in existing structures and respectful of the diversity of the Swiss educational landscape:

Cross-disciplinary approaches

AI literacy develops at the convergence of complementary competencies, such as digital literacy, data literacy, computational thinking and applied ethics. Cross-disciplinary approaches would be a structuring element of the innovation ecosystem, allowing traditional silos to be transcended and favoring the creation of learning environments where co-thinking can truly flourish as a cross-cutting competency.

Communities of practice

Supported by existing competence centers, exchange networks between teachers would allow the sharing of experiences and methodologies. These communities, coordinated but autonomous, would be an innovation accelerator while offering support to teachers.

Experimentation laboratories within teacher education universities

Rather than creating new structures, teacher education universities could host spaces where teachers, researchers and developers design and test together educational approaches integrating co-thinking. These laboratories, distributed across different linguistic regions, would allow the most effective practices to be identified before their large-scale deployment, while ensuring their integration into teacher training.

School-business-research partnerships

Structured collaborations between educational institutions, companies using co-thinking and research centers could be established, with clear knowledge transfer mechanisms. Financed by mixed public-private models, these partnerships would align educational practices with labor market needs, while enriching them with the latest scientific advances.

A national resource platform

A national platform hosted by educa.ch for example could centralize educational resources, methodological guides and validated AI tools, including an observatory of international practices to adapt relevant innovations to the Swiss context.

06

Collaborative governance for smooth transformation

Swiss federalism, with its cultural and linguistic diversity, offers unique terrain for innovation but requires careful coordination. AI Swiss proposes:

Communities of practice by subject

Recognizing that co-thinking takes distinct forms according to subjects, AI Swiss proposes the creation of voluntary communities of practice bringing together experts from different subjects, AI specialists and educators to develop specific approaches. These communities, supported by SERI and CDIP, would produce evolving methodological guides, enriched by teachers' feedback from experience.

Strengthening educa.ch for AI literacy

The mandate of platforms like educa.ch could be extended by integrating a division dedicated to AI and human-AI co-thinking, to evaluate tools and support specialists facing technical complexity.

A national guidance framework for co-thinking

Developed with the Swiss Conference of Cantonal Directors of Public Instruction (CDIP), this framework would define essential competencies to develop while preserving cantonal autonomy. This approach would integrate naturally into existing coordination structures, such as the “Digitalization of Education” committee where Confederation and cantons already collaborate closely.

For higher education, the Swiss Conference of Higher Education Institutions (CSHE) would also be an appropriate forum, having already identified in 2019 the encouragement of young talent in STEM subjects and the strengthening of digital competencies as national priorities for 2021-2024.

This governance architecture, both structuring and flexible, would allow a coherent educational transformation to be orchestrated at the national scale, while capitalizing on local innovation and the diversity of educational approaches that make the richness of the Swiss education system.

A stylized illustration of a woman with long dark hair, wearing a red graduation gown and VR goggles. She is positioned in front of a dark background filled with various educational and technological icons: a globe, books, a network graph, a large leaf, a magnifying glass, and a grid. The overall theme is the intersection of education and technology.

CHALLENGES AND OPPORTUNITIES:

Co-constructing educational transformation

AI Swiss recognizes that integrating co-thinking into the Swiss education system requires a collaborative and thoughtful approach. In this section, we present paths for reflection to engage constructive dialogue with the entire educational community. These preliminary proposals aim to stimulate collective reflection on different areas:

The balance between innovation and educational heritage

CHALLENGE Preserve the recognized excellence of the Swiss education system while adapting it to the requirements of the AI era.

PROPOSED APPROACH Favor organic integration where each institution identifies the most natural “entry points” for co-thinking in its specific context. This approach would respect institutional autonomy while favoring internal transformation that preserves fundamentals while adapting them to contemporary realities.

CONCRETE PATHS

- Prioritize subjects where co-thinking offers immediately visible educational value
- Create sanctuary spaces and moments of learning without technology
- Systematically measure the impact of innovations on fundamental competencies

Digital sovereignty as an ethical imperative

CHALLENGE Guarantee that Swiss educational data serves primarily the excellence of the Swiss education system.

PROPOSED APPROACH Build a sovereign technological ecosystem through public-private partnerships with the Swiss technology industry to develop AI educational solutions compliant with Swiss ethical and legal requirements, while guaranteeing that generated data benefits primarily the national education system.

CONCRETE PATHS

- Design a Swiss educational cloud infrastructure for secure data hosting
- Foster the emergence of a Swiss excellence sector in intelligent educational technologies
- Develop an exemplary regulatory framework for ethical use of student data

Linguistic and cultural diversity as an innovation laboratory

CHALLENGE Swiss multilingualism and cultural diversity can enrich the large-scale deployment of educational innovations.

PROPOSED APPROACH Transform this cultural mosaic into an incubator of excellence by establishing inter-cantonal learning communities where approaches developed in each linguistic region mutually enrich each other. This diversity would provide a unique testing ground for developing robust and adaptable co-thinking models, potentially exportable to other multilingual countries.

CONCRETE PATHS

- Create pilot institution partnerships between linguistic regions
- Develop a repository of multilingual educational resources on co-thinking
- Organize regular exchanges between teachers from different linguistic regions

Continuing education as an immersive co-thinking experience

CHALLENGE Develop in teachers not only technical skills but practical mastery of co-thinking.

PROPOSED APPROACH Reconceptualize training as an experiential laboratory where teachers can experience for themselves the cognitive transformation that co-thinking brings about. This meta-reflective approach would allow teachers to develop their own teaching methodologies from lived experiences, thus developing deep and authentic understanding of the transformative potential they will have to transmit to their students.

CONCRETE PATHS

- Present teachers with complex educational challenges solvable through co-thinking with AI
- Structure communities of practice for experience sharing and methodological co-creation
- Rigorously document co-thinking processes that work to build collections of good practices

Equity and inclusion as guiding principles

CHALLENGE AI could worsen existing disparities, notably in terms of gender representation in STEM fields.

PROPOSED APPROACH Integrate equity as a foundational principle of co-thinking, with particular attention to engaging women and underrepresented groups. Such an approach would directly respond to the need identified in the ERI 2021-2024 report which calls for “strengthening motivation and training of women for STEM subjects” (ERI, 2020). Co-thinking, by proposing a more collaborative and creative approach to technology interaction, can transform the attractiveness of STEM subjects among traditionally underrepresented populations.

CONCRETE PATHS

- Design co-thinking educational models sensitive to gender and cultural diversity dimensions
- Establish rigorous demographic monitoring of co-thinking initiatives' impact

Participatory research as a driver of continuous adaptation

CHALLENGE Evolve practices at the pace of technological advances without yielding to trend effects.

PROPOSED APPROACH Institutionalize a participatory research program where teachers, students and researchers would collaborate to document and analyze emerging co-thinking practices. This methodological triangulation would allow real impact of innovations to be evaluated while continuously adapting educational approaches according to an “evidence-based” approach, thus creating an autonomous educational innovation ecosystem.

CONCRETE PATHS

- Establish standardized but streamlined protocols for documenting innovative practices
- Formalize structural partnerships between educational institutions and teacher education universities
- Establish regular cross-sector forums for sharing research results

AI Swiss' approach is above all an invitation to collective reflection. True solutions will emerge from in-depth dialogue with education specialists who experience these realities on the ground every day.

It is precisely in this collective intelligence, where each perspective enriches common understanding, that lies the very essence of the co-thinking we promote.



CONCLUSION:

**A historic
opportunity
for Switzerland**

We find ourselves at an unprecedented digital crossroads. While our society still debates the consequences of screens, video games, internet and social networks introduced decades ago, AI enters our homes at lightning speed, announcing upheavals far more profound than those generated by these previous digital waves.

The phenomenon is growing to a worrying extent: digital entities become our children's preferred confidants, as many bewildered parents can attest. It is no longer just our attention that is captured — the human relationship itself is now in competition. Technology thus crosses a critical threshold, moving from tool status to that of relational partner.

Faced with this fundamental transformation, indifference or passive observation is no longer a viable option. Only deliberate education in critical interaction with these systems will preserve the integrity of our intellectual development and the irreplaceable richness of human relationships. This encounter with artificial intelligence also represents a unique opportunity — that of using our deepest cognitive capacities and, paradoxically, discovering in this digital mirror what makes us human beings.

Switzerland thus finds itself at a decisive educational crossroads. While national and international frameworks cautiously sketch the first institutional responses, the urgency of profound transformation is clear — dictated as much by the inevitable evolution of the labor market as by significant advances in learning sciences. The societal dialogue foundation developed by AI Swiss in this white paper responds precisely to this urgency: establishing a coherent continuum between the four-year-old child with no notion of AI and the citizen equipped with a sixth sense for AI interaction.



“Artificial intelligence offers us the rare opportunity to fundamentally rethink the act of teaching and learning. It is not simply about integrating a technological tool, but about redefining the educational relationship where the teacher becomes the architect of enhanced learning experiences”, emphasizes Stéphane Fallet, President of AI Swiss.



The human-AI co-thinking developed by AI Swiss transcends simple adaptation to emerging technologies. It represents a new form of collective intelligence that could become the distinctive signature of Swiss education. The six pillars we propose to realize this vision — natural integration of co-thinking

into daily school life, transformation of evaluation methods, transformation of the teaching role, an ethical digital foundation, an educational innovation ecosystem and collaborative governance for smooth transformation — outline the contours of a transformation that it will be necessary to co-think not only with AI, but also and especially with all actors of the Swiss education system.

AI Swiss's vision fits fully into national priorities defined by the "Vision 2030" action program and the ERI 2021-2024 message (ERI, 2020), where digitalization appears as a cross-cutting priority axis. As the report of the inter-departmental working group "Artificial Intelligence" rightly notes: "Although Switzerland has excellent research institutions, commits substantial resources in the field of digitalization and offers effective instruments for promoting R&D in digital technologies, skills development in the ERI domain must be strengthened given the strong technological dynamics and growing competition" (SERI, 2019b). Our co-thinking proposal responds precisely to this need by offering a pragmatic and ambitious framework for developing AI-related competencies at all levels of the education system. It also contributes to Switzerland's international influence in the "Digital Europe Programme" ecosystem (European Commission, 2021) and other European initiatives in which the Confederation actively participates via SERI.

AI Swiss commits to catalyzing this educational transformation by putting its expertise to serve institutions, the teaching body and political decision-makers. This collaborative approach, grounded in field realities and respectful of cantonal specificities, aims to make Switzerland a laboratory of excellence for 21st century education — an education where technology amplifies human potential without claiming to substitute for it, where the balance between innovation and educational tradition is carefully cultivated, and where digital sovereignty is preserved.

History shows us that nations that have been able to transform their education systems in step with great technological revolutions have prospered far beyond others. Human-AI co-thinking could become for Switzerland what universal literacy was for emerging industrial societies: a multiplier of human potential with profound and lasting effects on our collective prosperity and social cohesion.



Action Plan 2025-2028



AI Swiss commits to supporting this educational transformation as a strategic partner and innovation facilitator, recognizing that the true architects of change remain educational institutions, the teaching community, the scientific community and decision-making bodies. Our 2025-2028 support program unfolds along three complementary intervention areas, with absolute respect for the autonomy and expertise of actors in the Swiss educational system:

Area 1: Catalyze and connect (2025-2026)

- Targeted support for pioneering institutions in co-thinking experimentation, facilitating their access to necessary resources, expertise and infrastructure
- Creation of structured exchange spaces between innovative teachers to encourage cross-fertilization of emerging practices
- Collaboration with education specialists for developing educational tools adapted to Swiss field realities
- Methodological support for educational teams in developing rigorous evaluation protocols, co-constructed with researchers
- Facilitation of multiparty dialogue forums bringing together all actors of the Swiss educational ecosystem

Area 2: Document and showcase (2026-2027)

- Systematic analysis and targeted dissemination of feedback from pioneering initiatives
- Participation in rigorous scientific documentation of experiments, in close collaboration with Swiss research institutions
- Highlighting educational innovations developed by practitioners and institutions, respecting their intellectual property
- Support for creating self-managed and sustainable communities of practice
- Facilitation of inter-cantonal exchanges to enrich approaches through diversity of linguistic and cultural contexts

Area 3: Deploy and expand (2027-2028)

- Promotion of practices empirically validated by educational field actors
- Contribution to academic reflections on integrating co-thinking into initial teacher training curricula
- Active participation in working groups developing recommendations for cantonal and federal educational policies
- Co-organization of an international conference positioning Switzerland as an innovation laboratory in enhanced education

With this action plan, AI Swiss positions itself as a catalyst for educational innovations and architect of interdisciplinary synergies, mobilizing its scientific expertise and its network of AI experts to support an educational transformation that, by its very nature, can only flourish through collective intelligence and the visionary commitment of professionals who shape, day after day, Swiss excellence in education — thus making our country a cutting-edge laboratory for 21st century enhanced education.

About the Author



Dr Charles-Edouard Bardyn

A quantum physicist turned AI specialist, Dr Charles-Edouard Bardyn directs AI Swiss's scientific strategy while holding key positions at the intersection of health and technology. Chief AI Officer at domo.health, he also leads data science initiatives within NeuroTech at CHUV, one of Switzerland's main university hospital centers.

Holder of a doctorate from ETH Zurich, Charles-Edouard completed his training at EPFL and conducted research projects at the California Institute of Technology, developing an interdisciplinary approach to science and technology. His singular vision - developing concrete "human-AI co-thinking" where artificial intelligence amplifies human capabilities without substituting for them - today guides AI Swiss's mission: democratizing AI for all Swiss citizens, regardless of their technical skills.

Faced with media excitement around AI, Charles-Edouard advocates for placing scientific method and evidence-based data at the center of debates, thus allowing everyone to use this transformative technology with full knowledge of the facts.



AI Swiss

AI Swiss is an association dedicated to the ethical and responsible integration of artificial intelligence in Swiss society. Its mission is to enable every Swiss citizen, institution and company to fully use AI's potential, regardless of their technical maturity.

Operating at the interface between technology and society, AI Swiss acts on several fronts: AI literacy training programs accessible to all, strategic support for organizations in adopting human-centered solutions, and active participation in developing balanced regulatory frameworks.

Its strength lies in a diverse community bringing together cutting-edge researchers, passionate educators, innovative developers, visionary entrepreneurs and committed political decision-makers — all united by the conviction that artificial intelligence must be made understandable and beneficial for the entire Swiss social fabric.

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Appendix: Empirical Data on AI in Education

1. State of AI in education (2020-2025)

1.1 Institutional frameworks and international initiatives

The integration of AI in education has significantly accelerated in recent years, with the emergence of structuring institutional frameworks. In 2019, the OECD published principles on AI, laying the foundations for a human-centered ethical approach (OECD, 2019). UNESCO then published, in 2021, recommendations on AI ethics (UNESCO, 2021), followed in 2023 by guidance on generative AI in education and research (UNESCO, 2023b)..

These initial frameworks emphasize the global necessity to set rules to govern these technologies, encouraging transparency, data protection and digital ethics training. They are part of a series of international forums on AI and education organized by UNESCO between 2020 and 2022, allowing experiences and practices to be shared on a global scale.

More recently, in August 2024, UNESCO published its AI competency frameworks for teachers and students, defining certain essential competencies for navigating the AI era (UNESCO, 2024a; UNESCO, 2024b). The framework for teachers identifies 15 competencies distributed across five dimensions: a human-centered mindset, AI ethics, AI foundations and applications, AI pedagogy, and AI for professional learning. For students, the framework proposes 12 competencies organized across four dimensions: human-centered mindset, AI ethics, AI techniques and applications, and AI system design.

The OECD, alongside its “Digital Education Outlook 2021” report, emphasizes that “hybrid human-machine systems do not replace teachers, but help them reinvent themselves as mentors, coaches, tutors, peers and designers of learning experiences” (OECD, 2021). This vision aligns with our co-thinking approach, while remaining more limited in its transformative ambition.

In Switzerland, swissuniversities published in 2024 a position statement encouraging “pragmatic and dynamic integration of these technologies in teaching and assessments,” noting that the majority of institutions have chosen not to strictly prohibit these technologies, but to integrate them where it is relevant (swissuniversities, 2024). While open, this position remains primarily adaptive rather than transformative.

1.2 Pioneering experiments and case studies

Several significant experiments have been conducted in recent years, offering valuable empirical data on AI’s impact in education. Notably:

- **Khanmigo:** In partnership with OpenAI, Khan Academy developed Khanmigo, an AI tutor initially based on GPT-4. Initial results show that students using Khanmigo develop stronger problem-solving skills, with AI guiding them through Socratic questions rather than directly giving answers (Khan Academy, 2023).
- **École Ardévaz:** This school implemented a system of AI-generated video tutorials (using ChatGPT and Synthesia), allowing teachers to quickly create personalized explanations for students. This approach showed improved student engagement and reduced time spent by teachers on repeating basic explanations (Conexkt, 2023).
- **Zug pilot project:** From March 2024, Zug city schools integrated AI into their courses, in collaboration with the universities of teacher education of Zug and Lucerne. This project allowed teachers to explore how AI can enrich their courses, for example by generating exercises adapted to each student’s level. After several months of experimentation, the canton reached a positive assessment and is considering extending AI integration in teaching (PH Luzern, 2024).
- **ETH Zurich study:** A recent study conducted by ETH Zurich researchers evaluated GPT-4’s impact as a homework tutor in schools. Results show improved learning outcomes and student engagement, particularly when AI is used as a guide rather than a simple answer generator (Vanzo et al., 2024).
- **Stanford study on Tutor CoPilot:** A randomized study involving 1,800 students from disadvantaged communities revealed that when human tutors used Tutor CoPilot, an AI application developed by Stanford University, their students were 4% more likely to master mathematical

subjects than students whose tutors did not have access to the application. Tutors using the application asked more guiding questions rather than directly giving answers, which supported students' reasoning skills development (Wang et al., 2025).

- **Claude for Education:** In 2025, Anthropic launched a version of its AI assistant (Claude) specifically adapted to the educational environment. Their report on university usage reveals instructive usage patterns: 16.4% for direct problem solving, 33.8% for direct content creation, 9.2% for collaborative problem solving, and 40.6% for collaborative content creation (Anthropic, 2025b). The study also emphasizes that students particularly value AI's ability to propose multiple perspectives on the same subject. These results confirm our position: without a structured educational framework, usage remains primarily direct and utilitarian rather than collaborative and transformative.

These experiences, while promising, still conceive AI as an assistance tool, rather than a co-thinking partner.

In Switzerland, research on AI in education is also supported by the national research program NRP 77 on digital transformation, launched in 2020 by the Swiss National Science Foundation (SNSF). Part of this program specifically examines AI's impact in education, notably through its "Education, learning and digital turn" module. In June 2024, research teams presented their conclusions, emphasizing the importance of collaboration between researchers, teachers and decision-makers to successfully navigate the digital transition in teaching (SNSF, 2024).



2. Impact on skills and learning

2.1 Effects on creativity and critical thinking

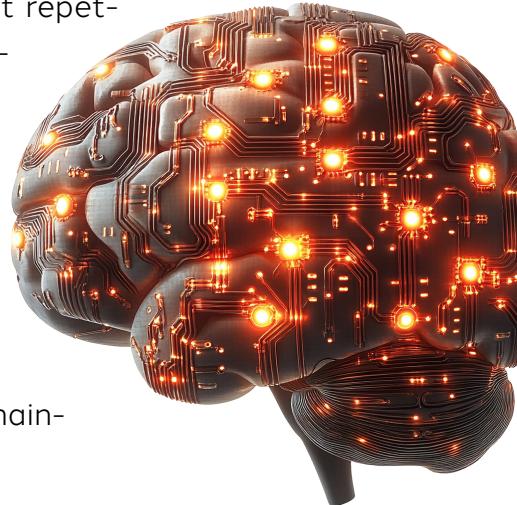
Recent studies reveal a dual effect of AI on students' creativity and critical thinking:

AI tools can stimulate creativity by introducing new ideas and problem-solving techniques. A study conducted among university students showed that the vast majority of participants found AI particularly useful for brainstorming, producing more diverse and detailed ideas than when working alone (University of South Carolina, 2024). By acting as a "judgment-free brainstorming partner," AI

can encourage a free flow of ideas that learners would not always dare express spontaneously in groups.

However, uncontrolled AI integration can sometimes constrain creativity by imposing overly rigid frameworks. A study showed that repetitive and impersonal interactions via AI can lead to emotional disengagement (Lin & Chen, 2024). Another recent study revealed that about three-quarters of participants perceived a risk of diminished critical thinking abilities in case of overconfidence in AI tools (Vieriu & Petrea, 2025).

These observations emphasize the importance of a balanced co-thinking approach, where AI stimulates reflection without substituting for it, and where humans maintain their critical role of evaluation and verification.



2.2 Personalization and learning adaptation

A significant contribution of AI systems as deployed today in education concerns learning personalization:

- Adaptive learning systems - from McGraw Hill or Carnegie Learning for example - automatically adjust content and learning pace according to each student's performance, offering individualized pathways (Crompton & Burke, 2023).
- Continuous formative assessments provide immediate feedback, allowing students to correct their errors more quickly.
- Early warning systems identify students at risk of dropping out, enabling targeted interventions before difficulties worsen.

The OECD observes that these personalized learning environments often improve students' self-efficacy and their attitude toward school (OECD, 2021). However, these systems generally remain in a logic of content adaptation for the learner rather than co-thinking.

The "Monitoring the digitalisation of education from the students' perspective" conducted by the Swiss Centre for Coordination in Educational Research (CSRE) shows that young people aged 8 to 18 in Switzerland already commonly use AI tools, emphasizing the importance of educating about good uses from an early age (CSRE, 2024). This study, published in November 2024, presents results from the fourth survey on this subject since 2020 and includes for the first time data on AI tool use in daily school life, thus offering the first

representative results for Switzerland on AI application adoption by students. These results echo AI Swiss's field experience: many parents report that their children regularly dialogue with AI tools, sometimes even before addressing them.

2.3 Development of future skills

Labor market analyses show that AI profoundly transforms sought-after skills:

While technical skills traditionally linked to AI (data science, programming) remain in high demand, “soft skills” paradoxically become increasingly essential, such as analytical thinking, complex problem solving, creativity or continuous learning and emotional intelligence (World Economic Forum, 2025).

In Switzerland, a recent survey revealed that 50% of employees feel overwhelmed by technological changes and are ready to train in new skills to adapt (PwC Switzerland, 2024).

Our co-thinking approach aims to fill this gap while preserving essential soft skills. Unlike autonomous AI tools deployed in certain so-called “AI-first” companies, which encourage neither human validation nor cognitive effort, we support productive partnership between human and machine, beyond simple technical mastery of AI tools.

3. Transformation of teachers' role

3.1 From transmitter to facilitator

AI integration profoundly redefines the teacher's role:

- AI handles routine tasks (automated grading, classroom data analysis), freeing time for teachers to focus on personalized support.
- The teacher becomes a facilitator: they must keep their hands on the “AI steering wheel” to guide its educational uses.

- Comparative studies between human tutors and ChatGPT-type AI indicate that both can be complementary: AI offers immediate availability and a non-critical approach, while humans provide personalized and empathetic feedback (Fakour & Imani, 2025).

This trend partially aligns with our vision with a fundamental difference: where existing approaches see the teacher as a learning facilitator, AI Swiss positions them as a true architect of co-thinking - a conductor of cognitive interactions between human and artificial intelligence.

3.2 Teacher training in AI

Several teacher training initiatives in AI have emerged. Notably:

- In France, the AI4T project (Artificial Intelligence for and by Teachers), funded by the Erasmus+ program and involving five European education ministries, equips educators with tools like MOOCs and open manuals to integrate AI in classrooms (Inria & University of Lorraine, 2023).
- In the United States, the National Science Foundation's EducateAI initiative provides resources to teachers at all levels to guarantee accessible and inclusive AI education (NSF, 2023).
- The AI4K12 project, launched in 2018 in partnership with the Association for the Advancement of Artificial Intelligence (AAAI) and the Computer Science Teachers Association (CSTA), has also developed a national AI teaching framework structured around "5 big ideas" (AI4K12 Initiative, 2024).

These programs do not aim to transform teachers into engineers, but to give them perspectives on ethical, social and philosophical aspects surrounding AI. Our co-thinking approach fits into this framework while aiming for richer integration of AI as a cognitive partner.

4. Equity and inclusion

4.1 Potential for reducing inequalities

AI has the potential to make education more equitable:

- Virtual tutors can provide individualized support where human tutoring is not available, thus reducing inequalities in access to academic support (World Economic Forum, 2025).

- Automatic translation and subtitling tools facilitate access to educational resources for non-native speakers or hearing-impaired students.
- AI-based assistive technologies can help students with special needs, for example by automatically converting text to speech or adapting interfaces.

Open source AI initiatives for education are also emerging, aiming to make these technologies accessible to developing countries and disadvantaged communities, thus contributing to the “AI for all” vision promoted by UNESCO and shared by AI Swiss.



4.2 Risks of new divides

AI integration also poses risks of increasing inequalities:

UNESCO’s latest global education monitoring report emphasizes that without coordinated efforts, AI could widen the digital divide: well-equipped schools will acquire advanced AI while others struggle to keep up (UNESCO, 2023a). At the end of 2023, a UNESCO survey also revealed that less than 10% of the 450 schools and universities surveyed had formal AI guidelines, and that access to these technologies remained very unequal across countries and regions (UNESCO, 2023c).

Our co-thinking approach addresses these concerns by proposing a coordinated national framework and concrete measures to ensure equitable access and usage.

5. Ethical and regulatory considerations

5.1 Data protection and privacy

AI use in education raises important data protection questions:

AI systems often handle personal and sensitive data — particularly when it involves conversations between students and AI. In Switzerland as in Europe, the law requires strict precautions regarding minors’ personal data. Institutions therefore receive instructions to transmit no personal student data to these tools if the legal framework is not assured (Fritic Competence Center, 2023). This approach complies with the new federal data protection law (nLPD), which entered into force on September 1, 2023.

Our co-thinking approach integrates data protection and sovereignty as a fundamental foundation.



Beyond selecting compliant solutions, we recommend standard techniques for enhanced guarantees, such as processing data directly on local devices rather than on remote servers, end-to-end encryption of conversations, automatic anonymization techniques, regular audit cycles by independent experts, and automatic data deletion after educational use.

This “privacy by design” approach reflects our conviction that digital trust is inseparable from ethical and responsible human-AI co-thinking.

5.2 Emerging regulatory frameworks

Several regulatory frameworks specific to AI in education are emerging:

The European Union, with its AI Act, classifies educational AI systems as “high risk,” requiring strict standards for transparency, robustness and human supervision (FeedbackFruits, 2023). Close to us, a French national plan for artificial intelligence in education was launched in early 2025, including measures to train teachers, equip institutions and support students in AI use (Ministry of Higher Education and Research, 2025).

In Switzerland, educational legal frameworks currently leave cantons to decide, but common principles are beginning to emerge through bodies like the Conference of Cantonal Directors of Public Instruction (CDIP), which brings together the 26 state councilors responsible for education.

Our proposal to collectively develop guiding principles fits into this dynamic, with the goal of coordinating practices at the national level.

Beyond regulatory frameworks, several fundamental ethical questions remain open, notably concerning algorithmic equity (how to prevent AI from disadvantaging certain students) and system reliability (what level of reliability to require before deploying AI). These questions will require deeper and continuous reflection with the educational community.

6. International comparative analyses

AI integration in education progresses worldwide, but with sometimes very different approaches (Education Futures, 2023). Notably:

Since 2018, the Chinese state has made teaching AI concepts mandatory in high school and has authorized 345 universities to open a dedicated artificial intelligence curriculum — which has become the country's most popular engineering program (Peterson et al., 2021).

Historically more decentralized and experimental, the American approach has recently changed significantly with the executive order “Advancing Artificial Intelligence Education for American Youth” recently signed by President Trump, establishing a federal Task Force, launching a national “Presidential AI Challenge,” and requiring public-private partnerships to develop educational resources (The White House, 2025).

Switzerland, with its federalist system and tradition of educational excellence, has the opportunity to develop a balanced approach respecting cantonal autonomy while ensuring national coherence in co-thinking skills development.

In October 2024, a first national initiative was launched by EPFL and ETH Zurich with the founding of the Swiss National AI Institute (SNAI), aiming to coordinate AI research and training, including innovative educational applications (EPFL & ETH Zurich, 2024). This initiative seeks to provide a national perspective on AI-based research, education and innovation, emphasizing transparency, open source and reliability. It illustrates Switzerland’s commitment to play a leading role in responsible AI development, including in the educational field.

7. Conclusion: toward human-AI co-thinking

The empirical data presented in this appendix shows that AI is already profoundly transforming education, with significant impacts on student skills, teachers' role and learning approaches. However, most current approaches center around the paradigm of AI as an assistance or automation tool, rather than as a thinking partner.



Our vision of human-AI co-thinking goes further: it proposes a profound transformation of the educational relationship, where AI becomes a cognitive partner capable of amplifying the natural abilities of both students and teachers.

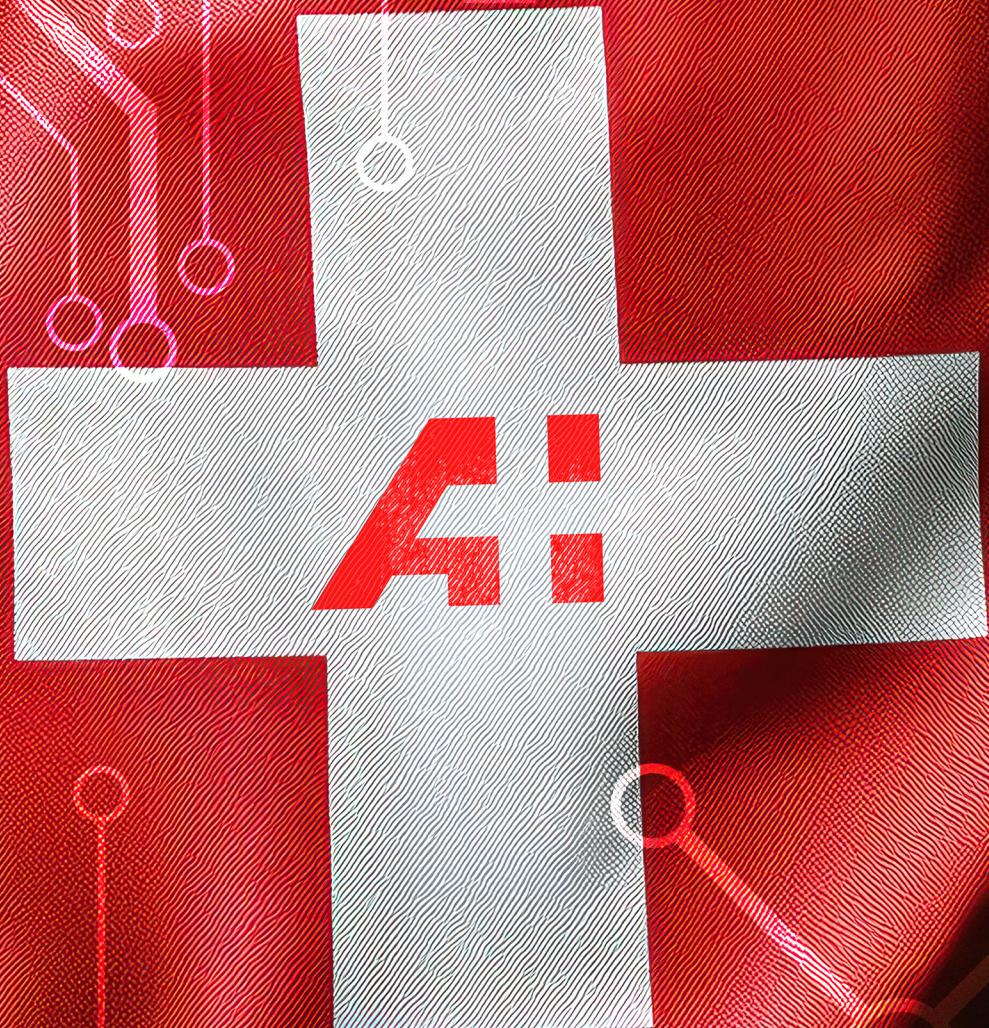
This approach, focused on the future, offers Switzerland the opportunity to develop an educational model of excellence that fully prepares every citizen for 21st century challenges.

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