AI & the Future of Work: A Keynote Script

Good morning, everyone. Two decades into the 21st century, artificial intelligence (AI) is rapidly changing how we **work, live, communicate, learn, and play**. Whether we notice it or not, AI touches many facets of daily life – from **applying for loans to scrolling social media** – often with profound impact on individuals. This technology holds enormous promise to **improve lives and drive growth**, but it also raises serious questions about jobs, ethics, and equality. In fact, experts predict AI's impact will be **as globally transformative as past innovations** like the steam engine, electricity, or the internetblogs.cdc.gov. Such comparisons aren't made lightly – they underscore that we stand in the midst of a new industrial revolution, one that is **blurring the lines between human and machine capabilities**. Today, I invite you – teachers, trainers, students – to explore how AI is reshaping the world of work and what it means for education. We will examine AI's broad **societal and economic impact**, how it's **transforming labor markets**, which **competencies are now essential** (and which are fading), and how these shifts demand new **learning pathways and lifelong learning**. Most importantly, we'll discuss **actionable steps** for education systems, especially in technical/vocational education and training (TVET) and teacher education, to respond proactively. By the end, I hope you'll share my optimism that if we harness AI wisely, we can **elevate human potential** and create a future of work that is inclusive, meaningful, and empowering.

Let's start with the big picture. AI isn't just another tech trend; it's a **general-purpose technology** driving what many call the *Fourth Industrial Revolution*. AI algorithms now perform tasks in **manufacturing, services, agriculture, and beyond**, often faster and more accurately than humans. Over **50% of organizations worldwide report using some form of AI** in their operations, and that number grows yearly. One report famously estimated that **about half of all work tasks could be automated by 2055** with current technology. Imagine that – half of the tasks humans do today, from factory floors to offices, potentially handled by machines in the next few decades. No wonder there's intense debate about what work will look like for the next generation.

Yet history teaches us that technology's impact on work is **double-edged**. Yes, AI can **displace jobs**, but it can also **create new ones**, and elevate the nature of work to be more interesting and productive. As one 2025 study puts it, *AI is fundamentally reshaping the workplace*, transforming job roles and even the **nature of work itself**, much like electricity or computing did in earlier erasijirset.com. The same study highlights that alongside the risk of job displacement, AI is driving **creation of new roles** – particularly in fields like data analysis, machine learning, and AI ethicsijirset.com. AI is not a story of humans *versus* machines; it's a story of humans *and* machines. It's about how we adapt and **leverage AI to amplify human capabilities**.

Finally, let's acknowledge the societal ripple effects. AI's rise brings tremendous opportunities – **higher productivity, new services, better decision-making** – but also stark challenges. It can exacerbate inequalities between those who have AI skills and those who don't. It raises ethical dilemmas around **data privacy, bias, and accountability** in automated decisions. It even forces us to revisit fundamental questions: What *is* uniquely human in the workplace? How do we ensure **dignity and purpose** in work when algorithms take over routine tasks? These questions place education at the center of the conversation. As we'll explore, the mission of education in the AI age expands beyond preparing people for employment – it includes safeguarding our **values**, fostering **lifelong adaptability**, and making sure **no one is left behind**in this revolution.

AI's Impact on Labor Markets: Automation, Evolution, and New Opportunities

AI is transforming labor markets at a startling pace. We've all seen the headlines about automation – robots in factories, algorithms in offices – and the fears of job loss. Indeed, AI-driven automation is taking over many **repetitive, routine tasks** across sectors like manufacturing, data entry, and customer servicelinkedin.com. A landmark study by McKinsey predicted that by 2030, **up to 375 million workers worldwide may need to switch occupations** due to automation and AIijirset.com. But let's unpack this carefully. Historically, every wave of technological change – from mechanization to computers – has **both destroyed and created jobs** on a massive scale. AI appears to be no different. The **World Economic Forum** projected a few years ago that while 85 million jobs might be displaced by AI and automation by 2025, about **97 million new jobs** could also emerge by that timeijirset.com. In other words, the *quantity* of work might hold steady or even grow – but the *nature* of work is being profoundly altered.

What does this alteration look like? Researchers describe a "**hollowing out**" of the job market – where **middle-skill, routine jobs** decline, while jobs at the high-skill and low-skill ends grow. Routine, rule-based tasks (the kind often done by clerks, bookkeepers, assembly line workers, etc.) are easiest for AI and robotics to handle, so demand for those roles is shrinking. At the same time, demand is rising for both **high-skill tech roles** (like AI developers, data scientists) and for **services requiring personal interaction** (care workers, hospitality, etc., which are harder to automate). There's a tendency toward polarization: more jobs at the top and bottom, fewer in the middle. However, let me emphasize that **middle-skill work is not going extinct** – it's *changing*. Analyses by occupation show many "intermediate" jobs persisting, but the skill profile of those jobs is shifting. In the AI era, an **electrician**, a **medical technician**, or a **manufacturing technician** will still be needed – but they'll likely work alongside AI tools, requiring more digital savvy and adaptive skills than in the past. **Intermediate-level education (like TVET) remains crucial**, provided it evolves with the times.

Perhaps the best way to illustrate this transformation is with examples. Consider the **construction industry**, traditionally very hands-on. Today, we see construction sites using **drones for surveys, AI-driven software for design, and even robotic bricklayers**. Does that mean we won't need construction workers? Not at all – but their roles shift. As one report on the German construction sector put it, workers are moving "from purely manual tasks to ones where they **oversee, program, and maintain** smart machines". **Human labor isn't ending; it's being *redefined***. We need people to manage complex processes, interpret AI outputs, and make nuanced decisions that machines can't. A roofing specialist might spend less time carrying shingles up a ladder and more time operating a drone that scans the roof, then using judgment to plan repairs. AI can take over routine decisions, but ensuring those AI recommendations make sense on the ground **still falls to humans**.

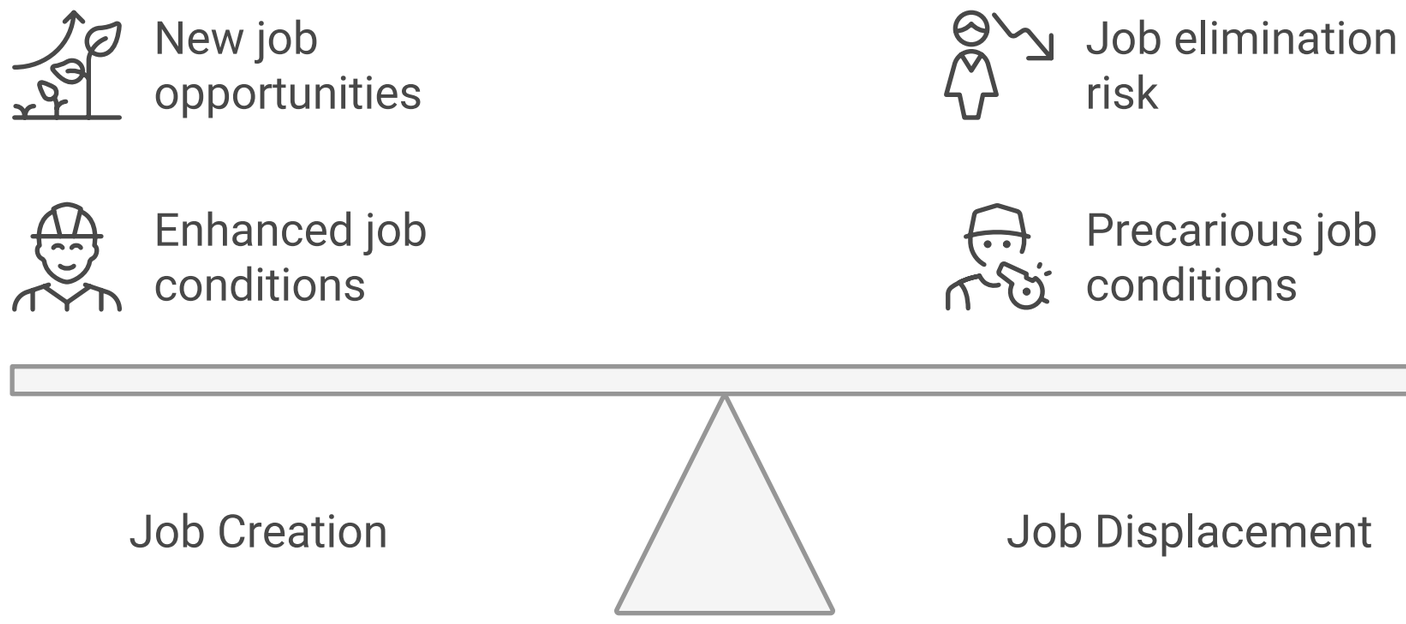
Another example is customer service. AI chatbots now handle many basic customer inquiries. But rather than replace customer service agents entirely, **AI is handling the easy queries so that human agents can focus on the ***complex or emotionally nuanced cases***linkedin.com. In call centers, AI might triage requests, provide suggested answers, even detect customer sentiment. The human agent's role becomes less about rote scripts and more about problem-solving, empathy, and relationship management – skills AI can't (yet) replicate. *The keyword here is collaboration, not replacement*, as one observer notedlinkedin.com. Many companies talk about a future where **employees work *with* AI "co-workers"** – an idea supported by management research. Callen Anthony and colleagues (2023) suggest we view AI not just as a tool, but as a **"counterpart" in a work system**, affecting how tasks are designed and split between humans and machinesnyuscholars.nyu.edu. This means redesigning workflows so that AI and humans augment each other, each doing what they do best. It's a fascinating shift from the old mindset of automation = substitution, to a new mindset of **automation = augmentation**.

Of course, **new job roles** are emerging directly because of AI, creating fresh career paths. We now hear job titles like **AI ethicist**, **prompt engineer**, **machine learning operations specialist (MLOps)**, **data annotator**, or **human-AI interaction designer** – roles barely existent a decade agolinkedin.com. Entirely new specialties are forming to build, maintain, and audit AI systems. Even in traditional fields – healthcare, education, law – organizations are hiring **AI consultants and specialists** to integrate intelligent systems into their worklinkedin.com. For instance, hospitals need medical AI analysts to deploy diagnostic algorithms; schools might employ learning technologists to implement AI tutoring systems.

Impact of AI on Various Industries

Characteristic	Construction	Customer Service	New Job Roles
Role of Humans	Oversee, program, maintain smart machines	Focus on complex, nuanced cases	Build, maintain, and audit AI systems
Role of AI	Surveys, design, robotic bricklayers	Handles basic inquiries, triages requests	Creates fresh career paths directly
Nature of Change	Redefinition	Collaboration	Augmentation

Yet, even as AI creates jobs and augments others, we must be candid: some jobs **will be eliminated or diminished**. Self-driving vehicle technology may reduce the need for drivers; automated checkout systems may reduce cashier positions. And it's not only blue-collar work – AI is now writing reports, drafting basic legal contracts, and performing data analysis, threatening some white-collar jobs too. A recent New York Times piece described how even certain **office jobs are newly at risk** due to AI advances in writing and analysis (e.g. AI that can produce first drafts of marketing copy or computer code). So, how do we reconcile this? Studies like Moradi & Levy (2020) urge a **nuanced view**: yes, AI will displace some workers, but focusing only on job loss is too narrowpapers.ssrn.com. We should also watch how AI **changes the conditions of jobs that remain**. For example, some companies use AI for **algorithmic scheduling** – essentially letting AI decide worker shifts to maximize efficiency. That might not "fire" anyone, but it can make a job more precarious or stressful, shifting risk onto workerspapers.ssrn.com. AI can also introduce intense monitoring (think of AI surveillance of warehouse workers' every move) which raises **workplace safety and privacy issues** (Howard, 2019)researchgate.net. In short, AI's labor impact isn't just about **how many jobs**, but **which jobs, whose jobs, and under what conditions**. As educators and leaders, we need to anticipate these shifts and prepare people not just to *find* work in the AI era, but to **thrive in it sustainably**, with rights and wellbeing intact.



The big takeaway: **the future of work with AI is not a simple story of replacement.** It's a story of **transition and transformation**. Jobs will evolve; many will require higher-order skills; new occupations will arise even as others disappear. This calls for us – especially in education – to be forward-thinking. We must ask: what skills will our students and workers need when routine work is automated? How do we equip them for a career that might span **multiple job changes and new job titles** that don't even exist yet? These questions lead us to the next part of our discussion: the **competencies that become essential in an AI-driven labor market, and those that are fading into history**.

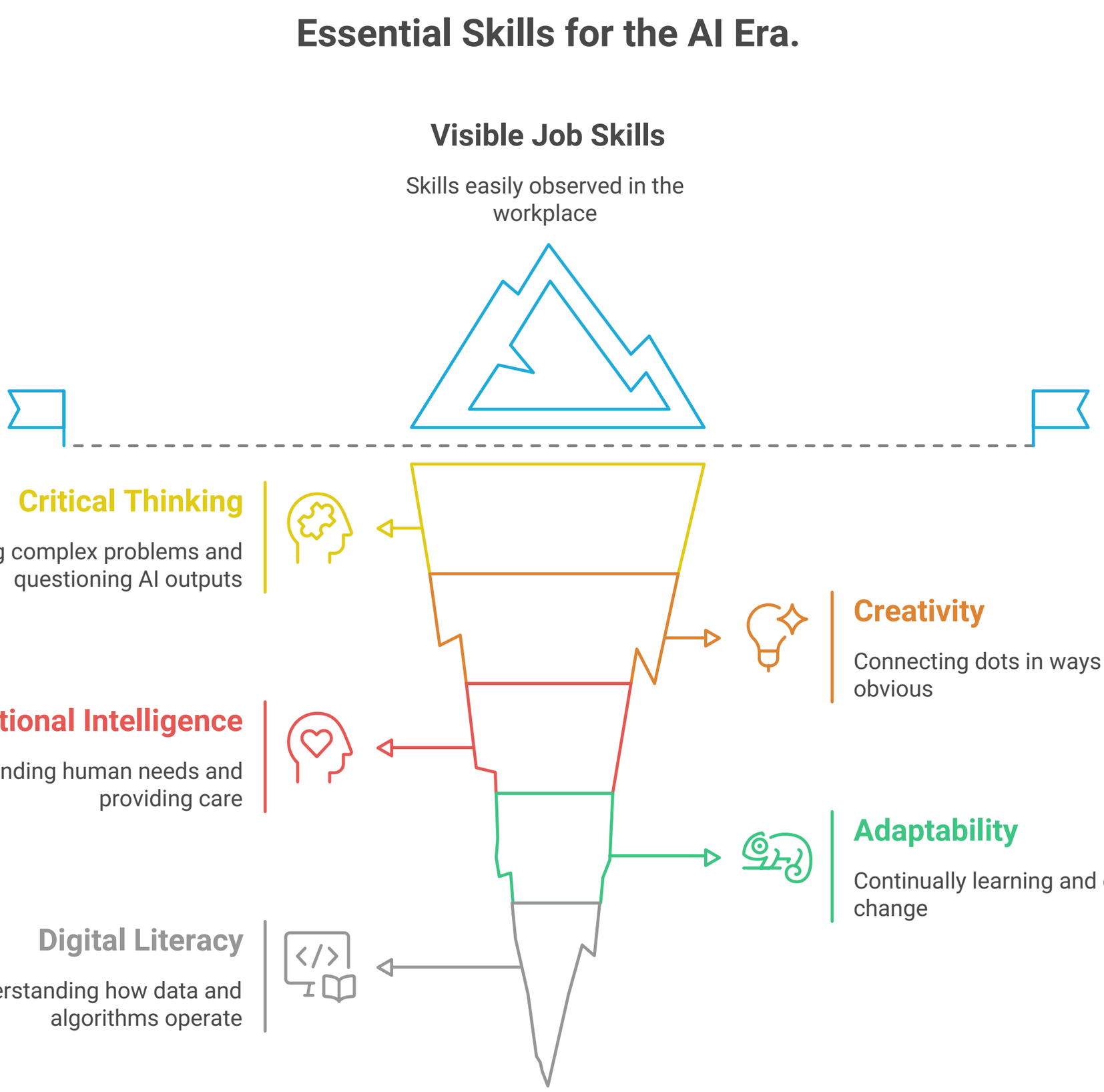
Essential Competencies in the Age of AI (and the Ones Fading Away)

One clear message from research and industry alike is that as AI takes over routine tasks, the **skills that remain uniquely human become even more valuable**. What are these skills? They're often called *transversal skills*, *21st-century skills*, or *soft skills*, but I prefer to think of them as the **timeless human competencies** that machines can't easily replicate. They include **critical thinking, complex problem-solving, creativity, emotional intelligence, communication, teamwork, adaptability, and ethical judgment**. Let's break that down and see why these are rising to the top.

- **Critical thinking and problem-solving:** AI is great at answering well-defined questions (say, optimizing a schedule or diagnosing a disease from an image), but it still lacks true general reasoning in messy, novel situations. In the workplace, we need humans who can **analyze complex, ambiguous problems**, challenge assumptions, and ask the right questions – especially *about* AI outputs. As AI systems become common, an essential skill is knowing **when to trust vs. question an algorithm's result**. Employers increasingly seek people who can interpret data critically and make decisions that are not strictly defined by rules. One study noted these **"higher cognitive skills" are in greater demand** precisely because AI handles the low-level decisionslinkedin.comlinkedin.com. In construction, for example, while an AI might flag a potential structural issue in a building plan, a human expert must critically evaluate that warning and decide if it's valid given real-world context. **Judgment** – that blend of experience, ethics, and critical analysis – is something we can't download into a machine.
- **Creativity and innovation:** AI can recombine existing data to *simulate* creativity (like generating a new image or piece of music in the style of XYZ), but genuine innovation often comes from human insight – connecting dots in ways that aren't obvious. As routine production is automated, human workers will be expected to focus more on **creative tasks, design, and big-picture ideas**. Take marketing: AI can generate tons of ad variants and even personalize them, but the creative brand strategy – the emotional storytelling that resonates with people – still typically comes from human creatives. Moreover, entire new fields (AI ethics, green tech, etc.) require imaginative thinking to pioneer approaches. Countries and companies alike are saying *we need creators, not just operators*. So, educational systems must nurture creativity – through project-based learning, arts, interdisciplinary thinking – as a core competency, not a luxury.

- **Emotional and social intelligence:** As AI handles technical tasks, **interpersonal skills** become more pronounced. Jobs of the future will emphasize understanding human needs, providing care, teamwork, and leadership. A robot might assist a nurse by taking patient vitals, but **compassionate patient care** is still very much a human art. Similarly, an AI can tutor a student in algebra problems, but a teacher's ability to **motivate, mentor, and inspire** is irreplaceable. Many "people-facing" skills – listening, negotiating, teaching, coaching – will retain their value. In fact, as automation spreads, **human interaction may become a premium service** in some fields (think of bespoke customer service, personalized consulting, etc.). Education can cultivate these skills through collaborative group work, communication exercises, and social-emotional learning programs.
- **Adaptability and learning-to-learn:** Perhaps the most critical skill in the AI era is the ability to **continually adapt**. With technology and job roles changing rapidly, the capacity to learn new skills, unlearn outdated ones, and **embrace change positively** is paramount. In educational terms, this is sometimes called "learning to learn" – developing students' metacognition so they know how to acquire knowledge on their own. We won't be doing anyone a favor if we train them for one fixed job that vanishes in 10 years. Instead, we need to inculcate a mindset of **continuous improvement and curiosity**. This might involve encouraging students to tackle unfamiliar problems, teaching them how to use new digital tools on the fly, and giving them opportunities to work in different contexts (e.g. interdisciplinary projects, internships, etc.) so they become comfortable moving across domains. Adaptability also ties into resilience – being able to handle failures or shifts without being overwhelmed. Given that many of you are teachers, think about how we can make our classrooms places where change is not feared but seen as normal. Are we exposing students to emerging technologies like AI, and more importantly, teaching them *how to approach* such tools critically and flexibly?

- **Digital and data literacy:** It goes without saying that in an AI-rich world, **basic digital skills are as essential as reading and writing**. By digital literacy I mean not just the ability to use software, but an understanding of how data and algorithms operate. **Data literacy** – interpreting data, understanding data privacy, knowing the limitations of data – is increasingly important across all jobs. We want everyone, from factory workers to CEOs, to have a baseline understanding of AI: knowing, for example, that AI models can be biased if trained on biased data, or that correlation is not causation. In some countries, curricula are already introducing concepts of AI and coding from primary school. **Finland's "Elements of AI" course** is a famous example of a free online module intended to teach 1% of the population the basics of AI. The goal is to ensure citizens can "speak AI" at a fundamental level. We don't need every student to become a programmer, but they **should** graduate with an ability to engage with digital systems and perhaps even do a bit of coding or data analysis. The UNESCO report *Understanding the Impact of AI on Skills Development* (2021) put it well: *understanding AI and its role in society is a transversal skill that all students should be equipped with.*



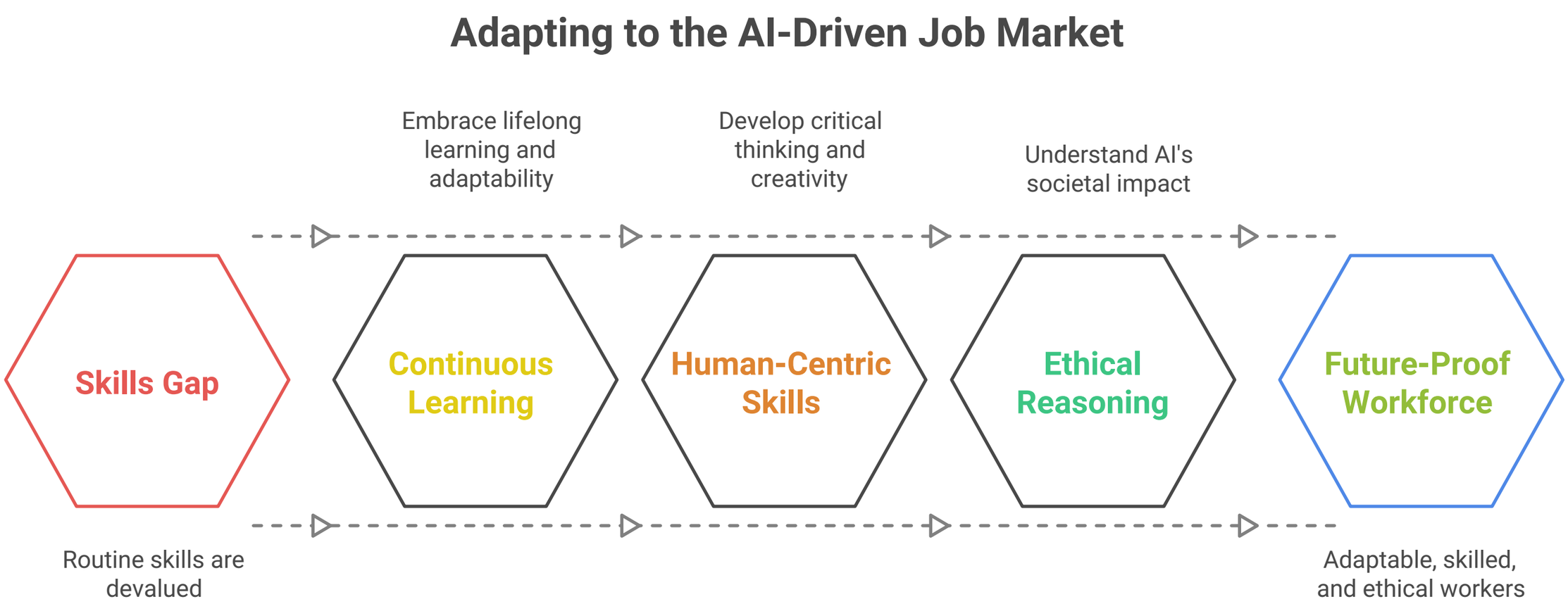
Now, which skills or competencies are being displaced or devalued by AI? Broadly, **routine skills** – whether manual or cognitive – are less in demand. This includes things like rote memorization, basic computation, or repetitive manufacturing tasks. For instance, the ability to do mental arithmetic is less critical when AI can calculate instantly; what matters more is understanding which calculation to ask for. **Physical skills involved in repetitive motions** (e.g. basic assembly line tasks) are declining, as robots handle those. Likewise, jobs that consisted of pure information retrieval (like a junior researcher combing archives) are partially automated by search engines and AI assistants. We also find that **narrow technical skills can quickly become outdated**. For example, knowing a specific software is great, but five years later that software might be obsolete. So, an over-emphasis on very narrow tool-specific training can be risky; it's the underlying conceptual skill that counts. Even in coding, AI "co-pilots" can now write chunks of code automatically – so a programmer's value shifts to higher-level design and critical debugging, rather than cranking out routine code.

Crucially, the **ability to continuously learn new tech** is more important than knowing any one tech. This doesn't mean technical expertise isn't needed – it absolutely is, and in fact advanced *technical* skills (AI development, cybersecurity, biotech, etc.) are in huge demand. But those technical experts also need the softer, human skills we discussed, because they'll work in teams, address ethical issues, and communicate with non-experts. The **sweet spot** is a T-shaped skill set: depth in one field, but breadth across many. If you're deeply knowledgeable in, say, data science, and also a good communicator and critical thinker, you're golden.

One more emerging competency is worth noting: **ethical and responsible reasoning** in context of technology. As AI's influence grows, every profession is encountering questions about bias, fairness, and impact. From engineers to policymakers, there is a call for what UNESCO and others term *values-driven AI competencies*. This means understanding ethical frameworks, being able to anticipate the societal impact of technology, and ensuring AI is used to benefit all. It's a competency set somewhat new to the forefront, blending knowledge of AI with philosophy and civics. For educators, weaving ethics into STEM education is increasingly important – so future workers not only can build AI, but also guide its use responsibly.

Let me underscore how multiple sources converge on these essential skills. A **2025 international study** explicitly emphasizes critical thinking, creativity, and digital literacy as must-haves for future workersijirset.com. It argues that reskilling programs should focus on these areas and that educational institutions **"must evolve"** to instill such skills and foster a culture of **lifelong learning**ijirset.com. Another analysis finds that employers now *value* adaptability, problem-solving, and creative thinking **even more than formal qualifications** – in other words, **"skills are the new currency"** in the job marketlinkedin.com. Companies like Google or IBM, for example, have placed less emphasis on college degrees and more on demonstrated skills and portfolios. And UNESCO's work on *transversal skills* notes that these skills (critical thinking, communication, etc.) **enable workers to adapt to change** and transfer across jobs – exactly what's needed when AI is continually shifting the goalposts.

In summary, to thrive in the future of work shaped by AI, individuals will need a **strong foundation of human-centric skills**: think critically, solve complex problems, create and innovate, communicate and collaborate, adapt and keep learning, and exercise ethical judgment. Conversely, purely routine skills or one-time learning will not carry someone through a 40-year career. This has profound implications for how we design education at all levels, which is our next topic: how are these changes forcing us to rethink **learning pathways, lifelong learning, and the mission of education**itself?



Learning Pathways and Lifelong Learning in an AI-Driven World

The era of AI is accelerating a shift that educators have talked about for years: the shift from a one-and-done education model to a **lifelong learning model**. In the past, many people followed a predictable pathway – go to school in youth, learn a trade or get a degree, then work in that field until retirement. That model is quickly becoming a relic. With AI and other forces changing industries on a dime, people of all ages will need to **cycle in and out of education and training throughout their careers**. As the ILO (International Labour Organization) has pointed out, continuous upskilling and reskilling are now the name of the game – not just for a few, but for the *masses*. The **"renewed requirement for lifelong learning"** is one of the defining features of the future of work.

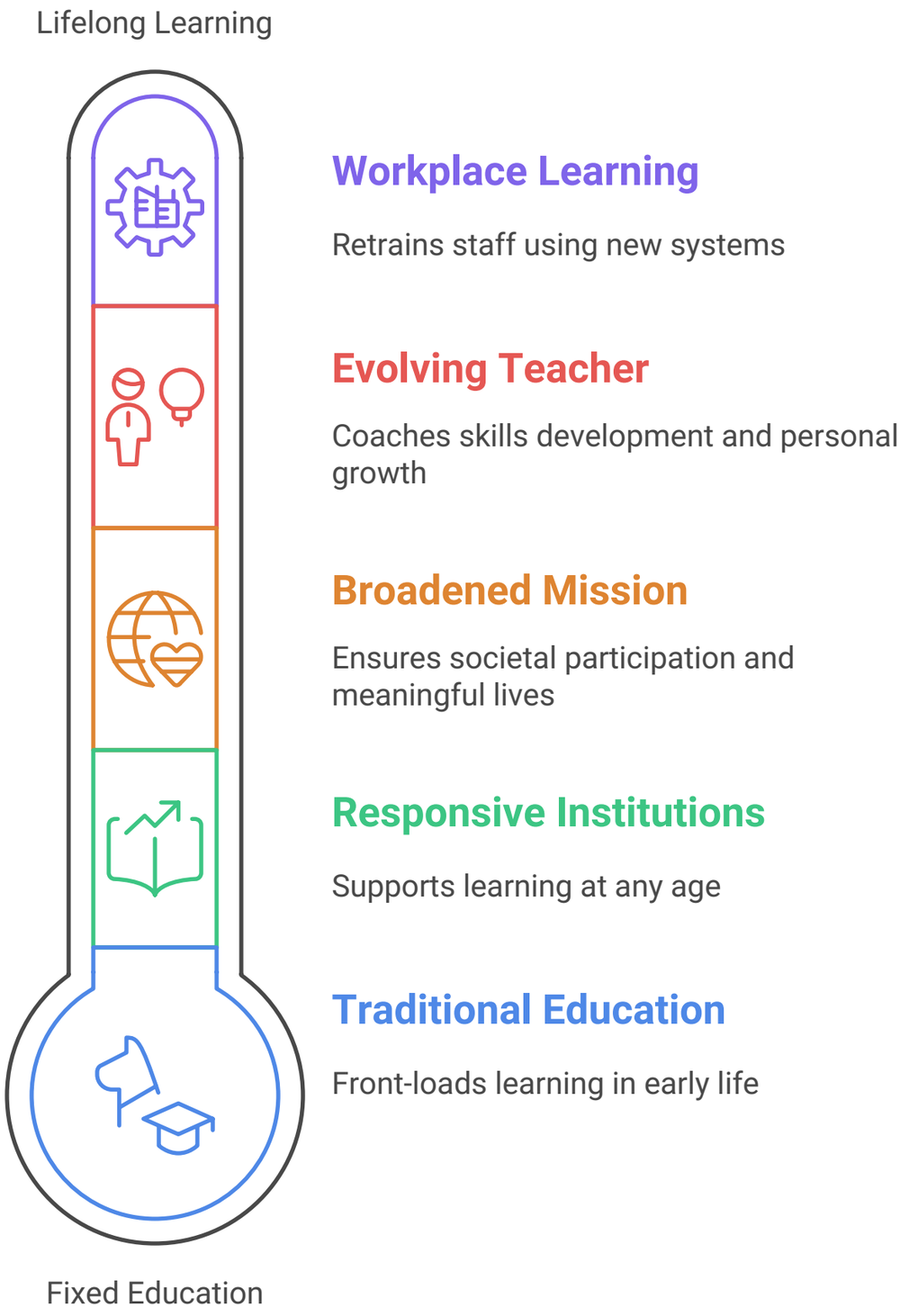
What does this mean in concrete terms? First, educational institutions (schools, colleges, vocational centers) must become more **flexible and responsive**. Instead of front-loading all learning in the first 20-25 years of life, we need to support learning at **any age, any career stage**. This involves creating **flexible learning pathways**: part-time programs, online courses, micro-credentials, recognition of prior learning, and more bridges between formal and non-formal learning. Imagine a future where a mid-career worker can seamlessly take a three-month online course to transition into a new role, or where an apprenticeship program for young people allows easy entry into further education later. In fact, this is already happening: many universities and training providers offer certificate courses targeted at working adults. **Micro-credentials** – short, focused qualifications in specific skills (like data analytics, or AI ethics) – are gaining popularity as building blocks of lifelong learning. UNESCO's TVET strategy highlights the importance of such flexible credentials and pathways to allow continuous upskilling.

Second, the **mission of education is broadening**. It's no longer sufficient to aim only at immediate employability; education must also ensure learners can **participate fully in society and lead meaningful lives** in an AI-driven context. This resonates with what Dr. Georg Spöttl writes: vocational education shouldn't just prepare "skilled workers for employability alone," but clarify what is required in the age of AI to ensure a **meaningful life for people**. In practical terms, this means curricula need to incorporate not just technical knowledge but also learning on **ethics, civic values, and the societal impacts of technology**. For example, a computer science program might include modules on AI ethics and data privacy, so that graduates enter the workforce with a moral compass about AI. Even at the TVET level, a plumbing or electrical program could include discussion of smart home tech and the implications for privacy or labor. This is a shift toward a more **holistic education** – blending cognitive, technical, and socio-emotional learning outcomes.

Third, the **teacher's role** and the education methods are evolving. Teachers are no longer simply transmitters of content (content is abundant and a lot can even be delivered by AI tutoring systems). Instead, teachers become **facilitators of skills development, coaches in learning how to learn, and mentors in personal growth**. They also become learners themselves – needing continuous professional development to stay current with AI tools and new pedagogies. We'll talk more about teacher training in the next section, but it's worth noting here: just as students must be lifelong learners, so must teachers and trainers. The *UNESCO AI Competency Framework for Teachers (2024)* is one initiative defining what teachers should know about AI in education – from using AI educational tools to teaching about AI critically.

We should also consider **where** learning happens. Workplaces themselves are becoming sites of continuous learning – sometimes called "learning-integrated work". With AI, many companies realize they have to constantly retrain their staff to use new systems. The most forward-thinking organizations set up internal academies or partner with educational institutions to provide training on the job. Industry plays a big role here: **public-private partnerships** can help create up-to-date curricula and apprenticeships for emerging roles. For example, a tech company might collaborate with a community college to create a certificate in AI maintenance or data visualization, ensuring the curriculum matches real job needs. **Governments** also are key actors, needing to update policies to support lifelong learning – whether through funding models, incentives for worker training, or flexible certification systems. Several countries are experimenting with things like personal learning accounts (funds that citizens can use throughout their career for retraining). These systemic supports are crucial, because expecting individuals to just constantly retrain at their own expense is neither fair nor realistic.

Education shifts from fixed to continuous learning throughout life.



An interesting trend in lifelong learning is the recognition of informal learning. People are learning from **YouTube tutorials, online communities, open online courses** (like MOOCs), etc. How do we acknowledge and harness that? The concept of **“recognition of prior learning” (RPL)** is gaining ground – offering formal credit or certification for skills people acquired outside formal school. In the AI era, this is especially relevant, as many individuals are self-teaching new tech skills. If someone learns coding via an online platform and develops an app, there should be pathways for them to certify that skill without necessarily going back to a 4-year degree.

I want to highlight the equity dimension of learning pathways. Without deliberate action, AI could widen educational inequalities. Those who have access to good training will surf the AI wave; those who don't could be left further behind (what some call the "digital divide"). Thus, when we talk about evolving education, **inclusion** must be front and center. Lifelong learning opportunities have to be accessible to rural populations, marginalized groups, and people with disabilities. This might mean providing community training centers, free online resources, or assistive technologies – and of course, starting with universal quality basic education as a foundation. UNESCO-UNEVOC's medium-term strategy stresses *"flexible pathways to lifelong learning opportunities for all"*, with special attention to vulnerable groups. That is encouraging, because a future of work with AI that only benefits the privileged is not the future we want. We want AI to help **"elevate TVET for a just and sustainable future for all"**.

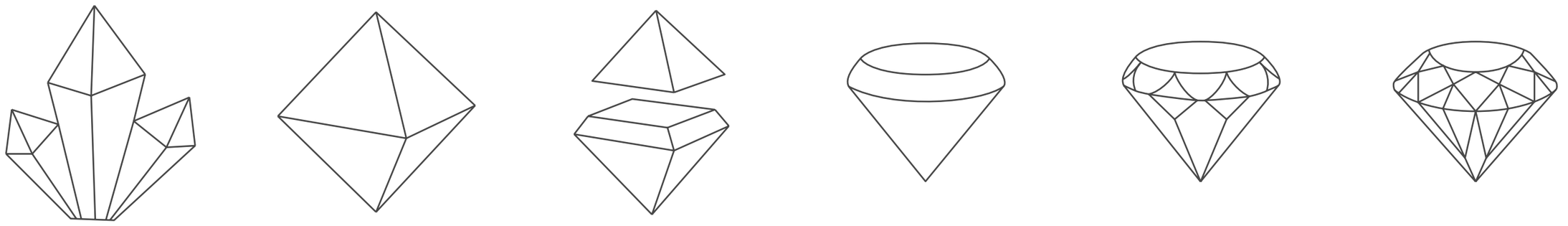
Now, lifelong learning isn't just a policy slogan; it's a culture we need to cultivate. **Learners must see education as a lifelong pursuit**, and educators must embrace new roles. Many of you in this room are probably already adapting – maybe you're taking your own courses on AI to better teach your students, or redesigning curricula to include project-based learning that mimics real-world problem-solving. That's fantastic. We need champions in schools and colleges who push for these changes. It can be as simple as updating a lesson plan with the latest industry case study on AI, or as complex as overhauling a whole qualification to include work-based learning modules.

One more aspect of the evolving mission of education: **collaboration and networking**. In such a fast-changing landscape, no single institution can have all the answers. We see **networks of institutions (like the UNEVOC Network of TVET institutions)** working together to share knowledge on new trends and what works in teaching them. Similarly, schools and universities are partnering with tech companies, startups, and research centers to stay at the cutting edge. For example, some universities have "Industry Advisory Boards" for their programs that include AI entrepreneurs and technologists who advise on curriculum. Education is becoming more of an **ecosystem** rather than a silo.

In summary, the rise of AI is forcing education systems to become more **agile, inclusive, and learner-centric than ever before**. We're moving towards a model where **learning is a lifelong journey with multiple on-ramps and off-ramps**, where the purpose of education is not just landing a job but navigating a lifetime of change and contributing to society. It's a monumental shift, but also an exciting one – it means education is increasingly about *empowering* learners to shape their own futures.

With these broad shifts in mind, let's turn to **what we can do in practice**. How can the education sector – especially vocational education and teacher training – respond to ensure we equip people with the right skills and support? In the next section, I'll outline some actionable insights and strategies, drawing on the latest research and successful examples.

Evolving Education in the AI Era



Traditional Education
Siloed, rigid learning

Informal Learning
Recognize prior learning (RPL)

Inclusion Focus
Accessible lifelong opportunities

Collaboration Boost
Networks sharing new trends

Agile Mindset
Learner-centric approach

Future Education
Lifelong, inclusive learning

Actionable Insights for Education Systems: Adapting Curricula, Training Teachers, Aligning Policies

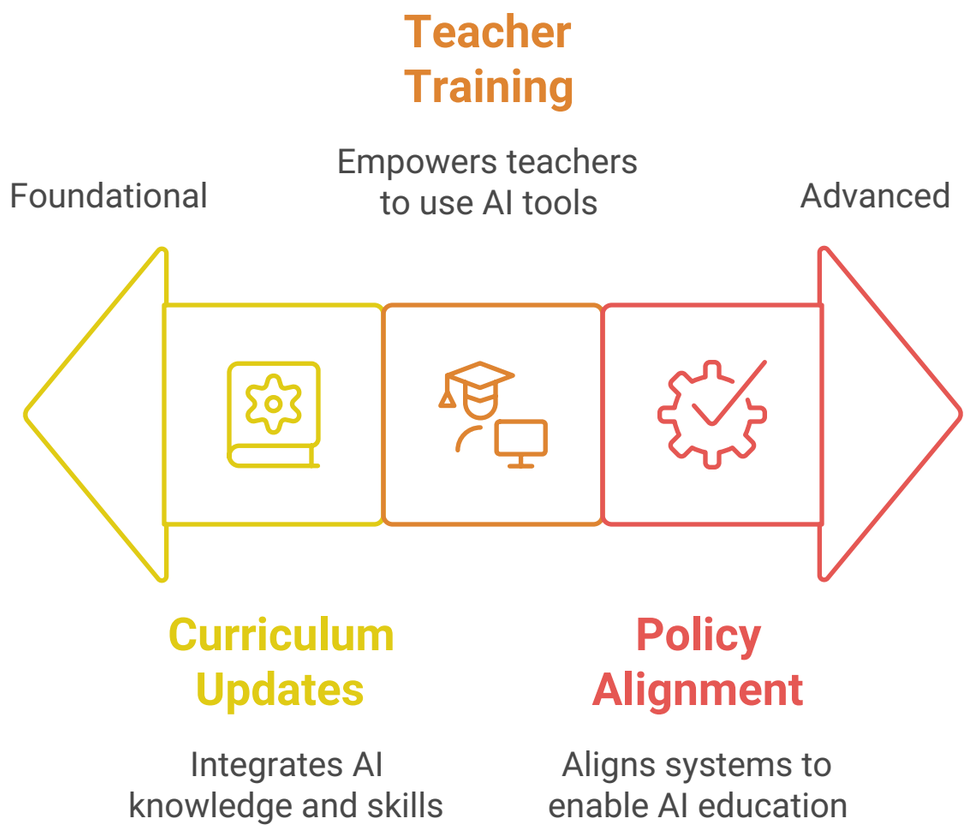
Preparing the workforce for the AI era is a complex challenge, but there are clear steps education systems can take. I'll frame this around three levels of action: **Curriculum & pedagogy updates**, **Teacher training & support**, and **Policy & system alignment**. These correspond to *what* we teach, *who's teaching it*, and the *environment that enables it*.

1. Updating Curricula and Programs: We need to **integrate AI-related knowledge and skills into curricula across the board**. This doesn't mean every student must become a machine learning engineer, but all students should gain a basic literacy in how AI works and its implications, as discussed earlier. For those in technical and vocational tracks, curricula should reflect the **digitalization of industry**. The UNESCO *Strategy for TVET 2022–2029* notes that topics like digitalization, automation, and even 5G and IoT are now core to vocational training, not optional extras. For example, an automotive mechanics program might include diagnostics with AI-powered tools; an agriculture program might cover precision farming with AI.

Curriculum reform should aim for a **balance**: students need to learn new technologies *and* the enduring fundamentals of their profession. A German initiative in construction education highlighted this: they updated curriculum to teach use of drones and BIM (Building Information Modeling) software, but also maintained focus on fundamental construction principles and manual skills. The philosophy was that **digital tools must be seamlessly integrated, not taught as an isolated add-on**. So in a carpentry class, students might learn to read digital blueprints on tablets alongside traditional blueprint reading. In healthcare training, students might practice with AI diagnostic aids but also hone bedside clinical exam skills. The goal is **augmented competence** – using digital tools to enhance, not replace, core professional competences.

Another key is embedding the **transversal skills** into curricula. We talked about critical thinking, problem-solving, etc. These can be cultivated through pedagogical approaches like inquiry-based learning, teamwork projects, interdisciplinary tasks, and real-world problem scenarios. Some countries are revamping their national competency standards to explicitly include these soft skills. For instance, one UNESCO-supported project calls for building "**transversal digital competencies**" into vocational curricula, enabling learners to adapt to new tech over time. Practically, this might mean a course in *office administration* spends time on digital literacy and data handling skills that cut across any software, rather than training only on a specific software that might be obsolete in 5 years.

AI as a subject is also emerging. High schools in some regions offer introductory AI courses or modules as part of computer science. At the vocational level, short courses on AI basics for various trades can be introduced. For example, "AI for automotive technicians" could cover how modern cars use AI for predictive maintenance. Even a module on *AI ethics for everyone* could be valuable, to raise awareness among students of all disciplines about the societal context of AI (linking back to the mission of education including meaningful life skills).



2. Empowering and training teachers: Our educators are the linchpin of any change. We must invest in **professional development for teachers and trainers** so they feel confident teaching about and with AI. A 2024 UNESCO framework suggests teachers need competencies in three areas: **(a) understanding AI basics, (b) using AI tools in their teaching practice, and (c) teaching students to use AI responsibly**. How do we achieve that? First, by offering training workshops and courses for teachers on AI in education. For example, some teacher education programs now include a module on educational technology that covers AI-driven learning analytics or adaptive learning systems. In-service teachers might attend summer institutes or online courses to learn about the latest educational AI tools (like intelligent tutoring systems, automated grading, etc.) and – critically – their limitations and ethical issues.

There are also emerging models like **AI mentorship for teachers**, where tech professionals or specially trained “digital coaches” work with school staff to integrate AI tools into lesson plans. A teacher might partner with an AI expert to design a class project where students use a simple AI platform to solve a problem. Such collaborations can demystify AI for teachers. And just as students learn best by doing, so do teachers – so encouraging teachers to experiment with AI (maybe using a chatbot to generate quiz questions, or an AI-based simulation in class) can build their skills. Key is creating a safe environment for teachers to try new methods without fear. School leaders should support pilot projects and share success stories.

Teacher education institutions (colleges and universities) have a responsibility too: they should update their curricula for pre-service teachers. Concepts like data literacy, tech-enabled pedagogy, and AI ethics should feature in courses for aspiring teachers. Moreover, frameworks like the European **DigCompEdu** now have **AI-specific supplements** outlining what digital and AI competencies teachers need. Aligning certification and standards for teachers with these frameworks ensures a common direction.

We should remember that while technology evolves rapidly, core pedagogical principles still apply. Teachers will always need to foster critical thinking, adapt to student needs, etc. AI can assist by providing analytics on student progress or by handling administrative burdens, freeing teachers to focus on human-centric teaching. But teachers need to be shown the value of these tools. Often, professional development that showcases *how AI can save time or enhance learning outcomes*is persuasive. For instance, showing language teachers an AI tool that gives instant feedback on student pronunciation – and training them on its use – can encourage adoption. On the other hand, teachers should also be trained to handle challenges of AI in class, such as students using AI (like ChatGPT) to do assignments. What are the new forms of academic honesty? How to teach students to use AI as a support, not a crutch? These are very real questions teachers face today, and training and clear policies can help.

3. Policy alignment and system support: At the broader level, ministries of education and national policymakers should integrate the **future-of-work perspective into strategies**. The UNESCO *Medium-Term Strategy 2024–2026* for UNEVOC, for example, explicitly focuses on **"the dual digital and green transformation"** and the need for **reskilling and upskilling the workforce** as key drivers. This kind of high-level recognition is important because it drives funding and initiatives. Concretely, policies could incentivize curriculum updates (through revised qualification frameworks or funding grants for innovation), support apprenticeships in AI-related fields, and promote TVET in sectors where AI is creating jobs (like renewable energy tech, smart manufacturing, etc.).

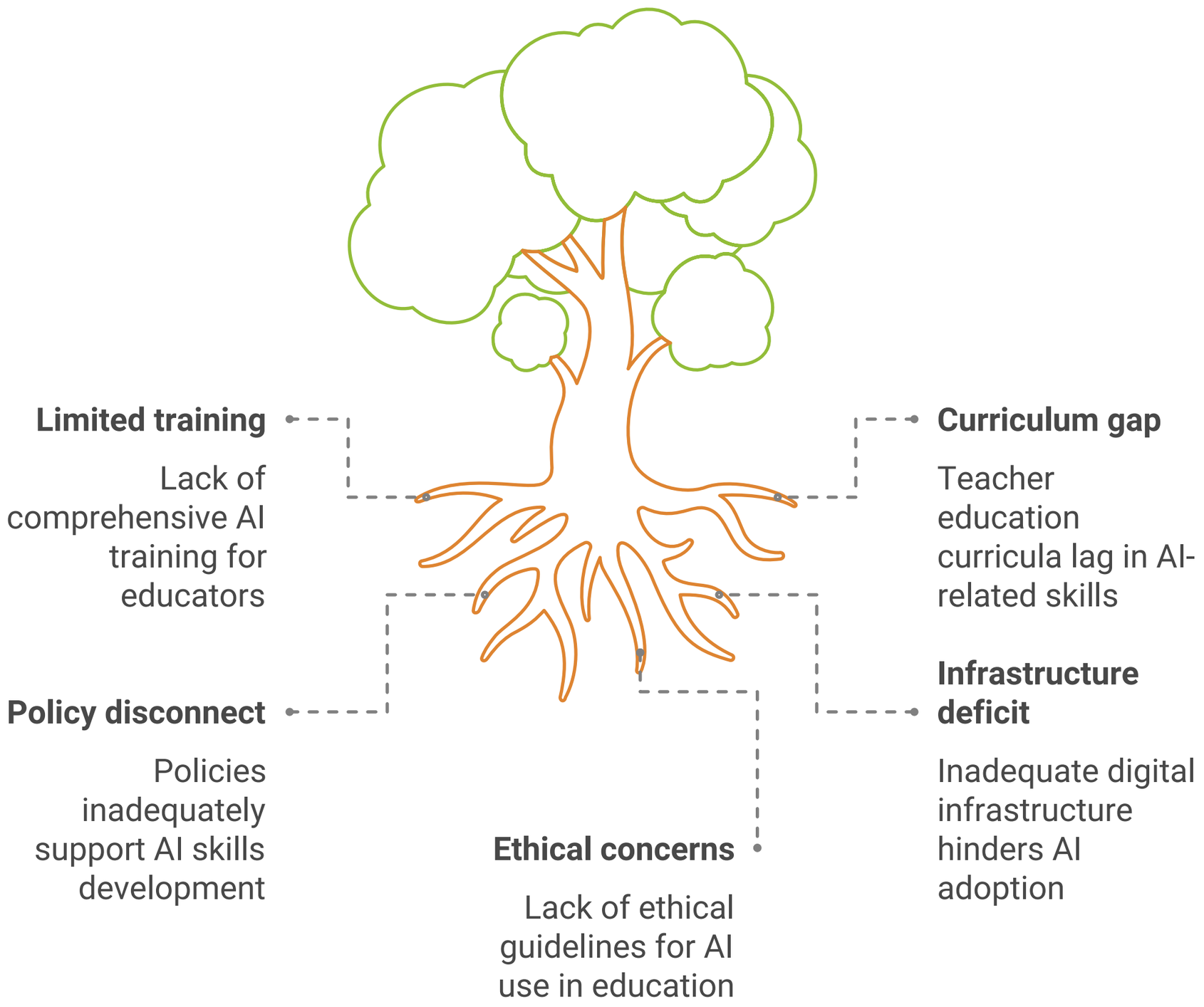
Another policy aspect is **labor market information and skills forecasting**. Governments and institutions should use AI itself (and other data tools) to continually scan for emerging skill needs and adjust training offerings accordingly. For example, if data shows a surge in demand for cybersecurity analysts or robotics technicians, TVET programs can be expanded in those areas. Some countries have set up **skills anticipation units** that use big data (like online job postings analysis) to detect shifts in real time. This tight feedback loop between labor market and curriculum is vital in the fast-paced AI economy. It means education is not static but constantly updated – a concept often referred to as making education **"future-ready"**.

Collaboration mechanisms are also a big part of system alignment. Inter-agency collaboration (education, labor, industry ministries working together) and public-private partnerships can align objectives and resources. The UNESCO Strategy for TVET calls for reinforcing partnerships with industry and leveraging networks like UNEVOC to share innovations. When policy, industry, and academia speak to each other, programs like specialized AI training centers or innovation hubs in TVET can flourish. One example: some countries have established **Centers of Excellence in AI and robotics for TVET**, where students and teachers can get exposure to cutting-edge equipment and practices. These centers often come about through government funding plus industry sponsorship.

Quality and inclusion standards should also evolve with AI. Accreditation bodies might include criteria on how institutions are integrating digital skills and fostering inclusive access (e.g., are there programs to help retrain workers at risk of automation?). And, as mentioned, there should be funding models that encourage individuals to upskill. This could be through tax benefits for companies that invest in employee training, or government-funded training vouchers that workers can use. The idea of a "right to lifelong learning" is being discussed in policy circles – making continuous education an expected and supported part of one's career, not an exceptional personal pursuit.

Let's not forget **infrastructure**. Embracing AI in education requires digital infrastructure – internet access, devices, and electricity, not only in elite schools but in all schools. The pandemic already revealed the gaps in digital access. As we push for AI integration, policy must ensure investments in closing the digital divide (rural broadband, device subsidies, etc.). Otherwise, we risk amplifying inequities.

Finally, **ethical guidelines and data privacy** frameworks in education are needed when using AI. If schools use AI systems that collect student data, there must be clear policies protecting that data and ensuring it's used transparently and fairly. UNESCO and others have issued recommendations on **AI ethics** – such as making sure AI in education doesn't perpetuate biases or infringe on student rights. Teachers and administrators should be aware of these and integrate ethics into tech adoption plans.



To bring these ideas to life, consider a tangible scenario: a national initiative for “AI & Future Skills in TVET” that many countries could implement. It would involve: revising the national vocational curricula to include digital/AI content; rolling out teacher training modules on AI; partnering polytechnics with tech companies to provide equipment or internships; offering workers short courses at local colleges on latest industry 4.0 technologies; and updating qualifications frameworks to recognize micro-credentials and modules. All under an umbrella policy that frames these as essential for economic competitiveness and social inclusion in the AI age. Some countries are already on this path, and the UNESCO guidelines encourage it. One more actionable insight – **don’t work in isolation**. Schools can pilot new approaches and share results. If a particular college successfully embedded an AI project in their nursing program (say using a virtual patient simulator with AI), those learnings should be shared in conferences or networks so others can adapt it. We need that collective learning process. And including **students and industry voice** in curriculum reform is critical – students can tell us how they use technology and what they feel they lack, and employers can articulate what they seek (though, sometimes they are not sure either in this fast-changing world). A *system view* approach, echoing Anthony et al. (2023) in an educational sense, helps ensure all stakeholders co-create the future of learning.

Before we wrap up with a vision and call to action, let's quickly summarize the ground we've covered: AI is changing jobs, requiring higher-order skills and lifelong learning; education must respond by updating **what** is taught (curriculum content), **how** it's taught (pedagogy and teacher prep), and **where/when** it's taught (lifelong flexible pathways), all supported by enlightened policy and collaboration. This is a **transformational agenda** for education – as significant as any we've seen in the last century. It can feel daunting, but it's also inspiring because it positions education as the key to unlocking AI's benefits for all, rather than letting AI's upheavals simply happen to people.

Transforming TVET with AI Integration