AI + Education Act Now for Young People

A reflection on acting in the field of Artificial Intelligence Education, Training and Youth.

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The four big moments

All these advances took place in different geographical coordinates, some faster in time than others, have left their mark on what defines us today. On the other hand, four other, more individualized moments were crucial in our evolutionary demand (Floridi, 2014). These moments were due to the genius of four amazing persons. First, Copernicus (when he proposed that the planets revolved around the sun and that our planet was not the center of the universe in his book "De Revolutionibus Orbium Coelestium"). The second one was Darwin (when he presented us the theory of evolution of the species through his book "On the Origin of Species"), the one that followed Darwin was Freud (when he structured and developed psychoanalysis and showed us that our decisions are mostly made unconsciously). Faced with these three events, as a human being we realize that our last field of exclusivity is Intelligence. Until we reached Turing, and he proved us that once we were wrong. We had lost this exclusivity.

It is, thus, in relation to the latter, that today we live some of the moments with more transformative power, than all the others, because for the first time in our existence we are faced with challenges where the capacity for intelligence is not ours only. This era begins when Alan Turing, in his famous scientific article "Computing Machinery and Intelligence", asks the question that marks our present and will shape our future tremendously: "Can Machines Think?" (Turing, 1950, p. 433)

In the face of such a great challenge, perhaps the greatest that humanity has ever faced, what strategies, policies and approaches will be defined and implemented by the EU in the field of education and training for Young People concerning Artificial Intelligence?

AI+Education. Now, why?

"Education and training are crucial to harness AI"[1]

This article aims to establish some principles and guidelines that will allow the development of a common response at the European level. This is a response which should be framed and guided by the principles which govern us as the European Union and which, in the social and solidarity field, distinguish us from other social and economic blocs.

It is therefore important to begin by reflecting on the type of policies and measures in the field of education and training that should be developed to enable a common policy (at least a common strategy, safeguarding the national educational policies of each member state) in the field of Artificial Intelligence in and for Education. The Digital Education Plan (2018 - 2020), pointed to 11 actions divided in 3 priorities areas [2]. Action 10 was framed on the topics of Artificial Intelligence (AI) and analytics. As a new plan is to be defined, with a public consultation open [3], we mentioned the importance and the need to focus more than ever in Artificial Intelligence and Education. Is crucial that we should understand that today Artificial Intelligence is not only about data, but also much more than data, we have to focus more than that just using data to make predictions at an educational level.

[1] https://ec.europa.eu/knowledge4policy/ai-watch/topic/education-skills_en

[2] https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

[3] https://ec.europa.eu/education/news/public-consultation-new-digital-education-action-plan_en

Also, it is crucial that concerning digital technology and Education we clearly need to shift the focus of the previous decades (mainly around basic skills of manipulating the digital), the demands concerning digital are becoming more and more challenged, and are asking for high level skills and for the mastery to that in complex contexts.

Our children's and young people will be challenged by smart and cognitive machines, that are only in the beginning of their amazing capabilities (what will be the superpowers of these agents in 10, 20 years?). Is the actual educational framework enough for these challenges? For example, "assuming that some occupations, perhaps such as truck drivers, data entry keyers or utilities meter readers, will become obsolete in the near future, an important question for education policy is how people in these occupations can move to new jobs."[4] So, if we do not introduce the thematic of AI in a deep curriculum approach how will our students be prepared for these (new) times?

We have really interesting and pertinent initiatives in the area of digital in the European Space, initiatives such as the translation of the course Elements of AI to all EU official languages [5], the EU Code Week [6], Safer Internet Day [7], DigiEduHack [8], but we need to understand that these isolated initiatives are not enough, we need strong, impacted, deep interventions in order to be able to address these challenges, this should not be something for some students (who have the opportunity to take part in these initiatives) but have to be driven to all students...with the focus on AI, because AI nowadays is like an umbrella where several area different fields of knowledge take place (computer science, statistics, maths, econometrics, cognitive science, neuroscience, ethics), as well all components of us as a society are impacted today, from business to industry, from journalism to art, from education to sports, from leisure to law.

We are facing a period of strong transformations that are happening at a pace never seen in human history. This speed obliges us to act in a fast but considered, very concrete and precise way. Faced with the current context, the absence of time is possibly our greatest obstacle when it comes to defining and implementing the necessary strategies. We should remember our natural tendency to follow Amara's law on the effect of technology: "We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run." [9].

This way of looking at the impacts of new technologies at various times in our history has resulted in poorly structured and poorly implemented actions. Recognising the strong impacts of Artificial Intelligence, we have the need and the obligation to implement, in due time and with the appropriate structures and support, the measures required in education in non-higher education (K12 educational systems).

On the other hand, is have evidences of the need to master the highly agency the digital skills of an AI world, "Talent is one essential ingredient for disruptive technologies to be developed and used .AI and digitalisation are producing a strong impact in the European economy and society, affecting also the work environment and requested digital skills."[10] and how crucial this will be for the societies that want to prosper and be able to face

[4] https://ec.europa.eu/jrc/en/publication/impact-artificial-intelligence-learning-teaching-and-education

[5] https://ec.europa.eu/digital-single-market/en/news/elements-artificial-intelligence-course-gives-basic-introduction-ai

[6] https://codeweek.eu/

[7] https://www.saferinternetday.org/

[8] https://digieduhack.com/en/

[9] http://www.rationaloptimist.com/blog/amaras-law/

[10] https://publications.jrc.ec.europa.eu/repository/bitstream/JRC113966/jrc113966_jrc113966_academic_offer_and_demand_for_advanced_profiles_in_the_eu_ai-hpc-cs.pdf

the future with harmony and the ability to live up to the challenges we face. We also have signs that considering the labour market the AI revolution will create more jobs than the ones that will be destroyed. A report from the World Economic Forum mentions that the net gain will be 58 million jobs. [11] [12] Nevertheless, the competences the mastery and agency need to thrive in these contexts are completely different from the ones we have prepared our students so far, and the ones that will be maintained will be strongly changed. That is one more reason, not the only one, but a strong and valid reason AI should be integrated in all the educational curriculums of the countries' Member States.

The basics pillars of an AI+Education Framework

Regarding Artificial Intelligence, in the field of Education, and how we should develop education and training policies and measures so that all EU citizens can benefit as a whole from the added value generated by AI, it is important first to define which fields of action should be structured and analysed. Only then we are prepared and able to think, reflect, and design a consistent, valid, and efficient framework.

Thus, the first step is to identify specific areas of action about Artificial Intelligence and Education. One of the best approaches for this is the AIED framework that identifies 3 areas: Learning with AI, Learning for AI, Learning about AI (Holmes, 2020).

Having said that, these three essential areas, in what concerns AI and Education, should be framed for us to then build the necessary policies and measures of action.

It is important to act with a valid and safe approach so that we can ensure that everyone in the common European area, and in accordance with the European principles that guide our decision-making, will benefit, and not be excluded, from the strong and disruptive transformations caused by the impacts of Artificial Intelligence.

However, we must emphasize that the waves of disruption of Digital Transformation, mainly fed by AI, currently affect all aspects of our life, whether they are social, economic, labour, cultural, among many others.

For us to intervene properly, a general framework must be defined at the EU level as a reference for all Member States. In the face of such a powerful revolution, we cannot allow general measures and guidelines to be defined only at a national and/or regional level; this would entail significant constraints in the short term. If this care is not taken, we may be contributing to a greater discrepancy in development within the EU. Nevertheless, in this paper we will drive to a broader spectrum and establish key pillars for a Transatlantic Cooperation with the Atlantic Ocean as the bridge to connect the European block and the American block.

Firstly, will focus on the European Common Space and from there establish a connection with the measures and initiatives developed in the United States that can be integrate as a piece of puzzle in what we propose.

Given the current political scenario, this would contribute to more difficulties and constraints as far as EU unity is concerned, it would create an even wider gap within the EU between those who are best prepared to achieve success and those who cannot. Such consequences would be dramatic for the future of the Union and for the future of Europe.

[11] http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf

[12] http://reports.weforum.org/future-of-jobs-2018/shareable-infographics/

The impacts will be so violent (not in the literal sense of the word, but in the depth of its effects) that we must necessarily act in a fixed and united manner in the implementation of measures at the educational and training level in the European space as far as Artificial Intelligence is concerned.

This requires, as mentioned above, an understanding of the three key areas, which will be crucial when moving to the operationalization of the different strategies that will have to be defined for each of them. These three areas should be worked in full articulation with experts from different fields, such as education, technology, psychology, neuroeducation, among others, to be target in-depth analysis and serve as guidelines in the implementation of theoretical models of support, which serve for the definition of concrete action plans, easily applicable by the different educational actors in their educational contexts.

The 3 approaches: AI + Education

So, regarding the spectrum to operationalize efficient and impacting measures that bring about a real and significant change in the field of education regarding AI, we should focus on these 3 areas mentioned before.

1st Area - Learning for Artificial Intelligence

Creating the educational contexts that make it easier for students to acquire the necessary skills to live in a world surrounded and shaped by Artificial Intelligence. It will be necessary a review of current frameworks of skills that fit the impacts of AI in general and transversal terms. This is a new world where, for the first time, we will be challenged by "intelligent agents" to whom we will have to adapt to interact and collaborate with them in a commutative way, making the most of their capabilities, combining them with human intelligence. Many of the decisions in our students' lives will be made by these agents, it is important that they are aware of this and that they are also aware of the ethical principles required for these environments.

2nd Area- Learning with Artificial Intelligence

This area focuses on the application of Artificial Intelligence solutions that support the work of the teacher, at a pedagogical and administrative level. It also involves the integration of tools to support student learning, so that we can, for the first time, respect the individuality of each student's learning and have solutions that adapt to these different profiles. However, we must take care that the tools developed (or to be developed) do not appear in the service of the reinforcement of outdated and maladjusted pedagogical practices placing the focus on the isolation of the student, controlled, in his learning process, by any agent. Today, what matters most is to appeal to our human capacities, since they are the ones that will distinguish us the most and will mark our difference by the positive. It is important that the development of these platforms is accompanied by constant scrutiny by education specialists and duly validated before being implemented, respecting the framework that will be developed at the EU level.

Several questions arise in this context, mainly related to Learning Analytics and other prediction tools, for example regarding the definition of individualized learning pathways. These questions arise because the careless application of these tools could, in certain situations, compromise the future of the students, as they lack an intervention and human analysis capacity considering details that the algorithm does not have the sensitivity to detect and correct. This will happen with several tools and platforms supported on AI, if we insist on the current education model with the parallel action of these solutions, which are intended for outdated education models without the capacity to respond to current challenges and even to social models of the past. Using these powerful tools without the structural alteration of other components - education, society, economy, among others - we will be defining an ecosystem of inequality that will contribute to social problems of strong impact. Another clear example of the concerns these tools raise is the proposals to use big data to predict a student's success in a specific training context. Faced with this possibility, how will this "prediction"

be communicated to the student, the family? How can this be justified, through a closed algorithm in a black box? What data were used for this decision? What will schools do in these situations, will they have the autonomy to create specific follow-up plans, or will we wrongly potentiate the situation, handing over all the decisions to the "hands" of an ITS. An ITS, which isolates the student in the evolutionary process of his learning because these systems do not promote moments of collaboration and peer learning? It is also necessary to think about the formative paths that will be developed so that these solutions have the proper framework according to the educational purposes defined for today's challenges and realities.

3rd Area - Learning about Artificial Intelligence

In the current scenario, the market will need specialized professionals in the field of Artificial Intelligence, actually “there is a significant and persistent ICT skills gap. Demand for skills in emerging areas such as AI” (López Cobo M & all, 2019, p.45). Only with a competent and properly prepared workforce in this area, we can be sure to aspire to lead in the field of innovation and development in Artificial Intelligence. However, for that to happen, it is urgent to integrate in the secondary school curriculum offers of subjects (regular education) and specific courses (professional education) in the scope of AI, so that we can have a solid base of professionals in this area, trained according to the defined ethical principles. Not implementing this measure at the secondary school level, through curricular and extracurricular offers in the field of Computer Science, as is already done by other countries, is putting us in a position of clear disadvantage, in a race where the match has already been given - that of Artificial Intelligence.

It should be noted that all measures to be implemented must be based on respect for social and human values, with which we all identify, and therefore fit in with the ethical principles defined for this matter in the European area.

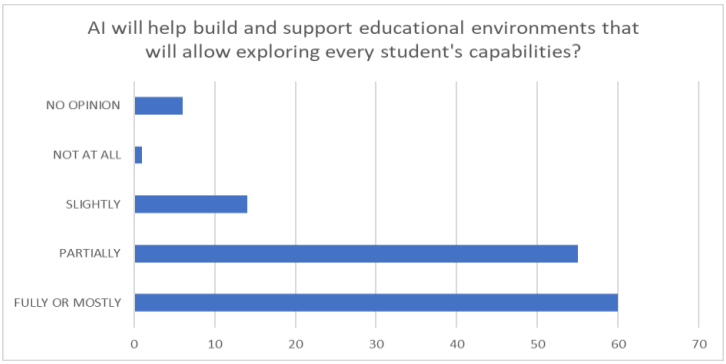
Once again, we stress the urgency, we feel in implementing these measures at the level of non-higher education. Without this, in the current scenario, we run the risk of clearly losing the capacity not only to lead in research and innovation but also to equip our citizens with the necessary skills and knowledge so that they can meet the (new) challenges that will be presented to them. Only effectively prepared will they be able to take advantage of all the new opportunities generated in this new environment, where analogue and digital are confused and mixed and where, for the first time, the human being will be challenged by agents with cognitive capabilities that we considered exclusively from the domain of the human being.

European teachers' perception of Artificial Intelligence and Education

In order to have a brief picture of the current situation regarding the knowledge of the teaching staff on Artificial Intelligence (because having an educational staff properly prepare is a guarantee that our children and young ones will have access to education opportunities in the field of A), education and the capacity of schools (in the European context) to make it operational, we present the result of a survey applied to teachers from several European countries in the context of a Webinar on Artificial Intelligence and Education, which I carried out for 170 teachers, within the School Education Gateway13 where 136 teachers answered the following questions:

[13] https://www.schooleducationgateway.eu/en/pub/teacher_academy/webinars/artificial-intelligence.htm

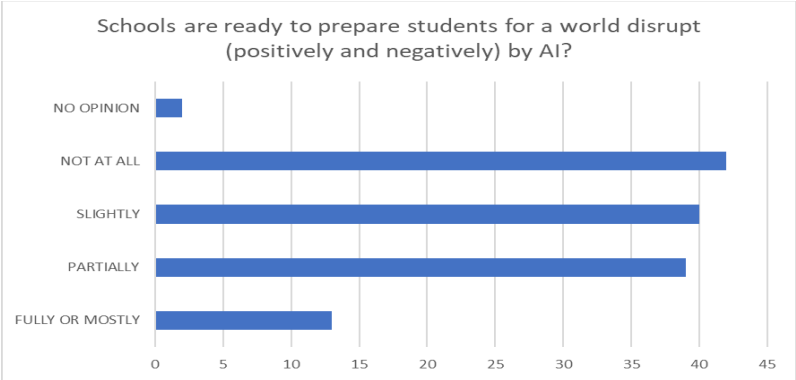
AI will help build and support educational environments that will allow exploring every student's capability?



FULLY OR MOSTLY	PARTIALLY	SLIGHTLY	NOT AT ALL	IN OPINION
44.12% - 60	40.44% - 55	10.29% - 14	0.74% - 1	4.41% - 6

Most teachers believe that Artificial Intelligence can contribute effectively to supporting the development of learning according to the specific abilities of each student. With the support of Artificial Intelligence, we will be able to make use of the latest results of cognitive neuroscience, which presents us with new horizons regarding the way students learn and how it is important to defend and respect their rhythms and the most appropriate approaches for each one. Only in this way, we will be able to leverage the best of each one of them.

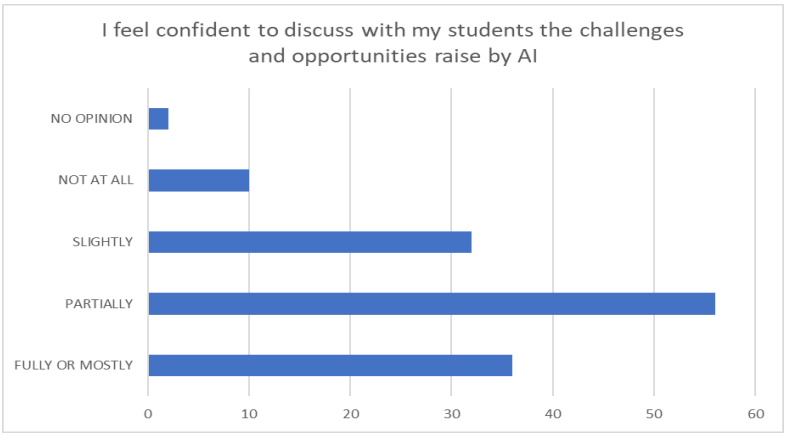
Schools are ready to prepare students for a world disrupted (positively and negatively) by AI?



FULLY OR MOSTLY	PARTIALLY	SLIGHTLY	NOT AT ALL	IN OPINION
9.56% - 13	28.68% - 39	29.41% - 40	30.88% - 42	1.47% - 2

The results obtained in relation to this question are already more worrying because, according to the general feeling of teachers, schools are not prepared for the challenges and impacts of Digital Transformation and, consequently, of Artificial Intelligence. This question lacked more specificity, but the needs are felt in terms of equipment and technical conditions, curricula, and specific training of teachers in this area.

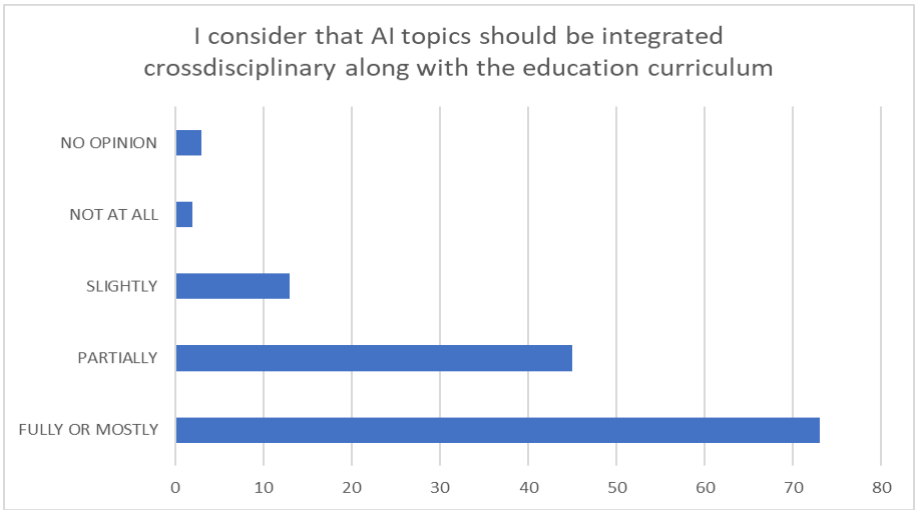
I feel confident to discuss with my students the challenges and opportunities raised by AI



FULLY OR MOSTLY	PARTIALLY	SLIGHTLY	NOT AT ALL	IN OPINION
26.47% - 36	41.18% - 56	23.53% - 32	7.35% - 10	1.47% - 2

It is interesting to note that teachers (participants in this survey) have some confidence when it comes to addressing not so many specific issues in the teaching of and for Artificial Intelligence, but specifically about the impacts and challenges of Artificial Intelligence. However, it should be noted that some of the participants had already had the opportunity to participate in specific online training promoted about the subject [14] [15], where the issue of opportunities and challenges was addressed. It is therefore important to understand that teachers need to receive specific training in this area in a structured and organised way, accompanied by specific curricular adaptations that reflect the contexts and moments of today, and not those that supported the massification of the school in the 19th century.

I consider that AI topics should be integrated cross disciplinary along with the curriculum



FULLY OR MOSTLY	PARTIALLY	SLIGHTLY	NOT AT ALL	IN OPINION

[14] https://learninglab.etwinning.net/87060/home

[15] https://www.schooleducationgateway.eu/en/pub/teacher_academy/webinars/artificial-intelligence.htm

53.68% - 73	33.09% - 45	9.56% - 13	1.47% - 2	2.21% - 3

These numbers clearly show that teachers consider it especially important that the issue of Artificial Intelligence be included in the educational curricula of the various countries. The problem that arises has to do with the delay and difficulty in adapting educational entities to the transformations that take place outside of school. For this reason, and with the speed at which the transformation occurs today, it is imperative that this curricular adaptation happens as soon as possible.

Measures proposal for Artificial Intelligence and Education

In view of the scenario described above, there is an urgent need to act quickly, since it takes too long for concrete results to become visible, knowing that the implementation of reforms at the educational level, by different orders of reason.

If in other contexts of our existence this was not so critical, because the pace of change and transformation did not require the same urgency, today the context is completely different. We are facing the most impacting and fastest wave of transformation ever. Never in history has a revolution been so socially and geographically comprehensive. It affects and will affect all social strata and at very identical paces all over the globe.

Act now, tomorrow will be too late

And it is important to think not only in the short term, but also in the medium term. We need to look closely at the education system and the studies that allow us to observe/persecute what will happen 10 years from now and align education systems with the needs and challenges of 2030.

We are not referring merely to labour and professional issues (without taking away their importance that we all acknowledge) but also to our role as individuals in a society continually faced with new challenges and where we are losing the exclusivity of being unique in the field of "intelligence".

The first big step is to include the theme of Artificial Intelligence in the curriculum space and effectively in the classroom. It is in the classroom that the most important thing happens in education, it is in the classroom space that the real transformations happen at an educational level.

The teacher is the great agent of change in daily contact with his students. If the strategies that are designed and the measures defined to be implemented do not reach the core of the educational process, then we will not succeed in this demand of ours.

Changes at the curriculum level are time-consuming and require decisions at the national level but must be aligned with an overall strategy defined at the European level.

It is important, first, to start a joint work of the Ministries of Education, in order to define objectively, at the level of these new realities, what is pertinent to our students to dominate in concrete terms in the field of knowledge and practices that come from the changes provoked by Artificial Intelligence in a time frame of 10 years - strategy for 2030. The guiding document produced by those entities will serve as a working basis for action at the national level, within this theme, in an environment of collaborative work and constant sharing.

We also need to involve other stakeholders in the whole process, we need input from all areas of society to ensure that this basic document is as comprehensive as possible and gives us a comprehensive and integrative vision.

Against this background, there is also an urgent need for a general training plan for teaching staff, providing them with the necessary basis for knowledge of the challenges and opportunities of Artificial Intelligence.

A European structural approach will have to be defined to include as many teachers as possible. To this end, training of the MOOC type (adapted to European level) will initially be the most appropriate. It will then be up to the national level to define the training strategies best suited to their contexts and needs.

At this point, we are operationalising the Learning for Artificial Intelligence area as a first and comprehensive measure.

In the area of Learning with Artificial Intelligence, platforms and tools will have to be thought out to "extract" from Artificial Intelligence its greatest capacities and virtues. In this area, the involvement of technological partners is crucial. This is a joint work, to align the solutions found according to the guiding lines of the defined framework.

In another aspect, it is necessary that the specific theme of AI (operationalization of the area Learning about Artificial Intelligence) be included as an offer in secondary education (high school). This will allow pre-preparing future specialists in AI, who will develop their skills at higher education level, but with a generic and basic training already developed in secondary education. We cannot afford not to have enough supply for the new jobs that will be created in the specific framework of the development of platforms, solutions, Artificial Intelligence tools. On the other hand, for us to lead in the field of innovation and be at the forefront of development, this training of young people in the field of Artificial Intelligence must necessarily start at this level of education.

Another crucial point in this area concerns ethical and data privacy issues and how they will be used, to eliminate prejudices that may reflect previous predispositions. Artificial Intelligence, in this component, in addition to supporting learning, can and should also be a teacher's ally in the automation of bureaucratic and administrative tasks. This will allow the teacher to make time available for what really matters most, the work and close interaction with his students.

It is important to clearly define the field of action of the teacher and the intelligent agents/guardians and the dual interactions that will be established with the students and with these systems.

K-12 AI Education for Young People

Europe is in the midst of an AI revolution. European children today are growing up with AI, as they converse daily with Alexa and watch TikTok videos curated by machine learning algorithms. It is critical for these “AI natives” to learn how to navigate an AI-driven world and feel empowered to use these tools. Universal AI education is necessary for several reasons. First, we need to raise informed citizens to understand the basics of AI as our society begins to make AI-related decisions. Second, AI has already caused and will continue to cause a shift in the job market with job losses and job changes in some sectors and gains in others. To prepare children for the growing demand in AI jobs, we must ensure they learn what they need to succeed in their careers. Lastly, universal AI education is important to make sure these AI-related career opportunities are feasible for all students and so those diverse demographics are represented in the people who design and develop AI.

Talent remains the most important driver of progress in all facets of AI. Efforts are underway in the United States, China [16], Israel, South Korea [17] and many other countries to promote AI education in elementary, middle, and high schools. Compared to other nations, the STEM achievement of European students appears inconsistent with a continent seen as the leader in technological innovation. The time is now to teach AI so that the EU retains access to the best AI talent and thereby assumes global leadership in the long term. To that end, it is also critical to introduce AI early before entering college to enhance students' enthusiasm and confidence level. To cultivate homegrown talent in AI, we need to center AI education in EU STEM education policy and develop supporting efforts such as developing professional development opportunities and fostering a community of teachers, parents, and other stakeholders. In the long term, investment in K-12 AI education will underpin the EU AI strategy on all fronts.

The current AI4K12 initiative [18] in the United States that is serving as guidelines for what students should learn about AI, can serve as a new transatlantic cooperative framework in AI education. The EU school system can adapt these guidelines that address four grade bands of K-2, 3-5, 6-8, and 9-12, in the context of "five big ideas in Artificial Intelligence": Perception, Representation & Reasoning, Learning, Natural Interaction, and Social Impact.

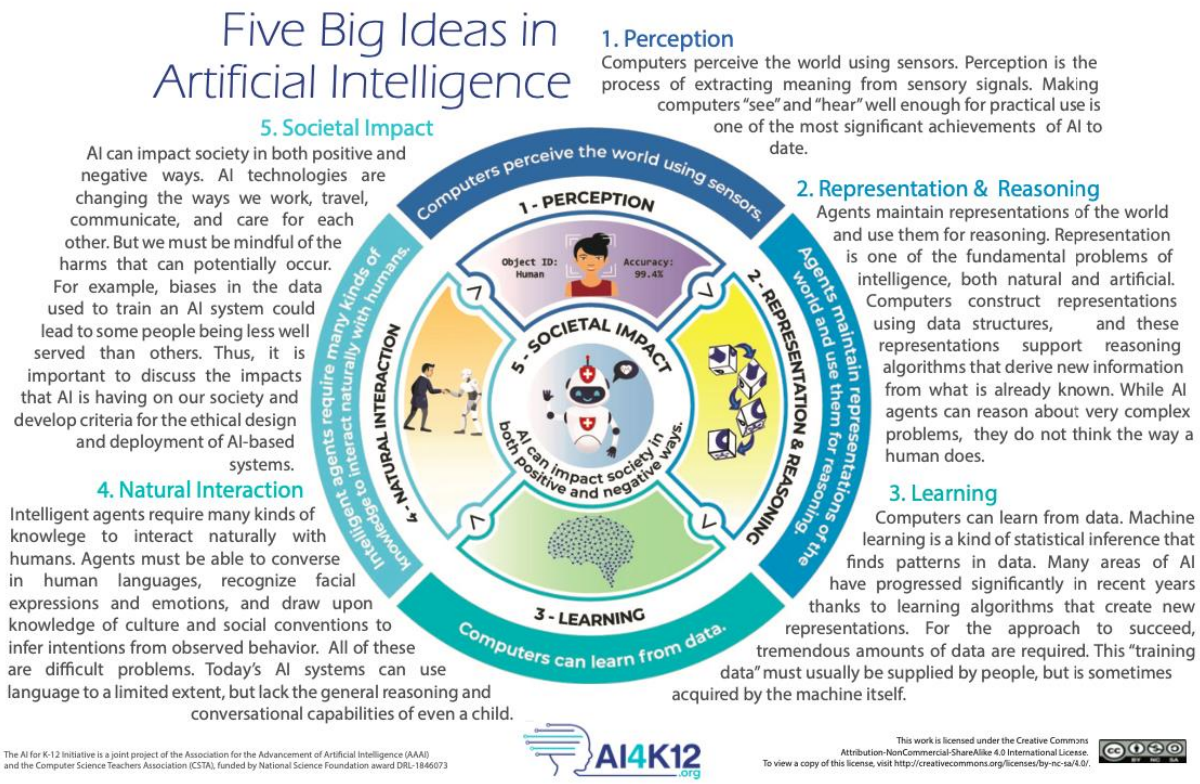
The Five Big Ideas in Artificial Intelligence can be a method of introducing school teachers, parents and most important students to these critical concepts, where AI can truly teach students about more than technology, it can assist them in a better appreciation of the complexity of our lives, collective humanity and human values.

It remains vital for the Five Big Ideas to be translated and made available in all 24 official EU languages.

[16] https://www.technologyreview.com/2019/08/02/131198/china-squirrel-has-started-a-grand-experiment-in-ai-education-it-could-reshape-how-the/

[17] http://koreabizwire.com/s-korean-schools-bring-ai-technology-to-the-classroom/135905

[18] https://github.com/touretzkyds/ai4k12/wiki



Materials produced by the AI4K12 Initiative, including the "Five Big Ideas in AI" poster and infographic, are licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. Other licensing terms are possible by special arrangement.

Need for Policy-Level Advocacy

The need for EU, Member State, and local K-12 education policy to put an emphasis on AI is clear. Since AI is not a "core academic subject," this perceived lack of importance trickles down to the school level. Member state standards reflect EU priorities. If EU education legislative actions, executive orders, and guidelines do not emphasize the importance of AI, schools are less likely to consider AI classes. Students are then less likely to be exposed to AI and teachers (STEM or non-STEM) have less opportunity and flexibility to bring AI into their classrooms. It is important to note that AI can exist independently of Computer Science. In fact, because of AI's inherent societal implications, it can easily be and should be an integral part of today's social science and humanities curricula.

Although teaching licensure and continuing education are decentralized in the EU, there can be a portion that is unified, required for teachers of all subject matters. In various member states, for instance, a good way to start is by making AI content part of the Business, Computers & Information Technology skills test required for licensure. In addition, we must provide comprehensive professional development opportunities for teachers. By offering AI as a recommended CE credit and offering other career incentives (higher pay or more secure employment), all teachers, especially those who are intimidated by AI, will realize the urgency to teach AI and ways to incorporate it into their curriculum. To get more teachers on board with teaching AI, we need to first immerse them in powerful learning experiences.

Moreover, the push for continuing education must come from the EU level. Today school systems are cutting back on professional development programs due to tightening budgets and austerity measures implemented by different national and European institutions, leaving, in some contexts, the responsibility for professional

development on the teacher, but in particular for AI there are no specific measures and actions in what concerns AI and Education. However, teachers today have increasingly limited bandwidth to seek out appropriate professional development opportunities and students suffer as a result. Policymakers have an obligation to ensure teachers have the support they need to learn new topics like AI and adapt to student learning needs.

The EU education plan, if proposed, must also address the issue of diversity in the AI field. All students, especially those from historically underrepresented groups, should have access to AI learning opportunities. Women are grossly underrepresented in artificial intelligence, making up to 12% to 22% of AI researchers and 6% of software developers in the field [19] [20]. This data reflects a larger problem of representation in the broader computer science and STEM fields. However, because AI is used in classification, detection and prediction systems, the lack of diversity directly impacts the perpetuation of historical bias and power imbalances. But this also means that as AI in K-12 is still in its early stages, we have an opportunity to make a difference now before AI issues get even more complex.

Accessible Tools and Materials

We have seen a considerable amount of enthusiasm from teachers of all subject areas to "add a little bit" of AI to their existing curriculum. However, these early adopter teachers remain the minority. To have AI introduced widely to all schools, we must make AI teaching tools and materials, especially those with interdisciplinary connections, widely accessible to teachers. In the beginning phase of AI in K-12, the focus should be reducing "time to the classroom" with shorter lesson plans and connections between AI and other subject areas.

Teachers need to be made aware that AI has a place in other classes. For example, an AI/CS teacher and social science teacher can come together to design a project investigating loan fairness with quantitative analysis in Python. The need to get teachers from beyond STEM subject areas interested in integrating AI in their curriculum is growing. One way to do that is by developing interesting lesson plans that are designed for classroom implementation. Public-Private Partnership with universities to adapt college-level AI concepts for K-12 remains a critical component. With 50-minute lessons on topics such as neural networks and speech recognition, teachers can pick up a lesson and start teaching AI in minutes.

The adoption of the project-based approach has demonstrated a real impact on student achievement. Every year ReadyAI [21] hosts a summer camp teaching AI to K-12 students [22] where students spend half of their time working in teams to design and code a demo of positive use of AI in society. This approach allows students to come up with their own idea, therefore, be actively engaged in their own learning. It also brings in the full spectrum of STEAM since students are designing the storyline and their demo set. ReadyAI often hears from parents after the camp that the project proved a fun challenge in that it was their child's first experience conducting a project from start to finish.

[19] https://unesdoc.unesco.org/ark:/48223/pf0000367416.page=1

[20] https://reports.weforum.org/global-gender-gap-report-2018/assessing-gender-gaps-in-artificial-intelligence/

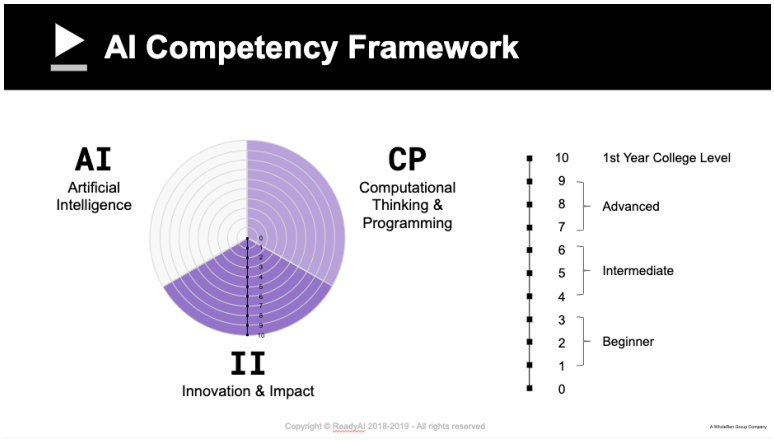
[21] https://www.readyai.org/

[22] https://www.readyai.org/summer-camp/

Need for Standardized Assessment

For a subject as complex and as constantly evolving as AI, it is understandable that teachers feel overwhelmed when the topic is broached. Many teachers, even as they want to incorporate AI into their teaching, they do not know how to start. Efforts such as AI4K12, a joint initiative from AAAI and CSTA [23], have made substantial progress in consolidating what every student should know about AI into the Five Big Ideas. However, without a roadmap and standardized assessments, teachers are again left alone to devise their own plans.

At the AAAI 2019 Fall Symposium [24], we proposed the AI Competency Framework, which incorporates three areas as core components of AI competency: Computational Thinking & Programming, Artificial Intelligence, and Innovation & Impact. Each component has a score ranging from 1 to 10, indicating a student's mastery of knowledge in that area. We believe that a standardized framework such as this one allows teachers to see clearly the different skills involved in AI and therefore be able to measure their student's outcome against a common measure.



Moreover, the inclusion of Innovation & Impact emphasizes that AI is designed by humans and ultimately only useful when it positively impacts the human experience. We believe that Innovation & Impact is just as important, if not more, than learning the technical concepts. By encouraging students to take charge and realize their agency over AI, they are empowered to advance European technological edge further and develop systems that reflect our values.

European Leadership in AI-era Starts in Classrooms and with Young People

It is no secret that artificial intelligence (AI) is transforming our lives in profound ways and will mainly transform the lives of the young people. AI is an enabling technology that is impacting everyday devices, products, and means of communication. It is providing everything from our cars to cell phones with the capability to interact with the world around them. Although just starting, AI and related technologies are evolving, and they are having lasting impacts on our work, education systems, national and international politics, security, and very lives.

In every city across Europe and every industry, AI continues to lead and shape existing industries and allows new ones to take root. Today even our politics is undergoing its macro-level impact, particularly in the domain of economics due to advances of AI.

Mastery over the research and development of AI will become increasingly vital, and the frontrunners of this upcoming AI era in human history will be the countries and companies that can build the most robust algorithms, collect the most talent, accumulate the most data, and obtain the most computing power. Putting

[23] https://www.aaai.org/ojs/index.php/AAAI/article/view/5053
[24] https://aaai.org/Symposia/Fall/fss19symposia.php#fs08

aside the political noise of populism around the world, AI is the next great technology race of our times, and the stakes are high.

As a country, we must embrace the full range of social and political changes that these technologies will introduce; therefore, it is vitally important the education and training we provide our youth that will feed the engines of future AI, and consequently geopolitical success.

Every aspect of our European life; healthcare, education, agriculture, energy, finance, national politics, security, is being reshaped in some form by AI. We believe K-12 education will be the pivot point around which the future of the EU revolves. This is not solely a matter of social change, but, in fact, a more significant national issue.

How as a country we change the K-12 education system to prepare our next generation of leaders will directly determine whether the EU maintains its leadership in critical fields of relevance in the emerging digital environment. Without a sufficiently educated population and workforce, Europe will likely shift behind other nations for whom AI is not only meant for the improved social organization but strategic superiority and ultimately digital and physical conquest. If our classrooms lack AI learning, we will face a future in which Europe is second in the race for AI technology and lead our collective society to social, technological inadequacy with dire consequences.

In the 20th Century, we witnessed European capacity in leading on many fronts. Behind this unique European leadership was this sheer power of our intellectual and technical abilities and aptitudes, and behind that was a near unlimited supply of talented engineers, each trained by a system of education undisputed in its excellence. Our 20th Century education system was built from the ground up with a focus on fundamental science, technology, and math in the numbers needed to ensure European strategic leadership.

We owe it to the health of our liberal-democratic way of life, our competitive advantage, and the strategic security of our nation, the basis for tomorrow's system of education must reflect a deliberate tuned and calibrated system that proactively emphasizes AI teaching and learning in every classroom across Europe.

We firmly believe EU leadership in the 21st Century can be preserved, safeguarded, and sustained through a system of education that imagines the changes necessary and sufficient to embrace and apply relevant technologies. It will also be underwritten by educators who grasp the profound shifts in the pedagogical skills essential to the educational needs of the 21st Century.

Every classroom, every school, every district must adapt. We must collectively educate and train entire generations of educators to be relevant in the 21st Century and beyond. We must preserve European leadership in AI, big data, and supercomputing. And it can only be achieved through a highly educated society and acquired workforce, and even-further through leaders who understand these issues on a fundamental level and have the will to develop and resource a comprehensive plan for reimagining our national education efforts. Every school must adopt a strategy for AI age so it can provide the best education and develop the next generation of leaders.

The fundamental question that every school district must ask of itself: are the teachers of today ready to develop the leaders we will need in our shared AI future? A difficult question, to be sure, and the answer today is no. We believe teaching and learning requirements must be substantially changed and the dynamics of learning versus teaching in AI based systems of education will be very different. We must address the importance of conditions for teaching degrees and related certificates in this new environment, and the necessary adaptation of the science of pedagogy to these changes.

In the next decade and the rise of AI, every aspect of the traditional learning environment must change. Will virtual space using networked augment or virtual reality technology replace physical classrooms? There are also significant challenges in measuring the success of students in an AI-based educational process. For example, if students can become more deeply involved in the pathways of their learning through AI, the measurement could potentially take place moment to moment, the success of remediation. In a project-based approach, teachers will know at the end of each student's day if he or s/he is meeting requirements and quickly corrects what is defined as necessary to stay on track.

It is vital for the private sector and schools across Europe to routinely be interested in creating synergy and symbiosis to enhance our educational process. Because of one of the most profound aspects of K-12 education in the AI environment is that these technologies will unleash the potential and productivity of a vast sector of European and global society previously constrained by their educational experience and resulting lack of opportunity. Our K-12 education has an important responsibility, as the AI-powered digital space, "opportunity for every student" may become a reality for those who previously had little means of achieving their piece of the European Vision. Today there are large segments of the EU where our education system, and our youth, have limited-to-no access to AI education. To achieve our digital potential and to continue to maintain our lead in AI and other emerging technologies, a national program to bring AI education to all our young citizens is essential and will in any case help to close the sometimes yawning gaps created by racial and income inequality in the US.

AI promises to usher in a bold new era of human history, one where the machines we create will often be smarter, faster, and more powerful than those who created them, and our schools have a responsibility to catch the train. Every school in Europe will face a new reality with profound implications for the field of education and introduces complex ethical, legal, societal implications that academics, policymakers, and average citizens alike will need to contend with as every aspect of society reshapes around them. To protect our next generation from the risk of inferiority at the global stage, we must bring AI education to every classroom in Europe and further develop a comprehensive strategy for reimagining our education system at the national level.

As we visit schools across Europe, we witness that we are not training our young future leaders with the tools required to be successful in the digital age. We believe this very fact has deeply troubling implications for the future of our society. As a student of history We think, just as the EU preserved through the Cold War through technological superiority, we remain hopeful that the 21st Century will once again be one defined by European leadership, which our best and brightest must lead.

A conclusion

The moments we are experiencing are too impacting for all this discussion and need to adapt not to enter the Education space. The new realities present us with immense challenges and questions that even touch on philosophical and ethical issues.

We have an obligation to create all the conditions so that teachers and students can recognise and identify what is happening. We have an obligation to provide the contexts within the school space that are effective in preparing the young generation, making them capable of living in a world where Artificial Intelligence will prevail, and where we will be constantly challenged by these new forms of intelligence. Our students will have to be aware of these new realities and, more than that, critical and demanding before those who make the decisions that will affect their lives so deeply.

In a world full of uncertainty, one certainty remains: ***only with and through Education*** will we be able to find the answers to the enormous challenges that are being placed in front of us.

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