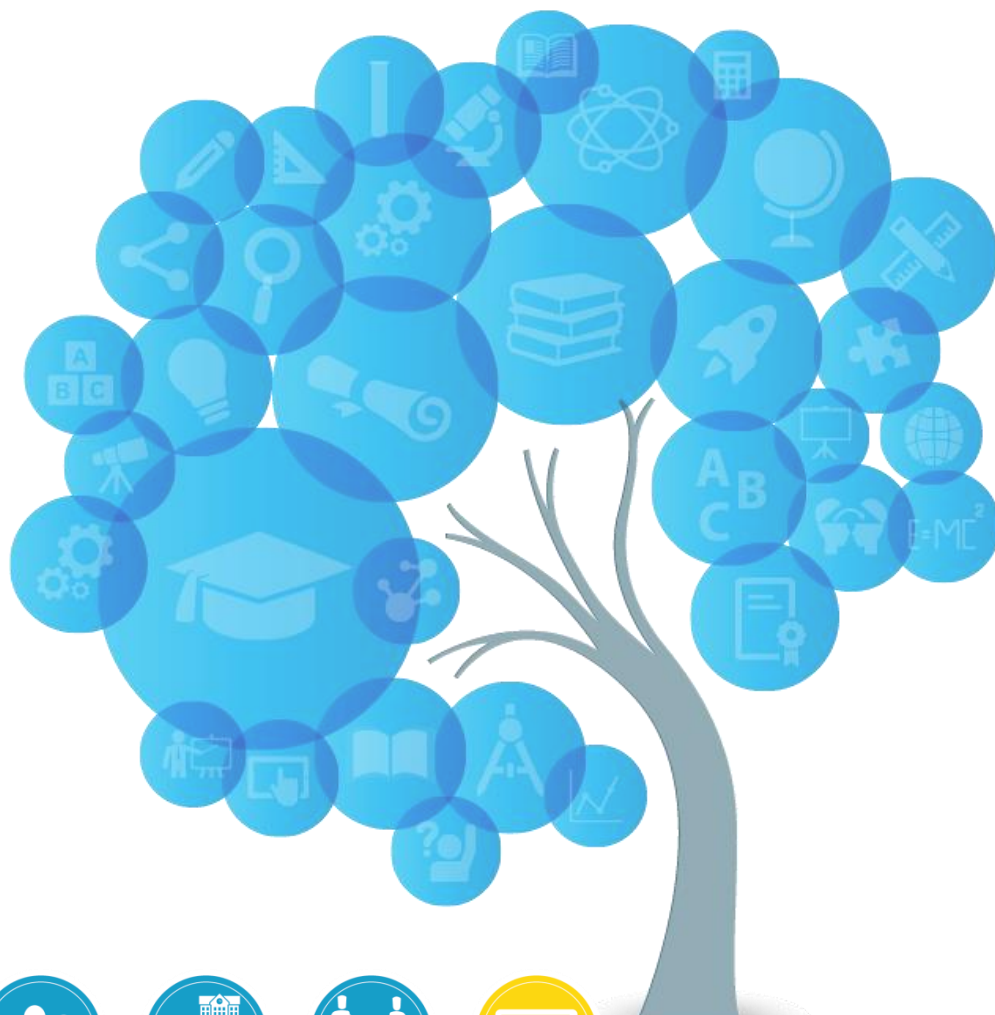




European
Commission



DRAFT

Key Messages on Artificial Intelligence in Education

Ljubljana 26-28 June 2019

Education & Training 2020 Working Group on Digital Education: Learning, Teaching and
Assessment

Education
and Training

In a nutshell

Defining Artificial Intelligence. Artificial intelligence (AI), sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and animals. Colloquially, the term "artificial intelligence" is used to describe machines that mimic "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving". AI is a current trend, but it is not a new concept and it can be traced back to work of Alan Turing in the 1950's.

Education for AI and AI for Education. There appears to be two dominant issues when talking about AI and education: 1) Education for AI, referring to the need to educate every learner and teachers about AI and its implications for everyday life, and the need to nurture and educate AI specialists and a pool of AI talent; AI for Education, referring to the AI developments that may be beneficial for improving teaching and learning practices. Many countries in Europe are on a journey when it comes to explore AI in and for education. There is a need to ensure that all in society have the requisite knowledge and skills to fully partake on this journey.

AI for all society. AI is an issue for all in society and not just for certain elite groups. It is affecting and having implications for every citizen. There is therefore a need to provide education on what AI is and on the consequences of its use for all citizen, because such knowledge and awareness is a mean to empower every citizen.

AI and teachers. While discussing about AI is important for society as a whole, it has a special relevance for teachers, both in terms of how they teach it and how it impacts on their work. Yet to date teacher voice has been lacking from much of the discourse around AI in Education. Involvement of teachers is central, however, the scope and added value of AI in and for education should be clear for all stakeholders. There is a need to ensure that teachers are knowledgeable about information technology and about AI in particular. Moreover, teachers should be involved in the development of AI solutions as to inform developers about their specific needs.

Educating about AI. There is no consensus on what educational systems should teach in relation to AI. When educating about AI, we should think about how AI is relevant for different education sectors and levels; from Kindergarten to Adult Education. AI within general education should be associated with teaching computing, coding, and computational thinking. General guidelines could help member States to tackle this issue.

AI in a lifelong learning perspective. It is important that all stakeholders, including industry and civil society, have opportunities to participate in education programmes around AI and this may require different approaches to upskill and reskill sectors of society whose lives could be impacted by AI now and in the future. This includes the provision of AI courses for those who need the knowledge, skills and competences to use it in new jobs, that may not yet have been created and also for those already in work, such as professionals in the fields of medicine and Law, who may need to reskill.

AI solution need to solve real education problems. There is currently a lot of hope and hype in relation to AI for Education, but all too often technological solutions are developed for problems or issues that were identified by technologists and not educators. The main areas where AI can contribute to education are: personalisation of learning; automation of domain-specific knowledge; tackling learning difficulties (e.g. dyslexia, dyscalculia, attentional disorders...) and automation of (large-scale) assessments.

Ethical implication of the use of AI in education are central. There is widespread agreement on the need to develop ethical guidelines on AI that are specific for education. Moreover, there is a need in education to have a clear vision and understanding on the use of data by AI systems.

Detailed Key messages

The 2nd PLA of the ET2020 Working Group on Digital Education: Learning, Teaching and Assessment (DELTA) was held in Ljubljana between June 26th and 28th 2019. The purpose of the PLA was to discuss and exchange experiences and opinions on Artificial Intelligence (AI) and its implications for education. The objectives of the PLA were to:

- explore emerging practices in AI developments for education;
- share current initiatives or plans in different member states;
- and contribute to the EC coordinated plan on AI.

The PLA was hosted by the Slovenian Ministry of Education, Science and Sport and our host for the PLA was Borut Čampelj. The PLA agenda provided a platform for a range of experts from academia and industry to share their views and emerging research in the field, while also providing members with opportunities to share their experiences. The PLA offered multiple opportunities for members to engage in discussion and to consider a number of key questions in relation to AI in Education. This short report captures the key messages that emerged from these presentations and the discussions that accompanied them. In introducing the PLA, it was noted that many countries are on a journey when it comes to AI in Education and that there is a need to ensure that all in society have the requisite knowledge and skills to fully partake on this journey. This metaphor of a journey dominated the PLA and several speakers returned to this idea during the 3 day event.

Defining AI and its role in education

A number of speakers noted that we need to be clear in relation to what we mean by AI and specifically in relation to its implications in education. Currently, much of the discussion around AI centres on *Machine Learning*, and there is still some way to go to reach true AI. *Colin de la Higuera* in his presentation stated that *in computer science, artificial intelligence (AI), sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and animals. Colloquially, the term "artificial intelligence" is used to describe machines that mimic "cognitive" functions that humans associate with other human minds, such as "learning" and "problem solving".* Furthermore, it was noted that though AI is a current trend, it is not a new concept and it can be traced back to work of *Alan Turing* and the term dates back to 1958.

Within AI in education there appears to be two dominant issues that need to be considered. They are:

- *Education for AI*, referring to the need to educate every learner and teachers about AI and its implications for everyday life, and the need to nurture and educate AI specialists;
- *AI for Education*, referring to the AI developments that may be beneficial for improving teaching and learning practices.

Much of the PLA focused on what implications these issues have for all stakeholders involved in education. Ultimately each country needs to define what AI means for them and their education and training systems. A number of countries have already begun this work by establishing groups to consider what AI entails for all aspects of society including:

- *General Education*
- *Higher Education*
- *Vocational Education and Training*
- *Adult Education*
- *Lifelong Learning*
- *Teacher Education*

However, it should be noted that we are still in the early stages of AI in education and there is still uncertainty about what constitutes AI and how we should teach it across all areas of education.

Need to involve all stakeholders in AI Education

A number of presentations and the subsequent group discussions noted that AI is an issue for all in society and not just for certain elite groups. There is a need to provide education on what AI is, because such knowledge is power and ultimately AI should belong to everyone. Decisions to be taken on AI should be understandable by all and everyone should have an awareness and understanding of the implications of AI in our lives. Finland has taken a lead on this issue and has created a MOOC, entitled [Elements of AI](#), by taking a systemic approach to AI. In so doing they are sharing knowledge and raising awareness on AI, while ensuring that everyone has an understanding of the topic and can enjoy the benefits of AI in their lives. The MOOC will be available in Sweden, Germany and Estonia in the near future. Other countries, such as France and Portugal, are also embarking on similar initiatives where they are developing MOOCs for teachers and these courses, while focused on educators, will be available to all.

While AI belongs to all in society, it has a special relevance for teachers, both in terms of how they teach it and how it impacts on their work. Yet to date teacher voice has been lacking from much of the discourse around AI in Education. A forthcoming handbook from the JRC¹ will put teachers at the centre of developing guidelines on AI use in Education, thus giving teachers a central role in shaping the use of AI within the profession. In this way JRC wants to co-create the future of AI in Education with teachers. The member states highly appreciate the guidelines issued by the JRC but in this context the member states expressed their concern that in terms of AI it is too early to put the focus of creating the path for and of AI on teachers while in general terms the concept and content of AI in education is still to be figured out by the AI experts as well as researchers. Sufficient research needs to be carried out before introducing AI as a concept into mainstream education. Member states expressed that such guidelines/handbook has to rely on research and not put the experimenting role on teachers.

It is important that all stakeholders, including industry and civil society, have opportunities to participate in education programmes around AI and this may require different approaches to upskill and reskill sectors of society whose lives could be impacted by AI now and in the future. This includes the provision of AI courses for those who need the knowledge, skills and competences to use it in new jobs, that may not yet have been created and also for those already in work, such as professionals in the fields of medicine and Law, who may need to reskill. Undoubtedly AI has the potential to impact on many aspects of society and therefore careful consideration needs to be given to how countries upskill certain sectors within society to use AI within their work. This will require a range of learning offerings to meet the unique needs of each cohort. This is not only a matter of education and training but includes the full roadmap of AI in industries – countries need to look at the skills set in interoperability with their investment plans, tax policies, and other policy areas.

Education for AI

There are significant initiatives taking place across Europe to teach AI and to prepare future and current generations to work with AI. It was noted that this is a '*young topic*' and one that is still evolving. There is no consensus on what educational systems should teach in relation to AI, as it is constantly changing and today we are primarily talking

¹ The Joint Research Centre of the European Commission.

about Machine Learning. Thus, when educating society about AI, we should think about how AI is relevant for different education sectors and levels; from Kindergarten to Adult Education. AI within general education should be associated with teaching computing, coding, and computational thinking. A number of countries presented that they have such programmes, with Austria using [Lego WeDo](#) and [Bee-Bots](#) in the early years and programmes, such as EDLRIS - [ECDL for Robotics and Intelligent Systems](#), for adult learners. But others suggested that this is not enough with Colin de la Higuera suggesting that systems should also consider teaching topics such as Data; Randomness; Coding and computational thinking and Critical thinking. DELTA members suggested that in addition to these topics education systems also need to consider how/if we embed AI as a tool into the development and assessment of Key Competences.

Those in attendance were of the view that the European Commission could help in this area by developing an AI Framework, similar to existing digital frameworks, such as [DigComp](#) and [DigCompEdu](#), to ensure a **coherent understanding** among member states on the expected skills, knowledge and attitudes related to AI on different education levels.

While it is acknowledged that the Education for AI programmes will expand and evolve in the future, such assistance would greatly help ministries plan and develop appropriate education programmes. It was also noted that there is a need for research on AI for education. The [European Commission](#) has undertaken a mapping activity to identify AI related courses in member states and this work to date has focused on Higher Education institutions. Though this work has proved challenging to complete, others have suggested that it needs to be expanded to include General Education and VET courses. While a course may not focus exclusively on AI, it may contain elements of AI that may not be included in any such mapping exercise. Therefore, the creation of a framework, that includes hard and soft skills, and that embeds AI in digital competences would be most welcome. Such a framework could suggest what learners should know and be able to do in relation to AI at key milestones along their education journey. Some countries are already creating such frameworks, as in the case of Austria (see Figure 1 below), but there was a view that this should also be conducted centrally at an EU level.

Main goals

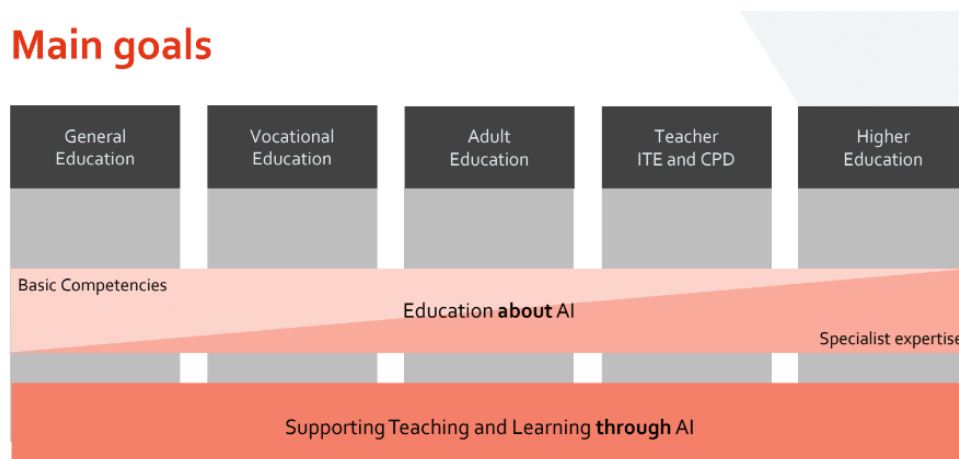


Figure 1, Austrian AI programme

There is a need to ensure that teachers, right throughout their professional lives, are educated about Information Technology in general and AI in particular and thus there is a need to address this in initial teacher education programmes and in continuous professional learning programmes. An AI framework would also assist countries in this area by suggesting content and skills that could be included in such programmes. In Education programmes development, consideration should be given to the final aim of an education about AI. Policy-makers and programmes developer should focus on the implication of this programme for fostering consumption of AI or on developing citizens to be producers of AI to predominantly meet industry needs.

In reality there we will need to design programmes that meet both of these needs and inevitably there will be commonality across countries in relation to what and how these programmes are offered.

Potential of AI in Education – AI for Education

The question of what impact AI can have for Education is another major issue. AI is already transforming the work of other sectors, such as transportation, health and manufacturing. Within education there is emerging evidence that AI can also have a positive impact on the lives of teachers and of their learners. During the course of the PLA numerous contributors highlighted areas such as: personalisation of learning; automation of domain-specific knowledge; tackling learning difficulties (e.g. dyslexia, dyscalculia, attentional disorders...) and automation of (large-scale) assessments. While the JRC noted that today teachers are under enormous work pressures in terms of the amount of administration tasks they need to perform and that this is an area where AI might be able to assist them. There is growing evidence that teachers are over-worked and there is a hope that AI can reduce their workload and redress this trend. Some members, such as Flanders, are about to embark on research to explore if AI can help their teachers better manage their diverse classroom settings and undoubtedly similar research is also required in all countries.

There is currently a lot of hope and hype in relation to AI for Education, but many cautioned that we need to involve teachers centrally in such discussions and pilots. All too often technological solutions are developed for problems or issues that were identified by technologists and not educators. [Kati Clements](#) noted that we rarely ask teachers did they want such tools or solutions and such questions are vital if AI is going to be used to help teachers solve their problems and not those of others. Again Colin de la Higuera suggested that '*man + a machine*' is a better approach to solving some of these problems that just using a machine or a human alone. But ultimately we need to use AI to solve real problems in education and not just use AI for its own sake. Therefore, educators need to be at the core of such discussions and decisions.

AI for Education is strongly linked to the issue of teacher professionalism and the role of the teacher. The use of AI has implications for the work that teachers engage in and it also has broader implications for teacher unions and the ethical use of AI within education. The use of AI in education raises issues such as ethical use of data, learners' rights, data ownership. One of the important questions raised was how we can operate with AI that relies on personal data (for instance, learning analytics for adaptive learning) within the GDPR framework. Teachers and other stakeholders need to be aware of these issues and supported in using AI in ethically appropriate ways.

Members underlined the importance of the following objectives of AI for Education:

- *AI for personalised learning (student oriented approach/responsibility of student, SEN, supporting career counselling etc);*
- *AI for smart teaching (learning analytics, solving the problem of lack of teaching / shortfall of teaching competences etc);*
- *AI for effective administration;*
- *AI for policy design (governments, schools);*
- *AI for the quality of educational content (learning materials, curricula).*

Potential Challenges of AI in Education

While AI is certainly generating great excitement within education and other sectors, it also presents major challenges for education systems. These challenges need to be recognised and addressed so that education can avail of the potential benefits of AI. The JRC has identified the following major challenges:

- *AI can easily scale up and automate "bad pedagogical practices"*
- *(Neural) AI may generate stereotyped models of students' profiles and behaviours & automatic grading*
- *Need for big data on student learning (privacy, security & ownership of data are crucial)*
- *Skills for AI & implications of AI for new skills requirements*
- *Need for policy makers to understand the basics of ethical AI*

Those in attendance noted that AI presents a range of policy challenges and these include:

- *AI for education is a spill over from other areas, not purpose-built for education.*
- *Experts tend to be concentrated in the private sector and may not be sufficiently aware of the requirements in the education sector.*
- *Ethical and privacy issues*
- *Lack of research and good practice around using AI in Education*

There was widespread agreement that these issues are common to all DELTA members and that there is a need for supports such as:

- *Ethical guidelines specific to AI in/for Education*
- *International Research programmes on AI in/for education*
- *Facilitate communities of practice around AI in/for education*
- *Facilitate a common understanding on the skills/knowledge/attitude basic set for every citizen to be able to cope around and next to AI*
- *Provide recommendations on the knowledge/skills/attitude set for different education levels.*

When referring to the need to draw specific ethical guidelines, it was noted that such guidelines can be well framed by the European values, those that are foundational and stated in the treaties and those that are common to our European societies.

Others noted that much of the discussion around AI is coming from other sectors and that there is a potential shortage of expertise within education and training. This knowledge deficit is common across all stakeholders: policy creators; administrators; teachers; parents and ultimately learners. Therefore there is a need to address this knowledge deficit and to provide opportunities to develop the necessary expertise within the sector.

Need for AI in Education Action Plans in all countries and regions

Silvia Merisio, DG CNECT, informed the PLA that on the 10th of April 2018 all European countries signed a [declaration of cooperation on AI](#) and all countries are to submit a plan for AI by mid-2019. A number of attendees reported that while their countries are developing such plans they tend to focus on areas such as Health, Transport and Business while Education is not included. Some countries, such as Austria, Bulgaria and France, are developing stand-alone policies for AI in/for Education and there was agreement that all countries should engage in similar practices. It is clear that AI is not a major priority for education, as yet, in most countries but there is a need for plans to identify the problems that AI may address in education. Some suggested that there is a need to bring together experts on AI in/for Education, similar to the "[Group of 52](#)" experts exploring AI issues in general, so they can deliberate and provide specific advice on AI applicability within education. Ultimately the education sector needs to have a view on AI has for our sector and to ensure that we have a voice at a national and European level in relation to this topic. National AI plans should be holistic and not just focused on the future skills needs of employers and the potential role of education in solving these major challenges. While this is clearly a key focus for AI plans in all countries, it should not be the sole focus. DELTA members would like support from the Commission to begin to explore the key issues associated with AI. Some members have even questioned if we should have separate AI plans or rather should we embed AI within existing policies so as to address existing challenges within education and training.

Ultimately, it appears that countries need to ask **why** we need a policy for AI and once this is answered they should consider **what** content should be contained within it and **who** will it ultimately impact? Such a process needs to involve all the key stakeholders and it should be regularly reviewed to reflect the ongoing advancements in relation to AI. In so doing education is being proactive and providing ownership of this important issue.

Mapping AI to our Education Systems – Need for Frameworks

The PLA highlighted the need for the EU to better support member states in relation to AI and Education. There was a consensus that this is an EU wide issue and while some DELTA members are further along than others, there is a need and an opportunity for the Commission to support members. It was suggested that there is a need for a common framework around AI, similar to existing digital frameworks such as **DigComp** and **DigCompEdu** (especially regarding the research and impact). Members want assistance on both Education for AI and AI for Education. There is a believe that this could be done centrally, as all members are struggling with similar issues. As one contributor noted, this is a '*young topic*', and it is now timely to begin work on such frameworks so people can share their experiences, both good and bad, so all can learn from this.

Need for additional research and support

While there is tremendous interest in AI and its potential to help teachers and learners, many in attendance sounded a note of caution. Numerous contributors noted that the role of digital technology has often been over-claimed and over-hyped in education, while others commented that the use of AI is more advanced in other sectors and we now need greater research on its uses in education. While Flanders, France, Slovenia, Luxembourg Austria, and others are embarking on research projects on elements of AI in/for education, it was felt there is a need for greater research and support at EU level. Some felt that it is possibly too early to develop policies in this area and that instead we should be implementing a range of '*actions*', small research projects and learning from these, so that ultimately they will inform national policies in this area. There are a wide range of areas that require action and some of these include:

- *Personalisation of learning experiences*
- *Activation of learners*
- *Self-regulation of learners*
- *Provision of feedback directly to the learners [care]*
- *Activation of self-regulated learners*
- *Support evidence based policy making*
- *Provision of better foresight data [scenario settings]*
- *Detection of early school leavers - attempts to avoid dropouts*
- *Early warning systems for student behaviours*
- *Enhanced monitoring across education and training systems*

This list is not exhaustive but captures some of the areas where members believe AI can have an impact. However, there is a need to carry out research into these areas to see if AI can help education and under what conditions. The results from these actions should then be shared with all member states to enhance the quality of education and training right across the EU.