



8 December 2020
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Synthesis report

Context

We live in a world full of challenges and opportunities with increasing complexity and uncertainty. Advances in digital communication, artificial intelligence (AI) and biotechnology are fundamentally transforming the way we live as well as our status as persons, citizens, workers, entrepreneurs, and communities. The current crisis caused by COVID-19 highlights the urgency of charting possible futures of education. In these times of disruptive technological advances, it is especially important to reflect on how emerging technologies can influence education and education.

To support education policy and planning in the era of AI, UNESCO, Ministry of Education of the People's Republic of China (MOE China), National Commission of the People's Republic of China for UNESCO (NatCom China), co-organized the first International Conference on AI and Education (Beijing, May 2019). The conference resulted in the first international consensus on

AI and education, the Beijing Consensus. The Consensus reaffirms UNESCO's humanistic and ethical approach to the use of AI and preparing all people with the appropriate competencies needed for the future. To follow up the implementation of the Beijing Consensus, UNESCO, MOE China and NatCom China co-organized the online International Forum on AI and the Futures of Education (December 2020) under the theme *Developing Competencies for the AI Era*.

In the Forum, UNESCO International Bureau of Education (IBE-UNESCO, or IBE) organized the Parallel Session 1 on 8 December 2020, under the subtheme *Curriculum and textbooks in the AI Era*. The parallel session aimed to inspire participants to think deeply about the transformation of education and education systems, and in particular around curriculum related issues and textbooks, to unleash the potential of AI in education regarding supporting the development of personal, interpersonal, and social competencies in a disruptive changing context. The IBE Senior Curriculum Expert **Mr. Renato Opertti** moderated the session.

The IBE Director a.i. **Mr. Yao Ydo** delivered the opening remarks and highlighted the important role that AI plays in curriculum and content related areas. He strongly advocated that by undertaking a strong introspection around AI, integrating AI into curriculum could lay a foundation for a just, sustainable, and more inclusive human prosperity. The richness and diversity of human intelligence can steer artificial intelligence to better respond to the diversity, expectations and needs of learners in all circumstances, and thereby help significantly to enhance and democratize learning opportunities, processes, and outcomes. In light of moving forward to the hybrid digital curriculum modes, AI can facilitate the access and the use of platforms, resources and contents to personalize learning and crucially to ensure curriculum and pedagogical continuity as well as effective teaching, learning and assessment practices. In this context, the IBE envisaged to promote the Hybrid Education, Learning and Assessment (HELA) initiative in 2021, which aims to provide a conceptualized framework to mainstream AI as a cross-cutting axis to the post-COVID-19 curriculum transformation, with a focus of strengthening integration and complementarity between face-to-face and online learning to support all learners.

The session was attended by the following experts: **Mr. Philippe Jonnaert**, BACSE International – Bureau d'appui curriculaire aux systèmes éducatifs, Canada; **Mr. Aliou Sow**, Education, Textbooks specialist, Guinea; **Mr. CHEN Yunlong**, Vice Director, National Institute for Curriculum and Textbook Research, Ministry of Education, China; **Ms. Toyosi Akerele-Ogunsiji**, Social Entrepreneur in Data Science and Artificial Intelligence Education, Nigeria; **Ms. Raïssa Malu**, Director, Investing in People, D.R. Congo; **Ms. Mariana Montaldo** and **Mr. Emiliano Pereiro**, Plan Ceibal, Uruguay; **Mr. CUI Yunhuo**, Professor, Institute of Curriculum and Instruction, East China Normal University, China.

Guiding questions, lessons learnt and the way forward

With a common understanding of AI in education as a driver of curriculum transformation, the panelists shared their individual and institutional perspectives addressing the various dimensions of AI and Curriculum from ECCE onwards. The parallel session was therefore guided along four lines of enquiry: How can AI in education serve to enhance and improve learning

opportunities, processes, and outcomes for all learners? How can AI in education contribute to the development of learners' autonomous thinking, creativity, and resilience? What are main developments of AI in education with regard to personalizing education in hybrid modes of education, learning and assessment? How shall we reform curriculum to help learners obtain the competences needed in the AI era?

A synthesis of issues and ideas raised during the discussion is presented as follows: 1) AI as a window of opportunities for Post-Covid19 curriculum related issues; 2) The critical use of AI to support the production and dissemination of learning materials and on-line resources for in-person and distance learning as going hand in hand; 3) The critical use of AI tools to ensure inclusion, address diversity of learners' needs and customize learning and assessment; 4) How AI can contribute to hybrid teaching, learning and assessment.

1) AI as a window of opportunities for Post-COVID19 curriculum related issues

Digital transformation posed by AI on our societies shows that we need to have a profound reflection of its consequences. It is critical to think about the effective practices that we want to adopt to integrate AI in curriculum. It is necessary for us to have a general vision about AI, and treat AI like human intelligence.

Artificial Intelligence, according to Jean Piaget, is a scientific discipline, with an objective to create machines that will mimic human intelligence. The first research effort towards AI starting around 50 years ago is to develop a general theory of intelligence that applies to both human intelligence and artificial intelligence. The work of AI has evolved over time and has an impact on the way we understand cognitive processes and human behaviors that shape curricula. Nowadays, it is not possible anymore to adopt an approach solely based on old-fashioned theories. We have to integrate cognitive science when we think of AI. It has gone even further today that AI can serve as a support to human intelligence. However, AI can only be simulation of human intelligence and its cognitive processes, even if we can draw a parallel between the logical functions of artificial intelligence and of human intelligence. AI is autonomous but it has no conscious in the way that human brains have.

When it comes to curricula based on AI, we have to make sure that we develop an ethical approach, establishing strong links between artificial intelligence, human intelligence, and education. It is important to have teachers play active roles to enable learners to identify and create algorithms at early age. For example, in D.R. Congo, high school students have been invited to build algorithms in different disciplines. Here, adding new disciplines is not the key issue. What is important is how to integrate AI in curricula from the start following different disciplines. Understanding the software use in the classroom has a critical reflection on these programs. In order to integrate AI in the development of curriculum, we have to keep in mind several factors: curriculum based on a vision of citizenship; teachers' responsibility based on peer learning and experience sharing; curriculum has to be open, flexible, inclusive and evolving overtime; all AI tools has to be used to help learners prepare for a better future.

2) The critical use of AI to support the production and dissemination of learning materials and on-line resources for in-person and distance learning

- **Experience from Guinea: Have a coherent understanding of textbooks and curriculum in the AI era**

Given the fact that there is no general consensus of the definition of AI, the curriculum approach is more or less based on the idea of “digital era”. We should consider the following three factors in the approach of integrating AI into curriculum: 1) Digital literacy must be developed among students at all levels of education in order to grasp the issues associated with AI. It should start from ECCE onwards ; 2) Teachers must have a good understanding of AI and the consequences it may cause before introducing AI into the classroom; 3) Clearly identify the educational objectives for which the use of AI is useful.

Concerning the “triolet” composed AI textbooks and curriculum in Africa, we have to produce appropriate learning materials supported by pedagogical practices. The operationalization of any curricular reform necessarily involves the timely planning of the educational materials (especially textbooks), which should be consistent with the pedagogical objectives, as well as the training and professional development of teachers. This exercise requires ongoing consultation with other partners in education, particularly schoolbook publishers. However, the latter, who are supposed to design textbooks in support of curriculum reform, are generally not involved in the general process. The same thing happens to parents and other stakeholders in the educational community. Learner-centered and competency-based curricula require textbooks that assist the teacher in co-developing this pedagogy for competency development in learners. Unfortunately, many of the textbooks in use do not actually help in achieving this goal. In addition, the production of new textbooks or the revision of existing paper-based textbooks takes time, keeping in mind that the process must be undertaken in a timely manner. In the curriculum implementation phase, countries may easily find themselves in one of the following situations:

- i. Teachers has been trained and they have material (ideal scenario)
- ii. Learning materials are available but teachers are not well trained
- iii. Teachers have neither training or materials

How can AI bring new perspectives in the production of educational materials that are adapted, effective and easily usable in the current African school context? This is not easy to answer, given the major economic and technological challenges that most African states are facing now. Based on the experiences over the last decade, we can say that we are not starting from scratch and that innovative models can be envisaged, evolving alongside existing models. Examples include: *Initiative un élève un ordinateur* (One laptop per child) in Rwanda, from 2014 to 2030; *Cartables numériques Qelasy* in Côte d'Ivoire; *Tableau numérique interactif* (TNI : projet Sankoré) in Sénégal.

Facing the covid-19 pandemic, African education ministries have taken the responsibilities of establishing online education systems in a short time. For example, the virtual library called BELUGA was developed upon the request of the UNESCO Abuja Office. It shows concretely how such AI tools can be used in education by students, teachers, school supervisors, and parents: <https://beluga-edu.org/index.php/fr/>.

- **Experience from China: Key experiences and considerations of curriculum development and reform in China in the AI era**

Only constant curriculum reform can enable education systems to adapt to the digital era. There are three considerations on how curriculum reform should be carried out in the AI era.

First, revise the curriculum in a timely manner and showcase the features of the time. For basic education, curriculum plan (according to which the country cultivate the talent), subject standards (which describe the academic requirements for talent cultivation) and their effective implementation are crucial for curriculum reform. We need to restructure of the subjects and appropriately add new Information and communications technology (ICT) related courses. These ICT courses can be delivered either separately or together with other subjects. For example, in China's senior high schools, ICT courses and general technologies courses are set up separately to build capacities in coding, data management, technology design and AI. This is because besides ICT courses, you can also find the competences required by AI in Mathematics (statistics, modeling) and Moral lessons (IT ethics).

Second, it is important to leverage the power of AI to create new forms of textbooks. Textbooks are not only important instrument for teaching and learning, but also a symbol of values that a country or a nation believes in. Thanks to the development of AI, textbooks have taken a new digital form that brings together the content of paper textbooks, digital teaching materials, and IT tools. As a result, textbooks, practices, videos, and audios are available through online platforms such as teaching and learning Apps. All these mentioned above are promising advances using AI in textbook development.

Finally, cultivate the core competences posed by AI to prepare learners for the future. We need to prepare students for the unknown realities through education, as they will all become the citizens of the future. It is important for students to be able to solve complicated and practical problems to address competently the challenges of the digital era. In the era of AI, digital literacy will be among the core competences that students must have. In China, senior high school students are required to take Math and ICT courses to develop core competences through mathematic modeling, data analysis, awareness of computing, engineering, etc.

3) The critical use of AI tools to ensure inclusion, address diversity of learners' needs and customize learning and assessment

- **Experience from DRC: Education solutions using AI are real opportunity for DRC**

In the Democratic Republic of Congo (DRC), a holistic reform of the education system is under way, taken by the Ministries of Education. This is a six-year project (2016-2021) financed by the World Bank to the tune of 200 million USD. This project has two objectives: (i) improving the teaching and learning of mathematics and science at the secondary level and (ii) enhancing the relevance of technical and vocational education in the priority sectors of agriculture, extractive industries, construction, and public works.

In the dimension of improving the STEM/AI discipline, DRC is trying to modernize education programs, to provide education that makes sense to the students. It is within this framework that we have opted for an intelligent learning assessment system to measure student performance in real time and offer automated remediation solutions. The solution adopted is called Math Whizz, a virtual tutor developed by Whizz Education. The virtual tutor in the program can simulate the behavior of a human teacher, then each student can have a learning experience that responds to his or her specific needs. This virtual tutor can also sense the cognitive problems, for example, if students understand the questions, or how much time they need to finish exercises. The tutoring begins with an initial diagnostic assessment, which matches to the difficulties and progress bar of the programs. MOEs aim to build a balanced program so that each student can develop themselves and find out what benefits them. Once students have learning challenges, the virtual tutor can guide them to identify the gaps.

The platform is currently being tested in 20 schools in 6 provinces of the Democratic Republic of Congo. It generates qualitative and quantitative data of learning processes that can help teachers assess the implementation of the program. Teachers are involved in this process as well. After some initial orientation sessions, teachers can conduct the baseline assessment to continue using the Maths-Whizz Tutor to improve their mathematics knowledge. By using it regularly, learning progress expected to be done roughly in two to three months can be achieved in one month.

The team are now completing the phase of the initial evaluation of the students' learning, but the use of the virtual tutor in these pilot schools has already led to a significant increase in the number of students enrolled in the science stream, especially girls. Learning mathematics is becoming fun and attractive for students. To conclude, this pilot experiment allows the DRC Ministry of Education for the first time to have real-time data at the levels of teachers and of students in order to take actions. It is important for DRC where education resources are scarce in terms of infrastructure, internet, and electricity. This experience shows that education solutions using AI are real opportunity for DRC and for Africa to accelerate its human capital.

4) How AI can contribute to hybrid teaching, learning and assessment

- **Experience from Uruguay: Three questions and five points concerning AI and education**

There are three questions that help us to think prospectively about the continuity in education in the AI era:

- i. What opportunities are we providing for students and teachers if we use AI? Pedagogy should be at the center of this reflection, not technology. In the pedagogical model, we shall think about how AI could help us to provide continuity in education and adaptivity for personalized learning, such as Math courses.
- ii. For policy makers, what are the implications and bias of using AI for education policy design? How to address this issue in the classroom? It is important to pose this question and to work around digital citizenship in the 21st century to develop the skills and competences required.
- iii. How to design relevant in-service teacher education and professional development? For teachers, AI is a great ally to process the evidence, but we have to train teachers and policy makers to understand the process to make right decisions.

In addition, there are five points about the AI's contributions in the futures of education:

- i. AI can automate administrative tasks for teachers. By using AI, teachers can emancipate themselves from admin tasks and therefore have more time to spend with each student. There is a great potential for AI to play an active role in the school management process.
- ii. AI can help in differentiating learning. Previously, it was impossible for 1 teacher to manage 30 students in a classroom. AI can help provide personalized feedback to students from primary school level onwards. It also provides an opportunity to customize curriculum for each student.
- iii. AI can support the virtual class room.
- iv. AI can help make classrooms available to all.
- v. AI can help learners understand the world and envisage the future.

- **Experience from China: Curriculum form transformation and curriculum implementation innovation in the AI era**

AI is believed to be the strongest driving force to push forward technological and industrial transformation. The scenarios where AI can be applied to education involve: smart tutoring; microteaching; adapted learning; immersive learning, automatically assessment; classroom assessment, data informed decision making and smart governance. Here are three trends shaping the future of education.

First, the era of AI does not mean we transfer human intelligence into artificial intelligence. We need to train learners to control and develop AI. In order to achieve this goal, we have to ask ourselves a fundamental question: what kind of people are needed in the future? What are the core future competences?

Second, there is a shift from “education for all” to “tailored education for all”. In the AI era, traditional subjects have been breaking down into silos across subjects through thematic areas. Through automatic scheduling, we are able to offer diversified selective courses to students.

Finally, the combination of “Learning + Data” will be a sign for the future pedagogical practices. Time changes as well as themes. In the era of philosophy, the theme is about how to teach; in the era of psychology, it is about how to learn; in the era of AI, it is important to move beyond the pure study center. Learning produces data, and data helps to improve the learning process.

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