The arrival of AI in education in Latin America: under construction
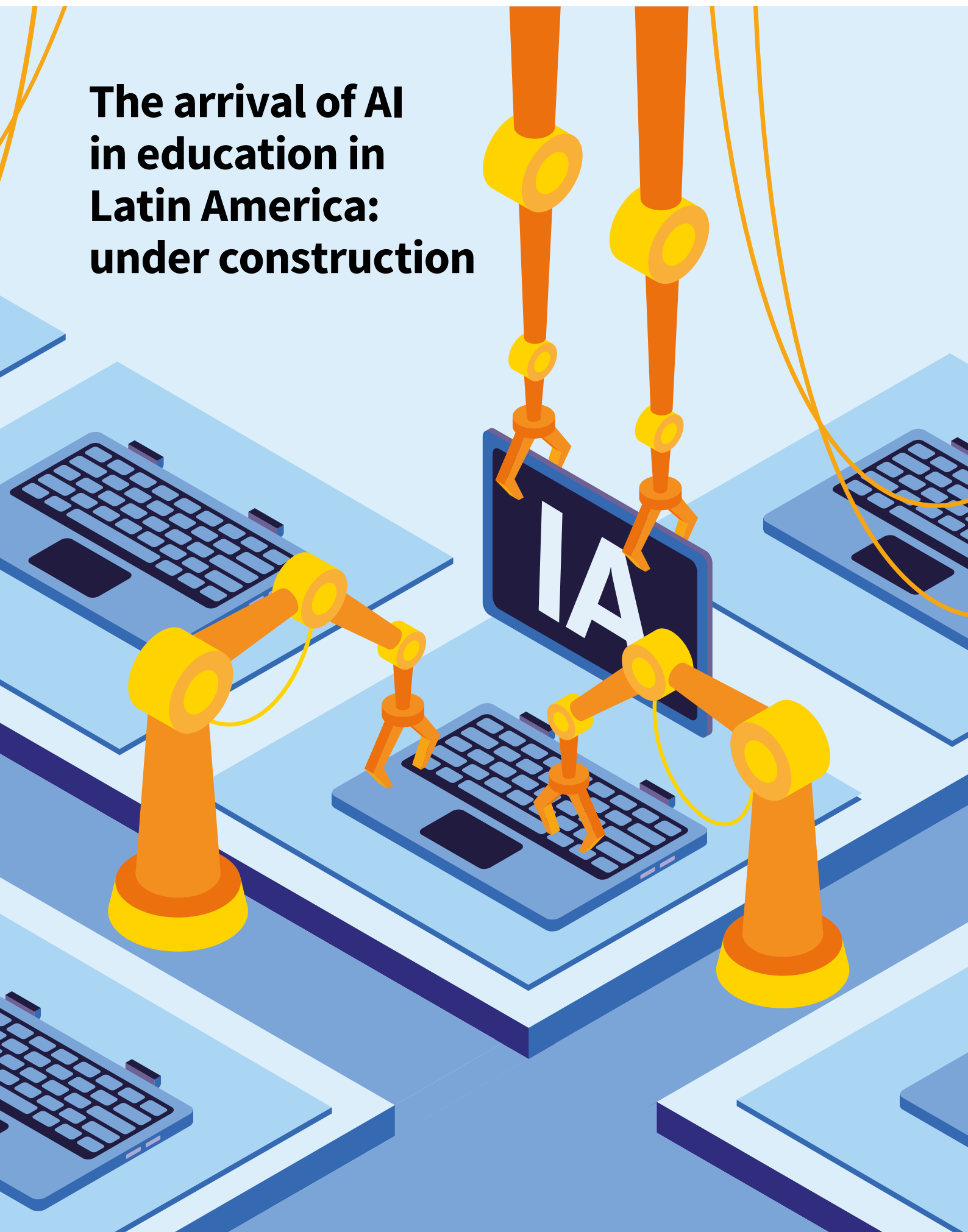
Cooperación Española

Explanatory note: In this document, care has been taken to avoid sexist and discriminatory language. In those cases where the masculine generic is used as a term for groups of people of both genders, please note this clarification.

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PRESENTATION //

Magdalena Brier.
Director General of the ProFuturo Foundation

Mariano Jabonero.
Secretary General of OEI

The Organisation of Ibero-American States (OEI) and the ProFuturo Foundation reaffirm their commitment to educational transformation in Ibero-America through this new research, which is a continuation of a previous study carried out jointly in 2023 on the future of artificial intelligence (AI) in education in Latin America.

This topic, of particular relevance for both institutions, is addressed in greater depth in this report, based on the mapping of initiatives using AI that have emerged in Latin America, a comparative analysis with the main initiatives underway in other countries and recent studies related to the subject and, finally, the analysis of some of the main challenges and opportunities that AI presents for the region's education systems.

This report is of unique value: it offers a mapping of initiatives that, with its limitations, has not previously been undertaken in Latin America. Although similar efforts exist in other geographical contexts, this work represents a novelty for the region and opens the door to more in-depth and collaborative research in the future.

This research has also allowed us to investigate both the benefits and risks, as well as the barriers to implementation of AI in education management. We believe that with its publication we contribute to the necessary reflection and debate in which all those who seek to integrate AI into their education practices must participate, with the aim of ensuring a more impactful and quality education for all.

In the presence of a new technological era, Latin America is at a historic crossroads in the field of education. AI emerges as a revolutionary tool with the potential to radically transform the region's educational systems, offering innovative solutions to long-standing problems and opening up new avenues for learning and development. But at the same time, this potential is accompanied by significant challenges that require careful consideration and a strategic approach for effective implementation.

Ibero-America, with its rich cultural diversity and complex socio-economic realities, presents a unique scenario for the integration of AI in education. The region has experienced remarkable progress in educational coverage in recent decades, but still faces considerable obstacles in terms of quality, equity and access, especially in rural areas and vulnerable communities. The digital divide, the lack of technological infrastructure and the lack of digital competencies among teachers are some of the challenges for the widespread adoption of AI-based solutions.

In fact, we risk experiencing a reverse phenomenon with AI: increasing exclusion of those regions that could benefit most from these technological advances.

One of the conclusions drawn from the research findings is that Latin America remains relatively untouched by both risks and opportunities. With few exceptions, the process of AI adoption in Latin American education systems is very limited. This situation raises the need to open our eyes to a reality that could consolidate a permanent exclusion of the region in the new global digital order.

And of all the reflections the author shares in these pages, we would like to highlight some that are particularly important to both institutions:

The first is the need to recognise that many forecasts about the future of education do not adequately consider the social role of schools, beyond the mere acquisition of instrumental learning. In this sense, we fully agree with the allusion to the strategic importance of strengthening teacher training in digital skills and computational thinking, both for practising professionals and those in training. And we join in the concern that the use of technologies in education, such as AI, may represent in some contexts, a "second quality" option aimed at the poorest and most disadvantaged sectors, who are offered a cheaper and depersonalised alternative to face-to-face teaching.

The second aspect we would like to highlight is the fundamental role given to funding, both public and private, in the education sector, as well as the need for adequate infrastructure to create the conditions that will allow the region to develop autonomous and contextualised capacities in the field of artificial intelligence. Beyond the challenges and risks, we continue to advocate for the integration of AI into Latin America's education systems, as it represents an unprecedented opportunity to address historical inequalities and prepare new generations for a digital future. While we understand that the success of this transformation will depend on a collaborative approach involving governments, the private sector, educators and communities. Only through concerted efforts and strategic partnerships can we ensure that the benefits of AI in education reach all students, regardless of their socio-economic background or geographic location.

Finally, we would like to thank the author and the coordination teams of this study. This research is another example of the excellent relationship and institutional collaboration between OEI and the ProFuturo Foundation, both of which have long been committed to promoting significant changes in the education sector in Ibero-America. Both organisations are actively involved in reducing educational inequalities in the region, and we are sure that the richness of this analysis, together with the initiatives compiled, will be an inspirational and reference tool for the different actors in the education sector who face the challenge of integrating artificial intelligence into their work.

INTRODUCTION //

Suddenly the era of intelligent machines. The tipping point in the adoption of Artificial Intelligence (AI) arrived in November 2022 with the launch of ChatGPT. Accelerated advances made science fiction become reality. Humans chat or talk directly to machines. These are increasingly fluid, deep and varied dialogues. AI has become creative in multiple languages: text, image, video, programming. A stream of synthetic content begins to navigate the digital tide and, just as societies are adapting to a new world, education is beginning to explore the age of AI.

This paper focuses on situating these transformations in Latin America as a process **under construction.** The arrival of AI in education is a multifaceted and dynamic phenomenon. Here we will try to capture the first initiatives that are being developed in the region in order to understand the directions, rhythms and meanings of these changes. In light of these developments and those coming from other countries, we seek to open up questions about what is at stake at this turning point.

The region faces enormous educational challenges and the urgency of post-pandemic learning recovery (Unesco, 2024). Inequalities and structural poverty coexist with teaching practices. Policy discontinuity and resource constraints limit the scope of education. In this complex context, can AI be a source of educational improvement and transformation? Or is it just another promise, like so many that digital technologies have generated in recent years?

"The ability of AI to perform cognitive tasks has increased exponentially in recent years. In particular, learning and problem-solving capabilities have been boosted, with technological innovations such as machine learning, natural language processing and neural networks (Jo, 2023)".

To address these questions, we begin with a few brief definitions. According to the OECD (2023), AI is a machine-based system that, by explicit or implicit goals, infers from the information it receives how to generate outputs based on predictions, content, recommendations or decisions that can influence physical or virtual environments. AI is a set of sciences, theories and techniques whose purpose is to reproduce by means of a machine the cognitive abilities of a human being (Council of Europe, 2024).

In the field of education, the impacts of AI have long been felt. Some classifications indicate that AI has differentiated developments inside and outside the classroom, with applications promoting autonomous learning in educational systems and platforms closely linked to schools and teachers (Pons, 2023). Other studies differentiate the roles of AI for educational administration, for teaching and for learning (Chen et al., 2020).

Some of the main applications of AI include (Vicari et al., 2024):
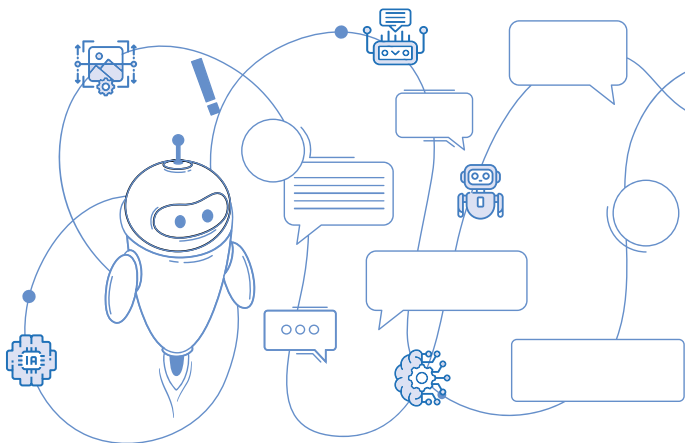
Natural language processing:
chatbots and voice recognition interfaces.

Machine learning:
systems capable of autonomous learning with a large amount of data.

Computer vision:
systems capable of recognising images.

Generative AI:
creation of texts, images and videos.

Intelligent robotics:
robots and autonomous vehicles.

These technologies can modify students´ learning experiences with digital tutors, assist teachers in their role as instructional designers, or create intelligent data management systems for decision-making (Homes & Tuomi, 2022). It is about developments that are only just taking shape and will change the direction of education systems in uncertain ways.

This document continues a previous study on AI in Latin America entitled *The Future of Artificial Intelligence in Education in Latin America*, in which specialists from the public, private and academic sectors were consulted in order to build future scenarios on the subject in the region (OEI and ProFuturo, 2023). This study opened up different questions on the subject and, in continuity with this work, the current study was designed to focus on AI initiatives underway in education in Latin America.

In this paper we carry out two phases. First, we conducted an empirical study to map AI in education in Latin America through an exploration of the different initiatives in the region, from the public, private and civil society sectors. The study presents a brief description of these initiatives and reports on four cases in more detail based on interviews with their protagonists. Secondly, the paper presents a state of the art of the possibilities and risks of AI developments in the field of education, analysing not only the cases detected in Latin America, but also the main AI initiatives underway in other countries and recent studies on the state of the art. The paper concludes by posing some challenges for this critical stage of building platforms, policies and algorithms that will define a substantial portion of the future of education.
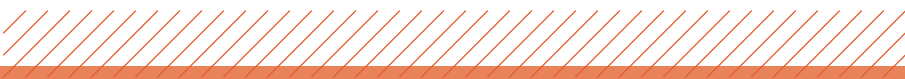
02.

What is happening in Latin America with AI in education?

This paper begins with a survey of initiatives using Artificial Intelligence in education in Latin America. The central purpose of this exploration was to find concrete cases of AI development in the region, beyond the existing use of platforms and applications originating from other countries around the world. Examples of initiatives that have emerged in Latin America were sought in order to analyse the current state of development of AI in education and the potential for the future.

The methodology for gathering information and selecting cases was twofold. First, a broad base of more than 200 digital education initiatives developed in Latin America in the last fifteen years (from 2010 to the present) was explored. This database was fed by a keyword search on the web and a selection based on previous mapping studies of digital initiatives in Latin America (World Bank, 2024; Soletic & Kelly, 2022; Salas-Pilco & Yang, 2022; IALAB, 2022).

Secondly, a survey was conducted with actors specialised in AI in education. The starting point for the sample was the database of references in digital education and educational technology in the region selected for the aforementioned previous study (ProFuturo and OEI, 2023), which is a direct antecedent of this document. A total of 63 academics and 57 private sector referents were consulted. An email consultation was sent to this group. A response was received from 14 academics and 17 leaders of theprivate sector, a total of 31 specialists in the field.

The consultation had two parts. The first part asked about initiatives that use AI in their technological developments in education in Latin America. Then we asked for specific references (more data on the concrete use of AI in each case and contacts for interviews) or went deeper in a second consultation on the experiences mentioned.

A total of 31 responses were received from specialists, with varying degrees of depth and systematicity, in order to identify ongoing initiatives in the use of AI in education developed in Latin America. The referents consulted are academic specialists in the field, developers within the private sector of digital education initiatives and key players in the areas of educational technology in the region's ministries of education. They were asked about specific initiatives that were previously selected in stage one of the methodology and others that were not mentioned in this first list.

This selection of cases is exploratory and not systematic, as each respondent has only partial information on the issue and many initiatives not surveyed may have been left out of the sample.

The complete survey allowed for a list of 26 initiatives that are using AI developments and solutions in education to be compiled. In order to classify the initiatives, the official websites of each selected case and some additional documents or references were explored. Each initiative was synthesised according to the functions that AI has in their developments and classified into categories based on their main function (several of the initiatives perform more than one function within the classification that was made). These categories were developed in order to synthesise the predominant themes and areas of AI impact in education.

Likewise, each initiative was sought to be created and launched in Latin America and the country of origin of development and operation was identified. In addition, the public, private or social sector origin of each initiative was analysed in order to classify them and the cases in which the initiative has a different name from the company or institution that developed it. The table summarises all this information.

Table 1 AI initiatives in education

Name of the initiative	Institution	Sector	Country of origin	Web	Category
TeeRead	TeeRead	Private	Argentina	https://www.teeread.com	Language learning
Musiglota	Musiglota	Private	Chile	http://www.musiglota.com/	Language learning
Leah	Leah AI Test	Private	Colombia	https://www.linkedin.com/company/leahai/	Language learning
Letrus	Letrus	Private	Brazil	https://www.letrus.com	Learning and proofreading assistant
Pontue	Pontue	Private	Brazil	https://pontue.com.br/	Learning and proofreading assistant
Geekie	Geekie	Private	Brazil	http://www.geekie.com.br	Adaptive learning for exams
OE Saber	Operation Success Education Group	Private	Colombia	https://grupoeducativooe.com/saber/	Adaptive learning for exams
Escuela de datos vivos	EDVai	Private	Argentina	https://www.escueladedatosvivos.ai/	Job Skills Learning Assistant
Platzi	Platzi	Private	Colombia	https://platzi.com/	Job Skills Learning Assistant

Magnus learning	Magnus	Private	Colombia	https://manguselearning.com/	Job Skills Learning Assistant
Flex Flix	Competing Edtech	Private	Argentina	https://www.flexflix.tv/main?locale=es	Generation of educational content
Knotion	Knotion	Private	México	https://www.knotion.com/	Generation of educational content
HistoriA	Quinyx	Private	Brazil	https://play.google.com/store/apps/details?id=com.quinyx.historIA&hl=es_CL	Generation of educational content
Plataforma AZ	SEB Group	Private	Brazil	https://www.plataformaaz.com.br/	Generation of educational content
UmmIA	UmmIA	Private	Chile	https://ummia.cl/	Support for teacher planning
E-Valuados	Assessed IA	Private	Argentina	https://evaluados.ai/	Support for teacher planning
RDV.IA	Rivadavia	Private	Argentina	https://www.rvd.ai/	Support for teacher planning
Teachy	Teachy	Private	Brazil	https://www.teachy.com.br/	Support for teacher planning
IApptitudes	Apptitudes Foundation	Social Organisation	Chile	https://iapptitudes.com/	Support for teacher planning
Student Success	Uplanner	Private	Chile	https://uplanner.com/es/	Data management
Icapiedu	Icapiedu	Private	Brazil	https://icapiedu.com.br/	Support for educational management
Diccionario bilingüe de señas	Pontifical Catholic University of Peru	University	Peru	https://puntoedu.pucp.edu.pe/investigacion-y-publicaciones/investigacion/primer-diccionario-virtual-bilingue-de-lengua-de-senas-peruana-a-espanol/	Promoting inclusion and human rights
Quispe Chequea	Public Eye	Digital media	Peru	https://ojo-publico.com/4879/quispe-chequea-inteligencia-artificial-contra-la-desinformacion	Promoting inclusion and human rights
SEA+	ANEP	Public	Uruguay	https://sea.anep.edu.uy/	Adaptive assessments
Quiero ser profe	Choose to Educate	Social Organisation	Chile	https://eligeeducar.cl/quieres-ser-profe/	Support for education management
Sistema de Alerta Temprana	Ministry of Education of Mendoza, Argentina	Public	Argentina	https://www.mendoza.edu.ar/las-escuelas-secundarias-ya-pueden-acceder-al-sistema-de-alerta-temprana/	Support for education management

Note. Prepared by the author.

Some observations stand out from this survey. Firstly, several specialists consulted point out that there are still few experiences developed in Latin America that actively use AI in their digital education proposals, much less generative AI, which has had a very recent exponential development. The number of selected cases can surely be expanded with a more exhaustive survey, but in the process of searching for the two methodological paths, few initiatives were found in comparison with the impressive growth of AI in the international techno-educational market.

Many of the educational technology companies using AI are coming to Latin America from their home base, especially in the United States. This indicates that the development of AI for education seems to be concentrated, at least for now, in a few hands and in international companies originating outside Latin America.

Secondly, most of the developments found in the survey originate from the private sector. These are recent startups and, in some cases, initiatives initiated by educational companies with a long history. Some proposals emerging from the public sector focus on the development of early warning systems, but there is little AI momentum in other areas more focused on educational content for students and teachers.

The survey found very few cases of third sector and civil society developments. The necessary capacities and resources still seem to be beyond the reach of non-profit institutions.

And a final point. Looking at the map, it is evident that there are different levels of information. Some initiatives have detailed and clear descriptions, others are presented in a more brief or superficial manner. This disparity is not accidental, but reflects the "under construction" state of the sector, as the name of the study indicates. The heterogeneity of the descriptions shows the diversity of approaches and degrees of formalisation of the experiences.

It is important to note that the lack of findings is also a finding in itself. The absence of information in certain areas or themes reveals gaps in the state of the art and points to opportunities for further exploration. Through this research, it makes visible not only what is present, but also what still remains in the shadows.

The following is a brief review of the initiatives selected according to the different thematic axes developed to organise the findings of this study.

TeeRead
(Argentina)
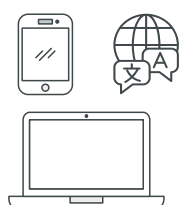
It is a web-based and mobile English language learning platform that uses AI as a tutor to help students with their reading level, comprehension, speaking, phonics, vocabulary and reading fluency. It offers reading and pronunciation exercises in a personalised manner through real conversations.

AI is also used as an enabler for a virtual currency system that offers to the student different rewards to redeem their assets according to the level at which they are placed in their learning.

Musíglota
(Chile)

It is a mobile application for learning English through interactive classes generated with the music that the user has on their device. Its development is articulated with the curricular contents of Chile.

The AI analyses song lyrics to provide interactive exercises that reinforce skills in reading, listening, pronunciation and writing.

Uses speech recognition AI to identify errors and provide feedback. It has two major functionalities:

- First, it interacts with the lyrics and the translation by detecting the pronunciation.

- Second, when a song is finished, it transforms it into an interactive lesson with exercises to complete.

It is offered to schools as a service with training and teaching materials.

Leah
(Colombia)
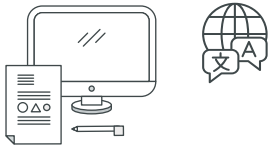
With an AI-based system, the platform:

- Assesses users' language skills quickly (in just ten minutes) and in real time.

- It generates a data dashboard to monitor the progress of users.

It is an initiative that seeks to be an ally for academies and schools that teach English.

It allows institutions to make data-driven decisions about their students' progress and offers nationally and internationally recognised certification based on the GEP English Exam.
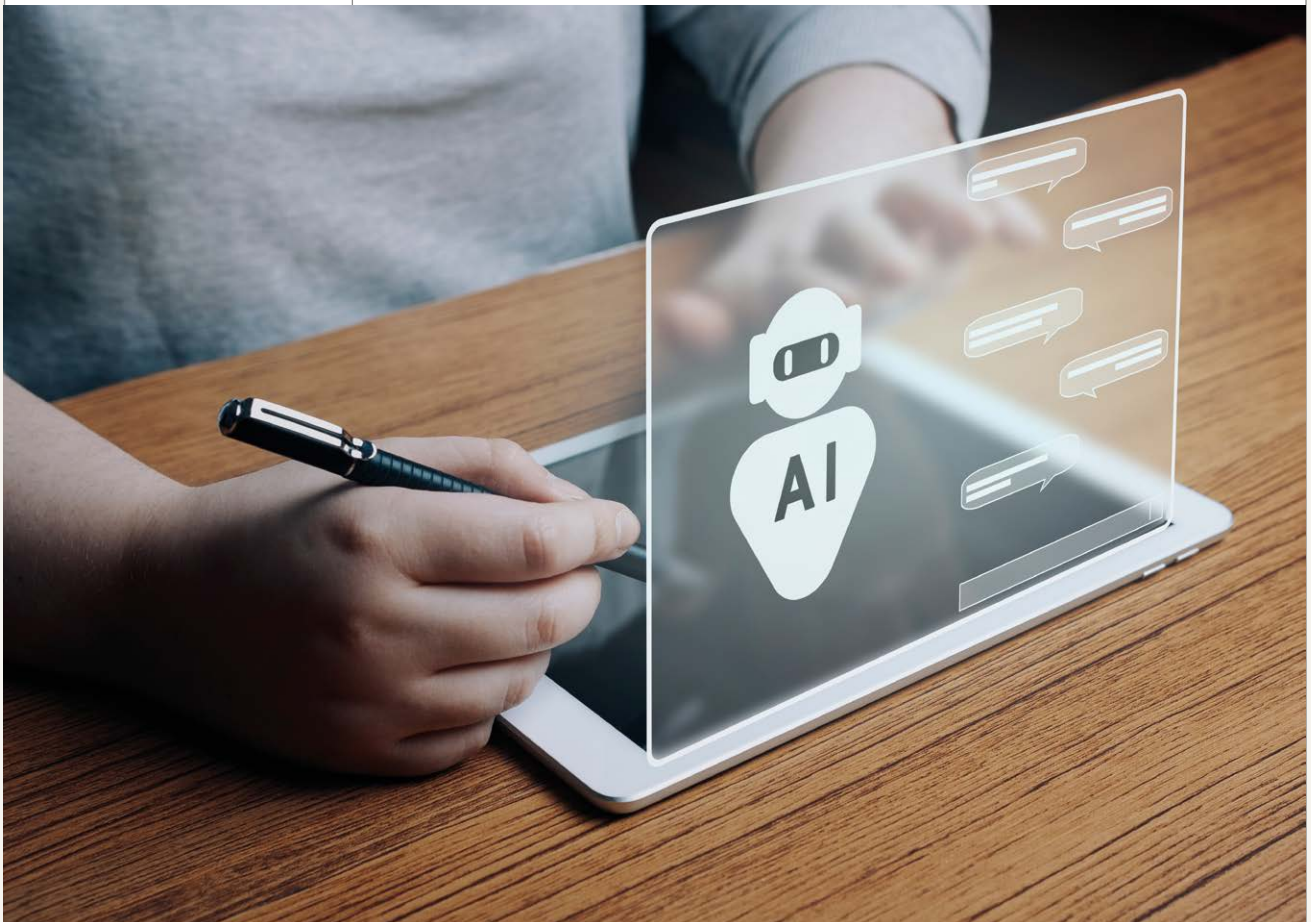
Letrus
(Brazil)

It is an educational platform that uses AI to improve the teaching and learning of writing in Portuguese. Its main objective is to help students and teachers develop more effective and accurate writing skills. It offers the following functions:

1. Writing assessment: analyses texts written by students and provides detailed feedback on aspects of their writing. such as grammar, coherence, cohesion and style.

2. Continuous improvement: offers personalised recommendations so that students can progressively improve their writing skills.

3. Teachers can use the Letrus tool to detect possible cases of plagiarism, evaluate their students' progress and adapt their teaching methods according to individual needs. The tool allows editing by the teacher, who can make his or her own comment and/or edit the one returned by the AI.

4. The Letrus tool generates reports and analyses to help institutions to better understand the performance of their students and to make informed decisions.

Pontue
(Brazil)
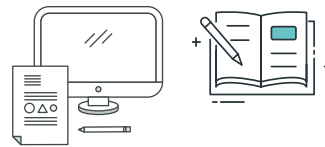
It is an educational platform that is specialises in the correction and evaluation of written texts in Portuguese. It uses AI to analyse and provide detailed feedback on students' writing. It offers the following functions:

1. Automatic proofreading: checks texts for grammatical, spelling and stylistic errors, offering suggestions to improve the quality of the writing.

2. Competence assessment: the platform assesses students' writing skills, helping to identify areas for improvement.

3. Personalised feedback: provides specific and personalised feedback so that students can learn from their mistakes and continuously improve.

4. Tool for educators: teachers can use *Pontue* to monitor their students' progress and adapt their teaching methods according to individual needs.

Geekie
(Brazil)

It is an educational platform that uses AI to personalise learning for students. It offers the following functions:

1. Personalised assessment: provides adaptive assessments that identify each student's strengths and weaknesses, allowing for a more personalised approach to learning.

2. Educational content: provides interactive and personalised educational resources that are tailored to the level and pace of learning of each student.

3. Exam preparation: helps students prepare for the ENEM higher education entrance exam by offering simulations and practice based on national educational standards.

OE Saber
(Colombia)
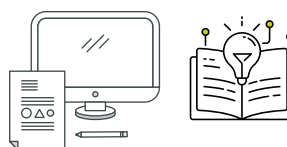
It is a platform to train students for the SABER 11 test for access to higher education in Colombia. The software uses AI-based algorithms to define a personalised study path for each student. This allows for accurate prediction of results and optimisation of learning.

The programme makes use of a short diagnostic test and a questions and content recommendation engine, which form a personalised learning pathway that guides the learner towards obtaining the highest possible score or result at the end of the process.

The application has an extensive bank of questions for each of the priority areas in the SABER tests, as well as lessons that address the relevant topics. This material will be unlocked and revealed to the learner as the application is used.

Escuela viva de datos
(Argentina)

It is a coding-house that offers AI-assisted data science courses in intensive mode with real-world practice ("bootcamp"). The initiative has an AI assistant (called "Athena") that guides the user through the learning path of the courses and offers help and code to solve the activities.

It is an educational institution specialising in teaching the latest technologies in the field of data and artificial intelligence.

It offers programmes geared towards the world of work, helping students to acquire the necessary skills to gain access to job opportunities in the data and AI sector.

Platzi
(Colombia)

It is a platform of online courses aimed at training professionals in web and app development, online marketing, interface design and servers. Its courses are set up as degrees with both compulsory and optional instances, oriented towards training for the labour market. It uses AI in two ways.

- First, with an AI assistant (called "Ada") that helps the user to define his or her best learning route and through a code assistant where routes can be customised (Platzi Bot).

- Second, through ChatGPT-style content generation, where learning paths can be personalised.

Using machine learning algorithms, Platzi analyses users' behaviour and preferences to recommend courses and learning paths that match their interests and career goals.

AI as a job skills learning assistant

Magnus learning
(Colombia)
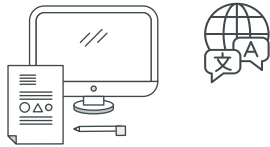
It is a platform for certifying skills through courses and activities.

It focuses on thinking-based learning, with an educational methodology that promotes the development of critical and autonomous thinking skills in students, beyond the simple memorisation of concepts.

The platform offers a catalogue of courses and the possibility to create tailor-made courses.

AI is implemented through a guide that provides recommendations on the next lesson, what course to take for the next skill, recommended resources and activities to participate in the community.

Flex-Flix

(Argentina)
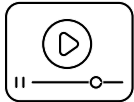
It is an AI-powered video on-demand (streaming) content platform for children and teenagers.

It has its own theoretical framework for content generation called "MIA" (Augmented Immersive Method). The videos created with IA contain virtual characters pretending to be streamers or youtubers for different age groups with content segmented according to formal curriculum subjects.

The platform integrates the concept of "virtual co-pilots", AI-generated virtual characters that accompany viewers, generating comments and reactions in real time.

Knotion

(México)
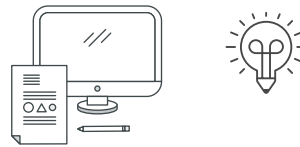
It is a transdisciplinary content platform to support students' learning, with an emphasis on the development of competences for global citizenship.

It has its own pedagogical model called IMPACT, which combines elements of Design Thinking for global problem solving.

It uses AI algorithms to analyse data generated from student interactions (completed assignments, study time, areas of difficulty and performance on assessments).

Based on data analysis, the platform adapts the educational content and activities proposed to each student.

KHistorIA
(Brazil)
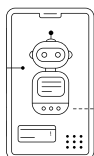
It is an application produced by the company Quinyx that uses AI to allow students to choose characters from the story and include them in different contexts to generate dialogues and approach the story in a more dialogical and creative way.

The application contains different stories to facilitate its use in the classroom and to adapt the content and activities according to the needs and pace of learning of each student.

Plataforma AZ
(Brazil)
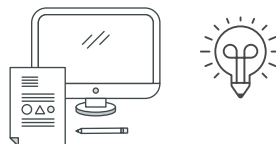
It is part of Conexia Educação of the SEB Group, which develops educational solutions for 400 schools in Brazil. The AZ platform uses a generative text model (called AzellA) to support the curriculum and provide pathways for students.

This technology is combined with the "Hibus" model, which provides immersive content in bilingual schools supported by generative AI.

The application allows you to create personalised weekly study plans and offer video lessons, exercises and assessments with immediate feedback.

UmmIA
(Chile)
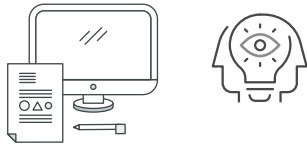
It is a platform designed for teachers that offers assistance in planning lessons and materials based on AI-based algorithms.

The lesson planner is called "UmmiaPlan" and allows you to create lesson plans by filling in a form.

It also integrates two other applications (UmmiaChat and UmmiaApps), for management tasks such as writing a letter to the school's legal representative, answering an email, creating a rubric, creating a mini-test or getting ideas for evaluation.

E-valuados
(Argentina)

It is a content generation solution for university teachers.

It is a learning management system that integrates as a plugin into other systems.

The student has an app from which he/she can access the content and activities that allow him/her to generate plans, activities and classes.

The teacher completes a form with the subject, number of students and other variables, and the application generates different assessment items and activities.

RDV.IA
(Argentina)

It is an initiative of the Rivadavia publishing company that uses AI to assist teachers in the design of their classes.

The platform enables the automation of key teacher tasks, fostering an interdisciplinary and collaborative approach.

The proposal includes ideas for creating lessons, AI content generation, specific adaptations of content, automation of oral and written assessments and continuous monitoring of student progress through a teacher dashboard.

It also integrates a chat that allows students to have personal conversations with an AI engine focused on educational content.

Teachy
(Brasil)

It is one of the largest platforms in Brazil that uses AI to assist some 300,000 teachers.

The initiative offers didactic planning to support lessons, exercises and evaluations. With a search engine aligned to the National Curriculum Base, Teachy compiles more than 450,000 learning materials.

One of the main proposals it puts forward is the possibility of reducing the time spent by teachers on marking tests.

IApptitudes
(Chile)
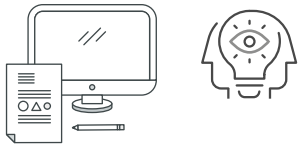
It is a proposal developed by the Apptitudes Foundation (a non-profit organisation) to achieve digital inclusion.

One of its most recent initiatives is the development of the "GUD Bienestar Docente" application. This AI-powered tool is designed to support the emotional wellbeing and professional skills of teachers who work with vulnerable students.

The technology is based on software specially adapted to the needs of schools, relativising dependence on the internet.

Primer diccionario bilingüe de Lengua de Señas Peruana
(Peru)

It was developed by an interdisciplinary team of the Pontificia Universidad Católica del Perú with the collaboration of deaf people and gathers 750 words translated from Spanish to the Peruvian sign language and 38 signs registered for AI detection.

The interdisciplinary work made it possible to approach the construction of the dictionary, from the recording, annotation and processing of videos up to the training of the AI model for sign recognition, the implementation of the model in the cloud and user flow evaluation with deaf people.

Quispe Chequea
(Peru)

It is a tool that uses AI resources to produce journalistic verification content in different formats and in up to three native Peruvian languages: Quechua, Aymara and Awajún.

It is a platform that automates the generation of texts and their conversion into audios to be broadcast by radio stations from different regions of the country.

The project was supported by the Google News Initiative and was developed by a team of journalists, technologists and translators and interpreters to combat misinformation affecting citizens and communities in the Andes and the Amazon.

Icapiedu
(Brazil)
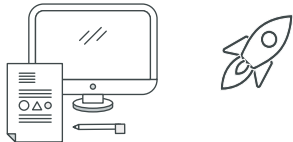
It is a startup focused on the development of the socio-emotional skills of pupils and tools to prevent bullying.

Among its strategies, it includes a platform with gamified stories for students to go through while AI-based software analyses the socio-emotional content to detect possible symptoms of bullying.

This is complemented by a multidisciplinary team that supports schools in the development of socio-emotional skills and bullying prevention.

SEA+
(Uruguay)
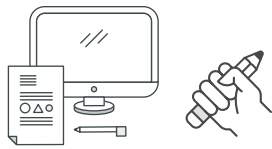
It is an adaptive platform for assessing the level of knowledge and learning of students in Mathematics, Reading and Natural Sciences.

In addition to the application of assessments and immediate feedback, the platform offers the possibility of formative feedback to students through functionalities such as group correction or the rubric.

Each student is presented with an initial activity and then the system proposes new activities of greater or lesser difficulty until their level of performance is identified.

This initiative is coordinated by the Research, Evaluation and Statistics Division of ANEP in Uruguay. For its development, an agreement was made with the Faculty of Psychology of the University of the Republic and the Ceibal Plan.
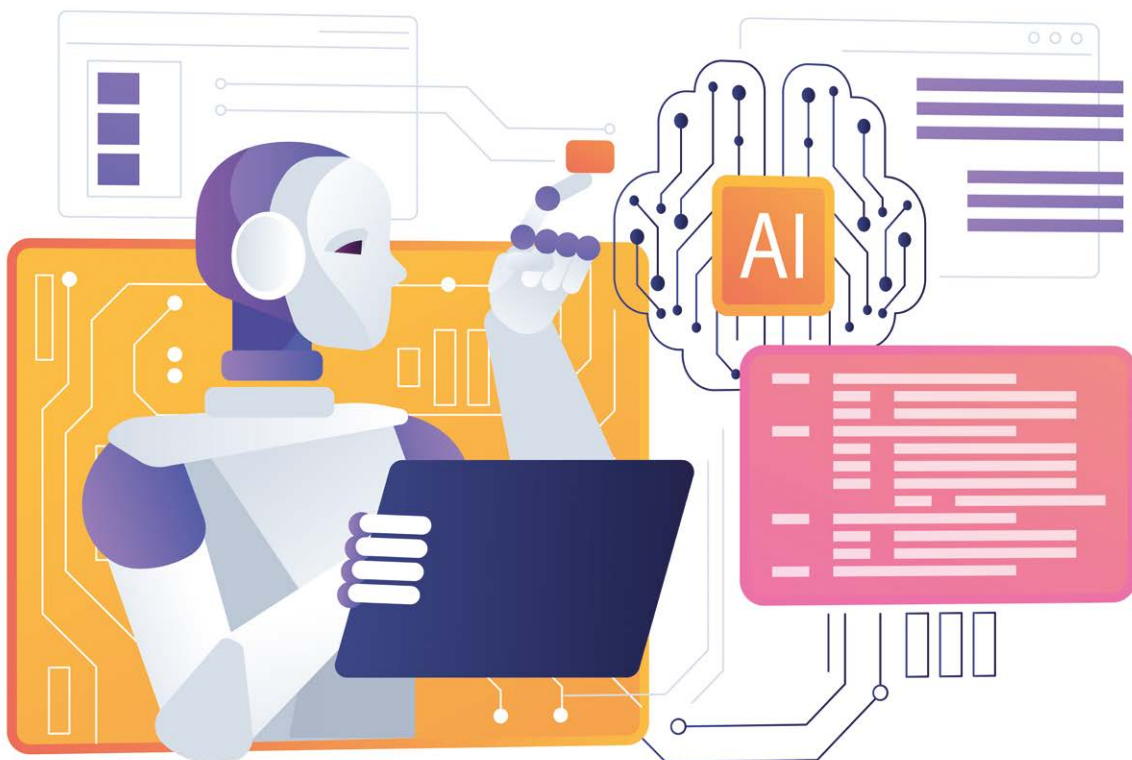
"Quiero ser profe"
(Chile)
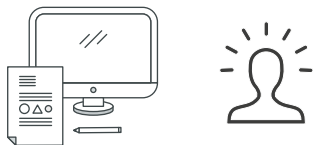
It was developed by the organisation "Elige Educar" in Chile and uses AI to improve teacher retention and recruitment.

The "Quiero ser Profe" programme uses pre-programmed chatbots along with human tutors to provide personalised information and feedback to students interested in pursuing a teaching career, helping them make informed decisions.

A similar project was developed in Ecuador in the "Quiero ser maestro" competition, with support from the Inter-American Development Bank.

Student Success
(Chile)

It is a support system for the management of academic institutions that focuses on the use of data to prevent student dropout.

The model, developed by the company UPlanner, uses predictive solutions based on automatic learning analytics.

This tool evaluates different types of information ranging from personal data, payment behaviours to academic results and makes it possible to generate predictions to prevent drop-outs from university studies.

Sistema de Alerta Temprana (Early Warning System)

(Mendoza, Argentina)
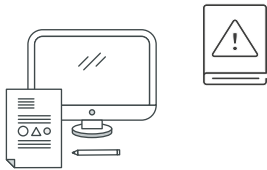
It was created by the Directorate-General of Schools of the province of Mendoza, Argentina, to detect situations of students at risk of dropping out of school.

It makes it possible to diagnose and make visible the real educational trajectories of students and to focus on those students who are at educational risk, activating the different networks to reorient and accompany them with resources and strategies to assist students and improve their educational quality.

AI analyses patterns in student data and generates early warnings that are sent to school supervisors and management teams.

These warnings include guidance to address the specific needs of each at-risk student, allowing for personalised and effective intervention.

In Latin America, there are other early warning systems that use AI to manage data on students' educational trajectories. Some outstanding cases are those of Uruguay, Jalisco in Mexico or Cordoba in Argentina.
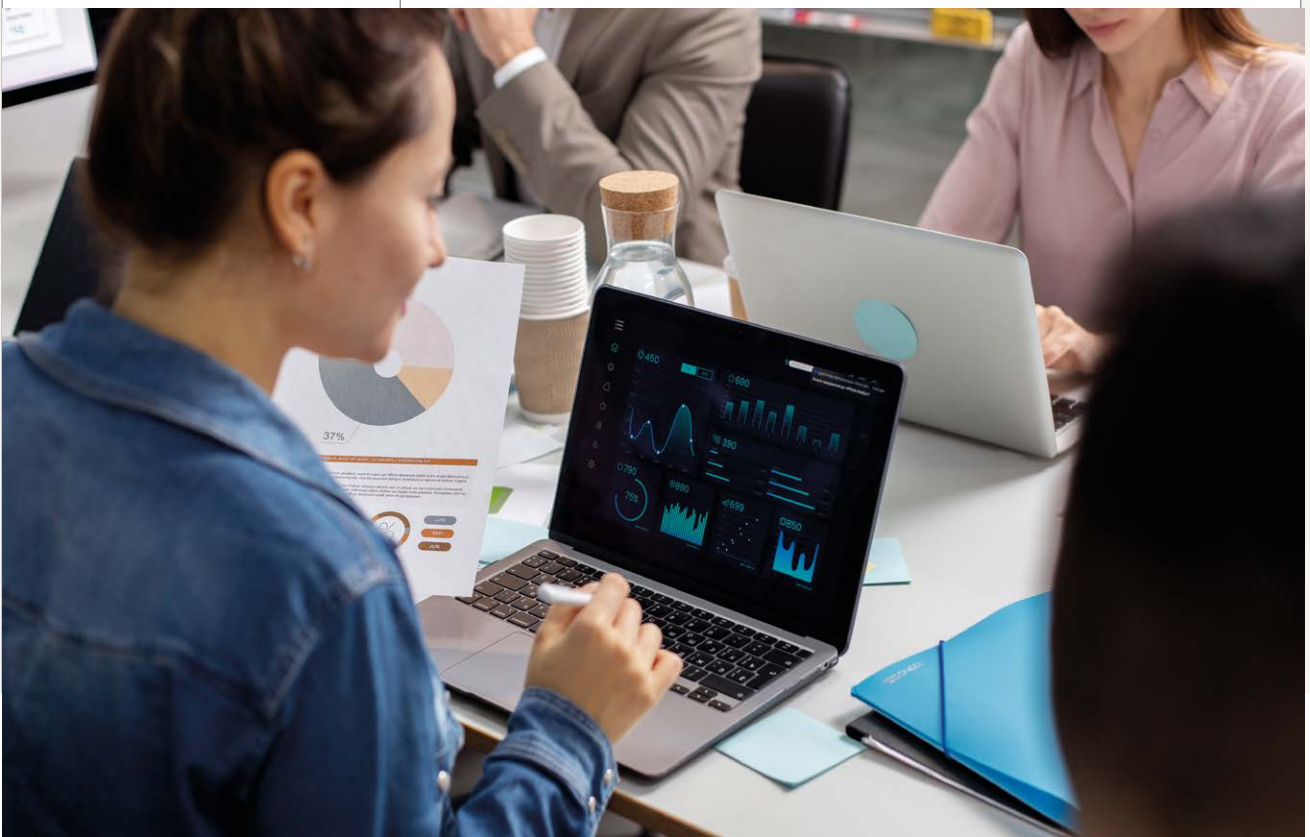
An example from the education system: the Robotics School in Misiones, Argentina
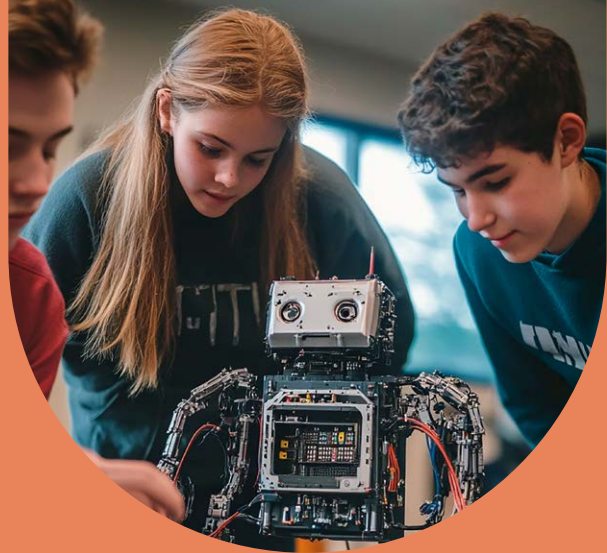
The vision of the use of AI in education presented in this paper is more focused on large-scale developments by companies and other organisations. However, the potential that digital technology opens up for appropriation by different actors in the education system should also be explored. Here, a concrete experience is presented that was surveyed in more detail in the province of Misiones, Argentina.

The Robotics School was born in 2017 as part of a series of proposals to renew the educational perspective in the province of Misiones, Argentina. It is a state-run public school. Its focus on technology was developed through the teaching of robotics and programming, in combination with key topics such as renewable energies for sustainable development and socio-emotional education. Teaching is centred on the development of interdisciplinary projects and agile methodologies that generate greater motivation and a sense of belonging in students.

In this context, the school works with AI along three axes[1].

- Firstly, **AI assists in the didactic planning of learning trajectories**. The interdisciplinary team of school coordinators works with teachers to collaboratively plan learning sequences and uses AI to enrich the activities. Applications such as Copilot are used to make videos and develop their own content with the assistance of AI.

- Secondly, **students use AI in their robotics, design and computing projects.** In line with a constantly updated and project-based approach, students learn through the application of technology in real solutions.

- Thirdly, **the school is a node for the development of software systems and applications in the province.** Students aged fourteen and above form development and programming teams to create solutions to real problems.

Some examples of this dynamic are:

→ The creation of an object sorting system for waste collection that used AI for image recognition.

→ A seed identification system for different types of crops.

→ The use of AI to combat dengue fever, a disease spread by mosquito bites. Students take photos of mosquitoes and tag them on a platform, which are then processed with AI for larval recognition to detect breeding sites and mitigate the source of the disease's spread.

These projects show the expansion of the school in the community with developments that have real possibilities of application.

Examples from this school show the potential of AI for learning, student motivation and collaborative teacher work.

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[1] Review based on an interview with the General Coordinator, Solange Schelske. For more information, please visit the website: https://www.escueladeroboticamisiones.com/

03.

Can AI change education?

AI offers new doors for rethinking education. It is a time of opportunity to reflect on teaching, learning and the very organisation of education systems. In this section we intend to focus on the possibilities that AI opens up for improving and transforming education in Latin America.

Here we return in another way to what was analysed above. To understand the trends, the map of initiatives underway in the region is not enough. These initiatives are limited and are not enough to explain the opportunities that AI opens up in education. For this reason, this section proposes a broader view that allows us to place the cases found in Latin America in the international concert of changes based on the use of AI in education.

To achieve this goal, looking only at development trends in the region provides a limited and fragmented picture. In other countries, the development of AI is much more advanced and ongoing experiences allow us to map the directions, opportunities and risks of these trends in education. Using the international and Latin American cases already reviewed, this section maps some of the opportunities that AI can offer for improving education.
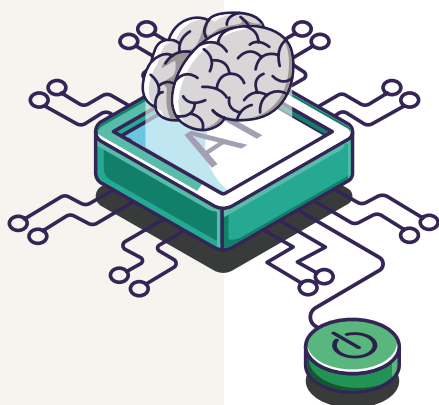
OPPORTUNITY 1
Enriched content at low cost.

The digitisation of content is a process that has enabled the multiplication and diversification of educational resources over the last three decades. Generative AI has the potential to accelerate this process exponentially. The creative capacity of new techniques based on machine learning and natural language processing open new doors to generate personalised and/or enriched resources to foster motivation and a sense of learning.

Some of the initiatives surveyed in the region are beginning to explore these possibilities. For example, **Flex-Flix** explores the world of new youth cultures with videos created with AI for different curriculum subjects; **Knotion** develops transdisciplinary content for global citizenship; **HistorIA** allows story characters to be adapted to different situations and dialogues; and **Musiglota** helps learn English with the music of students' favourite songs.

Other international experiences show the potential development of content enriched by generative AI. It is now possible to translate texts in real time or to summarise texts with high precision. AI-based applications make it possible to transform content into different formats. **DiffIt** is a tool that makes it possible to rework different learning topics on multiple levels. It works as a kind of didactic adaptor; the same topic can be explained to a five-year-old or a fifteen-year-old student.

AI video generation platforms have burst onto the scene with great speed. **Synthesia**, **Dall-e-2** or **Elai. io** sare examples of a new era of visual content pro-

> *The creative capacity of new techniques based on machine learning and natural language processing open new doors to generate personalised and/or enriched resources to foster motivation and a sense of learning.*

duction with AI. For example, **Stability** can translate text into image, video, audio and 3D. In the educational field, videos such as **ProJim** or augmented reality simulations such as **Ludenso** are emerging examples of this field of AI content production. **LuzIA** is a Spanish development that answers questions, summarises texts, transcribes audios or creates images.

Other resources show the potential of interactivity enabled by recent AI developments: **Curipod** is an AI-based tool that generates interactive lessons to motivate students on adaptive learning paths. **Sway** is a multimedia story creation software for teachers with interactive components. **MindMeister** is a collaborative model for creating mind maps and visualising ideas, concepts and thoughts.

Augmented reality and virtual reality use devices designed for immersive experiences in fully virtual worlds (VR) or mixed reality (MR) devices that combine real-world elements with digital holo- grammes (e.g. **HoloLens** o los **Meta Quest Headsets**), also use AI to produce immersive worlds that open up possibilities for experiential learning. The development of new learning environments and even the creation of educational metaverses can be a new opportunity to engage learners in more experiential versions of educational content (Hwang et al., 2023).

Automated content creation is emerging as a novelty in all fields of culture and in education (Ahmed et al., 2021). One of its promises is to achieve Universal Design for Learning (UDL)[2].

Since learners perceive and incorporate information differently, UDL allows for multiple formats of content representation to enable them to learn using different options for perception, language, symbols and comprehension. AI can feed into the principles of UDL by providing multiple avenues of representation, expression and motivation for learners. This approach can expand learners' opportunities and reach into the deepest secrets that generate interest and engagement in learning.

However, self-driven design via AI is a trend that opens up new questions: Who controls the meaning and quality of the resources created by AI? What are the criteria that feed the algorithms? How far can automation go? Are we entering the exponentially ungovernable era of "synthetic educational resources", created by AI?

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2 UDL is an educational approach that seeks to create inclusive and accessible learning environments for all learners, irrespective of their abilities, learning styles or cultural contexts. See: https://www.afoe.org/dua-principios/

OPPORTUNITY 2
More efficient and more powerful didactic planning.

Teachers draw on a variety of sources and resources to prepare their lessons. With the explosion of the internet in recent decades, digital resources have become ubiquitous. Some platforms have been able to interpret the needs of teaching communities to better group and package the anarchic diversity of resources offered by the web. With the advance of generative AI, the landscape is beginning to open new doors to assist teachers in their work as didactic designers of learning experiences.

Platforms such as **Teachy**, **Ummia** and **RDV.IA** are pioneers in Latin America in this new horizon. Although they are in an initial phase, these platforms seek to adapt to the needs of teachers to provide AI-powered services: they help plan classes aligned with curricular content, create rubrics and evaluations, and provide ideas to assist in different pedagogical management tasks.

In the United States, one of the most popular AI platforms used by teachers is **Magic School**, an initiative that builds bridges to teaching practices. It is a platform that makes it possible to simplify typical teaching tasks. Its presentation states that its daily use "saves more than ten hours of teachers' daily work". It integrates a number of teaching planning tools and tools to help students in their learning process "without replacing their own thinking" (as the website makes clear).

Other similar tools compete for the market of pedagogical assistance for teachers to design their lessons with AI, such as **MyLessonPal**, **Copilot**, **Nolej**. ASome platforms assist with tips for teacher-created lessons, such as **TeachingLab** or **Coteach**. Other applications, such as **EduGPT**, ffunction as teaching advisors in different subjects or as assistants in the creation of projects, such as **ProjectLeo**.

The emergence of these new tools shows positive incipient trends that raise hopes. The reduction in instructional design time may give teachers more time for other tasks (or for their personal lives), as previous studies indicate (Bryant et al., 2020). The creativity associated with curriculum implementation offered by generative AI-based tools can help teachers to translate complex content in diverse situations (age, interests and context of their students). This could enrich teaching with better didactic courses.

Some platforms are also beginning to explore the field of AI-assisted teacher training. There are already initial experiments with digital facilitators that can analyse a class and give formative feedback to teachers (Copur-Gencturk et al., 2024). One example is **Edthena**, an AI agent that analyses teacher planning and lessons to drive personalised formative self-assessment.

These opportunities are just beginning to emerge. How will AI help teachers of language, mathematics, music and each discipline in every part of the education system? Will we have more and more AI-assisted "cyborg teachers"? What skills are required to really take advantage of these opportunities? Will this not also be a way of expanding inequalities in teachers' access to technology and availability of time and training?

OPPORTUNITY 3
Ubiquitous tutors to personalise learning.

One of the major problems faced by the traditional education system is the ratio of students per teacher, which does not allow for the allocation of individual time for constant work with each student. Different models of human tutoring have been studied as a key contribution to improving learning (Nickow et al., 2020; Hevia et al., 2022). However, these interventions are very costly and difficult to scale. Therefore, the emergence of generative AI has shown promise for the widespread use of digital tutors to personalise learning.

Intelligent tutoring systems use algorithms to individually adapt the proposed learning paths for students (Mousa- vinasab et al., 2021). New models of natural language processing enable dialogue in each specific learning area by providing instant feedback and accompany the development of increasingly complex thinking (Labadze et al., 2023).

In the initiatives analysed in Latin America, we did not find cases of advanced development of chatbots that dialogue with students and help them to understand different areas of learning. Globally, some innovative initiatives are beginning to emerge. The following are some examples of those underway in mid-2024.

Google has powered the **Socratic** model, one of the platforms adapted to all major curricular areas with an interface that assists students with visual explanations of each subject through speech and text recognition. The Khan Academy launched the "**Khanmigo**" model in partnership with Open AI, adapting ChatGPT for subject learning. The chatbot interacts with students even using the mobile camera, which takes a visual record of their handwriting to assist them as they speak and write.

Replika is another model that started in 2017 as a "friend" for students who can give advice and help them in their studies. It is a model of AI agents that take on a personality of their own and become advisors to students. This model has generated debate because of the invasion of privacy that knowing students in depth may entail (Pentina et al., 2023).

The possibilities opened up by digital tutors are just emerging on the horizon. For example, **Sorcerer** is a tool designed to generate depth in conceptual understanding through dialogue with a chat room. The **Mathnet** platform assists students in the development of mathematical thinking by identifying and helping them with comprehension problems in a

variety of exercises. **Piazza** is an AI-based model that promotes conversations and collaborative work in educational spaces. **Carnegie Learning** is an adaptive platform that provides learning experiences adapted in real time to student interactions.

Some initial studies show the potential positive impact that these new mentoring systems can have (Chen et al., 2023). The possibilities opened up by these models are seen by some proponents as a unique revolution in the history of education (Khan, 2024). However, it is still too early to venture into the evolution of these learning models based on intelligent tutoring systems. Will it be a time of greater autonomy in learning possibilities? Will it open up new horizons or will it be a continuation of the shadow learning systems of academies and private tutors to prepare for exams? To what extent will relationships with machines become personalised, making AI agents new subjects that add an affective social fabric to students' lives?
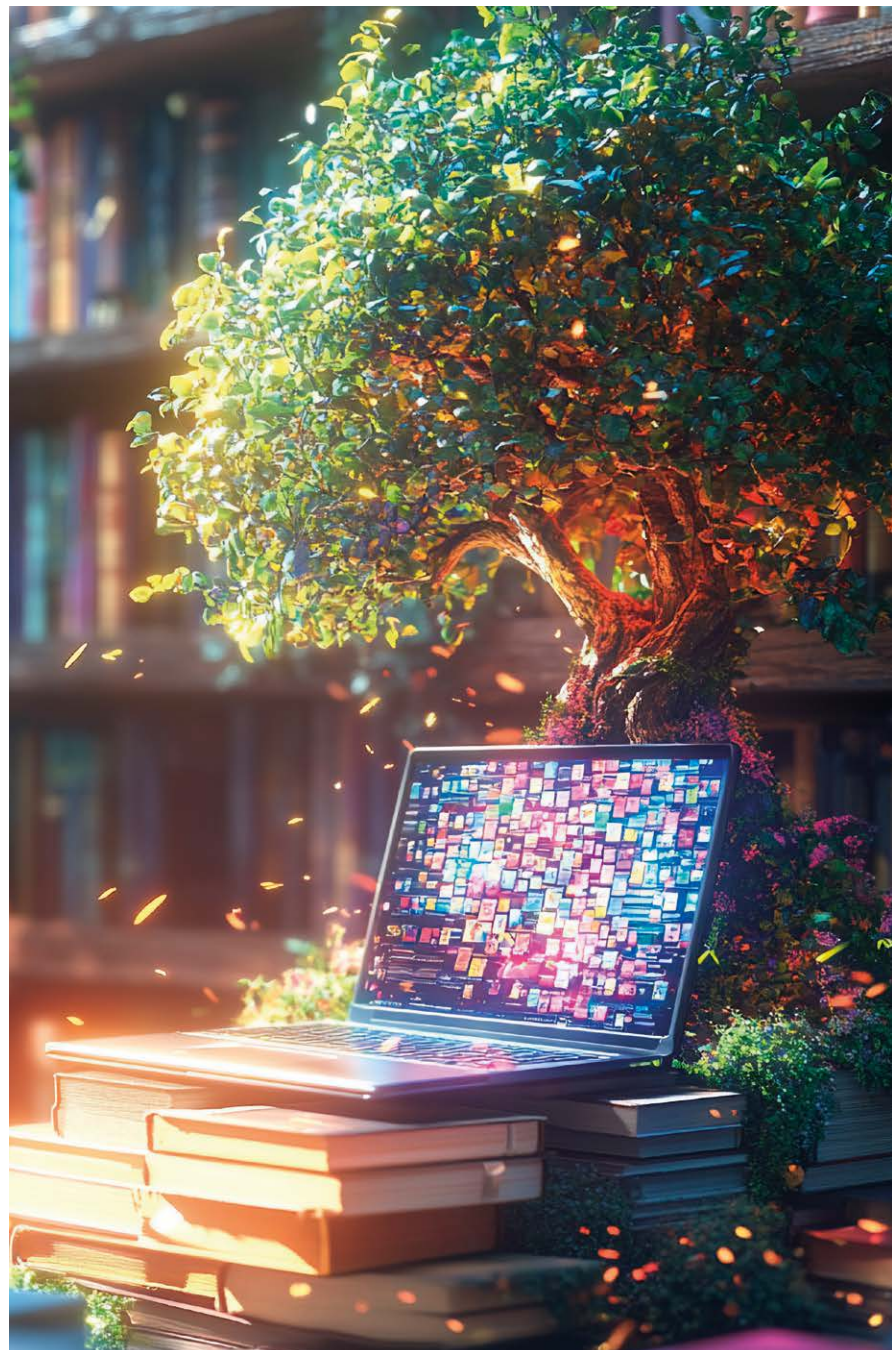
OPPORTUNITY 4
New automatic assessments and systemic data management.

The assessment of learning is a dimension that crosses the boundaries of inside and outside the classroom: it can be seen as part of the new opportunities that technology offers teachers to design and correct tests or as a redesign of the standardised assessments of education systems. In both fields, the self-mapping of assessments is one of the areas with the greatest potential impact of generative AI (Minn, 2022).

Automated AI assessment tools can detect patterns in student performance, identifying specific areas where they need to be addressed.

These models can assist teachers to make data-driven decisions and develop personalised interventions that are tailored to individual learning needs, providing real-time information and deep insight into learners' strengths and weaknesses.

In Latin America, there are already several examples of the potential of technology in this area. Some of the initiatives aimed at teachers include the possibility of using embedded assessments and assisting in marking, such as **Teachy** or **UPlanner**. On a systemic scale, the case of the **Sea+** test in Uruguay is a good example of the possibilities offered by AI to automate correction, provide immediate feedback to students and teachers, and favour a more detailed knowledge of learning from the planning of educational policies.

At the international level, developments are multiplying, in addition to some of the initiatives already mentioned in point 2 on assistance for teacher planning. One example is the Canadian platform **Zelexio**, designed to "transform evaluation" (as stated in its presentation). With AI supportit enables the creation of competency-based assessments, self-assessments or collaborative assessments. **Kognity** is aligned with the International Baccalaureate programme and connects curricu-

lum content with assessments through a unified platform for real-time tracking of student progress. **Gradescope** is a platform specialised in grading assessments in all subjects using teachers' and institutions' own assessments. **Examsoft** is another of the most renowned platforms that assists in the development and correction of assessments, with the promise of providing objective grades in corrections based on AI assistance. Another example is **EssayGrader**, an AI assistant specialising in correcting essays that provides formative feedback to students and teachers.
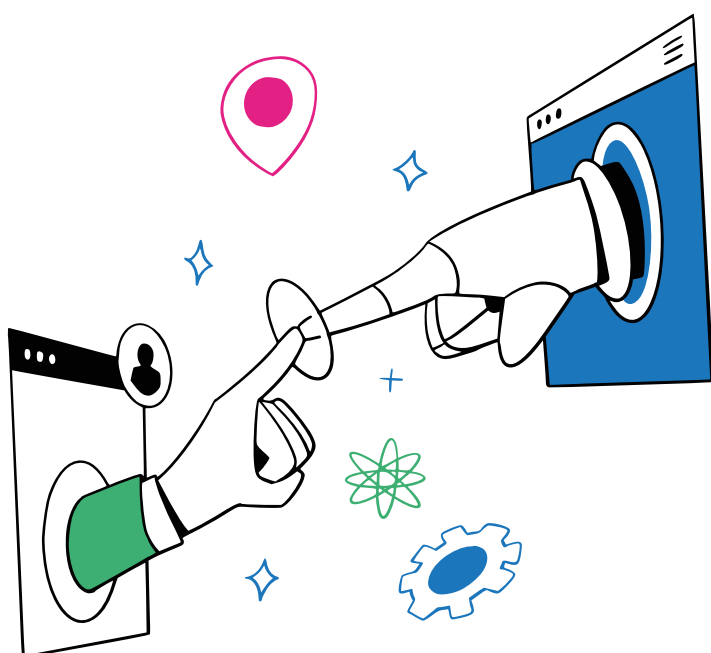
In the broader field of course generation, tools are emerging that provide assessments aligned to different content. One example is **Coursebox** which uses AI to convert documents, videos and websites into courses aligned with assessment metrics.

The use of AI can be used to assist teachers and educational institutions to spend less time on marking assessments, a task that is generally time-consuming (Kamalov et al., 2023). Automated marking can be very rigorous and assist teachers' work at a higher level of accuracy and detail. These new models are integrated with learning management systems to create blended solutions that allow teachers to manage courses and groups of learners.

AI evaluations can also achieve a higher level of sophistication in the design of instruments to measure complex competencies and skills (Foster & Piacentini, 2023). This opens up new scenarios for rethinking assessments. It is now possible to design more sophisticated tests, with open-ended

and diverse items, without the economic and time costs of such human-corrected assessments, since AI allows for immediate feedback. This opportunity requires expert supervision to endorse and monitor the quality of the automatic correction, but it becomes a new field of possibilities for education assessment policies.

The new AI-enhanced assessments complement or are part of the new tutoring systems mentioned in the previous point. In this task, they can help to personalise both assessment and correction by providing feedback to students in dialogue with their teachers.

Paradoxically, AI assistance can also serve to counteract what developments in generative AI are enabling: a tendency for students to facilitate copying and plagiarism. Teachers can use AI to detect plagiarism, in a kind of paradoxical race of technological developments that allows for the facilitation and detection of cheating at the same time.

Another facet of this paradox opens up some key questions about the use of AI to assist teachers in their assessments. If machines can automatically correct essays and grade all kinds of assessments, could teachers leave this task to them? What will be the new bridges between teachers' professional knowledge and AI assistance in assessing learning?

OPPORTUNITY 5
Reducing inequalities and generating new educational opportunities.

The distribution of the new opportunities opened up by AI can widen or narrow social inequalities. For example, new digital tutors can be a vital step in narrowing the learning gap at home, provided that access to technology is made available and affordable to the most disadvantaged.

Generative AI also opens new doors for learners with special visual, auditory, physical and cognitive needs (Holmes, 2023). Recent studies indicate that AI has the potential to recognise the specific difficulties of individual students and generate support tools that facilitate their educational opportunities (Gottschalk & Weise, 2023). A systematic review of the literature indicates that certain evaluations show the positive impact that some tools can have, especially in cases of dyslexia (Panjwani-Charania & Zhai, 2023).

Among the international cases, different developments can be seen that open up new opportunities for educational inclusion. For example, **Dystech** introduced a tool to accurately detect dyslexia based on machine-learning analysis of children reading from audio recordings (Radford, 2021).

Tools to assist deaf learners draw on recent developments in generative AI. For example, **Deaf AI** offers a sign language translator into more than sixty languages. **AudioPen** is a tool that transcribes spoken speech into text in multiple languages. **Voiceitt** is an AI-based speech recognition application designed for people with speech impairments. The app learns the user's unique speech patterns and translates them into clear speech, enabling better communication with others.

Real-time translation tools are also a great opportunity for migrant learners who do not speak the language of the school they attend. For example, **Talkao** is one of the most widely used applications for real-time language translation.

Students with autism can also benefit from technological tools that allow them to exercise social skills. The **Echoes** model was developed as a "magic garden" in which to interact with a virtual character named Andy and showed positive effects on educational interactions (Porays-ka-Pomsta et al., 2018). The **Re-Think Autism** platform uses AI to provide personalised social skills programmes for students with autism through video modelling, interactive exercises and re-

al-time feedback for the development of social-emotional skills.

The use of AI robots also opens up a new area of possibilities. For example, the **NAO** robot fulfils therapeutic and educational functions for the practice of social skills (OECD, 2021). Other robots have been designed to expand learning opportunities for students with autism, with a positive impact on their well-being (Lemaignan et al., 2022).

The advent of these possibilities invites us to think of new scenarios where institutional strategies can be combined with enriched opportunities at home through access to technology. Interactions with machines can be, paradoxically, a space for humanisation (Papert, 1993). Can these tools be harnessed to expand opportunities for those with barriers to educational inclusion? Or are they "second-rate" possibilities for the poorest and most disadvantaged who are offered technology as a cheaper and more anonymous alternative to that offered by flesh-and-blood educators?

RISKS //

What harm can AI do?

The accelerated process of socio-technological changes opens up questions and anxieties. The opportunities of AI have their shadow: the risks of AI and the risks of innovations that uncontrollably transform the environment in which education systems operate. This section introduces five central risks that we identify from a review of the literature on the subject.

These risks require responses from public policy and from social and political debate. Educators have to be attentive to the impact that these technological changes may have and seek answers to protect educational spaces with a perspective centred on humanism, social justice, and the pedagogical vision of the possibilities opening up in the age of AI.

RISK 1
The devaluation of what is true.

The sudden emergence of ChatGPT in November 2022 quickly translated into a threat to schools and universities around the world. A new Pandora's box was opened, bringing academic copying and plagiarism within reach. The speed of generative AI to learn to answer questions as if it were a human grew exponentially. Studies show that the most advanced AI tools can pass typical MBA course exams (Terwiesch, 2023) or effectively answer open-ended questions that require complex cognitive processes (Dwivedi et al., 2023).

Copying is a risk expressed by teachers (Sullivan et al., 2023). Some early studies show, however, that the emergence of generative chats did not lead to an increase in copying, but rather a change in the mechanisms by which it is practised (Lee et al., 2024). Students who have a certain predisposition towards copying now have more multi-functional tools to replace their own thinking and complete tasks that schools or universities send home (Greitemeyer & Kastenmüller, 2024).

This opens up a whole battery of questions about power, evaluation and didactics. Do we need to change assessment systems, or should we go back to face-to-face tests, or should we focus on building confidence and increasing intrinsic motivation for learning in order to overcome temptations based on an ethic of will?

In the midst of these questions, some certainties can be harboured. The first is to clarify a misconception about the impact of generative AI on academic copying (Rivas, 2023). Machines have advanced so much in such a short time that they are now capable of performing complex tasks as if they were human. This does not mean that these tasks have no value. The misunderstanding is formulated in this way: "if ChatGPT can do it, then it is not worth teaching (or assessing)".

The risk is real: many valuable tasks that are sent home can today be more easily forged. To address this risk, it is necessary to combine renovation of teaching and assessment strategies.

In this context, it is advisable to advance in formative assessment processes that accompany student learning with feedback. Formative assessments are generating human-human (teacher-student) iterations that limit the risks of academic fraud (Zapata Ros, 2024). This can be complemented by project-based teaching and real problems, as they require multiple contextualised conversations that (all-way) machines cannot perform accurately.

> *The sudden appearance of ChatGPT in November 2022 quickly translated into a threat to schools and universities around the world. A new Pandora's box was opened that places copying and academic plagiarism at our fingertips. The speed of generative AI to learn to answer questions as if it were a human grew exponentially.*

The risk of fraud also opens the door to rethinking what is worth learning and what role the intersection of external (AI-enhanced) support plays in any learning process. One example is learning to write with a high level of autonomy to produce one's own texts. The writing process fully impacts on the development of key cognitive skills such as the production of thoughts with the distance and reflexivity that writing produces, the communication and argumentation skills that are generated in the iterations of writing, among other major cognitive tasks at play in the art and work of writing well (Fulwiler, 1982). Defending these reasons (in every subject and at every age of learner development) becomes a central task of the education system to prevent the lack of answers from tempting artificial shortcuts that replace real learning.

RISK 2
The dehumanisation of education.

Another risk of AI advancement is the loss of human relationships and values in the age of intelligent machines. The debate on the replacement of teachers by digital systems or robots has been recurrent in recent years and is re-edited with generative AI. A school without teachers or a society without schools is one of the constant references in futuristic predictions about education. Some authors have even predicted that by 2024 schools will be an obsolete technology replaced by on-demand digital education (Christensen et al., 2008).

The forecasts do not take into account that the social role of the school is much deeper than achieving instructional learning. Recent studies indicate that it will be very difficult - if not impossible - to replace the role of experienced teachers in the human bonding and social relationship of learning (Chan & Tsi, 2023). Irreplaceable human qualities such as critical and conscious thinking or the generation of bonds based on empathy and emotions make teachers an indispensable part of the construction of values, interactions and links that fill educational institutions with life (Felix, 2020).

However, the threat of dehumanisation does not require the elimination of schools and teachers. The risks of increasing interactions with screens and machines are present in today's digital society and can be enhanced by AI. The loss of human sensitivity and values such as empathy, ethics and solidarity appear on the horizon of the critique of unchecked educational digitalisation (Selwyn, 2023).

Digital platforms also pose the risk of a certain form of education that prioritises individual learning over human relations, socialisation among peers and the social and collective learning process itself. The ways of relating to screens and robots can normalise a distance from reality that accentuates the lack of solidarity with the other, the absence of a common project or the possibility of interacting in one's own communities, making education a social practice in service (Chetouani et al., 2023).

RISK 3
Invasion of the privacy of learning.

The digitisation of learning carries the risk of accessing learners' personal information that may harm their privacy. AI-based systems require a large amount of personal data to provide individualised assistance. The emergence of chatbots is a clear example of a model that relies on private dialogue with learners, even to discuss personal lives, which may be one of the keys to their emotional relationship with learning. The potential use of such information presents great risks in the present, as well as projected in different future scenarios of the expansion of AI robots (Timan & Mann, 2021).

As AI tools penetrate educational institutions, they collect and process large amounts of sensitive information, including students' personal data, academic records and behavioural patterns. Consequently, the potential misuse or unauthorised access to this data presents significant risks to stakeholders, especially if controlled by new AI monopolies (Huang, 2023).

According to Human Rights Watch (2022), many educational technology products use data practices that compromise children's rights. These products collect detailed personal information, such as location, activities, family information and socio-economic status. Children, parents and teachers are often unaware of these practices.

Several solutions have been proposed to avoid these risks, such as the implementation of strong data protection policies, encryption techniques and strict access controls. Ensuring the protection of sensitive information and complying with data privacy regulations, such as the General Data Protection Regulation[3] developed by the European Union, is crucial to maintain trust and avoid potential misuse (Bessen et al., 2020).

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3   https://gdpr.eu/what-is-gdpr/

In 2019, Unesco published the Beijing Consensus on Artificial Intelligence and Education (Unesco, 2019), the first document to offer recommendations on how best to harness AI technologies for SDG 4 of the 2030 Education Agenda. It highlights the importance of considering the dilemmas of balancing open access to data with privacy protection and proposes adjusting existing or adopting new regulatory frameworks to ensure the responsible development and use of AI tools for education.

The risks behind the advancement of AI are much broader and were comprehensively addressed in Unesco's first global standard on the ethics of AI. The "Recommendation on the Ethics of Artificial Intelligence" was adopted by all 193 member states (Unesco, 2022). It states that the use of AI systems should not go beyond what is necessary to achieve a legitimate objective. Risk assessment should be used to prevent harms that may arise from their uses. Both unintended harms (security risks) and vulnerabilities to attacks (safety risks) must be prevented and controlled.

RISK 4
Widening inequalities in education.

Closing the digital divide remains a central public policy challenge in Latin America (Agudelo et al., 2024). Even in a context in which the expansion of mobile technologies has favoured greater democratisation of access, the COVID-19 pandemic has highlighted unpaid debts in this area (Soletic & Kelly, 2022). Connectivity in schools for pedagogical use by students is a slow process that only Uruguay, through Plan Ceibal, has managed to achieve at a systemic level (Unesco, 2016).

AI risks exacerbating these inequalities in access and in the likelihood of appropriate use based on social factors such as socio-economic status, gender, age and cultural background. Technical factors, such as technology availability, broadband speed and computational data, are crucial for the effective use of AI tools (Carter et al., 2020). The possibilities opened up by AI may perhaps be closer for those with prior resources, more time, better household productivity and favourable conditions for introducing technology in education.

In addition to this, there are warnings about the risks of the commoditisation of education with the growth of the digital offer, which have been systematised in Unesco's An Ed-Tech Tragedy? report (2023). The report analyses the many neg-ative and unintended consequences of the expansion of educational technologies during the COVID-19 pandemic. Many of the solutions that were proposed, which focused primarily on technology rather than pedagogy and schools, missed a large majority of students. AI runs the same risk of rushing ahead with a commercial logic without addressing the consequences it leaves in its wake for individuals and educational institutions.

It is no coincidence that the GEM Report (2023) focuses on "Technology in education" and asks "a tool in what terms?" (Unesco, 2023). The ever-increasing development of technological solutions, from a strictly commercial point of view, is behind this central question. Technological innovation can generate new inequalities and widen existing gaps with the commodification of access to new digital resources. The role of the state and other social actors is fundamental to define the desired directions for the use of AI in education and not to depend on commercial interests in a decisive way.

RISK 5
## The lack of control of accelerated change.

The risks outlined above combine in an unpredictable scenario of accelerated change. The possibility of a General Artificial Intelligence that has autonomy and can develop new skills exponentially is indicated by many experts as possible and close on the horizon (McLean et al., 2023). AI developments have almost no control. Regulations are slow, delayed or virtually non-existent (except in certain countries and especially in the European Union). AI is a complex social, cultural and material artefact that is understood and constructed by different stakeholders in different ways, and these differences have important social and educational implications (Eynon & Young, 2021).

In this context, teachers and schools in Latin America face countless daily problems and see the tide of a new, out-of-control technological world coming in. It is logical that they feel fear and envy. Even the addictive effect of mobile phones in the hands of their students is of growing concern and policies are proposing to ban or regulate their use in classrooms.

Generative AI is developing in a race to get further and further into the business of accumulating data, computational power and better engineers who are able to accelerate the impact of their products (Kalota, 2024). This process carries the risk of generating biases that under-represent social groups excluded from the data that AI uses. The material that AI takes in is based on languages, cultures, identities and values prevalent in the databases.

Aggregation bias results from combining several different groups into a single model, making the model ineffective for some or all groups. For example, a student achievement prediction model trained with a combination of urban and rural students may create generalised recommendations that do not effectively address the specific learning needs of any of the groups, resulting in suboptimal or ineffective predictions (Suresh & Guttag, 2021).

The AI ecosystem may be involved in a form of knowledge production that reaffirms certain types of epistemologies over others, creating risks of domination of certain worldviews that are not entirely conscious. Some studies have begun to map the discourses generated by AI to understand its internal organisational system and epistemological assumptions (Nemorin et al., 2022). Machines that make decisions based on machine learning mechanisms do not explain the way in which they work. This opens up new questions about the role of the public and necessary discussions about the direction of AI in education and society.
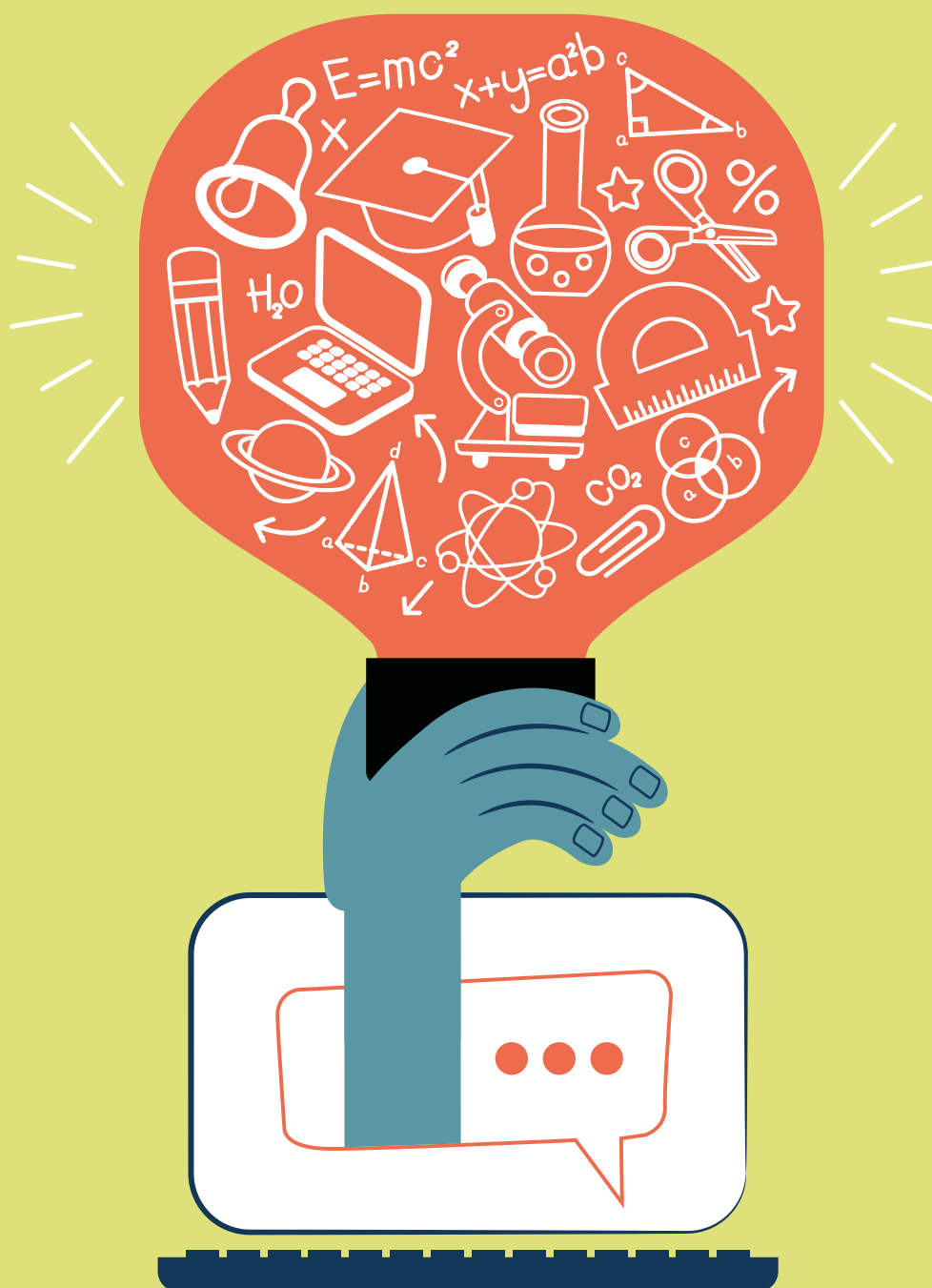
New times?

The opportunities and risks of AI are compressed into a very short period of time that takes off with the emergence of new natural language processing models in November 2022. While the development of AI has a long history and multiple offshoots, this most recent stage has opened up an exponential race around the world that leaves a big question mark over the near future. Perhaps never before has technology had such a sudden and indeterminate acceleration as we are experiencing with AI right now.

It is a time when it would be good to reflect and understand what is really at stake, and yet the race to get there first is driving the industry forward at full speed regardless of what might happen. In this race, we do not know if AI will become aware and be a threat to humanity. We do not know whether the tools in place can be used by humans to cause large-scale damage. The danger is too great and seems to be unmanageable (Regis et al., 2024).

For the field of education this translates in a special way. Most teachers have their time occupied by the day-to-day running of schools and see these new waves of technology as phenomena that are indecipherable and bewildering. Ministries of education, on a different scale, are in a similar situation: in Latin America, political discontinuity in educational management and lack of budget predominate. The result is a progressive drift away from the technological vanguard. The world is changing too fast for schools to adapt. The gap is widening every day.

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This has a positive consequence: schools are not automatic consumers of everything new. AI advances have ethical risks, and students cannot be guinea pigs in the data and algorithm laboratories of big techno-educational companies. That school is a pause in a fast-paced world may be good news that enhances its institutional bark as a safety belt in the face of external change.

However, thinking this way carries the mark of a reactive process. What if AI could actually generate more and better learning opportunities for all students? What if students with special needs had better tools to learn, or those who are lost in the classroom found a better way with the support of digital tutors? What if teachers had support for tailored lesson planning, dashboards to track their students' progress, automatic corrections with formative feedback to give them back valuable time to rethink their pedagogical role?

All these questions deserve to be answered. The opportunity to improve education should not be lost for fear of the new. The path of AI in Latin American education is under construction. The following challenges may define the direction technology takes if humans can control it and use it to build a more just education.

CHALLENGE 1
Training in critical digital citizenship.
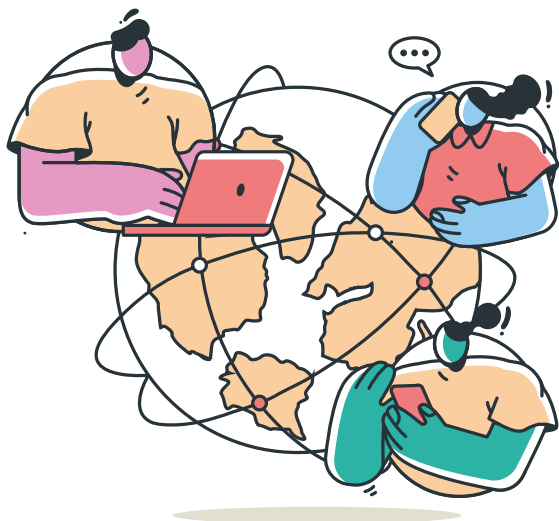
The first challenge that the advance of AI means for education is curricular and pedagogical. What new knowledge, skills and values must education systems shape in this changing world? How to prepare students to live in an uncertain future where AI may take over many existing jobs and feed new imaginaries and artificial cultures?

The challenges posed by AI are philosophical and epistemological. To be citizens of this world, education systems need to develop the capacity to think critically about the dynamics of technological change. Students must learn how to use AI applications, but it is even more important to teach them the implicit concepts of how AI works, such as literacy to understand the principles, dynamics and logics that enable the design of AI and the social effects they produce.

The formation of critical, reflective and applied critical thinking requires an approach within disciplines in order to integrate it into different learning domains (Lee et al., 2020). Some specific frameworks have started to design proposals for developing a curriculum focused on AI literacy (Ng et al., 2021; Long & Ma- gerko, 2020). Unesco has just published the most recent guide for teaching AI[4].

Several countries have made progress in recent years in incorporating these visions into their curricula (Unesco, 2023). In Latin America, one of the first countries to have developed a curriculum document is Uruguay, with the Framework of Reference for Teaching AI in Ceiba. The document presents an integrated and multidisciplinary approach, which aims to develop AI literacy and enhance skills related to critical thinking, problem solving, creativity and collaboration (Ceibal, 2023)[5].

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4 https://www.unesco.org/es/digital-education/
   ai-future-learning/competency-frameworks

5 https://pensamientocomputacional.ceibal.
   edu.uy/wp-content/uploads/2024/02/Marco-
   referencial-IA.pdf

CHALLENGE 2
The assembly of AI with the education system.

The digital ecosystem is within reach of anyone with connectivity. Beyond the economic cost of accessing some tools (such as advanced versions of Chat-GPT and many educational applications), the possibilities at low or no cost are immense. However, this does not ensure that AI will penetrate learning on a large scale. As we have seen with the digital technologies already available, their use is very limited when it depends on the individual student's motives and fails to be incorporated into school practices.

The strength of education systems lies in their daily continuity (going to school every day), their routines (keeping to timetables, having learning sequences), their organisation (having weekly subjects, courses, grades, degrees, diplomas), and even their compulsory nature. But, above all, the power of school education lies in having human teachers who can give meaning and substance to teaching and the care of interactions between students. This is why it is so important to find bridges between the new technological possibilities and their incorporation into education systems.

One of the vital bridges is the training of current and future teachers in digital skills and computational thinking. Teacher training is a central axis to start from the grassroots in the formulation of a reflective digital citizenship for pedagogical practice. The document "Competencia digital docente para la transformación

One of the vital bridges is the formation of digital skills and computational thinking in current and future teachers. Teacher training is a central axis to start from the roots in the formulation of a reflective digital citizenship for pedagogical practice.

educativa" (OEI, 2023) and the recent guide for the use of AI published by Unesco (2020) are clear examples in this direction.

In Latin America, too, there are already examples of materials developed to work with teachers. The Chilean Ministry of Education has also published a guide for teachers on how to use ChatGPT to enhance active learning"[6]. In Colombia, ProFuturo compiled different materials in the guide "Integrando aprendizajes" (ProFuturo, 2024).

In some countries, very interesting projects have been developed for vocational training. For example, the AI4T project promoted "IA para y por docentes", a three-year pilot project that develops skills based on AI to be introduced into teaching practices in innovative ways in several European countries (OECD, 2024).

Integrating the promises of AI into education also requires a re-shaping of the organisation of teaching. For example, the possibility of AI-powered digital tutors or automatic test correction will involve building bridges to the teaching task. If teachers have a learning management platform where all their students are connected, they can design activities that simplify the organisation of their work. But if students are not active, or teachers are not trained in the use of the new tools available, AI may end up widening existing socio-educational gaps.

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6   https://ciudadaniadigital.mineduc.cl/wp-content/uploads/2023/05/Guia-para-Docentes-Como-usar-ChatGPT-Mineduc.pdf

CHALLENGE 3
The pedagogical identity of AI.

The commercial primacy of technological developments is one of the factors that puts the debate on pedagogical ideas on hold. The incorporation of technological innovation as an end in itself is tempting for many schools and educational policies. Therefore, the advancement of digital technologies in education faces the challenge of finding a pedagogical identity to sustain it amidst the shortcuts to win the race for innovation (Cueto et al., 2023).

The cultural biases of AI construct identities based on what feeds the algorithms. The voices of populations furthest from the web are silenced in the spiral of dominant content (Hillman, 2023). Algorithms may be biased towards Latin Americans if they are constructed with predominant language processing in English or other regions.

At the same time, it is important to give pedagogical meaning and cultural identity to AI designs that interact with education. For example, criteria can be developed that prioritise content from different cultures and indigenous minorities whose language and voice in digital media is marginalised (Reihana et al., 2023).

In times of AI acceleration, it is key to think about and debate the design of algorithms, confronting biases and values at play. How AI is designed depends on multiple human decisions that are rarely discussed (Williamson et al., 2023).

This implies a challenge for actors inside and outside the digital ecosystem. For companies and developers there is an ethical responsibility to understand the pedagogical discussions at stake in any AI in education initiative. The choice of gamification mechanisms, the way in which interfaces are designed and the content that feeds the algorithms are critical decisions that should be advised by educational experts.

For example, learner journey modelling is a key component of intelligent tutoring systems. This is a process in which AI generates dynamic models of students' knowledge, skills and learning preferences based on their interactions with the system. These systems analyse students' learning behaviours, track their progress and provide personalised guidance (Kochmar et al., 2022).

The creation of curation sites for digital resources with AI is also an option to take up the challenge from outside the industry. Critical and reflective analysis of digital market offerings can open the door to an educational vision that allows teachers and industry specialists to give their opinion on each AI tool. For example, the EdSurge platform is an example (in English) that allows for an informed consumption of the multiplicity of digital tools in education. Developing spaces where technological solutions can be analysed with educational criteria is a way of taking on board the changing scenario with the voice of educators.

CHALLENGE 4
The role of the public in the AI ecosystem.

A final challenge concerns the role of the public sector in the uncontrollable advance of AI. In the midst of the huge debts and social challenges facing governments in Latin America, taking a strategic, dynamic and up-to-date view of technological developments raises the question of the limits of public administrations' capacities. Can the pace of AI innovation be sustained by the state? With what roles? Can AI be controlled, regulated, used and developed for education?

The Oxford Insights index of state capabilities for AI development[7] shows that Latin American countries are far behind developed countries. The region appears to be lagging behind in the innovation capacity dimension and better positioned on the governance axis. In the technological development pillar, Brazil emerges as the regional leader. In the dimensions together, the cases of Brazil, Chile, Uruguay, Colombia and Argentina are positioned with higher levels of development.

A recent step at the regional level was the signing of the "Santiago Declaration: To promote ethical Artificial Intelligence in Latin America and the Caribbean"[8]. The countries of the region assumed the willingness to work together so that cultures, laws and data are considered with an ethical eye in AI developments.

At the educational level, an important step towards articulating a prospective vision is the development of national plans for AI in education (Schiff, 2022). The report *Guidelines for the formulation of ICT policies and master plans in education* presents the main challenges Unesco assumes in its approach to the subject:

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7   https://oxfordinsights.com/ai-readiness/ai-readiness-index/

8   https://minciencia.gob.cl/uploads/filer_public/40/2a/402a35a0-1222-4dab-b090-5c81bbf34237/declaracion_de_santiago.pdf
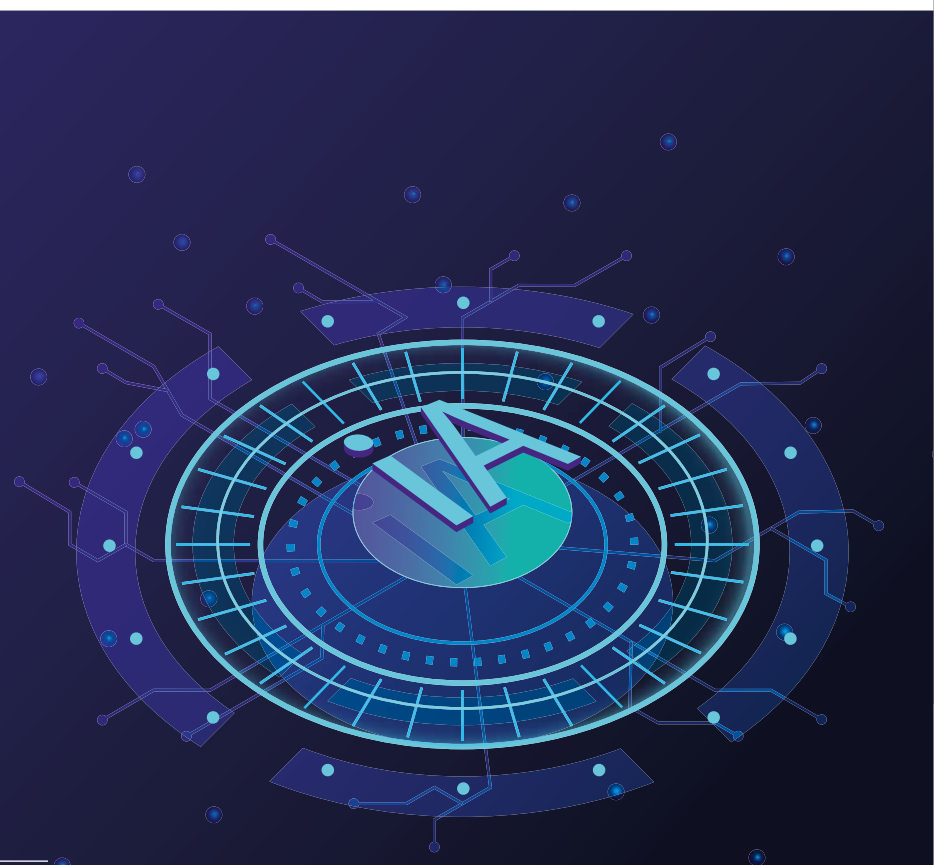
> *Coordinating public and private sector efforts, creating strategic investment spaces and systematising the concrete achievements and progress of education initiatives with AI is part of a renewed vision of education policy.*

1. Avoid technological solutionism.

2. Protect the welfare of teachers and students.

3. Reduce and neutralise the digital carbon footprint.

4. Humanist principles in e-inclusion.

5. Inclusion of different voices and cultures.

6. Data privacy and cybersecurity (Unesco, 2023e).

For more than a decade, the Ceibal Plan in Uruguay has been an exemplary case worldwide in the development of a comprehensive strategy for incorporating technology in education. It is no coincidence that it also leads advances in the field of AI (Ceibal, 2024).

Planning from the public sector is combined with the challenge of developing advanced scientific and technological research capacities in AI within higher education. Some universities have begun launching new specialized degree programs in AI engineering, data science, robotics, and computer science. Public and private efforts in funding and infrastructure to ensure adequate training conditions are key to achieving greater autonomy in AI development capacities in the region.

Effective governance capacities in public policy is a key indicator in the development of ecosystems that can give sustainability to the educational initiatives studied in the first part of this report. Coordinating public and private sector efforts, creating strategic investment spaces and systematising the concrete achievements and progress of education initiatives with AI is part of a renewed vision of education policy. The limit to the risks and the bet on the possibilities summarised in this report require new conversations and public policies to make AI a source of improvement and transformation of education.

Future studies will be able to better analyse the concrete effects of students' use of generative AI on their approach to, extension of or restructuring of learning. It will also be possible to study how teachers enhance their ability to plan lessons, create low-cost teaching resources or better support their students with the assistance of virtual teachers. Future research in Latin America may also indicate to what extent AI advances are used by education policy to further the reach of education and to be closer to students' learning in depth.

Agudelo, M., Chomali, E. y Torres, L. (2024). *Hacia el cierre de la brecha digital.* Caracas. https://scioteca.caf.com/handle/123456789/2272

Ahmed, A.A.A. & Ganapathy, A. (2021). Creation of automated content with embedded artificial intelligence: A study on learning management system for educational entrepreneurship. *Academy of Entrepreneurship Journal, 27*, 1–10.

Bessen, J.E., Impink, S.M., Reichensperger, L. & Seamans, R. (2020). *GDPR and the Importance of Data to AI Startups.* NYU Stern School of Business: New York, NY, USA.

Bryant, J., Heitz, C., Sanghvi, S. & Wagle. D. (2020). *How artificial intelligence will impact K-12 teachers.* https://www.mckinsey.com/industries/education/ourinsights/how-artificial-intelligence-will-impact-k-12-teachers

Carter, L., Liu, D. & Cantrell, C. (2020). Exploring the Intersection of the Digital Divide and Artificial Intelligence: A Hermeneutic Literature Review. *AIS Transactions on Human-Computer Interaction, 12*(4), 253-275, https://doi.org/10.17705/1thci.00138

Ceibal. (2024). *Marco referencial para la enseñanza de la inteligencia artificial.* https://pensamientocomputacional.ceibal.edu.uy/wp-content/uploads/2024/02/Marco-referencial-IA.pdf

Chan, C. & Tsi, L.H. (2023). *The AI Revolution in Education: Will AI Replace or Assist Teachers in Higher Education?* https://doi.org/10.48550/arXiv.2305.01185

Chen, L., Chen, P. & Lin, Z. (2020). Artificial Intelligence in Education. *IEEE Access*, Vol. 8, pp. 75264-75278, https://doi.org/10.1109/access.2020.2988510

Chen, Y., Jensen, S., Albert, L.J., Gupta, S. & Lee, T. (2023). Artificial intelligence (AI) student assistants in the classroom: Designing chatbots to support student success. *Information Systems Frontiers, 25*, 161–182.

Chetouani, M., Dignum, V., Lukowicz, P. & Sierra, C. (Eds.). (2023). *Human-Centered Artificial Intelligence: Advanced Lectures.* Springer Nature: Berlin, Germany; Volume 13500.

Christensen, C., Johnson, J. & Horn, M. (2008). *Disrupting class: How disruptive innovation will change the way the world learns.* New York, NY: McGrawHill.

Copur-Gencturk, Y., Li, J., Cohen, A.S. & Hawley Orrill, C. (2024). *The impact of an interactive, personalized computer-based teacher professional development program on student performance: A randomized controlled trial.* Computers & Education, Vol. 210.

Council of Europe. (2024). *Artificial Intelligence: Glossary.* https://coe.int/en/web/artificial-intelligence/glossary

Cueto, S., Balarin, M., Saavedra, M. & Sugimaru, C. (2023). *Ed-tech in the Global South: Research gaps and opportunities.* (Occasional Paper No. 91). Southern Voice.

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E.L., Jeyaraj, A., Kar, A.K., Baabdullah, A.M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., … Wright, R. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Managemet, 71*, 102642.

Eynon, R. & Young, E. (2021). Methodology, Legend, and Rhetoric: The Constructions of AI by Academia, Industry, and policy groups for lifelong learning. *Science, Technology, & Human Values, 46*(1), 166–191.

Felix, C. V. (2020). The Role of the Teacher and AI in Education. *In Innovations in Higher Education Teaching and Learning*, Volume 33, 33-48. International Perspectives on the Role of Technology in Humanizing Higher Education, Emerald Publishing Limited.

Foster, N. & Piacentini, M. (Eds.). (2023). *Innovating Assessments to Measure and Support Complex Skills*. OECD Publishing, Paris. https://doi.org/10.1787/e5f3e341-en

Fulwiler, T. (1982). Writing: An act of cognition. *New directions for teaching and learning, (12),* 15-26. https://onlinelibrary.wiley.com/doi/abs/10.1002/tl.37219821204

Gottschalk, F. & Weise, C. (2023). *Digital equity and inclusion in education: An overview of practice and policy in OECD countries*. OECD Education Working Papers, No. 299, OECD Publishing, Paris, https://doi.org/10.1787/7cb15030-en

Greitemeyer, T. & Kastenmüller, A. (2024). A Longitudinal Analysis of the Willingness to Use ChatGPT for Academic Cheating: Applying the Theory of Planned Behavior. *Technology, Mind, and Behavior, 5*(2: Summer 2024). https://doi.org/10.1037/tmb0000133

Hevia, J. F., Székely, M., Vinacur, T. y Zoido, P. (2022). *Tutorías remotas: revisión de la literatura*.Inter-American Development Bank, Document N° IDB-DP-00944. http://dx.doi.org/10.18235/0004304

Hillman, V. (2022). Bringing in the technological, ethical, educational and social-structural for a new education data governance. *Learning, Media and Technology*, *48*(1), 122–137. https://doi.org/10.1080/17439884.2022.2052313

Holmes, W. (2023). *The Unintended Consequences of Artificial Intelligence and Education.* Education International Research.

Holmes, W. & Tuomi, I. (2022). State of the art and practice in AI in education. *European Journal of Education, 57*(4), 542-570. https://doi.org/10.1111/ejed.12533

Huang, L. (2023). Ethics of Artificial Intelligence in Education: Student Privacy and Data Protection. *Science Insights Education Frontiers, 16*(2), 2577-2587. https://www.scirp.org/reference/referencespapers?referenceid=3600018

Hwang, G.J. & Chien, S.Y. (2022). Definition, roles, and potential research issues of the metaverse in education: An artificial intelligence perspective. *Computers and Education Artificial Intelligence, 3*(3): 100082.

IALAB (2022). *Inteligencia Artificial para mejorar el éxito estudiantil.* https://ialab.com.ar/wp-content/uploads/2023/02/IA-exito-estudiantil.pdf

Jo, A. (2023). The promise and peril of generative AI. *Nature, 614*(1), 214-216.

Kalota, F. (2024). A Primer on Generative Artificial Intelligence. *Education Sciences, 14*(2),172.

Kamalov, F.; Santandreu Calonge, D.; Gurrib, I. (2023). New Era of Artificial Intelligence in Education: Towards a Sustainable Multifaceted Revolution. Sustainability 2023, 15, 12451. https://doi.org/10.3390/su151612451

Khan (2024). How AI Will Revolutionize Education (and Why That´s a Good Thing). English Edition.

Kochmar, E., Vu, D.D., Belfer, R., Gupta, V., Serban, I.V. & Pineau, J. (2022). Automated data-driven generation of personalized pedagogical interventions in intelligent tutoring systems. *International Journal of Artificial Intelligence in Education, 32*(2), 323-349. https://link.springer.com/article/10.1007/s40593-021-00267-x

Labadze, L., Grigolia, M. & Machaidze, L. (2023). Role of AI chatbots in education: systematic literature review. *International Journal of Educational Technology in Higher Education, 20*(56). https://doi.org/10.1186/s41239-023-00426-1

Lee, I., Grover, S., Martin, F., Pillai, S. & Malyn-Smith, J. (2020). Computational thinking from a disciplinary perspective: Integrating computational thinking in K-12 science, technology, engineering, and mathematics education. *Journal of Science Education and Technology, 29,* 1-8, https://doi.org/10.36120/2587-3636.v28i2.41-49

Lee, V. R., Pope, D., Miles, S. & Zárate, R. C. (2024). Cheating in the age of generative AI: A high school survey study of cheating behaviors before and after the release of ChatGPT, *Computers and Education: Artificial Intelligence*, Volume 7, 100253, ISSN 2666-920X, https://doi.org/10.1016/j.caeai.2024.100253

Lemaignan, S., Newbutt, N., Rice, L. & Daly, J. (2022). "It's Important to Think of Pepper as a Teaching Aid or Resource External to the Classroom": A Social Robot in a School for Autistic Children". *International Journal of Social Robotics, 16,* 1083-1104. https://doi.org/10.1007/s12369-022-00928-4

Long, D. & Magerko, B. (2020). *What is AI literacy? Competencies and design considerations. CHI '20: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems.* April 2020. New York, ACM, Inc., pp. 1-16.

McLean, S., Read, G. J., Thompson, J., Baber, C., Stanton, N. A. & Salmon, P. M. (2023). The risks associated with Artificial General Intelligence: A systematic review. *Journal of Experimental & Theoretical Artificial Intelligence, 35*(5), 649-663.

Minn, S. (2022). AI-assisted knowledge assessment techniques for adaptive learning environments. *Computers and Education: Artificial.Intelligence, 3,* 100050.

Molina, E., Cobo, C., Pineda, J. & Rovner, H. (2024). La revolución de la IA en la Educación: Lo Que Hay Que Saber. Innovaciones Digitales de Educación. World Bank. https://documentos.bancomundial.org/es/publication/documents-reports/documentdetail/099355206192434920/idu18a4e03161fc3d14a691a4dc13642b-c9e086a

Mousavinasab, E., Zarifsanaiey, N., Niakan, R., Kalhori, S., Rakhshan, M., Keikha, L. & Ghazi, S.M. (2021). Intelligent tutoring systems: A systematic review of characteristics, applications, and evaluation methods. *Interactive Learning Environments, 29,* 142–163.

Nemorin, S., Vlachidis, A., Ayerakwa, H. M. & Andriotis, P. (2022). AI hyped? A horizon scan of discourse on artificial intelligence in education (AIED) and development. *Learning, Media and Technology, 48*(1), 38–51. https://doi.org/10.1080/17439884.2022.2095568

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence, 2,* 100041.

Nickow, A., Oreopoulos, P. & Quan, V. (2020). *The impressive effects of tutoring on prek-12 learning: A systematic review and meta-analysis of the experimental evidence.* National Bureau of Economic Research, Working Paper, 27476. https://www.nber.org/system/files/working_papers/w27476/w27476.pdf

OECD. (2023). *Council Recommendation on Artificial Intelligence.*

OECD. (2021). OECD *Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots.* OECD Publishing, Paris, https://doi.org/10.1787/589b283f-en

OECD. (2024). *The potential impact of Artificial Intelligence on equity and inclusion in education.* https://www.oecd-ilibrary.org/science-and-technology/the-potential-impact-of-artificial-intelligence-on-equity-and-inclusion-in-education_15df715b-en

OEI. (2023). *Competencia digital docente para la transformación educativa.* https://oei.int/oficinas/secretaria-general/publicaciones/competencia-digital-docente-para-la-transformacion-educativa

OEI and ProFuturo. (2023). *The future of artificial intelligence in education un Latin America.* https://oei.int/wp-content/uploads/2023/04/the-future-of-artificial-intelligence-in-education-in-latin-america-oei-profuturo.pdf

Panjwani-Charania, Sahrish and Zhai, Xiaoming, (2023). AI for Students with Learning Disabilities: A Systematic Review. In X. Zhai & J. Krajcik (Eds.). *Uses of Artificial Intelligence in STEM Education.* Oxford, UK: Oxford University Press (pp. 1-28). https://ssrn.com/abstract=4617715

Panjwani-Charani, S. & Zhai, X. (2024). AI for Students with Learning Disabilities: A Systematic Review. In X. Zhai & J. Krajcik (Eds.). *Uses of Artificial Intelligence in STEM Education.* Oxford, UK: Oxford University Press (pp. 469-493). https://doi.org/10.1093/oso/9780198882077.003.0021

Papert, S. (1993). *The children's machine: Rethinking school in the age of the computer.* BasicBooks. New York.

Pentina, I., Hancock, T. & Xie, T. (2023). Exploring relationship development with social chatbots: A mixed-method study of replika. *Computers in Human Behavior,* Volume 140.

Pons, A. (2023). Generative AI in the classroom: From hype to reality? OECD. https://one.oecd.org/document/EDU/EDPC(2023)11/en/pdf

Porayska-Pomsta, K., Alcorn, A. M., Avramides, K., Beale, S., Bernardini, S., Foster, M. E., Fraunberger, C., Good, J., Guldberg, K., Keay-Bright, W., Kossyvaki, L., Lemon, O., Mademtzi, M., Menzies, R., Pain, H., Rajendran, G., Waller, A., Wass, S. & Smith, T. J. (2018). Blending Human and Artificial Intelligence to Support Autistic Children's Social Communication Skills. *ACM Transactions on Computer-Human Interaction, 25*(6), pp. 1-35, https://doi.org/10.1145/3271484.

ProFuturo. (2024). *Integrando aprendizajes. Docentes ProFuturo ante los desafíos de la IA.* https://www.fundaciontelefonica.co/wp-content/uploads/2024/03/Integrando-Aprendizajes-IA-ProFuturo.pdf?_gl=1*1lo3fli*_ga*MTQwMjkzMjY1NC4xNzE4MjAwMDE5*_ga_NP91PXK-7J8*MTcyNTIzOTgzNS41LjEuMTcyNTIzOT-k3MC4wLjAuMA

Radford, J., Richard, G., Richard, H. & Serrurier, M. (2021). Detecting Dyslexia from Audio Records: An AI Approach. *Proceedings of the 14th International Joint Conference on Biomedical Engineering Systems and Technologies*, https://doi.org/10.5220/0010196000580066

Reihana, K. R., Wehi, P. M., Pomare-Peita, M., Harcourt, N., Ellis, J. I. & Murray, J. M. (2023). Indigitization: Technology as a mode for conservation sustainability and knowledge transfer in indigenous New Zealand communities. *Biological Conservation,* Vol. 285, p. 110237, https://doi.org/10.1016/j.biocon.2023.110237

Régis, C., Denis, J. L., Axente, M. L. & Kishimoto, A. (2024). *Human-Centered AI: A Multidisciplinary Perspective for Policy-Makers, Auditors, and Users*. Taylor & Francis.

Rivas, A. (2023). Los cuatro desafíos educativos de la Inteligencia Artificial. En OEI (Ed.). *El estado de la ciencia: Principales Indicadores de Ciencia y Tecnología Iberoamericanos / Interamericanos* OEI-UNESCO.

Salas-Pilco, S.Z. & Yang, Y. (2022) Artificial intelligence applications in Latin American higher education: a systematic review. *International Journal of Educational Technology Higher Education, 19*(21). https://doi.org/10.1186/s41239-022-00326-w

Schiff, D. (2022). Education for AI, not AI for Education: The role of education and ethics in national AI policy strategies. *International Journal of Artificial Intelligence in Education, 32,* 527–563.

Selwyn, N. (2023). *Resisting and reimagining Artificial Intelligence, Education International*. https://www.ei-ie.org/en/item/27927:resisting-and-reimagining-artificial-intelligence

Soletic, Á. y Kelly, V. (2022). *Políticas digitales en educación en América Latina. Tendencias emergentes y perspectivas de futuro.* IIPE-UNESCO, Buenos Aires.

Sullivan, M., Kelly, A. McLaughlan, P. (2023). ChatGPT in higher education: Considerations for academic integrity and student learning. *Journal of Applied Learning & Teaching, 6*(1).

Suresh, H. & J. Guttag (2021). A Framework for Understanding Sources of Harm throughout the Machine Learning Life Cycle. EAAMO 2021: *Equity and Access in Algorithms, Mechanisms, and Optimization*. https://doi.org/10.1145/3465416.3483305

Terwiesch, C. (2023). *Would Chat GPT Get a Wharton MBA?* [White Paper]. Wharton School of Business. University of Pennsylvania. https://mackinstitute.wharton.upenn.edu/wp-content/uploads/2023/01/Christian-Terwiesch-Chat-GTP-1.24.pdf

Timan, T. & Mann, Z. (2021). *Data protection in the era of artificial intelligence: Trends, existing solutions and recommendations for privacy-preserving technologies.* In The Elements of Big Data Value: Foundations of the Research and Innovation Ecosystem; Springer International Publishing: Cham, Switzerland; pp. 153–175.

Unesco. (2016). *Revisión comparativa de iniciativas nacionales de aprendizaje móvil en América Latina. El caso del plan Ceibal de Uruguay.* IIPE-UNESCO: Buenos Aires. https://www.buenosaires.iiep.unesco.org/sites/default/files/Documento%20Uruguay.pdf

Unesco. (2019). *Beijing Consensus on Artificial Intelligence and Education.* https://unesdoc.unesco.org/ark:/48223/pf0000368303

Unesco. (2020). *Ciudadanía digital: curriculum para la formación docente.* https://unesdoc.unesco.org/ark:/48223/pf0000378120

Unesco. (2022). *Recomendación sobre la ética de la inteligencia artificial.* https://unesdoc.unesco.org/ark:/48223/pf0000381137_spa

Unesco. (2023a). *Global education monitoring report, 2023: technology in education: a tool on whose terms?* https://unesdoc.unesco.org/ark:/48223/pf0000385723

Unesco. (2023b). *An ed-tech tragedy? Educational technologies and school closures in the time of COVID-19.* https://unesdoc.unesco.org/ark:/48223/pf0000386701

Unesco. (2023c). *Currículos de IA para la enseñanza preescolar, primaria y secundaria: un mapeo de los currículos de IA aprobados por los gobiernos.* https://unesdoc.unesco.org/ark:/48223/pf0000380602_spa

Unesco. (2023e). *Directrices para la formulación de políticas y planes maestros de TIC en educación.* https://unesdoc.unesco.org/ark:/48223/pf0000385091

Unesco. (2024). *La urgencia de la recuperación educativa en América Latina y el Caribe Documento sobre el monitoreo del ODS4-Educación 2030 para 2019-2023 preparado para la reunión de Ministras y Ministros de Educación.*

Vicari, R., Brackmannn, C. P., Mizusaki, L. & Galafassi, C. (2023). *Inteligência Artificial na Educação Básica*. 1. ed. São Paulo: Novatec Editora.

Williamson, B., Macgilchrist, F. & Potter, J. (2023). Re-examining AI, automation and datafication in education. *Learning, Media and Technology, 48*(1), 1–5. https://doi.org/10.1080/17439884.2023.2167830

World Bank (2024). *La revolución de la IA en Educación: Lo que hay que saber*. World Bank. https://documentos.bancomundial.org/es/publication/documents-reports/documentdetail/099355206192434920/idu18a4e03161fc3d14a691a4dc13642b-c9e086a

Zapata Ros, M. (2024). IA generativa y ChatGPT en Educación: Un reto para la evaluación y ¿una nueva pedagogía? *Revista paraguaya de educación a distancia (REPED), 5*(1), 12–44. https://doi.org/10.56152/reped2024-vol5num1-art2